Appendix 5.21

Water Supply and Service Appendices

Appendix 5.21A

Water Supply Assessment—Entrada South Project and Approval Resolution

Valencia Water Company

December 8, 2014

VALENCIA WATER COMPANY

December 8, 2014

RESOLUTION TO APPROVE

WATER SUPPLY ASSESSMENT

FOR

ENTRADA SOUTH PROJECT
Vesting Tentative Tract Map No. 53295

WHEREAS, California Water Code Sections 10910 et seq. (hereinafter "SB 610") requires an owner or operator of a "public water system" to act on a proposed "water supply assessment" in connection with those projects identified in Section 10912 of SB 610, and

WHEREAS, SB 610 requires the city or county to identify a public water system that may supply water for a project and to request that the public water system prepare a water supply assessment, and

WHEREAS, a "public water system" is defined to mean "a system for the provision of piped water to the public for human consumption that has 3,000 or more service connections" in section 10912 of SB 610, and

WHEREAS, VWC's current service area serves piped water to the public for human consumption, including approximately 31,000 service connections in the Santa Clarita Valley; and, therefore meets the definition of operating a "public water system" as defined in section 10912 of SB 610, and

WHEREAS, The County of Los Angeles Department of Regional Planning, pursuant to California Water Code section 10910(g)(1), has requested that VWC prepare a water supply assessment for a residential and commercial mixed-use project commonly known as Entrada South, Vesting Tentative Tract Map No. 53295, located in the Santa Clarita Valley, Los Angeles County, California (Entrada South Project), and

WHEREAS, the Board of Directors of the Valencia Water Company (VWC) has received and evaluated a Water Supply Assessment regarding the Entrada South Project, and

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of VWC (1) has reviewed the Water Supply Assessment for Entrada South Project, (2) has determined, exercising its independent judgment, that a sufficient water supply (within the meaning of SB 610) is available for the Entrada South Project based on the information contained in said Water Supply Assessment and other relevant records on file with VWC, and (3) hereby approves the Water Supply Assessment for the Entrada South Project; and

RESOLVED FURTHER, that any and all actions heretofore taken in furtherance of the matters authorized or contemplated by the foregoing resolution by each officer of VWC or member of the Board of Directors of VWC be, and they hereby are, ratified, approved and confirmed.

I, the undersigned, hereby certify that I am the duly appointed Secretary of VWC, and that at a special meeting of the Board of VWC held on December 8, 2014, the foregoing Resolutions were duly and regularly adopted by said Board, and that said Resolutions have not been rescinded or amended since the date of adoption, and that the Resolutions are in full force and effect.

Date: December 8, 2014

Beverly Johnson

Beverly Johnson, Secretary

WATER SUPPLY ASSESSMENT

Entrada South Project

Vesting Tentative Tract Map No. 53295
County Project No. 00-210-(5)

Prepared for:

The County of Los Angeles
Department of Regional Planning

December 2014

Prepared by

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1.0 INTRODUCTION

1.1 Background

This Water Supply Assessment (WSA) is prepared by Valencia Water Company (VWC) for the Entrada South proposed project (Project), a mixed-use planned community located in the Santa Clarita Valley of unincorporated Los Angeles County, west of Interstate 5 (I-5) and The Old Road, south of the Six Flags Magic Mountain Theme Park, north of the existing Westridge community, and east of the approved Newhall Ranch Specific Plan and pending Mission Village subdivision (VTTM 61105). The WSA is prepared pursuant to the requirements of Senate Bill 610 (SB 610; Costa; Chap. 643, Stats. 2001).[1]

Effective January 1, 2002, SB 610 was adopted, along with a companion measure Senate Bill 221 (SB 221), to improve the link between information on water supply availability and certain land use decisions made by a city or county.[2] As explained below, VWC is the retail supplier for the Project site, and Castaic Lake Water Agency (CLWA) is the wholesale water public agency for the entire CLWA service area, which includes the service areas of VWC and three other retail purveyors in the Santa Clarita Valley of unincorporated Los Angeles County.

Once a city or county determines that a project, as defined by California Water Code section 10912, is subject to the California Environmental Quality Act, Public Resources Code section 21000, et seq. (CEQA), SB 610 requires the city or county to identify a public water system that may supply water for the project, and request that the public water system prepare a water supply assessment.[3]

A "public water system" is defined to mean "a system for the provision of piped water to the public for human consumption that has 3,000 or more service connections."[4] VWC serves piped water to the public (i.e., residents of the Santa Clarita Valley) within its current service area, and the area includes about 31,000 service connections in the city of Santa Clarita and in the unincorporated Los Angeles County communities of Castaic, Newhall, Saugus, Stevenson Ranch, and Valencia. As a result, VWC is the "public water system" for purposes of this WSA.

VWC is the retail purveyor for the Project site and is the operator of the public water system that will provide water to the Project.[5, 6] A WSA is required for any project that is subject to CEQA[7]

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[1] SB 610 amended California Public Resources Code § 21151.9, amended California Water Code §§10631, 10656, 10910, 19811, 19812, and 19815, repealed California Water Code § 10913, and added and amended California Water Code §10657.

[2] California Department of Water Resources, *Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001* (October 8, 2003), p. iii.

[3] California Water Code §§ 10910(b), 10910(c)(1).

[4] Water Code § 10912(c).

[5] Water Code § 10912(c); Cardno-ENTRIX, Water Supply and Demand Technical Report. Entrada South (2014), p. 2-6 and Table 2-1 (Cardno-ENTRIX 2014).

and proposes, among other things, a residential development of more than 500 dwelling units.[8] This Project is a qualifying project under this definition.

1.2 Purpose

The purpose of the WSA is to comply with the requirements of SB 610, California Water Code sections 10910-10915, with respect to the water demand of the Project and answer the following basic question:

> *Whether the public water system's total projected water supplies available during normal, single-dry, and multiple-dry water years during a 20-year projection will meet the projected water demand of the Project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses?*[9]

If, as a result of its WSA, the public water system concludes that its water supplies are or will be insufficient, the public water system must provide to the city or county its plans for acquiring additional water supplies, setting forth the measures being undertaken to acquire and develop those supplies.[10] The WSA must include, among other information, an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the project, and water received in prior years by the public water system pursuant to those entitlements, rights, or contracts.[11]

The WSA is required to be included in any environmental document prepared for the project pursuant to CEQA.[12] In this case, the County of Los Angeles (County) is the lead agency under CEQA, and it has determined an environmental impact report (EIR) is required for the Project; and, thus, this WSA will be included as an appendix to the Entrada South Draft EIR.

1.3 Entrada South

The Project (County Project No. 00-210-(5)) consists of the proposed development of approximately 501 acres, of which about 382 acres are within proposed Vesting Tentative Tract Map No. 53295 (VTTM 53295), and about 119 acres comprise external tract map improvements

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6 Water Code § 10910(b).

7 Public Resources Code § 21080.

8 Water Code § 10912(a)(1). This section also includes other types of development that are defined as a "project" by this section of the code.

9 Water Code § 10910(c).

10 Water Code § 10911(a).

11 Water Code § 10910(d).

12 Water Code § 10911(b).

(including grading, utilities, roadway, drainage, and other infrastructure outside the boundary of VTTM 53295) necessary to support development of the Project. VTTM 53295 proposes a total of 1,574 residential units (339 single-family and 1,235 multi-family), 730,000 square feet of commercial/retail uses (295,000 sq. ft.) and office uses (435,000 sq. ft.), an elementary school (9.4 acres), a public neighborhood park (5.6 acres), two private recreational centers (2.9 acres), a spineflower preserve (27.2 acres), open space (101.7 acres), and other associated infrastructure improvements, facilities, and amenities.[13]

At build-out, the Project's total water demand is estimated to be approximately 1,143 acre-feet per year (afy), which includes a potable water demand of 703 afy and a recycled or non-potable water demand of 440 afy.[14]

1.4 Castaic Lake Water Agency

CLWA is a public water agency that serves an area of 195 square miles in Los Angeles and Ventura counties, and is one of the contractors that participate in the State Water Project (SWP) — a water storage and delivery system maintained and operated by the California Department of Water Resources (DWR). CLWA is one of 29 SWP water contractors holding long-term SWP water supply contracts (as amended) with DWR. CLWA, a water wholesaler, provides principally imported SWP water to retail water purveyors within its service area through its water supply contract with DWR. CLWA's current water supply contract with DWR is for 95,200 acre-feet (af) of SWP Table A Amount.

"Table A" is a term used in DWR's water supply contracts with SWP contractors, and the "Table A Amount" is the maximum amount of water to which a SWP contractor has a contract right to request delivery of each year under the SWP contractor's water supply contract. The Table A Amount is not equivalent to actual deliveries of water in any given year, and the water actually available for delivery in any given year may be an amount *less* than the SWP contractor's Table A Amount depending upon hydrologic conditions, the amount of water in storage, the operational constraints of the SWP, requirements imposed by regulatory agencies to meet environmental water needs, the amount of water requested by other SWP contractors, climatic conditions, and other factors. SWP supply also is subject to severe curtailment during dry years.[15] As discussed below, CLWA maintains other imported supplies, such as water from the Buena Vista Water Storage District (Buena Vista), the Semitropic Water Storage District (Semitropic), the Rosedale-Rio Bravo Water Storage District (Rosedale-Rio Bravo), and the Yuba County Water Agency.

CLWA provides about half of the water used by Santa Clarita households and businesses, and operates two potable water treatment plants/storage facilities and several miles of transmission

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[13] Cardno-ENTRIX (2014), pp. 1-1 - 1-2.

[14] Cardno-ENTRIX (2014), p. 1-2.

[15] 2010 Urban Water Management Plan (UWMP), Final June 2011, Appendix D.

pipelines. CLWA's imported SWP and other water supplements groundwater supplies from the local groundwater basin in the Santa Clarita Valley. The four retail purveyors served by CLWA are VWC, Los Angeles County Waterworks District #36 (District #36), Newhall County Water District (NCWD), and Santa Clarita Water Division of CLWA (SCWD).

CLWA also delivers highly treated recycled water from one of the two existing water reclamation plants (WRPs) in the Santa Clarita Valley owned by the Sanitation Districts of Los Angeles County. The recycled water is used to meet a portion of the non-potable water demands for a golf course and landscape irrigation in the Santa Clarita Valley.

CLWA receives its SWP water from the West Branch of the California Aqueduct, which terminates at Castaic Lake. SWP water from Castaic Lake is treated, filtered, and disinfected at CLWA's Earl Schmidt Filtration Plant and Rio Vista Water Treatment Plant, which have a combined treatment capacity of 122 million gallons per day (mgd). Treated water is delivered from the treatment plants to each of the four retail purveyors through a distribution network of pipelines and turnouts. Currently, CLWA delivers water to the four retail purveyors through 26 potable water turnouts.[16]

CLWA and the retail purveyors in the Santa Clarita Valley meet the balance of their demands primarily with local groundwater and recycled water.[17]

1.5 Valencia Water Company and Other Retail Water Suppliers

1.5.1 Valencia Water Company

VWC is an investor-owned water company, with 100% of its capital stock owned by CLWA.[18] VWC's service area encompasses approximately 30 square miles in the Santa Clarita Valley, and VWC serves approximately 117,000 people in the Santa Clarita Valley and its customer base is approximately 85% residential, with the remaining 15% comprised of commercial, industrial, public authority, and irrigation customers. VWC serves a mix of approximately 50% local groundwater pumped from wells in the Upper Santa Clara River Hydrologic Area, as defined by DWR, which is located almost entirely in northwestern Los Angeles County (also known as the East Groundwater Subbasin).[19] The remaining 50% of VWC's supplies are from imported water purchased from CLWA; VWC also delivers recycled water for a small amount of non-potable uses (golf course, road median irrigation).[20]

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[16] Luhdorff & Scalmanini Consulting Engineers (LSCE). 2013 Santa Clarita Valley Water Report (June 2014), pp. 3-12-3-15 (2013 Santa Clarita Valley Water Report).

[17] 2010 UWMP (2011), Section 1.4.1, p. 1-8-1-10.

[18] See Valencia Water Company website http://www.valenciawater.com/about/index.asp (accessed June 19, 2014).

[19] *Id.*; and see 2013 Santa Clarita Valley Water Report (June 2014), pp. 1-3-1-7.

[20] *Ibid.*

VWC's imported water supply sources consist of imported state water through 7 CLWA turnouts and local groundwater through 23 active municipal supply wells. All water is pumped from the turnouts and the wells into VWC's existing transmission and distribution system. There are 25 storage tanks and 17 pressure zones making up 6 hydraulic grade line elevations that are separated by booster pumps and pressure regulating stations. Well pumps, booster pumps, pressure regulating stations, and CLWA turnout valves and pumps operate automatically in response to system demands through a Supervisory Control And Data Acquisition system (SCADA) located in VWC's offices. VWC employs the SCADA system to remotely control and monitor its wells, turnouts, pumps, and tanks.

VWC's transmission and distribution system is designed to reduce energy demand and shift demands to off-peak periods. For example, VWC's SCADA system enables 90 percent of its wells and booster pumps to be operated on less expensive Southern California Edison time of use tariffs, which allows VWC's customer base to benefit from lower rates and electricity to be shifted to off-peak periods. VWC also has a maintenance plans for its wells and pumps to ensure that motors and pumps are operating optimally, thus reducing energy demands.

Further, VWC employs a near-term (over the next 3-5 years) and a long-term (over the next 20+ years) Capital Investment Plan (CIP). The CIP focuses on infrastructure needs and capital intensive projects based on VWC's evaluation of numerous factors, including: (a) company operations; (b) growth projections from area general plans (city of Santa Clarita and County of Los Angeles); (c) existing and emerging water quality regulations; (d) new technologies that improve service and water quality; (e) existing land use data and new housing/commercial construction information; and (f) consultation with land owners and developers within its service area. VWC's improvement plans for its water system occur incrementally as demand for water increases over time.[21] Improvements are made based on compliance with applicable rules and regulations, including the State Water Resources Control Board – Division of Drinking Water (DDW) and other requirements from local jurisdictions (such as the city of Santa Clarita and County of Los Angeles).

Since 1994, VWC has invested approximately $59 million in capital projects and water system improvements to ensure a safe, reliable water supply. VWC's CIP seeks to maintain a dependable, high-quality, and cost effective water system that operates regardless of mechanical breakdown, natural disasters, sudden contamination of a supply source, or protracted drought. VWC continues to invest in capital improvement projects and other system improvements, including its well replacement program, recycled water plans, water and energy use efficiency efforts, and water quality improvement programs.

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[21] For long-term planning purposes, water supplies and facilities are added on an incremental basis and ahead of need as it would be economically unsound to immediately, or in the short term, implement all the facilities and water supplies needed for the next 20 to 30 years. Such an approach would unfairly burden VWC's existing customer base with costs that should be borne by its future customer base. (2013 Santa Clarita Valley Water Report, p. 4-5.)

1.5.2 Other Retail Water Suppliers

A description of the four retail purveyors' service areas is provided below.

The **District #36** service area encompasses approximately 6,600 acres in the Hasley Canyon area and the unincorporated community of Val Verde.

The **NCWD** service area includes portions of the City of Santa Clarita and unincorporated portions of the County in the communities of Newhall, Canyon Country, Valencia, and Castaic.

The **CLWA SCWD** service area includes portions of the City of Santa Clarita and unincorporated portions of the County in the communities of Canyon Country, Newhall, and Saugus.

The **VWC** service area includes a portion of the City of Santa Clarita and unincorporated portions of the County in the communities of Castaic, Newhall, Saugus, Stevenson Ranch, and Valencia.

As of 2013, the retail purveyors provide water to about 71,550 service connections in the Santa Clarita Valley. **Table 1** shows the breakdown of service connections for each purveyor.

Table 1
Retail Water Purveyor Service Connections
for the Santa Clarita Valley

Retail Water Purveyor	Connections
SCWD	29,700
District #36	1,350
NCWD	9,700
VWC	30,800
Total	**71,550**

Source: 2013 Santa Clarita Valley Water Report (June 2014)

1.6 2010 Urban Water Management Plan

Pursuant to SB 610 requirements, if the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan (UWMP),[22] then relevant information from that document may be incorporated into the SB 610 WSA.[23] The 2010 UWMP was adopted by the CLWA, NCWD and VWC Boards of Directors in June 2011, and filed with the DWR.[24]

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[22] California Urban Water Management Planning Act (UWMP Act), Water Code § 10610, et seq.

[23] California Water Code § 10910(c)(2).

[24] 2010 UWMP for the Santa Clarita Valley, June 2011.

The 2010 UWMP is a regional planning document covering the CLWA service area, which includes the service areas of the four retail water purveyors in the Santa Clarita Valley.[25] Together, CLWA and the retail purveyors are the Santa Clarita Valley's "water suppliers." The 2010 UWMP is built upon previous documents, including the 2005 UWMP, an amendment to the 2000 UWMP, and the 2000 UWMP. Like the prior UWMPs for the Santa Clarita Valley, the 2010 UWMP encourages extensive public participation that includes information dissemination; public workshops, meetings, and hearings; plan adoption; and plan submittal to DWR.[26] The 2010 UWMP includes the adopted resolutions of CLWA, NCWD, and VWC, and encompasses the following nine major sections:

Section 1: Introduction
Section 2: Water Use
Section 3: Water Resources
Section 4: Recycled Water
Section 5: Water Quality
Section 6: Reliability Planning
Section 7: Water Demand Management Measures
Section 8: Water Shortage Contingency Planning
Section 9: References

Consistent with the UWMP Act, the 2010 UWMP accomplishes water supply planning over the required 20-year period in five-year increments (CLWA and the retail purveyors exceeded the requirements of the UWMP Act by approving the 2010 UWMP, which spans 40 years). The 2010 UWMP identifies and quantifies adequate water supplies, including recycled water, for existing and future demands, in normal/average, single-dry, and multiple-dry years, and implements conservation and efficient use of urban water supplies.

As stated, the Project's total projected water demand is estimated to be 1,143 afy. The timing of the Project places it within the timeframe for calculating "planned future uses" within the 2010 UWMP. This information is incorporated by reference in this WSA. VWC accounted for the Project's total water demand when it provided its projected single-family and multi-family residential account information through 2050 for inclusion in the 2010 UWMP (see 2010 UWMP, Table 2-6).

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[25] Water resource specialists with expertise in water resource management were retained by CLWA and the retail purveyors to assist in preparing the 2010 UWMP.

[26] The 2010 UWMP, Section 1.

1.7 VWC Policies and Regulatory Approvals/Permits

VWC Policies. The Project will be subject to all VWC policies that govern development and connection to the VWC public water system. As with other projects within its service area, the Project applicant is responsible for making appropriate financial and contractual arrangements with VWC to assure the necessary improvements are made to the water supply infrastructure to serve the Project site.

Other Regulatory Approvals/Permits. VWC is regulated by the DDW and must meet rigorous water quality standards. In addition, the County will evaluate the Project, conduct extensive environmental oversight and review, and independently determine the sufficiency of the water supplies to serve the Project site. In doing so, the County will determine if the Project will be provided with an acceptable level of water supply based on the criteria set forth in the County's General Plan Development Monitoring System (DMS), because the Project is located within the Santa Clarita Valley, an "Urban Expansion Area" within the County's DMS, and because it includes a subdivision map application. In making this determination, the County will rely on the water data set forth in the 2010 UWMP, the 2009, 2011, and 2013 DWR SWP Delivery Reliability Reports, the annual Santa Clarita Valley water reports, the Entrada South Draft EIR, the Cardno-ENTRIX technical report (2014) for the project, and other information provided by CLWA and the retail purveyors (see, for example, Section 1.8, below). In VWC's judgment, this data provides the best available information for estimating water demand and supply projections for the Santa Clarita Valley.

1.8 Information Used or Relied Upon in Preparing this WSA

This WSA used or relied on information contained in the documents identified below. Copies of the referenced documents are available for review at VWC by contacting Keith Abercrombie, (661) 295-6501, and can be obtained upon the payment of the actual costs of reproduction. These documents, which are part of VWC's record for the preparation of this WSA, are organized below by subject matter and are presented chronologically (earliest first):

DWR Documents

DWR. The Monterey Amendment to the SWP water supply contracts between DWR and SWP Contractors (1995-1996).

DWR. California's Groundwater, Bulletin 118. Santa Clara River Valley Groundwater Basin, Santa Clara River Valley East Subbasin, Update 2003 (DWR Bulletin 118; http://www.water.ca.gov/groundwater/bulletin118/update2003.cfm, accessed June 19, 2014).

DWR. Monterey Settlement Agreement, May 5, 2003.

DWR. Monterey Plus Draft EIR, October 2007 (SCH No. 2003011118), Final EIR certified February 2010.

DWR. The State Water Project Delivery Reliability Report 2009, August 2010. (2009 Delivery Reliability Report, http://baydeltaoffice.water.ca.gov/swpreliability/Reliability2010final101210.pdf, accessed June 19, 2014.) *The 2009 Delivery Reliability Report was used in preparing the 2010 UWMP.*

DWR. The State Water Project Delivery Reliability Report 2011, June 2012. (2011 Delivery Reliability Report, http://baydeltaoffice.water.ca.gov/swpreliability/FINAL_2011_DRR.pdf, accessed June 19, 2014.)

DWR. The Draft State Water Project Delivery Reliability Report 2013, December 2013. (2013 Delivery Reliability Report, https://msb.water.ca.gov/documents/86800/202762/DRR2013_Report_20131210.pdf, accessed June 19, 2014.)

CLWA Documents

DWR/CLWA. Water supply contract between DWR and CLWA 1963 (plus amendments including the "Monterey Amendments," 1995, and Amendment No. 19, 1999, the transfer of 41,000 af of entitlement from Kern County Water Agency (KCWA) to CLWA).

Kennedy/Jenks Consultants. 2002 Draft Recycled Water Master Plan.

DWR/CLWA/KCWA. 2002, 2003 Point of Delivery Agreements (Semitropic Groundwater Storage Program)

SAIC. Draft EIR — Supplemental Water Project Transfer of 41,000 af of State Water Project Table A Amount, Science Applications International Corporation (SAIC), June 2004 (SCH No. 1998041127).

SAIC. Final EIR — Supplemental Water Project Transfer of 41,000 af of State Water Project Table A Amount, December 2004 (SCH No. 1998041127).

SAIC. Draft EIR — Rosedale-Rio Bravo Water Storage District (RRBWSD) Water Banking and Exchange Program, August 2005 (SCH No. 2005061157).

SAIC. Final EIR — Rosedale-Rio Bravo Water Storage District (RRBWSD) Water Banking and Exchange Program, October 2005 (SCH No. 2005061157).

Buena Vista/Rosedale-Rio Bravo/CLWA Water Acquisition Agreement, 2006.

SAIC. Draft EIR — CLWA Water Acquisition from the Buena Vista Water Storage District and Rosedale-Rio Bravo Water Storage District Water Banking and Recovery Program, June 2006 (SCH No. 2006021003).

SAIC. Final EIR — CLWA Water Acquisition from the Buena Vista Water Storage District and Rosedale-Rio Bravo Water Storage District Water Banking and Recovery Program, October 2006 (SCH No. 2006021003).

Bon Terra. Draft Program EIR Recycled Water Master Plan, Bon Terra Consulting (Bon Terra), November 2006 (SCH No. 2005041138).

Bon Terra. Final Program EIR Recycled Water Master Plan, March 2007 (SCH No. 2005041138).

CLWA Data Document/Proposed 2011 Facility Capacity Fees, April 1, 2011.

CLWA. Budget Foreword, 2013 (http://clwa.org/docs/wp-content/uploads/2013/08/ch-2-1314-budget-foreword1.pdf, accessed June 19, 2014).

Groundwater Documents

Slade. Hydrogeologic Investigation, Perennial Yield and Artificial Recharge Potential of the Alluvial Sediments in the Santa Clarita River Valley of Los Angeles County, California, Vols. I and II, Richard C. Slade and Associates, LLC (Slade), December 1986 (Slade 1986).

Slade. Hydrogeologic Assessment of the Saugus Formation in the Santa Clara Valley of Los Angeles County, Vols. I and II, February 1988 (Slade 1988).

Memorandum of Understanding Between the Santa Clara River Valley Upper Basin Water Purveyors and United Water Conservation District (UWCD), August 2001 (MOU 2001).

Slade. 2001 Update Report: Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems, prepared for Santa Clarita Valley Water Purveyors, July 2002 (2001 Update Report).

LSCE. Groundwater Management Plan — Santa Clara River Valley Groundwater Basin, East Subbasin, December 2003 (2003 Groundwater Management Plan).

CH2M Hill. Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration, April 2004.

CH2M Hill. Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California, in Support of the Department of Health Services 97-005 Permit Application, December 2004.

CH2M Hill. Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property (Santa Clarita, California), in support of the amended 2000 UWMP, December 21, 2004.

LSCE. Impact and Response to Perchlorate Contamination, Valencia Water Company Well Q2 (Q2 Report), April 2005.

CLWA. Mitigated Negative Declaration — Groundwater Containment, Treatment and Restoration Project, August 2005.

Kennedy/Jenks. Interim Remedial Action Plan, to facilitate and restore pumping of groundwater from two Saugus Formation production wells impacted by perchlorate, approved by Department of Toxic Substances Control (DTSC), December 2005.

CH2M Hill/LSCE. Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California, prepared in support of the August 2001 Memorandum of Understanding between the Upper Basin Water Purveyors and UWCD, August 2005 (2005 Basin Yield Report).

GSI. Technical Memorandum: Potential Effects of Climate Change on Groundwater Supplies for the Newhall Ranch Specific Plan, Santa Clarita Valley, California, GSI Water Solutions, Inc. (GSI), March 18, 2008.

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Cardno-ENTRIX. Water Supply and Demand Technical Report for Entrada South Project. 2014.

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2.0 DOCUMENTATION OF EXISTING AND PROJECTED WATER SUPPLIES

The first substantive requirement of an SB 610 WSA is the identification and description of the existing water supply sources in the public water system that will serve the Project. Water Code section 10910(b) requires the WSA to identify any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the Project, and describe the quantities of water received in prior years by the public water system. The identification of existing water supply entitlements, water rights, or water service contracts held by the public water system must be demonstrated by providing information related to the following:

1. Written contracts or other proof of entitlement to an identified water supply;
2. Copies of a capital outlay program for financing the delivery of a water supply that has been adopted by the public water system;
3. Federal, state, and local permits for construction of necessary infrastructure associated with delivering the water supply; and
4. Any necessary regulatory approvals that are required in order to be able to convey or deliver the water supply.

As required by SB 610 (Water Code section 10910(d)), Section 2 of the 2010 UWMP (June 2011) and Section 2 of the 2013 Santa Clarita Valley Water Report (June 2014) summarize the total quantity of water used by each of the water purveyors in the Santa Clarita Valley to meet water demand since importation of SWP water began in 1980. Also, this Section 1.8, above, contains a list of documents with information related to the identification of the existing water supply entitlements, water rights, or water service contracts relevant to meet the Project's water demand, in addition to the existing and projected water supplies reported in the 2010 UWMP and the most recent Santa Clarita Valley water report.

The water supplies available to serve the Santa Clarita Valley as a whole are derived from five sources:

1. Groundwater from the Alluvial aquifer;
2. Groundwater from the Saugus Formation;
3. Imported SWP water and other imported supplies;
4. Dry-year groundwater banking programs; and
5. Recycled water.

Within the CLWA service area, these water supply sources can be characterized as: (a) *imported supplies*, transported *via* the SWP and consisting of SWP contract amounts and dry-year supplies delivered from groundwater banking programs; and (b) *local supplies*, consisting of groundwater

and recycled water. All of these sources are needed to meet the existing and projected water demands identified in the 2010 UWMP.

Demand-side management programs (conservation) are considered an important component of water supply. The conservation efforts of CLWA, VWC, and the other retail purveyors are important in reducing water demands on a long-term basis.

Potential future water sources include acquisition of additional imported water supplies, recycled water, stormwater runoff, increased short-term pumping from the Saugus Formation during dry years, and additional groundwater banking programs.

This WSA relies upon information from the 2010 UWMP, the 2009, 2011, and 2013 SWP Delivery Reliability Reports prepared by DWR, the Santa Clarita Valley annual water reports, and numerous other water resource and planning documents listed in Section 1.8, above.

2.1 Imported Water Supplies

CLWA obtains water supplies from the SWP, which is owned and operated by DWR. CLWA is one of 29 SWP contractors holding long-term water supply contracts with DWR. SWP water originates as rainfall and snowmelt in northern and central California. Runoff is stored in Lake Oroville, which is the SWP's largest storage facility. The water is then released from Lake Oroville down the Feather River to the Sacramento River and the Sacramento-San Joaquin Delta. Water is diverted from the Delta into the Clifton Court Forebay, and then pumped into the 444-mile long California Aqueduct. SWP water is temporarily stored in San Luis Reservoir, which is jointly operated by DWR and the U.S. Bureau of Reclamation. Prior to delivery to CLWA, SWP supplies are stored in Castaic Lake, located at the end of the West Branch of the California Aqueduct.

CLWA obtains SWP water from the SWP terminal reservoir, Castaic Lake, which is treated, filtered, and disinfected at CLWA's Earl Schmidt Filtration Plant and Rio Vista Water Treatment Plant. The two plants have a combined treatment capacity of 122 mgd. Treated water is delivered from the treatment plants by gravity flow to each of the four retail purveyors (VWC, SCWD, District #36, and NCWD) through a distribution network of pipelines and turnouts. At present, CLWA delivers water to the four retail purveyors through 26 turnouts.

In 2013, CLWA fulfilled the following major accomplishments in order to enhance, preserve, and strengthen the quality and reliability of existing and future supplies:

- continued participation in long-term water banking programs with Rosedale-Rio Bravo Water Storage District and the Semitropic Water Storage District;
- continued to participate in two-for-one exchange programs with Rosedale-Rio Bravo Water Storage District and West Kern Water District;
- completed water sales of 22,000 af to west Kern County agricultural water districts providing revenue to CLWA;

- completed water sales of 6,000 af to the San Luis Water District providing revenue to CLWA;
- continued implementation of the AB 3030 Groundwater Management Plan;
- continued implementation of the water conservation Best Management Practices, including measures in the Santa Clarita Valley Water Use Efficiency Plan;
- continued participation in the Santa Clarita Valley Water Committee
- pumped and treated almost 3,100 af from the Saugus 1 and 2 wells in 2013 as part of the remediation of the Saugus Formation groundwater perchlorate contamination;
- continued cooperative effort with the U.S. Army Corps of Engineers for characterization studies of the former Whittaker-Bermite site and in a task force effort with the City of Santa Clarita, local legislators, and state agencies to effect the cleanup and remediation of all aspects of the former Whittaker-Bermite site, including perchlorate contamination of local groundwater; and
- continued recycled water service.

Each SWP contractor has a specified water supply amount shown in Table A of its water supply contract with DWR that cumulatively total approximately 4.1 million af. The term of the contract is through 2035 and is renewable after that year. Although the SWP has not been fully completed, the SWP can deliver all of the 4.1 million af of Table A Amounts during very wet years. However, climatic conditions and other factors can significantly alter and reduce the availability of SWP water in a given year. The amount of water DWR determines is available and allocates for delivery in a given year is based on that year's hydrologic conditions, the amount of water in storage in the SWP system, current regulatory and operational constraints, and the SWP contractors' requests for SWP supplies.

CLWA has an annual SWP Table A Amount of 95,200 af through its water supply contract with DWR. This Table A Amount is a maximum and does not reflect the actual amount of water available to CLWA from the SWP, which varies from year-to-year.

Other Types of SWP Water. Each long-term water supply contract describes various types of SWP water that are available to SWP contractors to supplement their Table A water: (a) Article 21 water; (b) carryover water; and (c) turnback pool water.

Article 21 water (so named because it is described in Article 21 of the water supply contracts) is water that SWP contractors may receive on a short-term basis in addition to their Table A water, if they request it. DWR makes Article 21 water available to SWP contractors during periods when the supply of SWP water exceeds the cumulative delivery requests scheduled by the SWP contractors. Article 21 water may become available during drier year types, not just during wetter years.

Carryover water is SWP water that is allocated to a SWP contractor and approved for delivery to that contractor in a given year, but not used by the end of the year. This water is exported from

the Delta, but instead of being delivered to the SWP contractor, it is stored in the SWP's share of the San Luis Reservoir, when space is available, for the contractor to use in the following year.

SWP contractors also may offer a portion of their Table A water that has been allocated in the current year and exceeds their needs to a "turnback pool," where another contractor may purchase it. Contractors that sell their extra Table A water in a turnback pool receive payments from contractors that buy this water through the turnback pool.

The availability of Article 21 water and turnback pool water is uncertain. When available, these supplies provide additional water that CLWA may be able to use, either directly to meet demands or for later use after storage in its groundwater banking programs. To the extent CLWA is able to make use of these supplies when available, CLWA may be able to improve the reliability of its SWP supplies beyond the amounts reflected in the adopted UWMP for the Santa Clarita Valley.

While not specifically provided for in the SWP water supply contracts, in single-dry years, DWR has created dry year water purchase programs for contractors needing additional supplies. Through these programs, water is purchased by DWR from willing sellers in areas that have available supplies and is then sold by DWR to contractors willing to purchase those supplies. The availability of these supplies is uncertain. However, CLWA's access to these supplies when they are available would enable it to improve the reliability of its dry-year supplies beyond the amounts reflected in the adopted UWMP.

Flexible Storage Account. As part of CLWA's water supply contract with DWR, CLWA has access to a portion of the storage capacity of Castaic Lake. This "flexible storage account" allows CLWA to utilize up to 4,684 af of the storage in Castaic Lake. Any of this amount that CLWA borrows must be replaced by CLWA within 5 years of its withdrawal. CLWA manages this storage by keeping the account full in normal and wet years and then delivering that stored amount (or a portion of it) during dry periods. The account is refilled during the next year that adequate SWP supplies are available to CLWA to do so.

In 2005, CLWA negotiated with the Ventura County SWP contractor agency to obtain the use of its flexible storage account. This transaction allows CLWA access to another 1,376 af of storage in Castaic Lake. CLWA access to this additional storage is available on a year-to-year basis through 2015. While it is expected that CLWA and Ventura County will extend the existing flexible storage agreement beyond the 2015 term, it is not assumed to be available beyond 2015 in the adopted UWMP.

Factors Affecting SWP Table A Supplies. While Table A identifies the maximum amount of Table A water a SWP contractor may request, the amount of SWP water actually available and allocated to SWP contractors each year is dependent on a number of factors and can vary and be reduced significantly from year-to-year. The primary factors affecting SWP water delivery reliability include the availability of water at the source of supply in northern California,

regulatory restrictions on SWP operations, and the effects of climate change.[27] Uncertainty also exists because of the potential for interruptions in conveying SWP supplies through the Delta (*e.g.*, earthquakes, Delta levee failure). DWR and other agencies are engaged in ongoing efforts to reduce risks to the Delta and enhance emergency response capabilities.[28]

DWR accounts for the various factors affecting and reducing SWP water delivery reliability in its computer modeling, which simulates the expected SWP deliveries under estimated existing and future conditions. Specifically, DWR calculates the water delivery reliability of the SWP using the CalSim-II computer model, which simulates existing and future operations of the SWP. DWR's modeling is based on 82 years of historical data (water years 1922-2003), rainfall, and runoff, and the data have been adjusted to reflect 2013 current and future levels of development in the source areas. The resulting data is used to forecast the probable amount of water available to the SWP under current and future conditions (with the effects of climate change factored into the modeling for future conditions).

DWR's most current published estimate of SWP delivery reliability is found in the 2013 Draft SWP Delivery Reliability Report. As used by DWR, the term "water delivery reliability" refers to the annual amount of SWP water that can be expected to be delivered with a certain frequency, or in other words, the probability that a certain amount of water will be delivered by the SWP in a given year.

SWP Table A Supply Assessment. The SWP Delivery Reliability Report, prepared every two years by DWR as part of the Monterey Amendments settlement agreement, informs SWP contractors, city and county planning departments, regional and metropolitan planning departments, and the public about key factors important to the operation of the SWP and the reliability of its water deliveries. Commencing in 2002, DWR prepared and disseminated reliability reports for 2005, 2007, 2009, and 2011. The reliability reports are used for water planning purposes. For example, CLWA used DWR's 2009 reliability report and DWR's estimates of SWP water delivery reliability in preparing and adopting the 2010 UWMP for the Santa Clarita Valley.

The draft 2013 Delivery Reliability Report is the most current report, and includes DWR's estimates of SWP water delivery reliability under both existing (2013) and future (2033) conditions. According to the draft report, many of the same challenges to SWP operations that were identified in the 2011 reliability report remain; for example, like the 2011 report, the 2013 report shows reductions in SWP Delta exports and Table A deliveries due to the operational

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[27] Please refer to the SWP Delivery Reliability Report 2013, Chapter 3, for a detailed discussion of the factors affecting estimates of existing and especially future SWP water delivery reliability. In addition, the 2010 UWMP for the Santa Clarita Valley summarizes various factors that combine to affect and reduce SWP water delivery reliability (see 2010 UWMP, Section 3). Also, please see Appendix D to the 2010 UWMP for a more detailed discussion of these factors.

[28] Please refer to the SWP Draft Delivery Reliability Report 2013, Chapter 3, for an in-depth discussion of the actions being taken by DWR and other agencies to reduce risks to the Delta and enhance emergency response capabilities.

restrictions imposed on the SWP by Biological Opinions issued by U.S. Fish and Wildlife Service in December 2008 and National Marine Fisheries Service in June 2009, and Delta water quality and flow restrictions from the State Water Resources Control Board's water quality control plan for the Delta. Estimates of future reliability also reflect potential effects of climate change and sea level rise.

DWR Analysis Results. According to the 2010 UWMP for the Santa Clarita Valley, which relied on the 2009 reliability report, DWR estimates that the SWP can deliver 60 percent of the total maximum Table A amounts on a long-term average basis under both current (2009) and future (2029) conditions. In the worst-case single-dry year, DWR estimated that the SWP can deliver a total Table A supply of 7% of the total maximum Table A amounts under current conditions (2009), and 11% under future conditions (2029). During multiple year dry periods, DWR estimated that the SWP can deliver a total Table A supply averaging 34-36% of the total maximum Table A amounts under current conditions and 28-32% under future conditions.

As updated by the draft 2013 Delivery Reliability Report, DWR estimates that for all contractors combined, the SWP can deliver a total Table A supply of 62% of the total maximum Table A amounts on a long-term average basis under current (2013) conditions, and 58% under future (2033) conditions.[29] In the worst-case single-dry year, DWR estimates that the SWP can deliver a total Table A supply of 12% of the total maximum Table A Amount under current conditions, and 11% under future conditions. During multiple year dry periods, DWR estimates that the SWP can deliver a total Table A supply averaging 30-31% of the total maximum Table A Amount under current conditions and 24-31% under future conditions.[30]

DWR Analysis Results for SWP Supplies Under Current (2013) Conditions. The draft 2013 State Water Project Delivery Reliability Report includes the information presented in **Table 2**, Average and Dry-Period SWP Table A Deliveries Under Current Conditions and Resulting Deliveries to CLWA, which provides average and dry-period Table A deliveries for current conditions (2013) and compares those figures to those in the 2009, 2011, and 2013 Delivery Reliability Reports.

As shown on **Table 2**, applying the draft 2013 Delivery Reliability Report SWP Table A delivery percentages under current conditions to CLWA's Table A Amount of 95,200 af, results

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[29] See draft 2013 Delivery Reliability Report, Chap. 5, Table 5-4, and Chap. 6, Table 6-3. On average, the dry-period deliveries of Table A water are lower in the 2013 report than in the 2009 and 2011 reports. According to DWR, the change is due to model refinements discussed in detail in the technical memorandum accompanying the draft 2013 Delivery Reliability Report (see Chapter 5, p. 41).

[30] *Id.* According to DWR, the multiple year dry period shows lower Table A deliveries in the 2013 report than in the 2009 and 2011 reports, and the change is due to modeling refinements and reclassification of 1975 as a wet year rather than an above-normal year as was used in the 2009 and 2011 reports. Because 1975 is now considered a wet year, there are higher State Board requirements to be met, which leads to lower reservoir levels and lesser deliveries (see draft 2013 Reliability Report, Chapter 6, p. 48).

in approximately 59,024 af under average year conditions, 11,424 af under single-dry year conditions, and 28,560 af (on average) under multiple-dry year conditions.

Table 2
Average and Dry-Period SWP Table A Deliveries Under Current Conditions and Resulting Deliveries to CLWA

	SWP Table A Delivery (Percent of Maximum Table A Amount)[1]					
	Long-Term Average	**Single Dry Year (1977)**	**2-Year Drought (1976-1977)[2]**	**4-Year Drought (1931-1934)**	**6-Year Drought (1987-1992)**	**6-Year Drought (1929-1934)[3]**
2009 Report[4]	2,483 (60%)	302 (7%)	1,496 (36%)	1,402 (34%)	1,444 (35%)	1,398 (34%)
2011 Report	2,524 (61%)	377 (9%)	1,571 (38%)	1,455 (35%)	1,461 (35%)	1,433 (35%)
2013 Report	2,553 (62%)	495 (12%)	1,269 (31%)	1,263 (31%)	1,176 (28%)	1,260 (30%)
CLWA Table A Delivery (2013)[5]	59,024	11,424	28,560	28,560	28,560	28,560

(1) Maximum Table A Amount is 4,133 thousand acre-feet/year (taf/yr).

(2) Droughts are analyzed using the historical drought-period precipitation and runoff patterns from 1922-2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling.

(3) For reference, the worst multi-year drought on record was the 1929-1934 drought, although the brief drought of 1976-1977 was more intensely dry.

(4) The 2009 reliability report results are shown here because that was the report utilized in the most current 2010 UWMP for the Santa Clarita Valley.

(5) Rows 1-3 above reflect statewide maximum Table A Amounts expressed in thousand acre-feet (taf/yr) quantities. In contrast, this Row 4 expresses CLWA's maximum Table A Amount in acre-feet (af) quantities.

Source: 2009, 2011, 2013 Delivery Reliability Reports.

DWR Analysis Results for SWP Supplies Under Future (2033) Conditions. The draft 2013 Delivery Reliability Report includes the information presented in **Table 3**, Average and Dry-Period SWP Table A Deliveries Under Future Conditions and Resulting Deliveries to CLWA, which provides estimated average and dry-period Table A deliveries for future conditions (2033) and compares those figures to those in the 2009, 2011, and 2013 Delivery Reliability Reports.

As shown on **Table 3**, under updated future conditions (2033), average SWP delivery amounts may decrease from 60% to 58% of the maximum Table A Amount as compared to earlier estimates in the 2009, 2011, and 2013 Delivery Reliability Reports. In addition, in single-dry years, SWP delivery amounts remain the same (11%) in the 2009-2013 reports. Also, in multiple-dry periods, the 2013 report shows that SWP delivery amounts would decrease in reliability from 24% to 31% of the maximum Table A Amount as compared to earlier estimates from the 2009 and 2011 reports (30% to 38%).

Also, as shown on **Table 3**, applying the draft 2013 Delivery Reliability Report SWP Table A delivery percentages under future conditions to CLWA's Table A Amount of 95,200 af, results in approximately 55,216 af under average year conditions, 10,472 af under single-dry year conditions, and 26,656 af (on average) under multiple-dry year conditions.

Table 3
Average and Dry-Period SWP Table A Deliveries
Under Future Conditions and Resulting Deliveries to CLWA

	SWP Table A Delivery (Percent of Maximum Table A Amount)[1]					
	Long-Term Average	**Single Dry Year (1977)**	**2-Year Drought (1976-1977)[2]**	**4-Year Drought (1931-1934)**	**6-Year Drought (1987-1992)**	**6-Year Drought (1929-1934)[3]**
2009 Report[4]	2,487 (60%)	458 (11%)	1,570 (38%)	1,431 (35%)	1,308 (32%)	1,480 (36%)
2011 Report	2,465 (60%)	441 (11%)	1,457 (35%)	1,401 (34%)	1,226 (30%)	1,365 (33%)
2013 Report	2,400 (58%)	453 (11%)	978 (24%)[5]	1,263 (31%)	1,055 (26%)	1,251 (30%)
CLWA Table A Delivery (2013)[6]	55,216	10,472	26,656	26,656	26,656	26,656

(1) Maximum Table A Amount is 4,133 thousand acre-feet/year (taf/yr).

(2) Droughts are analyzed using the historical drought-period precipitation and runoff patterns from 1922-2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling.

(3) For reference, the worst multi-year drought on record was the 1929-1934 drought, although the brief drought of 1976-1977 was more intensely dry.

(4) The 2009 Delivery Reliability Report results are shown here because that was the report utilized in the most current 2010 UWMP for the Santa Clarita Valley.

(5) This drought period shows much lower Table A deliveries in the 2013 Delivery Reliability Report than in the 2009 and 2011 reports, because of modeling refinements and DWR's reclassification of 1975 as a wet year.

(6) Rows 1-3 above reflect statewide maximum Table A Amounts expressed in thousand acre-feet (taf/yr) quantities. In contrast, this Row 4 expresses CLWA's maximum Table A Amount in acre-feet (af) quantities.

Source: 2009, 2011, and 2013 Delivery Reliability Reports.

2.2 Effect of Monterey Plus EIR Litigation on SWP/CLWA Water Supplies

CLWA's water allocations from the SWP are governed by annual hydrology and the terms of the long-term water supply contract that CLWA's predecessor entered with DWR in 1963. Historically, DWR and the SWP contractors periodically amended the SWP contracts to adjust to changing conditions and new circumstances that were not envisioned when the contracts were executed. In 1994, DWR and the SWP contractors (including CLWA) engaged in mediated negotiations in a broader attempt to update management of the SWP and settle water allocations disputes arising under the long-term SWP water supply contracts that were executed in the 1960s

The negotiations grew into an omnibus revision to the contracts known as the "Monterey Amendment." The Monterey Amendment had several principle objectives: (1) resolve conflicts and disputes among SWP contractors regarding water allocations; (2) restructure and clarify SWP water allocation procedures and deliveries in times of shortage and surplus; (3) reduce financial pressures on agricultural contractors; (4) adjust the SWP's financial rate structure to more closely match revenues with needs; (5) facilitate water management practices and water transfers that improve reliability and flexibility of SWP water supplies in conjunction with contractors' other local supplies; (6) resolve legal and institutional issues related to groundwater storage of SWP water; and (7) transfer 20,000 acres in Kern County known as the "Kern Fan Element" to local water agencies to facilitate development of a locally operated groundwater bank.

After execution of the Monterey Amendment by DWR and a majority of the SWP contractors (including CLWA), the environmental group Planning and Conservation League filed suit in December of 1995 seeking to invalidate the Monterey Amendment and its environmental impact report (EIR) prepared under the California Environmental Quality Act (CEQA). That lawsuit ultimately ended in a court-approved settlement agreement in 2003. The settlement provided, among other things, that DWR would prepare a new EIR for the Monterey Amendment, the previously approved and executed Monterey Amendments would remain in effect for 27 SWP contractors, and DWR would implement the Monterey Amendment in operating the SWP while it prepared the new EIR.

On February 1, 2010, DWR certified the new EIR. On May 4, 2010 DWR's Director certified the EIR and decided to continue implementing the Monterey Amendment. On June 3, 2010, two petitioner groups filed separate lawsuits seeking to invalidate the Monterey Amendment and the related transfer of the Kern Fan Element based on alleged violation of CEQA.[31] The trial court held a bifurcated trial that culminated in a December 2012 finding that petitioners' reverse validation actions seeking to invalidate the Monterey Amendment and Kern Fan Element transfer were barred by the statute of limitations.

The trial court proceeded to hear briefing on the remaining CEQA claims and issued a ruling in January 2014 finding that DWR's new EIR for the Monterey Amendment complied with CEQA in all respects except for its analysis of the future impacts of the operations of the local Kern Water Bank that was developed by local water agencies on the Kern Fan Element land transferred as part of the Monterey Amendment. In October 2014, the trial court issued its ruling addressing the remedy under CEQA.

In terms of the remedy, the trial court found that the use and operation of the Kern Water Bank was severable from the remainder of the Monterey Amendment project; that severance will not prejudice complete and full compliance with CEQA; and that the remainder of the Monterey

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[31] *Central Delta Water Agency et al. v. Department of Water Resources et al.* (Sacramento Superior Court Case No. 34-2010-80000561), *Rosedale-Rio Bravo Water Storage District et al. v. Department of Water Resources* (Sacramento Superior Court Case No. 34-2010-80000703).

Amendment project is in compliance with CEQA. Further, the trial court found that the prior project approvals should remain in place pending preparation of an adequate EIR and that DWR (as the lead agency) and the Kern Water Bank Authority (as the responsible agency) must make a new determination whether to continue the use and operation of the Kern Water Bank, after compliance with CEQA. The trial court did not enjoin the use and operation of the Kern Water Bank pending CEQA compliance. Nonetheless, the trial court made clear that the scope of the additional environmental review should include all potential groundwater, water quality, and other impacts associated with the operation of the Kern Water Bank.

This remedy will not affect the amount of water CLWA annually receives from the SWP. This conclusion is based on several factors. First, the trial court ruling does not invalidate the Monterey Amendment project, nor limit or restrict its implementation in terms of SWP operations or water supply deliveries — all of which is consistent with the previous *PCL* litigation (*Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892), which found much more serious CEQA violations (*i.e.*, wrong lead agency), but did not invalidate the Monterey Amendment project, nor limit or restrict SWP operations or water supply deliveries. Also, the December 2012 court ruling barring petitioners' action to invalidate the Monterey Amendment project and Kern Fan Element property transfer through a reverse validation action confirms that neither DWR nor the SWP contractors will be required to set aside their approval of the Monterey Amendment project. The trial court's remedy is consistent with the prior December 2012 court ruling.

Moreover, the trial court's remedy does not enjoin the Kern Water Bank operations while the additional CEQA analysis is being performed; therefore, SWP operations and water deliveries to CLWA would be unaffected, because SWP operations are independent from operations of the separate Kern Water Bank facilities by the local entity that owns and operates it. Further, the trial court's order requiring additional environmental review of potential groundwater, water quality, and other impacts associated with the operation of the Kern Water Bank will not affect the water supplies needed for the Entrada South project because as shown in this WSA, the Entrada South project does not rely on Kern Water Bank operations; instead, the project's *potable* water supplies will be provided by VWC, which serves a mix of imported water and local groundwater within the Santa Clarita Valley groundwater basin, and the project's non-potable water supplies will be provided by VWC through local water reclamation plant(s) in the Santa Clarita Valley.

2.3 Dry-Year Supplies

As stated in the 2010 UWMP, with recent developments in conjunctive use and groundwater banking, significant opportunities exist to improve water supply reliability for CLWA. Conjunctive use is the coordinated operation of multiple water supplies to achieve improved supply reliability.

For the Santa Clarita Valley, groundwater banking programs involve storing available SWP and other imported water supplies during wet years in groundwater basins. Water is stored either

directly by surface spreading or injection, or indirectly by supplying surface water to farmers for their use in lieu of their intended groundwater pumping. During water shortages, the stored water is pumped out and conveyed through the California Aqueduct to CLWA as the banking partner, or used by the farmers in exchange for their surface water allocations, which are delivered to CLWA as the banking partner through the California Aqueduct.

CLWA has entered into four groundwater banking and water exchange programs with, in aggregate, more than 150,000 af of recoverable water outside the local groundwater basin. The first component of CLWA's groundwater banking program is the result of two agreements between CLWA and Semitropic Water Storage District whereby, over the terms of the two agreements, CLWA can withdraw up to 45,920 af of SWP Table A water that it stored in Semitropic to meet Santa Clarita Valley demands when needed in dry years (45,920 af is the net recoverable balance after originally banking 24,000 af in 2002 and 32,522 af in 2003, and withdrawing 4,950 af in 2009 for delivery in 2009 and 2010). In April 2011, Semitropic and CLWA extended the original agreements by 10 years to 2022/2024.

The second component of CLWA's groundwater banking program is with Rosedale-Rio Bravo in Kern County. This program, the Rosedale-Rio Bravo Water Storage District Water Banking and Exchange Program, has a recoverable total of 94,271 af in storage (including 1,006 af delivered in 2011, less contractual losses).

The third and fourth components of CLWA's groundwater program are the two-for-one banking plans that CLWA initiated with Rosedale-Rio Bravo and West Kern Water District in 2011 that now have a total of 9,973 af of recoverable water.

In addition, in 2009, CLWA entered into an agreement with DWR to participate in the Yuba Water Accord program (Yuba Water Accord). This non-SWP water supply is available to CLWA in critically dry years as a result of DWR agreements with Yuba County Water Agency and the U.S. Bureau of Reclamation relating to settlement of water rights issues on the Lower Yuba River in northern California. Additional supplies may be available in wetter years. The quantity of water varies depending on hydrology, and the extent of participation by other SWP contractors. CLWA currently projects receiving up to 1,277 afy pursuant to the Yuba Water Accord.

These groundwater banking programs allow CLWA to firm up the imported water component in the Santa Clarita Valley by storing surplus SWP and other water in wet years in groundwater basins outside the Santa Clarita Valley. This allows recovery and importation of that water as needed in dry years to maintain a greater overall amount of imported water to be used conjunctively with local groundwater, further supporting the sustainable use of local groundwater at the rates in the groundwater operating plan.

2.4 Recycled Water

Since 2003, existing local supplies have been augmented by the initiation of recycled water deliveries from CLWA's recycled water program. CLWA currently has a contract with the SCVSD for 1,700 afy of recycled water. Recycled water is available from two WRPs operated by SCVSD. This supply is available in an average/normal year, a single-dry year, and in each year of a multiple-dry year period.

2.4.1 Recycled Water Master Plan

Recycled water is available from two existing WRPs operated by the SCVSD. The two plants (Saugus WRP and Valencia WRP) are situated within the CLWA service area.

The Saugus WRP has a current treatment capacity of 6.5 mgd (7,280 afy), and no future expansion is possible due to space limitations. The Valencia WRP has a current capacity of 21.6 mgd (24,192 afy). To accommodate long-term growth, SCVSD has planned a 6 mgd expansion of the Valencia plant as reflected in SCVSD's 2015 Santa Clarita Valley Joint Sewerage System Facilities Plan and certified EIR. With this expansion, the capacity of the Valencia WRP would be increased to 27.6 mgd (30,912 afy), which SCVSD expects to be needed by 2035. Thus, the total planned treatment capacity for both existing WRPs is 34.1 mgd (38,197 afy).

These existing, local treated wastewater resources can be reused in the form of recycled water. Recycled water enhances reliability by providing an additional source of supply and allows for more efficient utilization of groundwater and imported water supplies in the Santa Clarita Valley.

Based on the Recycled Water Master Plan, reuse of the tertiary treated water from these two plants is anticipated to be 15.5 mgd (17,400 afy) by year 2030. Since the planning horizon for the 2010 UWMP extends to 2050, supplies in the Recycled Plan projected to be available by year 2030 have been assumed to be available through 2050 and beyond.

In 2002, CLWA completed an updated Draft Recycled Water Master Plan. CLWA's program is expected to ultimately recycle up to 17,400 af of treated (tertiary) wastewater. This is in addition to an expected recycled water use of approximately 5,400 afy within the Newhall Ranch Specific Plan from the Newhall WRP.

In 2007, CLWA and the retail purveyors completed CEQA analysis for CLWA's 2002 updated Recycled Water Master Plan. This analysis consisted of a Program EIR, covering the various options for a recycled water system as outlined in the Master Plan. The CLWA Board certified the Program EIR in March 2007.

In summary, CLWA previously completed Phase I of its Recycled Water Master Plan, and this initial phase will ultimately deliver 1,700 afy of recycled water. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips. In 2011, recycled water deliveries were 373 af, generally consistent with recycled water deliveries that have ranged between about 300 and nearly 500 afy over the past 9 years.

In addition, CLWA and the retail purveyors are preparing the design of the second phase of the Recycled Water Master Plan (Phase IIA) that will take water from the Saugus WRP and distribute it to identified users to the north, across the Santa Clara River and then to the west and the east, which will include service to Santa Clarita Central Park. The environmental documentation for this phase was completed in July 2011.

There is also a new phase of the recycled water system (Phase IIC) in design that would extend the existing system southward from the intersection of Valencia Boulevard and The Old Road, south along Rockwell Canyon Road to the intersection of Orchard Village Road and Lyons Avenue, serving irrigation customers along its proposed alignment (Phase IIB is located in another part of the Santa Clarita Valley). Collectively, these phases will have design capacity to increase recycled water deliveries by about 1,500 afy.

As stated in the 2010 UWMP, CLWA's recycled water program, along with the Newhall Ranch WRP, is expected to recycle up to 22,800 af of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping, and other non-potable uses.

2.4.2 Recycled Water Supply and Demand

The use of wastewater effluent is limited by various state water laws, codes, and court decisions. These regulatory limitations are described in greater detail in CLWA's Recycled Water Master Plan.[32]

CLWA is currently approved to use 1,700 afy of recycled water. The SCVSD will need to assess the issues of water rights and protection of biological resources relative to sections 1210 and 1211 of the Water Code as CLWA's recycled water program expands.

To determine potential recycled water users, a cost of service analysis was conducted. As explained in the 2010 UWMP, an initial list of potential recycled water users was reduced by evaluating the potential users that would be most expensive to serve until potential users totaled approximately 17,400 af. The unit cost to serve each user was calculated using the capital costs for pipelines, reservoirs, and pump stations, as well as operational costs for pumping. The areas retained for recycled water service have costs ranging from $120 to $5,000 per afy; however, only two of the proposed phases in the Recycled Water Master Plan had costs above $1,000 per afy. Areas eliminated from service had costs as high as $13,000 per afy. The resulting proposed recycled water service area encompasses a large portion of CLWA's western service area.

The total potential annual recycled water demand identified in the Recycled Water Master Plan that is cost effective to serve, including Newhall Ranch, is approximately 22,800 afy. Of this total, 21,300 afy is projected use by purveyor customers. Implementation of the recycled water system is expected to occur over the next 40 years.

[32] The 2010 UWMP includes more information regarding the Recycled Water Master Plan, including its implementation plan (see Section 4, Recycled Water).

Based in part on these cost considerations, the 2010 UWMP states that potential demand for recycled water is equal to supplies (see Table 4-5 in the 2010 UWMP).

2.5 Groundwater

2.5.1 Overview And Applicable Plans And Studies

As previously noted, VWC provides water service with a mix of about 50% groundwater and 50% imported water (with some recycled water) to residential and commercial land uses in portions of the Santa Clarita Valley in northern Los Angeles County. CLWA performs a wholesale function, contracting for water supplies from the SWP and other imported sources, treating those supplies in its Rio Vista and Earl Schmidt Treatment Plants, and delivering the supplies to the four retail purveyors for service to end-use customers. VWC's own water system includes 18 wells in the Alluvial aquifer, 5 wells in the Saugus Formation, about 368 miles of mainline, and 7 connections, called turnouts, to CLWA's system by which VWC receives SWP water purchased from CLWA.

Historically, the primary source of water supplies for the Santa Clarita Valley was groundwater pumped from a two-aquifer system — the Alluvium (also referred to as the Alluvial aquifer) and Saugus Formation. The Alluvium generally underlies the Santa Clara River and its tributary drainages, and the Saugus Formation underlies practically the entire upper Santa Clara River area. This groundwater basin, generally beneath the Santa Clarita Valley, is identified in DWR's Bulletin 118 as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07). As discussed below, since 1980, the Santa Clarita Valley groundwater supplies have been supplemented by importing SWP supplies to serve demand in the Santa Clarita Valley.

Groundwater Basin. The basin area encompasses about 654 square miles. The Santa Clara River and its tributary drainages flow intermittently within the basin area. The principal tributaries in the Santa Clarita Valley are Castaic Creek, San Francisquito Creek, Bouquet Creek, and the South Fork of the Santa Clara River. In addition to tributary inflow, the Santa Clara River receives treated wastewater discharge from the Saugus and Valencia WRPs, which are operated by the Santa Clarita Valley Sanitation District of Los Angeles County (SCVSD).

Within an aquifer, the amount of groundwater in storage is the total volume of water that exists in underground storage at a particular time and that could become readily available for extraction by wells.[33] The Alluvium generally underlies the Santa Clara River and its tributary drainages to maximum depths of about 200 feet. The Alluvium and its tributary drainages have a total area of approximately 16,410 acres (or about 25.6 square miles).[34]

Groundwater within the Alluvium occurs under unconfined (water table) conditions. Therefore, the amount of groundwater in storage is constantly changing and is strongly influenced by local

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[33] Slade 2002.

[34] Slade 1986.

rainfall and recharge (highly variable factors in southern California).[35] The amount of groundwater in storage within the Alluvium has varied considerably over the past approximate 60 to 70 years as the local climate has experienced periods of higher than average rainfall (wet years) and lower than average rainfall (dry years).[36]

For example, in April 1945, at the end of a 10- to 11-year period of above-average rainfall, groundwater elevations were at their highest recorded levels and the amount of groundwater in storage was calculated to be approximately 201,000 af.[37] Conversely, in November 1965, at the end of a severe 21-year dry period, groundwater levels in the Alluvium were at their lowest recorded levels and the amount of groundwater in storage in the Alluvium was calculated at approximately 107,000 af.[38] In the fall of 1985, groundwater in storage was approximately 176,400 af.[39] Groundwater in storage within the Alluvium in spring of 2000 (a period for which widespread water level data were available) was calculated at about 161,000 af.[40] The above data represents the best available information concerning the amount of groundwater in storage within the Alluvium.[41]

The Saugus Formation underlies a large portion of the Santa Clara River Valley area of Los Angeles County, to depths from approximately 1,500 feet to about 5,000 feet. The Saugus Formation's total surface area is approximately 37,390 acres (or about 58.42 square miles).[42] The amount of groundwater in storage within the Saugus Formation is approximately 1.65 million af.[43] This data represents the best available information concerning the amount of groundwater in storage within the Saugus Formation.

Groundwater in both the Alluvium and Saugus Formation is recharged from several sources. The Alluvium is recharged chiefly by infiltration of runoff waters in the Santa Clara River and its tributaries, with additional natural recharge from percolation of rainfall to the Valley floor and subsurface inflow. Additional recharge is from percolation of excess irrigation water applied to urban landscaping and of reclaimed water discharged into the Santa Clara River from upstream WRPs.

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35 Slade 2002.

36 Slade 2002.

37 Slade 2002; Slade 1986, Table 8.

38 Slade 2002; Slade 1986, Table 8.

39 Slade 2002; Slade 1986, Table 8.

40 Slade 2002; Table 4.4.

41 DWR Bulletin 118.

42 Slade 1988.

43 Slade 2002.

Recharge to the Saugus Formation is primarily from infiltration of rainfall on the exposed formation and percolation of water from the overlying Alluvium.[44] Discharge from the aquifer system is through pumping for municipal supply and agricultural irrigation purposes and outflow to the Santa Clara River in the western portion of the basin.[45]

Basin Yield. The groundwater basin's yield is based on the concept that pumping can vary from year-to-year within operational ranges that are based on long-term historic pumping records and groundwater modeling data. This operational yield allows for increased groundwater use in dry periods and increased recharge during locally wet periods, thereby collectively assuring that the basin is adequately replenished through various wet/dry cycles.

The reports supporting the basin yield were completed by Richard C. Slade, a consulting engineer with expertise in groundwater hydrology. In 2002, Slade completed the 2001 Update report,[46] which updated the analysis of the hydrogeologic conditions of the Alluvial and Saugus Formation aquifer systems from his earlier reports.[47] The 2001 Update report included the following findings relative to groundwater supply:

(a) Analysis of historical groundwater levels and production indicates that there have been no conditions that would be illustrative of groundwater overdraft;

(b) The utilization of operational yield (as opposed to perennial yield) as a basis for managing groundwater production would be more applicable in this basin to reflect the fluctuating utilization of groundwater in conjunction with imported SWP water;

(c) The operational yield of the Alluvium would typically be 30,000 to 40,000 afy for wet and normal rainfall years, with an expected reduction into the range of 30,000 to 35,000 afy in dry years; and

(d) The operational yield of the Saugus Formation would typically be in the range of 7,500 to 15,000 afy on a long-term basis, with possible short-term increases during dry periods into a range of 15,000 to 25,000 afy, and to 35,000 afy if dry conditions continue.

Groundwater Operating Plan. The groundwater basin is unadjudicated, meaning that neither VWC nor the other purveyors have adjudicated water rights that dictate their water supply. The total supply available to all purveyors in the basin and the ability of VWC to access those supplies determines the amount of water available to VWC to meet its long-term supply needs. However, in practice, as discussed below, VWC accesses the available groundwater supplies, in accordance with a groundwater operating plan developed by VWC, CLWA, and other retail

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[44] Slade 2002; DWR Bulletin 118.

[45] Slade 2002; DWR Bulletin 118.

[46] Slade 2002.

[47] Slade 1986 (Alluvium); Slade 1988 (Saugus Formation).

water purveyors in the Santa Clarita Valley, and complemented by analyses based on a numerical groundwater flow model of the basin.

The groundwater operating plan was developed by CLWA and the retail purveyors over the past 15 years to meet water demands (municipal, agricultural, and small domestic), while maintaining the basin in a sustainable condition (i.e., no long-term depletion of groundwater or interrelated surface water). As stated, the groundwater operating plan is based on the concept that pumping can vary from year-to-year to allow increased groundwater use in dry periods and increased recharge during wet periods. This assures that the groundwater basin is adequately replenished through various wet/dry cycles. The operating yield concept has been quantified as ranges of annual pumping volumes to capture year-to-year pumping fluctuations in response to both hydrologic conditions and customer demand.

The Santa Clarita Valley's groundwater operating plan is summarized below in **Table 4**, Groundwater Operating Plan for the Santa Clarita Valley. The plan addresses both the Alluvium and Saugus Formation.

Table 4
Groundwater Operating Plan for the Santa Clarita Valley

Aquifer	Groundwater Production (af)			
	Normal Years	**Dry Year 1**	**Dry Year 2**	**Dry Year 3**
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

Source: 2009 Basin Yield Update, 2010 UWMP, 2013 Santa Clarita Valley Water Report.

The operating plan for the Alluvial aquifer involves pumping in a given year, based on local hydrologic conditions in the eastern Santa Clara River watershed. Pumping ranges between 30,000 and 40,000 afy during normal/average and above-normal rainfall years. However, due to hydrogeologic constraints in the eastern part of the basin, pumping is reduced to between 30,000 and 35,000 afy after the first dry year and the multiple locally-dry years thereafter.

The operating plan for the Saugus Formation involves pumping in a given year and is tied directly to the availability of other water supplies, particularly from the SWP. During normal/average year conditions within the SWP system, Saugus pumping ranges between 7,500 and 15,000 afy. Planned dry-year pumping ranges between 15,000 and 25,000 afy during a drought year and can increase to between 21,000 and 25,000 afy if SWP deliveries are reduced for two consecutive years and between 21,000 and 35,000 afy if SWP deliveries are reduced for three consecutive years. Such pumping is followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 afy, to further enhance the effectiveness of natural recharge processes that cause groundwater levels and storage volumes to recover after the higher pumping during dry years.

The 2010 UWMP provided historical and projected groundwater pumping broken down by retail water purveyor. The 2010 UWMP is the applicable and most current water management plan for the Santa Clarita Valley. The plan is updated every five years. The next UWMP update must be approved by December 2015; until then, however, the 2010 UWMP constitutes the best available water management planning data for the Santa Clarita Valley. Please refer to **Table 5**, Historical Groundwater Production, and **Table 6**, Projected Groundwater Production (Normal Year), for pertinent groundwater usage data based on the 2010 UWMP.

Table 5
Historical Groundwater Production[1]

Basin Name	Groundwater Pumped (af)				
	2005	2006	2007	2008	2009
Santa Clara River Valley East Subbasin					
SCWD	12,408	13,156	10,686	11,878	10,077
Alluvium	12,408	13,156	10,686	11,878	10,077
Saugus Formation	0	0	0	0	0
District #36	343	0	0	0	0
Alluvium	343	0	0	0	0
Saugus Formation	0	0	0	0	0
NCWD	4,824	5,572	5,497	5,912	5,728
Alluvium	1,389	2,149	1,806	1,717	1,860
Saugus Formation	3,435	3,423	3,691	4,195	3,868
VWC	14,741	14,333	15,570	16,094	15,295
Alluvium	12,228	11,884	13,140	14,324	12,459
Saugus Formation	2,513	2,449	2,367	1,770	2,836
Total Purveyor	**32,316**	**33,061**	**31,690**	**33,884**	**31,100**
Alluvium	**26,368**	**27,189**	**25,632**	**27,919**	**24,396**
Saugus Formation	**5,948**	**5,872**	**6,058**	**5,965**	**6,704**
Agricultural and Other[2]	12,785	17,312	14,768	14,750	16,564
Alluvium	12,280	15,872	13,141	13,797	15,590
Saugus Formation	505	1,440	1,627	953	974
Total Basin	**45,101**	**50,373**	**46,458**	**48,634**	**47,664**
Alluvium	**38,648**	**43,061**	**38,773**	**41,716**	**39,986**
Saugus Formation	**6,453**	**7,312**	**7,685**	**6,918**	**7,678**
Groundwater Fraction of Total Municipal Water Supply	**46%**	**45%**	**41%**	**45%**	**44%**

Notes:
(1) From 2009 Santa Clarita Valley Water Report (May 2010).
(2) Includes agricultural and other small private well pumping.
Source: 2010 UWMP, Table 3-6

Table 6
Projected Groundwater Production (Normal Year)[1]

Basin Name	Groundwater Pumping (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
Santa Clara River Valley								
East Subbasin								
District #36								
Alluvium	0	0	0	0	0	0	0	0
Saugus Formation	500	500	500	500	500	500	500	500
NCWD								
Alluvium	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
Saugus Formation	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400
SCWD								
Alluvium	10,500	10,500	10,500	11,500	11,500	11,500	11,500	11,500
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
VWC								
Alluvium	11,675	12,675	13,675	14,675	15,675	16,675	17,675	18,675
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
Total Purveyor								
Alluvium	**24,000**	**25,000**	**26,000**	**28,000**	**29,000**	**30,000**	**31,000**	**32,000**
Saugus Formation	**10,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**
Agricultural and Other[2]								
Alluvium	14,500	13,500	12,500	10,100	9,100	8,100	7,100	6,600
Saugus Formation	900	900	900	900	900	900	900	900
Total Basin								
Alluvium	**38,500**	**38,500**	**38,500**	**38,100**	**38,100**	**38,100**	**38,100**	**38,600**
Saugus Formation	**11,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**

Notes:

[1] Existing and planned pumping by individual purveyors is shown in Appendix C of the 2010 UWMP. The distribution of pumping does not represent a formal allocation of water resources among the retail purveyors. To ensure sustainability, the purveyors have committed to the groundwater operating plan as described in the 2010 UWMP, and as reported annually in the Santa Clarita Valley water reports.

[2] Agricultural and other small private well pumping, including Newhall, Robinson Ranch Golf Course, Wayside Honor Rancho, Valencia Golf Course, and proposed Palmer Golf Course.

Source: 2010 UWMP, Table 3-7.

Groundwater Management Plan. In 2001, as part of legislation authorizing CLWA to provide retail water service to individual municipal customers, Assembly Bill (AB) 134 included a requirement that CLWA prepare a groundwater management plan in accordance with the provisions of Water Code Section 10753.

CLWA adopted the Groundwater Management Plan on December 10, 2003. This Plan contains the following four management objectives, or goals, for the basin: (1) development of an integrated surface water, groundwater and recycled water supply to meet existing and projected demands for municipal, agricultural and other water uses; (2) assessment of Basin conditions to determine a range of operational yield values that use local groundwater conjunctively with supplemental SWP supplies and recycled water to avoid groundwater overdraft; (3) preservation of groundwater quality, and active characterization and resolution of groundwater contamination problems, including perchlorate; and (4) preservation of interrelated surface water resources, which includes managing groundwater in a manner that does not adversely impact surface and groundwater discharges or quality to downstream basins.

Prior to preparation and adoption of the Groundwater Management Plan, a local Memorandum of Understanding (MOU) process among CLWA, the purveyors, and United Water Conservation District (UWCD) in neighboring Ventura County had produced the beginning of local groundwater management, now embodied in the Groundwater Management Plan. In 2001, those agencies prepared and executed the MOU. The MOU is a collaborative and integrated approach to several of the aspects of water resource management included in the Groundwater Management Plan. UWCD manages surface water and groundwater resources in seven groundwater basins, all located in Ventura County, downstream of the Basin. As a result of the MOU, the cooperating agencies have undertaken the following measures: (1) integrated their database management efforts; (2) developed and utilized a numerical groundwater flow model for analysis of groundwater basin yield and containment of groundwater contamination; and (3) continued to monitor and report on the status of basin conditions, as well as on geologic and hydrologic aspects of the overall stream-aquifer system.

The adopted Groundwater Management Plan includes 14 elements intended to accomplish the basin management objectives listed above. In summary, the plan elements are:

- Monitoring of groundwater levels, quality, production and subsidence;
- Monitoring and management of surface water flows and quality;
- Determination of basin yield and avoidance of overdraft;
- Development of regular and dry-year emergency water supply;
- Continuation of conjunctive use operations;
- Long-term salinity management;
- Integration of recycled water;
- Identification and mitigation of soil and groundwater contamination, including involvement with other local agencies in investigation, cleanup, and closure;
- Development and continuation of local, state and federal agency relationships;
- Groundwater management reports;
- Continuation of public education and water conservation programs;

- Identification and management of recharge areas and wellhead protection areas;
- Identification of well construction, abandonment, and destruction policies; and
- Provisions to update the groundwater management plan.

Work on a number of the plan elements had been on-going for some time prior to its adoption. This work continues on an on-going basis. An important aspect of this work was completion of the 2005 Basin Yield Report. The primary determinations made in that report are that: (1) both the Alluvial aquifer and the Saugus Formation are sustainable sources at the operational plan yields stated in the prior 2005 UWMP over the next 25 years; (2) the yields are not overstated and will not deplete or "dry up" the groundwater basin; and (3) there is no need to reduce the yields shown in the prior 2005 UWMP. Additionally, the 2005 Basin Yield Report concluded that neither the Alluvial aquifer nor the Saugus Formation is in an overdraft condition, or projected to become overdrafted.

Basin Yield Update. In 2004, CLWA and the purveyors assisted in developing a numerical groundwater flow model for use in analyzing the response of the groundwater basin to long-term operation at the operational yields used in the earlier 2000 UWMP. That groundwater flow model was used in 2005 to analyze the sustainability of groundwater supplies in both the Alluvium and the Saugus Formation, utilizing a long-term (78 year) hydrologic period. The model used this period to examine groundwater basin response to variations in groundwater pumping. The pumping variations used in the modeling were based on the CLWA/purveyor groundwater operating plan.

Utilizing the pumping ranges reflected in the groundwater operating plan, the model projections of groundwater levels, groundwater storage, and surface water flows show the basin to respond in a long-term sustainable manner, with no chronic depletion of groundwater levels, storage, or stream flows.

The analysis of groundwater sustainability was summarized in the 2005 Basin Yield Report, which included the following findings:

(a) The groundwater basin historically has been, and continues to be, in good operating condition (and not in a state of overdraft), based on the best available data.

(b) The CLWA/purveyor groundwater operating plan is sustainable over varying hydrologic conditions because it is feasible to intermittently exceed a long-term average yield for one or more years without creating long-term adverse impacts to the groundwater aquifer system or the Santa Clara River.

(c) The CLWA/purveyor groundwater operating plan for the Alluvium and the Saugus Formation can be used for long-term water supply purposes. In particular, although increased pumping from the Saugus Formation during dry periods can be expected to cause short-term declines in groundwater levels, it is not projected to cause permanent declines in groundwater discharges or stream flow and Saugus

groundwater levels can be expected to recover to pre-drought conditions when pumping is reduced in subsequent wet to normal years.

(d) The strategy around which the CLWA/purveyor groundwater operating plan was designed is viable on a long-term basis (*i.e.*, maximize the use of the Alluvial aquifer and imported water during years of average or above-average availability of these supplies, and limit use of the Saugus Formation during these periods, then temporarily increase Saugus pumping during years when SWP supplies are significantly reduced because of dry-year conditions).

(e) The historical observations of basin conditions and the model simulations together support the historical and ongoing confidence that groundwater can continue to be a sustainable source of water supply under the CLWA/purveyor groundwater operating plan.

In April 2009, the purveyors in Santa Clarita Valley determined that an updated analysis was needed to further assess groundwater development potential and possible augmentation of the CLWA/purveyor groundwater operating plan, partly in preparation for the 2010 UWMP, and partly in response to uncertainties associated with future SWP delivery reliability. As a result, the 2009 Basin Yield Update was completed.

The primary objective of the 2009 Basin Yield Update was to evaluate the planned utilization of groundwater by the Santa Clarita Valley purveyors, while considering potential impacts on traditional supplemental water supplies from the SWP, and recognizing ongoing pumping by others for agricultural and other private water supply. This objective also included the sustainability of the groundwater resources and the physical ability to extract groundwater at desired rates. Another objective of the 2009 Basin Yield Update was to investigate and describe potential impacts of expected climate change on the groundwater basin and its yield.

The 2009 Basin Yield Update analyzed, with the numerical groundwater flow model, two groundwater operating plans: (a) 2008 Operating Plan to reflect currently envisioned pumping rates and distribution throughout the Valley, including fluctuations through wet/normal and dry years, to achieve a desired amount of water supply that, in combination with anticipated supplemental water supplies, can meet existing and projected water demands in the Valley; and (b) potential Operating Plan that envisions potentially increased utilization of groundwater during both wet/normal and dry years.

The 2009 Basin Yield Update determined that the 2008 Operating Plan would not cause detrimental short- or long-term effects to the groundwater and surface water resources in the Valley and, therefore, is sustainable. Consistent with actual operating experience and empirical observations of historical basin response to groundwater pumping, the modeling analysis indicated that the 2008 Operating Plan would be expected to have local difficulty in achieving the amount of Alluvial pumping called for in the eastern end of the basin during locally dry periods. This condition is particularly evident if several decades of predominantly below-normal rainfall years were to occur in the future such as occurred during much of the five decades from the mid-1920s through the mid-1970s. In other words, while the basin as a whole can sustain the

pumping encompassed in the 2008 Operating Plan, local conditions in the Alluvium in the eastern end of the basin can be expected to repeat historical groundwater level declines during dry periods, necessitating a reduction in desired Alluvial aquifer pumping due to decreased well yield and associated actual pumping capacity. The modeling analysis also indicated that reductions in pumping from the Alluvial aquifer can be made up by redistributing pumping in an equivalent amount in other parts of the basin without disrupting basin-wide sustainability or local pumping capacity. For the Saugus Formation, the modeling analysis indicated that the aquifer can sustain the pumping encompassed in the 2008 Operating Plan.

Model simulations were conducted to validate Alluvial aquifer pumping redistribution assumptions. Model simulations of the 2008 Operating Plan, with pumping redistribution, indicate that westerly redistribution of 1,600 afy of Alluvial pumping from the eastern end of the basin would help, but not eliminate, the desired pumping regime. The model simulation also showed that the residual unachievable pumping in the east end of the basin, about 4,500 afy, could be redistributed to other areas of the basin with minimal impact on groundwater levels. In this case, total Alluvial pumping in the basin could remain near the upper end of the 2008 Operating Plan range of 30,000 to 35,000 afy. Conversely, absent any additional efforts to redistribute pumping, the total Alluvial pumping capacity during extended dry periods would likely fall toward the lower end of the 2008 Operating Plan range (toward 30,000 afy).

In summary, based on the combination of historical experience and modeled basin conditions, the groundwater operating plan for the local groundwater supply is to operate Alluvial pumping in the 30,000 to 40,000 afy range through average/normal water year conditions. In recognition of local conditions that reduce well yields in the eastern end of the Alluvium during dry conditions, the groundwater operating plan for the Alluvium includes reducing pumping into the range of 30,000 to 35,000 afy in dry periods. The operating plan for the Saugus Formation is primarily to retain its significant storage for intermittent dry year supply; thus, the long-term operating plan is to retain pumping in the 7,500 afy to 11,000 afy range for most years, with increased pumping to 15,000 af in a single dry year, further increased to 25,000 afy or 35,000 afy when dry conditions continue through multiple dry years.

Factors Affecting Availability of Groundwater Supplies. Three factors affect the availability of groundwater supplies under the groundwater operating plan. They are: (1) sufficient source capacity (wells and pumps); (2) sustainability of the groundwater resource to meet pumping demand on a renewable basis; and (3) addressing impacted well capacity from known contamination, or provisions for treatment in the event of contamination. All three factors are discussed below, and are addressed in further detail in the 2010 UWMP, Section 5, Water Quality, and the 2010 UWMP, Appendices C and I.

2.5.2 Alluvial Aquifer

Based on a combination of historical operating experience and recent (2005 and 2009) groundwater modeling analysis, the Alluvial aquifer can supply groundwater on a long-term sustainable basis in the overall range of 30,000 to 40,000 afy, with a probable reduction in dry

years to a range of 30,000 to 35,000 afy. Both of those ranges include about 15,000 afy of Alluvial pumping for current agricultural water uses. The dry year reduction is a result of practical constraints in the eastern part of the basin, where lowered groundwater levels in dry periods have the effect of reducing pumping capacities in that shallower portion of the aquifer. Over time, directly related to the rate of urban development and corresponding decrease in agricultural land use, the amount of Alluvial pumping for agricultural water supply is expected to decrease, with an equivalent increase in the amount of Alluvial pumping for municipal water supply. On an overall basis, Alluvial pumping is intended to remain within the sustainable ranges in the groundwater operating plan.

Adequacy of Supply. For municipal water supply, with existing wells and pumps, the three retail water purveyors with Alluvial wells (NCWD, SCWD, and VWC) have a combined pumping capacity from active wells of nearly 42,000 gallons per minute (gpm), which translates into a current full-time Alluvial source capacity of approximately 67,000 afy. Alluvial pumping capacity from all the active municipal supply wells is summarized in **Table 7**, Active Municipal Groundwater Source Capacity — Alluvial Aquifer Wells.

In terms of adequacy and availability, the 67,000 afy is more than sufficient to meet the municipal, or urban, component of groundwater supply from the Alluvium, which in the near term is about 24,000 to 26,000 afy of the total planned Alluvial pumping of 30,000 to 40,000 afy. (The balance of Alluvial pumping in the operating plan is for agricultural and other small, private pumping, which is readily covered by the 67,000 afy.)

Table 7
Active Municipal Groundwater Source Capacity — Alluvial Aquifer Wells

	Well	Pump Capacity (gpm)	Max. Annual Capacity (af)	Normal Year Production[(1)] (af)	Dry-Year Production[(1)] (af)
NCWD					
	Castaic 1	650	1,040	350	250
	Castaic 2	450	720	100	100
	Castaic 4	270	430	100	0
	Castaic 7	1,450	2,330	300	200
	Pinetree 1	300	480	150	0
	Pinetree 3	550	880	350	300
	Pinetree 4	400	640	300	200
	Pinetree 5	550	880	300	200
	NCWD Subtotal	**4,620**	**7,400**	**1,950**	**1,250**
SCWD					
	Clark	600	960	700	700
	Guida	1,000	1,610	1,300	1,200
	Honby	950	1,530	1,000	700
	Lost Canyon 2	850	1,370	300	0
	Lost Canyon 2A	825	1,330	300	0
	Mitchell 5A	950	1,530	500	200
	Mitchell 5B	700	1,120	800	300
	N. Oaks Central	1,275	2,050	850	700
	N. Oaks East	950	1,530	800	700
	N. Oaks West	1,300	2,290	800	700
	Sand Canyon	1,050	1,690	200	0
	Santa Clara	1,500	2,420	1,200	1,200
	Sierra	1,500	2,420	1,100	700
	Valley Center	1,200	1,930	1,200	1,200
	SCWD Subtotal	**14,650**	**23,780**	**11,050**	**8,300**
VWC					
	Well D	1,050	1,690	880	880
	Well E-15	1,400	2,250	800	800
	Well N	1,250	2,010	650	650
	Well N7	2,500	4,030	1,160	1,160
	Well N8	2,500	4,030	1,160	1,160
	Well Q2	1,200	1,930	1,100	1,100
	Well S6	2,000	3,220	1,000	1,000
	Well S7	2,000	3,220	500	500
	Well S8	2,000	3,220	500	500
	Well T7	1,200	1,930	750	750
	Well U4	1,000	1,610	800	800
	Well U6	1,250	2,010	800	800
	Well W9	800	1,290	1,000	1,000
	Well W10	1,500	2,420	800	800
	Well W11	1,000	1,610	950	950
	VWC Subtotal	**22,650**	**36,470**	**12,850**	**12,850**
Total Purveyors		**41,920**	**67,650**	**25,850**	**22,400**

Notes:
(1) Production amounts simulated in the 2009 Basin Yield Update.
Source: 2010 UWMP, Table 3-8.

Sustainability. Until 2003, the long-term renewability of Alluvial groundwater was empirically determined based on approximately 60 years of pumping and groundwater level records. Generally, those long-term observations show stability in groundwater levels and storage, with some dry-period fluctuations in the eastern part of the basin, over a historical range of total Alluvial pumpage from as low as about 20,000 afy to as high as about 43,000 afy. Those empirical observations have been complemented by the development and application of a numerical groundwater flow model, which was used to simulate aquifer response to the planned operating ranges of pumping.

To examine the yield of the Alluvium, or the sustainability of the Alluvium on a renewable basis, the original groundwater flow model was used to examine the long-term projected response of the aquifer to pumping for municipal and agricultural uses in the 30,000 to 40,000 afy range under average/normal conditions and in the 30,000 to 35,000 afy range under locally dry conditions, documented in the 2005 Basin Yield Report.

To examine the response of the entire aquifer system, the original model also incorporated pumping from the Saugus Formation in accordance with the normal (7,500 to 15,000 afy) and dry year (15,000 to 35,000 afy) groundwater operating plan for that aquifer. The model was run over a 78-year hydrologic period, which was selected from actual historical precipitation to examine a number of hydrologic conditions expected to affect both groundwater pumping and groundwater recharge.

Simulated Alluvial aquifer response to the range of hydrologic conditions and pumping stresses was essentially a long-term repeat of the historical conditions that have resulted from similar pumping over the last several decades. The resultant response included: (a) generally constant groundwater levels in the middle to western portion of the Alluvium, and fluctuating groundwater levels in the eastern portion as a function of wet and dry hydrologic conditions; (b) variations in recharge that directly correlate with wet and dry hydrologic conditions; and (c) no long-term decline in groundwater levels or storage. Consequently, the prior 2005 UWMP considered the Alluvial aquifer to be a sustainable water supply source to meet the Alluvial portion of the groundwater operating plan.

In 2008, partly in preparation for the 2010 UWMP, and partly in response to concerns about regulatory and litigation constraints that may impact the future reliability of SWP supplies, an updated analysis was undertaken (2009 Basin Yield Update) to assess groundwater development potential and possible augmentation of the groundwater operating plan. In addition to extending the model's calibration, the updated analysis simulated the historical record of climate and incorporated SWP deliveries for those climatic conditions for an 86-year period from 1922 through 2007, in place of the original model's 78-year hydrologic period that had been developed prior to the availability of combined climate and SWP deliveries since 1922.

While the overall groundwater operating plan ranges in the updated basin yield analysis did not change from the original operating plan, prevailing land-use conditions and the specific distributions of pumping were found to produce the same kinds of resultant Alluvial groundwater

conditions as concluded to be sustainable in 2005: (a) no long-term declines in Alluvial groundwater levels and storage; (b) multi-year periods of locally declining, or locally increasing, groundwater levels in response to cycles of below-normal and above-normal precipitation; and (c) short-term impacts on pumping capacities in eastern parts of the basin due to declining groundwater levels during dry periods, reduced by some redistribution of pumping (reflected in pumping volumes included in the 2010 UWMP) and by conformance with the dry-period reduction in Alluvial pumping in the groundwater operating plan.

Based on the results of the updated basin yield analysis (2009 Basin Yield Update), the groundwater operating plan is considered to reflect ongoing sustainable groundwater supply rates. In the Alluvium, sustainability was found via explicit simulation of pumping in wet/normal years near the upper end of the groundwater operating plan range. In dry years, sustainability was found via explicit simulation of pumping throughout the dry-year groundwater operating plan range, with the additional consideration that some pumping redistribution (reflected in the 2010 UWMP) be implemented to achieve pumping rates near the upper end of the dry-period range.

2.5.3 Saugus Formation

Based on historical operating experience and recent (2005 and 2009) groundwater modeling analysis, the Saugus Formation can supply water on a long-term sustainable basis in a normal range of 7,500 to 15,000 afy, with intermittent increases to 25,000 to 35,000 af in dry years. The dry-year increases, based on limited historical observation and modeled projections, demonstrate that a small amount of the large groundwater storage in the Saugus Formation can be pumped over a relatively short (dry) period. This would be followed by recharge (replenishment) of that storage during a subsequent normal-to-wet period when pumping would be reduced.

Adequacy of Supply. For municipal water supply with existing wells, the three retail water purveyors with Saugus wells (NCWD, SCWD, and VWC) have a combined pumping capacity from active wells of nearly 17,000 gpm, which translates into a full-time Saugus source capacity of about 27,000 afy. Saugus pumping capacity from all the active municipal supply wells is summarized in **Table 8**, Municipal Groundwater Source Capacity — Saugus Formation Wells. These capacities include two Saugus wells contaminated by perchlorate (Saugus 1 and 2), which have been returned to service with treatment facilities for use of the treated water for municipal supply under permit from the DDW. They also reflect the most recent replacement well, VWC's Well 207, in a non-impacted part of the basin. Excluded from these capacities is VWC Well 201 that was recently impacted by the detection of perchlorate. Well 201 represents a total of 2,400 gpm of pumping capacity (for a dry-year production capacity of 3,777 afy). VWC has removed Well 201 from service pending the installation of treatment.

Table 8
Municipal Groundwater Source Capacity — Saugus Formation Wells

	Well	Pump Capacity (gpm)	Max. Annual Capacity (af)	Normal Year Production[(1)] (af)	Dry-Year Production[(1)] (af)
NCWD					
	12	2,400	3,870	1,765	2,494
	13	2,250	3,630	1765	2,494
	NCWD Subtotal	**4,650**	**7,500**	**3,530**	**4,988**
VWC					
	159	500	800	50	50
	160	2,000	3,220	500	830
	205	2,700	4,350	1,211	4,038
	206	2,500	4,030	1,175	3,500
	207	2,500	4,030	1,175	3,500
	VWC Subtotal	**10,200**	**16,430**	**4,111**	**11,918**
SCWD					
	Saugus 1	1,100	1,770	1,772	1,772
	Saugus 2	1,100	1,770	1,772	1,772
	SCWD Subtotal	**2,200**	**3,540**	**3,544**	**3,544**
Total Purveyors		**17,050**	**27,470**	**11,185**	**20,450**

Notes:
(1) Production amounts simulated in the 2009 Basin Yield Update.
Source: 2010 UWMP, Table 3-9.

In terms of adequacy and availability, the combined active Saugus groundwater source capacity of municipal wells of 27,000 afy is more than sufficient to meet the planned use of Saugus groundwater in normal years of 7,500 to 15,000 afy. This currently active capacity is more than sufficient to meet water demands, in combination with other sources.

In order to supplement near term dry-year supplies, VWC Well 201 could be brought back into service utilizing treatment technologies currently being used in the Santa Clarita Valley. In October 2005, VWC Well Q2 was restored to service, six months after perchlorate was detected in the well in April 2005. In addition, in 2005, initially there was no third-party funding available to pay for the cost of putting the well back into service; VWC negotiated a separate agreement with the Whittaker-Bermite property owners to pay for the cost. Also in May 2007, the perchlorate litigation settlement agreement was executed, which established a "Rapid Response Fund" to immediately treat any additional wells impacted by perchlorate.

With the restored capacity of VWC Well 201, the Saugus Formation groundwater source capacity of municipal wells would be increased to about 31,000 afy. To accommodate longer-term dry-year needs, additional Saugus wells are planned by 2020 and expect to have a combined capacity of 10,000 afy, increasing the Saugus Formation dry-year production capacity to approximately 41,000 afy.

Sustainability. Until 2003, the long-term sustainability of Saugus groundwater was empirically estimated from limited historical experience. Historically (and continuing to the present), pumping from the Saugus has been fairly low in most years, with one four-year period of increased pumping up to about 15,000 afy that had short-term water level impacts but produced

no long-term depletion of the substantial groundwater storage in the Saugus. Those empirical observations have been complemented by the development and application of the numerical groundwater flow model, which was used to examine aquifer response to the groundwater operating plan for pumping from both the Alluvium and the Saugus, and to examine the effectiveness of pumping for both contaminant extraction and control of contaminant migration within the Saugus Formation. The latter aspects of Saugus pumping were being studied at the time of the prior 2005 UWMP, and, thus, were reflected as groundwater extraction capacity to be restored. Those restoration efforts have been undertaken and that pumping is reflected in the 2010 UWMP as part of the Saugus groundwater operating plan and pumping distribution.

To examine the yield of the Saugus Formation, or its sustainability on a renewable basis, the original groundwater flow model was used to examine long-term projected response to pumping from both the Alluvium and the Saugus over the 78-year period of hydrologic conditions that incorporated alternating wet and dry periods as have historically occurred (see 2005 Basin Yield Report). The pumping simulated in the model was in accordance with the then-current operating plan for the basin. For the Saugus Formation, simulated pumping included the then-planned restoration of historic pumping from the perchlorate-impacted wells.

The originally simulated Saugus Formation response to the ranges of operating plan pumping under assumed recurrent historical hydrologic conditions was consistent with actual experience under smaller pumping rates: (a) short-term declines in groundwater levels and storage near pumped wells during dry-period pumping; (b) recovery of groundwater levels and storage after cessation of dry-period pumping; and (c) no long-term decreases or depletion of groundwater levels or storage. The combination of actual experience with Saugus recharge and pumping up to about 15,000 afy, complemented by modeled projections of aquifer response that showed long-term utility of the Saugus at 7,500 to 15,000 afy in normal years and rapid recovery from higher pumping rates during intermittent dry periods, was the basis for concluding that the Saugus Formation could be considered a sustainable water supply source to meet the Saugus portion of the groundwater operating plan.

As stated above, in 2008, an updated basin yield analysis was undertaken to assess groundwater development potential and possible augmentation of the groundwater operating plan (see 2009 Basin Yield Update). After extended and updated model calibration and incorporation of extended historical records, the overall groundwater operating plan and specific distribution of Saugus pumping were found to produce the same kinds of resultant Saugus groundwater conditions as concluded to be sustainable in 2005: (a) long-term stability of groundwater levels, with no sustained declines; (b) groundwater levels slightly below historic Saugus levels, in response to greater long-term utilization of the Saugus; and (c) maintenance of sufficiently high Saugus groundwater levels to ensure achievement of planned individual pumping capacities. Thus, the groundwater operating plan for the Saugus, with fairly low pumping in wet/normal years and increased pumping through dry periods, is concluded to reflect sustainable groundwater supply rates.

2.5.4 Existing and Planned Groundwater Pumping

Impacted Well Capacity. Groundwater produced by VWC consistently meets groundwater standards set by USEPA and the DDW. However, the 2010 UWMP explains that perchlorate has been a concern with respect to the groundwater quality since it was detected in four wells in the eastern part of the Saugus Formation in 1997.

As explained in Appendix I of the 2010 UWMP, certain municipal wells were impacted by perchlorate and thus represented a temporary loss of well capacity within the CLWA service area. Six wells were ultimately taken out of service upon the detection of perchlorate including four Saugus wells and two Alluvial wells. All have been either: (a) abandoned and replaced; (b) returned to service with the addition of treatment facilities that allow the wells to be used for municipal water supply as part of the overall water supply systems permitted by the DDW; or (c) will be replaced under an existing perchlorate litigation settlement agreement. The restored wells (two Saugus wells and one Alluvial well) and the replacement wells (one Saugus and one Alluvial well), which collectively restore much of the temporarily lost well capacity, are now included as parts of the active municipal groundwater source capacities delineated in **Tables 7** and **8**, above. An additional two wells will be drilled to fully restore 4,200 gpm (6,776 afy) of the impacted well capacity, thus restoring the operational flexibility that existed prior to the perchlorate being discovered. The cost of drilling the remaining two wells will be fully reimbursed under the terms of the perchlorate litigation settlement agreement.

Most recently, in August 2010, VWC's Well 201, located downgradient from the former Whittaker-Bermite site and downgradient from the initially impacted Saugus 1, Saugus 2, and V157 wells, had detectable concentrations of perchlorate and the well was taken out of service. Water sampling tests from August 2010 through April 2011 also confirmed the presence of perchlorate over the adopted regulatory standard. This well was taken out of service in August 2010 and its capacity is not included in active groundwater sources delineated in **Table 8**, above.

VWC already has completed significant updated groundwater modeling analysis of the Saugus Formation, and is currently working with expert consultants to restore Well 201 as a drinking water source through installation of wellhead treatment. In addition, a process with DDW already is underway to add wellhead treatment to Well 201 so it can be returned to service. VWC currently plans to complete installation of wellhead treatment so that Well 201 is operable at or before the end of 2015, and DDW is working with VWC to accomplish this goal.

In addition, VWC's updated groundwater modeling analysis has shown that returning Well 201 to service is an important component of the strategy to contain perchlorate in the Saugus Formation. In particular, pumping Well 201 on a sustained, continuous basis at close to its full capacity (up to 2,400 gallons per minute), with an allowance for routine maintenance down-time each year, can provide hydraulic containment of perchlorate present in the Saugus Formation groundwater west of the Whittaker-Bermite site, and provide protection of downgradient production wells that currently are not impacted by perchlorate.

Alluvial Aquifer. In terms of adequacy and availability, the combined active Alluvial aquifer groundwater sources of municipal wells, approximately 67,000 afy, are more than sufficient to meet the current and potential future urban component of the groundwater supply from the Alluvium. The potential future urban component of groundwater from the Alluvium in the near-term is about 24,000 to 26,000 afy of the total planned Alluvial pumping of 30,000 to 40,000 afy. The higher individual and cumulative pumping capacities of the purveyors are due to operational reasons (i.e., to meet daily and other fluctuations from average day to maximum day and peak hour system demands).

Saugus Formation. In terms of adequacy and availability, the combined active Saugus groundwater source municipal well capacity of 27,000 afy is more than sufficient to meet the planned use of Saugus groundwater in normal years of 7,500 to 15,000 afy. This current active capacity is also more than sufficient to meet water demands, in combination with other sources. To supplement near term dry-year supplies, VWC Well 201 (with a dry-year production capacity of 3,777 afy) can be brought back into service utilizing treatment technologies currently being used in the Santa Clarita Valley or replaced, and thereby increase capacity to about 31,000 afy. To accommodate the longer-term demands, additional Saugus wells are planned by 2020 and expect to have a combined capacity of 10,000 afy, increasing the Saugus Formation dry-year production capacity to approximately 41,000 afy. This increase is more than sufficient to meet the planned use of 35,000 afy of Saugus groundwater during a multiple-dry year period.

2.5.5 Private and Agricultural Groundwater Pumping

The 2010 UWMP groundwater operating plan recognizes ongoing Alluvial pumping for both municipal and agricultural water supply, as well as other small private domestic and related pumping. In addition, the prior 2005 UWMP reported some limited information about the nature and magnitude of private well pumping as submitted by the Santa Clarita Valley Well Owners' Association. This included a detailed estimate of private well pumping in the San Francisquito Canyon portion of the basin: a total of 85 afy from 73 individual private pumpers, or nearly 1.2 afy per private well pumper.

As a result of that input, the 2010 UWMP reported that total private pumping is likely well within the 500 afy estimates of small private well pumping in recent annual Santa Clarita Valley Water Reports, or about 1 percent of typical Alluvial aquifer pumping by the purveyors and other known private well owners (*e.g.*, agricultural pumpers) combined. Thus, while the small private wells are not explicitly modeled in the basin yield analysis because their locations and operations are not known, their operation creates a pumping demand that is essentially negligible at the scale of the regional model. Ultimately, the intent to maintain overall pumping within the operating plan, including private pumping, will result in sustainable groundwater conditions to support the combination of municipal (purveyor), agricultural, and small private groundwater use on an ongoing basis.

Another change made in the 2010 UWMP is to respond to DWR's requirement to provide estimates of the projected groundwater use by each of the retail purveyors. For purposes of this

WSA, and in compliance with the UWMP Act, the purveyors have each set forth their estimates of projected groundwater use in Table 3-7 of the 2010 UWMP. CLWA and the purveyors recognize that these estimates of projected groundwater use are subject to adjustment based on various factors and conditions occurring from time-to-time. These estimates are provided for planning purposes in this WSA and in the 2010 UWMP; they do not constitute an allocation of groundwater from the local basin.

2.5.6 SB 610 Groundwater Requirements

Water Code section 10910(f) requires a WSA to include specific information describing groundwater resources if the water supply for a proposed project includes groundwater. Since at least the first UWMP in 2000, the Santa Clarita Valley water suppliers have committed to a groundwater operating plan that includes municipal, agricultural, and other smaller uses while maintaining the local groundwater basin in a sustainable condition (i.e., no long term depletion of groundwater or interrelated surface water). This has resulted in preparation of the following important studies funded by the Santa Clarita Valley water suppliers to ensure sustainability of the local groundwater resources:

1. Slade (2002) updates prior reports and includes a detailed review of the hydrologic conditions and a description of groundwater resources available to VWC and other large municipal and agriculture groundwater producers, including SCWD, NCWD, Newhall Land and Farming Company, and the Wayside Honor Ranch operating within the Santa Clara River Valley East Subbasin, one of several subbasins identified along the Santa Clara River in Los Angeles and Ventura counties by DWR in the updated Bulletin 118. The shallow aquifer system is designated the Alluvial aquifer and the deeper aquifer is designated the Saugus Formation. Slade reported that both aquifer systems were in good operating condition and not in an overdraft condition. Also included are hundreds of other small scale water producers that account for less than 1 percent of total production from these aquifer systems.

2. In 2003, CLWA in cooperation with VWC and other retail water purveyors completed and adopted a Groundwater Management Plan in accordance with Water Code section 10753. Among the elements of the adopted Plan is the preparation of annual groundwater management reports, such as the Santa Clarita Valley water reports, that provide information about local groundwater conditions, SWP supplies, water conservation, and recycled water. The Plan also contemplates other technical reports to address specific aspects of basin management. Recently, technical reports have been prepared on the development and calibration of a numerical groundwater flow model, an analysis of perchlorate containment in groundwater, and a groundwater yield study of the upper basin.

3. In August 2005, and again in 2009, work was completed in support of a Memorandum of Understanding (MOU) entered into by VWC, CLWA, other Santa Clarita Valley water

purveyors, and United Water Conservation District in Ventura County. The MOU is a commitment by the water purveyors to expand on the previous knowledge of groundwater conditions and, using a regional groundwater flow model, evaluate the long-term sustainability of the purveyor's groundwater operating plan under a range of existing and potential future hydrologic conditions. The primary conclusion of the modeling analysis is that the groundwater operating plan will not cause detrimental short-term or long-term effects to the groundwater and surface water resources in the Santa Clarita Valley and, therefore, is sustainable (see Basin Yield Study, 2005). This primary conclusion was again confirmed with completion of an updated basin yield analysis in 2009 (see 2009 Basin Yield Update).

The following sub-parts respond to specific requirements of Water Code section 10910(f):

2.5.6.1 Water Code section 10910(f)(1).

Review of relevant information contained in the Urban Water Management Plan.

Refer to Section 3 of the 2010 UWMP, Water Resources and Appendix G, CLWA Groundwater Management Plan for a description of the local Alluvial and Saugus Formation aquifer systems, their respective yields, and historical and projected production consistent with the groundwater operating plan.

2.5.6.2 Water Code section 10910(f)(2)

Description of any groundwater basin or basins from which the proposed project will be supplied, including information concerning adjudication and overdraft.

Slade (2002) provides a detailed description of the Santa Clara River Valley East Sub-basin (Basin) and the two aquifer systems, the Alluvial aquifer and the Saugus Formation. The Basin is about 22 miles long east to west and 13 miles wide. The Alluvial aquifer has an estimated storage capacity of about 161,000 af of water and approximately 1.65 million af of potentially usable groundwater is present from depths of 300 to 2,500 feet in the Saugus Formation (Slade 2002).

The groundwater basin is unadjudicated, meaning that neither VWC nor the other purveyors have adjudicated water rights that dictate their water supply. The total supply available to all purveyors in the basin and the ability of VWC to access those supplies determines the amount of water available to VWC to meet its long-term supply needs. However, in practice, as discussed in this WSA, VWC accesses the available groundwater supplies, in accordance with a groundwater operating plan developed by CLWA, VWC, and other retail water purveyors in the Santa Clarita Valley, and complemented by 2005 and 2009 basin yield analyses based on a numerical groundwater flow model of the basin. These studies concluded neither aquifer system is in overdraft and the purveyor's groundwater operating plan as described in the Groundwater Management Plan is sustainable.[48]

[48] See, e.g., Basin Yield Update, 2009.

The groundwater operating plan was developed by CLWA and the retail purveyors over the past 15 years to meet water demands (municipal, agricultural, and small domestic), while maintaining the basin in a sustainable condition (i.e., no long-term depletion of groundwater or interrelated surface water). As stated, the groundwater operating plan is based on the concept that pumping can vary from year-to-year to allow increased groundwater use in dry periods and increased recharge during wet periods. This assures that the groundwater basin is adequately replenished through various wet/dry cycles. The operating yield concept has been quantified as ranges of annual pumping volumes to capture year-to-year pumping fluctuations in response to both hydrologic conditions and customer demand.

The 2010 UWMP also contains an extensive description and analysis of the groundwater basin in the Santa Clarita Valley. Refer to Section 3 of the 2010 UWMP, Appendix G, CLWA Groundwater Management Plan, and Appendix I, Perchlorate Contamination and Impact on Groundwater Supplies in the Santa Clarita Valley.

2.5.6.3 Water Code section 10910(f)(3).

Description and analysis of the amount and location of groundwater pumped by the public water system for the past five years from any groundwater basin from which the proposed project will be supplied.

Covering the past 5-year period (2009-2013), VWC's groundwater production averaged approximately 12,764 afy from the Alluvial aquifer and approximately 1,398 afy from the Saugus Formation. Refer to Table 2-1 from the 2013 Santa Clarita Valley Water Report (June 2014) for a summary of the historical groundwater production for the past five years for VWC and all municipal water purveyors.

Total pumpage from the Alluvial aquifer in 2009 was 39,986 af. Of the total Alluvial pumpage in 2009, 24,396 af was for municipal water supply, and the balance, 15,590 af, was for agriculture and other (minor) miscellaneous uses.[49] In 2013, total pumpage from the Alluvial aquifer was 36,892 af. Of the total Alluvial pumpage in 2013, 21,431 af was for municipal water supply, and the balance, 15,461 af, was for agriculture and other (minor) miscellaneous uses.[50] Since 1980, when imported water deliveries began from the SWP, total pumpage from the Alluvial aquifer has ranged from a low of about 20,286 afy (in 1983) to slightly more than 36,892 afy (in 2013).[51]

Total pumpage from the Saugus Formation in 2009 was 7,678 af.[52] Of the total Saugus Formation pumpage in 2009, 6,704 af was for municipal water supply, and the balance 974 af

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[49] Refer to Tables 2-1 and 2-2 of the 2013 Santa Clarita Valley Water Report (June 2014) "for all municipal purveyors" and "all agricultural and other users" pumpage from the Alluvial aquifer.

[50] *Ibid.*

[51] *Ibid.*

[52] *Ibid.*

was for agricultural and other (minor) uses.[53] Groundwater pumpage from the Saugus peaked in the early 1990s and then declined steadily. On a long-term average basis since the importation of SWP water, total pumpage from the Saugus Formation has ranged from a low of 3,716 afy (in 1999) to a high of 14,917 afy in (1991).[54]

2.5.6.4 Water Code section 10910(f)(4).

Description and analysis of the amount and location of groundwater that is projected to be pumped by the public water system from any basin from which the proposed project will be supplied.

Refer to Table 3-7 in the 2010 UWMP for a summary of the range of the projected groundwater production by VWC and the other Santa Clarita Valley retail water purveyors. (Also refer to **Table 6**, above, for the same information.) Refer to Figure 3-2 and Figure 3-3 of the 2010 UWMP for the Alluvial and Saugus well locations within the basin.

To ensure sustainability, the purveyors have committed that the annual use of groundwater pumped collectively in any given year will not exceed the CLWA/purveyors' groundwater operating plan as described in the updated Basin Yield Study (August 2009), the 2010 UWMP, and reported annually in the Santa Clarita Valley water reports. A portion of the project's potable water demand of 703 afy may be mixed in any given year with groundwater produced from the Alluvial and Saugus aquifers.

2.5.6.5 Water Code section 10910(f)(5).

Analysis of the sufficiency of the groundwater from the basin or basins from which the proposed project will be supplied to meet the projected water demand associated with the proposed project.

VWC has determined that the sufficiency of the groundwater necessary to meet the initial and projected water demand associated with the Project was addressed in the 2010 UWMP; therefore, as provided in Water Code section 10910(f)(5), VWC incorporates by reference the 2010 UWMP's findings concerning the "adequacy of supply" in the Alluvium on page 3-24; and the "adequacy of supply" in the Saugus Formation on page 3-29.

In addition, Section 2.5 of this WSA provides an analysis confirming the sufficiency of the groundwater supply from both the Alluvial aquifer and the Saugus Formation. Subsection 2.5.4 of this WSA also evaluates existing and planned groundwater pumping, including impacted well capacity as a result of the detection of perchlorate, within the CLWA service area. Based on that analysis, VWC has determined that non-impacted groundwater supply will be sufficient to meet existing and planned groundwater pumping within the CLWA service area through the long-term planning horizon reflected in the 2010 UWMP.

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[53] *Ibid.*

[54] *Ibid.*

2.5.6.6 Sustainability of Existing Groundwater Supplies and Projected Supplies

Groundwater supplies were evaluated in the Basin Yield Study (August 2009) and reviewed in the 2010 UWMP to determine whether supply projections were realistic over varying hydrologic conditions. The review made the following critical findings:

1. Both the Alluvial aquifer and the Saugus Formation are reasonable and sustainable sources at the yields represented in the 2010 UWMP over the next 25 years;

2. The yields are not overstated and will not deplete or "dry up" the groundwater basin; and

3. Under the 2010 UWMP, there is no need to reduce the yields for planning purposes.

Additionally, the 2010 UWMP and Basin Yield Study (August 2009) concluded that both aquifers are in good operating condition (not in a condition of overdraft) and are not projected to become overdrafted.

3.0 WATER CONSERVATION

The 2010 UWMP summarizes VWC's and the other retail purveyors' projected water demands through 2050. The summary includes water demands without conservation, based on the retail purveyors' projected water demands shown in Table 2-2 of the 2010 UWMP, and with conservation, using the requirements described in Senate Bill 7 of Special Extended Session 7 (SBX7-7). SBX7-7 applies to retail water suppliers, and is intended to increase water use efficiency, and meet a 20% per capita reduction in urban water use statewide by 2020.

Table 2-22 of the 2010 UWMP summarizes the retail purveyors' normal year SBX7-7 water demand calculations with and without conservation within the CLWA service area from 2015 through 2050. The demand reductions reflected in Table 2-22 may be achieved through a combination of water conservation measures and the use of recycled water. Note the potable water demand reductions shown in Table 2-22 exceed the requirements of SBX7-7.[55]

In addition, Section 7 of the 2010 UWMP describes the water demand management (conservation) measures implemented by CLWA, VWC, and the other retail purveyors as part of the effort to reduce water demand in the Santa Clarita Valley. As part of Section 7, VWC provides a detailed description of its conservation programs, water conservation best management practices and water demand management measures. Further, the 2013 Santa Clarita Valley Water Report summarizes the water conservation efforts of CLWA and the four retail purveyors in the Santa Clarita Valley. This summary is found in Section 5 of the 2013 Santa Clarita Valley Water Report at pages 5-1 through 5-5. All such information is incorporated by reference.

[55] Refer to 2010 UWMP, page 2-21, and Table 2-22.

4.0 WATER SHORTAGE CONTINGENCY PLANNING ANALYSIS

Water supplies may be interrupted or reduced significantly in a number of ways, such as a drought which limits supplies, an earthquake which damages water delivery or storage facilities, a regional power outage, or a toxic spill that affects water quality. The 2010 UWMP, Section 8, describes how CLWA and the retail water purveyors plan to respond to such emergencies so that customer needs are met promptly and equitably. To date, both a Water Shortage Contingency Plan and a Drought Emergency Water Sharing Agreement have been prepared by CLWA and the retail purveyors. In addition, prohibitions, penalties, and financial impacts of shortages have been developed by CLWA, VWC, and the other retail purveyors in the Santa Clarita Valley, and are summarized in Section 8 of the 2010 UWMP.

In preparing this WSA, VWC has considered the urban water shortage contingency planning analysis set forth in the 2010 UWMP, Section 8, in determining the sufficiency of water supplies for the Project, in addition to all existing and planned future uses in VWC's service area within the Santa Clarita Valley.

On January 17, 2014, Governor Jerry Brown issued a statewide drought declaration in response to the driest year on record, which has resulted in water supplies that are drastically below normal. CLWA, VWC, and the retail purveyors support the Governor's declaration and conservation message, and have prepared a Voluntary Water Conservation Action Plan that calls on residents and businesses in the Santa Clarita Valley to take reasonable actions to reduce water use and eliminate waste. This Action Plan is aimed at increasing awareness of the critical water supply conditions throughout California and the immediate need for conservation by providing simple and easy steps for residents and businesses to take. The conservation goal is to reduce overall local water consumption by 20 percent. The water suppliers will continue to assess water supply conditions in 2014.

On July 15, 2014, the State Water Resources Control Board (State Board) approved an emergency regulation to ensure water agencies, their customers and state residents increase water conservation in urban settings or face possible fines or other enforcement measures. The State Board regulation is intended to reduce outdoor urban water use and also requires retail water providers to implement mandatory outdoor watering restrictions consistent with their water shortage contingency plans. In addition, in 2014, CLWA and the retail purveyors have prepared the Water Conservation Mandatory Action Plan as a component of the Water Shortage Contingency Plan calling for the adoption and implementation of mandatory conservation practices. Restrictions on outdoor watering include watering day restrictions and other measures designed to promote water conservation.[56]

If drought conditions persist through 2014 and 2015, the Santa Clarita Valley water purveyors may activate second and third stage conservation measures, which include mandatory restrictions

[56] For further water conservation information, please refer to the 2013 Santa Clarita Valley Water Report (June 2014), pages 5-1 through 5-5.

and prohibitions in addition to the measures that already have been enacted. The adopted UWMP, Section 8, describes how CLWA and the retail purveyors plan to respond to continuing drought conditions. The reliability planning provisions of the adopted UWMP, Section 6, also assist CLWA and the retail purveyors in responding to drought conditions, including the severe drought conditions that currently exist.

5.0 RELIABILITY PLANNING

CLWA, VWC, and the retail purveyors have implemented a number of projects that are part of an overall program to provide the facilities needed to firm-up imported water supplies during dry years. The program involves water conservation, surface and groundwater storage, water transfers and exchanges, water recycling, additional short-term pumping from the Saugus Formation, and increasing CLWA's imported supply. This overall strategy is designed to meet increasing water demands while assuring a reasonable degree of supply reliability. Part of the overall water supply strategy is to provide a blend of groundwater and imported water to area residents to ensure consistent quality and reliability of service. The actual blend of imported water and groundwater in any given year and location in the Santa Clarita Valley is an operational decision and varies over time due to source availability and operational capacity of purveyor and CLWA facilities. The goal is to conjunctively use available water resources so that the overall reliability of water supply is maximized while utilizing local groundwater at a sustainable rate.

The available water supplies and demands for CLWA's service area were analyzed in the 2010 UWMP to assess the region's ability to satisfy demands during the following variable periods: (1) an average water year; (2) single-dry year; and (3) multiple-dry years. The 2010 UWMP summary tables (shown in **Section 6.0**, below) demonstrate that existing and planned supplies are available to meet existing and projected demand under all such conditions for the projected planning period through 2050.

While many of the Santa Clarita Valley's available supply sources have some variability, the variability in SWP supplies has the largest effect on overall supply reliability. In any given year, SWP supplies may be reduced due to dry weather conditions or regulatory factors. As discussed above, during such an occurrence, the remaining water demands in the CLWA service area are planned to be met by a combination of alternate supplies such as return water from CLWA's accounts in the Semitropic Groundwater Storage Program and the Rosedale–Rio Bravo Water Banking and Exchange Program, deliveries from CLWA's flexible storage account in Castaic Lake Reservoir, local groundwater pumping, short-term water exchanges, and participation in DWR's dry-year water purchase programs.

Groundwater banking and conjunctive use offer significant opportunities to improve water supply reliability for CLWA. During dry periods, or when imported water supply availability is reduced, banked water can be recovered from groundwater storage to replace, or firm up, the imported water supply deliveries. CLWA and the purveyors have been conjunctively utilizing local groundwater and imported water since SWP water was imported to the Santa Clarita Valley beginning in 1980. SWP and other imported water supplies have supplemented the overall supply of the Santa Clarita Valley, which previously depended solely on local groundwater supplies.

Drought periods may affect available water supplies in any single year and even for a duration that spans multiple consecutive years. Hydrologic conditions vary from region to region

throughout the state. Dry conditions in northern California affecting SWP supply may not affect local groundwater and other supplies in southern California, and the reverse situation can also occur (as it did in 2002 and 2003). For this reason, CLWA and the purveyors have emphasized developing a water supply portfolio that is diverse, especially in dry years. Diversity of supply is considered a key element of reliability planning, giving CLWA and the purveyors the ability to draw on multiple sources of supply to ensure reliable service during dry years, as well as during average wet years.[57]

As described above, CLWA has entered into groundwater banking and water exchange programs and has, in aggregate, approximately 150,000 af of recoverable water outside the local groundwater basin, which is available during drought conditions. The CLWA and purveyor reliability planning associated with each water source is discussed in further detail in Chapter 6 of the 2010 UWMP. CLWA and the purveyors have assessed the impact of DWR's 2013 SWP Delivery Reliability Report on the CLWA/purveyor water supply, and have determined that current anticipated supplies are available to meet existing and projected demands through the year 2050 consistent with the 2010 UWMP.[58]

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[57] 2013 Santa Clarita Valley Water Report (June 2014), p. ES-9.

[58] Personal communication., Keith Abercrombie, General Manager, VWC, 2013; Dan Masnada, General Manager, CLWA, 2013.

6.0 WATER SUPPLY ASSESSMENT

As discussed above, the projected total water demand for the Project is 1,143 afy in an average/normal year. Projected water demand would increase by approximately 10% in a dry year to a total of about 1,257 af. To meet this demand, water would be provided to the Project by VWC. Water sources to be used by VWC include a combination of SWP water delivered through CLWA and local groundwater resources in the Alluvial aquifer and the Saugus Formation. The amount delivered from each source varies year-to-year due to statewide and local hydrologic conditions and other factors. However, according to the Entrada South Draft EIR, Section 5.21, Utilities and Service Systems — Water Supply and Service, such supplies are available without creating any water shortages or any significant environmental impacts.

6.1 Water Demand

Table 9, Summary of Projected Water Demands, below, summarizes the retail purveyors' projected water demands through 2050. The demands reflected in **Table 9** are from the most recently adopted UWMP. These demands reflect existing and planned water demands of the four retail purveyors in the Santa Clarita Valley. The demands also account for the water needed to serve the Entrada South Project because, as stated above, VWC included the Entrada South Project demand in VWC's current and projected water deliveries data provided as part of the adopted UWMP.

GSI Water Solutions, Inc., a consulting firm specializing in groundwater and other water resources, has provided updated land use and water demand projections for Entrada South Project. GSI's updated water demands are the subject of its May 16, 2014 technical memorandum, which is incorporated by reference in this WSA.

Table 9
Summary of Projected Water Demands[1][2][3]

Purveyor	Demand (afy)									Annual Increase
	2010	2015	2020	2025	2030	2035	2040	2045	2050	
District #36	1,243	1,759	2,189	2,619	3,048	3,478	3,908	4,338	4,768	3.5%
NCWD	10,560	12,571	14,246	15,922	17,598	19,273	20,949	22,624	24,300	2.2%
SCWD	27,816	31,633	34,814	37,995	41,176	44,357	47,538	50,719	53,900	1.7%
VWC	30,354	34,107	37,235	40,362	43,490	46,617	49,745	52,872	56,000	1.6%
Total Purveyor	**69,973**	**80,070**	**88,484**	**96,898**	**105,313**	**113,725**	**122,141**	**130,553**	**138,968**	**1.8%**

Notes:
(1) Summary of demands is from Tables 2-3 through 2-6 of the 2010 UWMP.
(2) Reflects existing and projected water demands of the four retail purveyors within the CLWA service area.
(3) Demands exclude non-purveyor water demands. Similarly, supplies evaluated in the 2010 UWMP generally exclude non-purveyor supplies; however, the annual Santa Clarita Valley Water Reports contain water supply utilization by agricultural and other users (see, e.g., 2013 Santa Clarita Valley Water Report, Tables 2-2 and 2-3).
Source: 2010 UWMP, Table 2-2; 2013 Santa Clarita Valley Water Report, Tables 2-2 and 2-3.

Table 10, VWC Past, Current, and Projected Metered Water Deliveries (by customer type), below, presents the past, current, and projected water deliveries by customer type for VWC through 2050.

Table 10
Valencia Water Company Past, Current, and Projected Metered Water Deliveries (by Customer Type)

Year	Water Use Sectors	Single Family	Multi-Family	Commercial	Industrial	Institutional/ Government	Landscape[1]	Total[2]
2010[3]	No. of accounts	25,386	8,854	1,546	451	646	13	**36,896**
	Deliveries (af)	14,384	1,845	6,981	1,856	4,586	702	**30,354**
2015	No. of accounts	26,497	11,956	1,598	485	647	362	**41,545**
	Deliveries (af)	14,883	2,993	7,203	1,990	4,595	2,442	**34,107**
2020	No. of accounts	27,423	14,552	1,641	514	648	652	**45,419**
	Deliveries (af)	15,299	3,949	7,389	2,101	4,603	3,894	**37,235**
2025	No. of accounts	28,348	17,127	1,684	542	650	943	**49,294**
	Deliveries (af)	15,715	4,906	7,575	2,213	4,611	5,343	**40,362**
2030	No. of accounts	29,274	19,713	1,727	570	651	1,233	**53,168**
	Deliveries (af)	16,130	5,862	7,760	2,324	4,619	6,794	**43,490**
2035	No. of accounts	30,200	22,298	1,770	599	652	1,524	**57,042**
	Deliveries (af)	16,546	6,818	7,946	2,436	4,627	8,244	**46,617**
2040	No. of accounts	31,125	24,883	1,813	627	653	1,814	**60,917**
	Deliveries (af)	16,962	7,775	8,131	2,548	4,635	9,696	**49,745**
2045	No. of accounts	32,051	27,469	1,856	656	654	2,105	**64,791**
	Deliveries (af)	17,378	8,731	8,317	2,659	4,643	11,144	**52,872**
2050	No. of accounts	32,977	30,054	1,900	684	655	2,395	**68,665**
	Deliveries (af)	17,793	9,687	8,503	2,771	4,650	12,596	**56,000**

Notes:

(1) Landscape customers consist of potable and recycled water users for outdoor irrigation.
(2) Totals do not include fire services.
(3) Year 2010 projection based on 2009 actual data. Growth to 2015 reflects six years of data.
Source: 2010 UWMP, Table 2-6

6.2 Water Supplies — Historic and Existing Sources

VWC, in conjunction with CLWA, has existing water entitlements, rights, and contracts to meet demand as needed over a 20-year horizon, and has committed sufficient capital resources and planned investments in various water programs and facilities to serve all of its existing and planned customers. VWC also has identified an operational strategy combined with a prudent and flexible management approach to ensure water reliability.

In 2012, VWC's service area-wide demands were 30,022 af, and the total municipal demand for water in the CLWA service area was 69,712 af. Based on VWC's water demand factors, VWC has estimated that the water demand for the Entrada South Project, as approved, is 1,143 afy at build-out in an average/normal year. Projected water demand would increase by approximately 10% in a dry year to a total of 1,257 afy.

The 2013 Santa Clarita Valley Water Report (June 2014) provides a detailed summary of the local and imported water supplies used to meet water demands in the Santa Clarita Valley over a 33-year horizon (1980-2013). The 2013 Santa Clarita Valley Water Report also analyzes the historical availability and use of water by each retail purveyor (VWC, SCWD, District #36, and NCWD), and for all agricultural, industrial and other users in the Valley, for the same 33-year horizon.

As shown in **Table 11**, Total Water Supply Utilization from Municipal, Agricultural, and Other Uses (af), since inception of the importation of SWP supplies to the Santa Clarita Valley in 1980, the total annual water demand has increased from about 37,000 af in 1980 to the mid-80,000 afy range through 2005, with a short-term peak of about 92,000 af in 2007, followed by a steady decline in water demand to 85,406 afy in 2012.

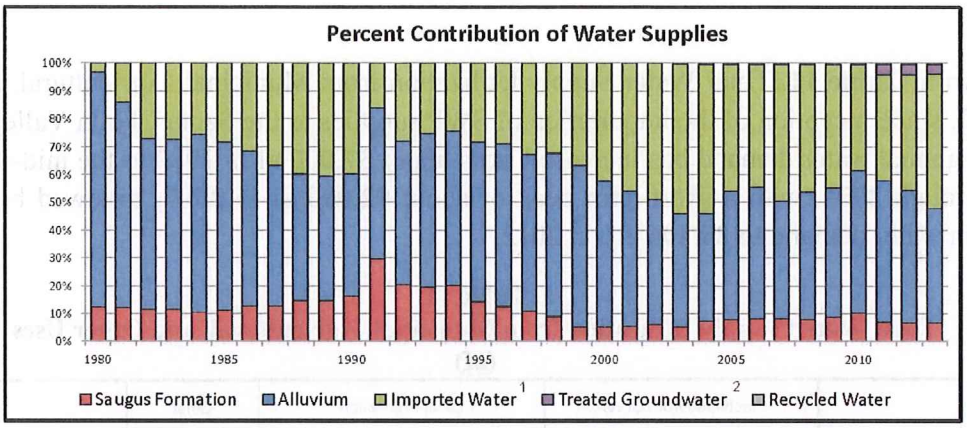
Table 11
Total Water Supply Utilization from Municipal, Agricultural, and Other Uses (af)

	Purchased from CLWA		Local Production		Other	
Year	*Imported Water*[1]	*Treated Groundwater*[2]	*Alluvium*	*Saugus Formation*	*Recycled Water*	Total
1980	1,126	-	31,463	4,589	-	**37,178**
1981	5,817	-	30,790	4,970	-	**41,577**
1982	9,659	-	21,868	4,090	-	**35,617**
1983	9,185	-	20,286	3,852	-	**33,323**
1984	10,996	-	27,318	4,449	-	**42,763**
1985	11,823	-	25,347	4,715	-	**41,885**
1986	13,759	-	24,205	5,485	-	**43,449**
1987	16,285	-	22,642	5,561	-	**44,488**
1988	19,033	-	21,648	6,928	-	**47,609**
1989	21,618	-	23,721	7,759	-	**53,098**
1990	21,613	-	23,876	8,861	-	**54,350**
1991	7,968	-	27,187	14,917	-	**50,072**
1992	14,898	-	27,591	10,924	-	**53,413**
1993	13,836	-	30,126	10,610	-	**54,572**
1994	14,700	-	33,133	12,025	-	**59,858**
1995	17,002	-	34,464	8,560	-	**60,026**
1996	18,873	-	38,438	8,186	-	**65,497**
1997	23,215	-	39,599	7,745	-	**70,559**
1998	20,266	-	36,648	5,555	-	**62,469**
1999	27,302	-	43,406	3,716	-	**74,424**
2000	32,582	-	39,937	4,080	-	**76,599**
2001	35,369	-	37,589	4,140	-	**77,098**
2002	41,763	-	38,276	5,160	-	**85,199**
2003	44,416	-	33,599	4,207	50	**82,273**
2004	47,205	-	33,757	6,503	420	**87,885**
2005	37,997	-	38,648	6,453	418	**83,516**
2006	40,048	-	43,061	7,312	419	**90,840**
2007	45,151	-	38,773	7,685	470	**92,079**
2008	41,705	-	41,716	6,918	311	**90,650**
2009	38,546	-	39,986	7,678	328	**86,538**
2010	30,578	-	41,159	8,092	336	**80,165**
2011	30,808	2,784	40,748	5,531	373	**80,244**
2012	35,558	2,956	40,701	5,763	428	**85,406**
2013	43,281	3,108	36,892	5,930	400	**89,611**

Source: 2013 Santa Clarita Valley Water Report, Table 2-3.

Figure 1 graphically illustrates the trends in the utilization of local groundwater and imported water, complimented by the recent addition of recycled water, in the Santa Clarita Valley.

Figure 1
Percent Contribution of Water Supplies



1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.
2. In January 2011, CLWA began operation of its Saugus Formation groundwater containment project. After treatment for perchlorate removal, that water was blended with treated imported water and delivered to the Purveyors through the CLWA distribution system.

Source: 2013 Santa Clarita Valley Water Report, p. 2-5.

Provided below is a summary of water supply and demand projections presented in the 2010 UWMP that address the requirements of SB 610 for the Entrada South Project.

6.2.1 Water Supplies — Current and Planned

Table 12, Summary of Current and Planned Water Supplies and Banking Programs, summarizes the existing and planned water supplies and banking programs available to the retail purveyors in the Santa Clarita Valley. This table is not intended to be an operational plan for how supplies would be used in a particular year, but rather identifies the complete range of water supplies available under a range of hydrologic conditions. Diversity of supply allows VWC and the other retail purveyors the option of drawing on multiple sources of supply in response to changing conditions such as varying climatic conditions (average/normal years, single dry years, multiple dry years), natural disasters, and contamination with substances such as perchlorate.

It is the stated goal of VWC, CLWA, and the other retail water purveyors to deliver a reliable and high quality water supply for their customers, even during dry periods. Based on conservative water supply and demand assumptions over the next 40 years in combination with conservation of non-essential demand during certain dry years, the water supply plan described in the 2010 UWMP successfully achieves this goal.

Table 12
Summary of Current and Planned Water Supplies and Banking Programs[1]

Water Supply Sources	Supply (af)								
	2010	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies									
Existing Groundwater[2]									
Alluvial Aquifer	24,385	24,000	24,000	24,000	25,000	25,000	25,000	25,000	25,000
Saugus Formation[3]	6,725	9,225	10,225	10,225	10,225	10,225	10,225	10,225	10,225
Total Groundwater	**31,110**	**33,225**	**34,225**	**34,225**	**35,225**	**35,225**	**35,225**	**35,225**	**35,225**
Recycled Water[4] **Total Recycled**	**325**	**325**	**325**	**325**	**325**	**325**	**325**	**325**	**325**
Imported Water									
State Water Project[5]	58,300	58,100	57,900	57,600	57,400	57,400	57,400	57,400	57,400
Flexible Storage Accounts[6]	6,060	6,060	4,680	4,680	4,680	4,680	4,680	4,680	4,680
Buena Vista - Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Total Imported	**76,967**	**76,767**	**75,187**	**74,887**	**74,687**	**74,687**	**74,687**	**74,687**	**74,687**
Existing Banking Programs[7]									
Rosedale - Rio Bravo	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Semitropic	15,000	15,000	15,000	–	–	–	–	–	–
Semitropic - Newhall Land	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Total Banking	**39,950**	**39,950**	**39,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**
Planned Supplies									
Future Groundwater[8]									
Alluvial Aquifer	–	–	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation	–	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Total Groundwater	–	**1,375**	**2,375**	**3,375**	**4,375**	**5,375**	**6,375**	**7,375**	**8,375**
Recycled Water[9] **Total Recycled**	–	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs **Total Banking**	–	–	–	**10,000**	**10,000**	**20,000**	**20,000**	**20,000**	**20,000**

Notes:
(1) The values shown under "Existing Supplies" and "Planned Supplies" are projected to be available in average/normal years. The values shown under "Existing Banking Programs" and "Planned Banking Programs" are the maximum capacity of program withdrawals.
(2) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.
(3) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.
(4) Represents recycled water being delivered in 2010 with existing facilities. CLWA currently has 1,700 afy under contract.
(5) SWP supplies are based on DWR's "2009 Delivery Reliability Report."
(6) Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with Ventura County entities expires after 2015.
(7) Supplies shown are annual amounts that can be withdrawn and would typically be used only during dry years.
(8) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial aquifer and the Saugus Formation. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production remains within the sustainable ranges identified in Table 3-8 of the Groundwater Basin Yield Update. As indicated in Table 3-10 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.
(9) See Table 4-3 of the 2010 UWMP. Total Purveyor Recycled Water less Existing Recycled Supply.
Source: 2010 UWMP

The subject of perchlorate contamination and its impact on groundwater supplies is extensively addressed in both the 2010 UWMP, Entrada South Draft EIR, Section 5.21, Utilities and Service Systems — Water Supply and Service, and the Cardno-ENTRIX technical report (2014). The source of the contamination is believed to be the former Whittaker-Bermite property located in the center of the Santa Clarita Valley and used as a munitions manufacturing facility for over 50 years. Significant progress has been made toward characterizing the extent of perchlorate contamination, along with implementing necessary measures for on-site and off-site containment and treatment. This WSA takes into account the impact of perchlorate on water supply operations in the Santa Clarita Valley, while the planning, design, and construction of perchlorate treatment, containment, and other restoration activities are implemented.

In Decision 06-08-012, dated August 24, 2006, the California Public Utilities Commission (CPUC) rejected the Sierra Club's claims that the perchlorate containment program in the Santa Clarita Valley had not progressed and was unfunded. The CPUC stated, at page 15:

> "According to Valencia, CLWA developed an Interim Remedial Action Plan to address groundwater contamination by perchlorate in conformance with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and that action plan was approved by the California Department of Toxic Substances Control in January 2006. CLWA also completed CEQA review of its remedial action plan in the same time frame, and neither the action plan nor the CEQA review has been subject to any judicial challenge. The final design for treatment facilities is nearly complete; the groundbreaking ceremony is set to occur in August 2006; the construction work is scheduled to be put out for bid in the fall of 2006, with construction to be completed and operation to commence in 2007. Funding to cover all remedial work has been secured by a settlement between Whittaker-Bermite and its insurance carriers, with many millions of dollars currently held in escrow. A settlement of claims by CLWA and other water purveyors is pending, and is expected to result in the assignment of the escrowed funds for implementation of CLWA's Interim Remedial Action Plan."

In summary, since 2006 to the present, work has continued on multiple levels to address groundwater contaminated by perchlorate stemming from past manufacturing activities on the former Whittaker-Bermite site. CLWA and the local retail purveyors are proceeding to restore the capacity of the remaining groundwater supply wells contaminated by perchlorate, while working on the objectives of containing the downgradient migration of perchlorate.

Based on the information presented in the 2010 UWMP, the Draft EIR for the Entrada South Project, and the Cardno-ENTRIX technical report (2014), it is appropriate to conclude that substantial progress continues to be made in responding to perchlorate contamination resulting from the former Whittaker-Bermite site and that the facilities needed for perchlorate remediation/treatment are in place and actively monitored by CLWA, local retail purveyors, and the regulatory agencies (*e.g.*, DDW).

6.2.2 Average/Normal Year Supplies and Demand

Table 13, Projected Average Year Supplies and Demands, summarizes the water supplies available to meet demands over the 40-year planning period studied in the 2010 UWMP during an average/normal water year. As presented, the water supply is broken down into existing and planned water supply sources, including wholesale (imported) water, local supplies, and banking programs. Demands are shown with and without the urban demand reduction resulting from SBX7-7 water conservation objectives. As shown in **Table 13**, CLWA and the retail purveyors have adequate supplies to meet all service area existing and projected demands during an average year through 2050.

Note also Appendix C of the 2010 UWMP provided additional "retail purveyor" tables reflecting available supply and water demand broken down by each retail purveyor during the same weather conditions (average, single-dry, and multiple-dry) and same planning horizon as used in the adopted UWMP.

The "retail purveyor" water supply and demand data (Appendix C of the 2010 UWMP) responds to County Development Monitoring System (DMS) criteria for determining an acceptable level of water supply by retail purveyor (VWC) in an average water year.

Specifically, Appendix C of the 2010 UWMP, Tables C-1 and C-2, reflect the average year existing and planned total water supplies broken down by retail purveyor, and Table C-3 compares average year demands to total supplies by retail purveyor, and shows that in an average year, VWC's total existing and planned supplies exceed demand from 2015 through 2050. These tables are reproduced in **Appendix 1** to this WSA — with the VWC demand and supplies yellow highlighted.

Table 13
Projected Average Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
EXISTING SUPPLIES								
Existing Groundwater[1]								
Alluvial Aquifer	24,000	24,000	24,000	25,000	25,000	25,000	25,000	25,000
Saugus Formation[2]	9,225	10,225	10,225	10,225	10,225	10,225	10,225	10,225
Subtotal Groundwater	*33,225*	*34,225*	*34,225*	*35,225*	*35,225*	*35,225*	*35,225*	*35,225*
Recycled Water[3]	325	325	325	325	325	325	325	325
Imported Water[4]								
State Water Project[5]	58,100	57,900	57,600	57,400	57,400	57,400	57,400	57,400
Flexible Storage Accounts[6]	—	—	—	—	—	—	—	—
Buena Vista–Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water–Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Subtotal Imported	*70,707*	*70,507*	*70,207*	*70,007*	*70,007*	*70,007*	*70,007*	*70,007*
Banking Programs[6]								
Rosedale–Rio Bravo	—	—	—	—	—	—	—	—
Semitropic	—	—	—	—	—	—	—	—
Semitropic–Newhall Land	—	—	—	—	—	—	—	—
Subtotal Banking	—	—	—	—	—	—	—	—
Total Existing Supplies	**104,257**	**105,057**	**104,757**	**105,557**	**105,557**	**105,557**	**105,557**	**105,557**
PLANNED SUPPLIES								
Future Groundwater[7]								
Alluvial Aquifer	—	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Subtotal Groundwater	*1,375*	*2,375*	*3,375*	*4,375*	*5,375*	*6,375*	*7,375*	*8,375*
Recycled Water[3]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs[6]	—	—	—	—	—	—	—	—
Total Planned Supplies	**2,350**	**5,100**	**8,600**	**12,150**	**15,650**	**20,150**	**24,650**	**29,350**

Table 13
Projected Average Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
Total Existing and Planned Supplies	**106,607**	**110,157**	**113,357**	**117,707**	**121,207**	**125,707**	**130,207**	**134,907**
	Demand (af)							
Demand (without conservation)[8]	80,070	88,484	96,898	105,312	113,726	122,140	130,554	138,968
20X2020 Reduction[9]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[10]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[11]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand with Conservation[12]	**72,343**	**71,908**	**80,236**	**88,564**	**96,892**	**105,220**	**113,549**	**121,877**

(1) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5 of the 2010 UWMP.

(2) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(3) Recycled water projections from Table C-1 and C-2 of the 2010 UWMP.

(4) The 2010 UWMP relied on DWR's "2009 State Water Project Delivery Reliability Report"; therefore, the water supply and demand data reflected above constitutes the best available information from an adopted plan.

(5) SWP Table A supply is approximately 60-61 percent (rounded) of CLWA's total maximum Table A amount of 95,200 af.

(6) Not needed in average/normal years.

(7) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial aquifer and the Saugus Formation. As indicated in Table 3-10 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

(8) Demand w/o Conservation data from Table C-3 of the 2010 UWMP.

(9) 20x2020 Reduction for the Region from Table 2-22 of the UWMP.

(10) Recycled Water Reduction for the Region from Table 2-22 of the 2010 UWMP; does not include demands from Honor Rancho.

(11) Reduction from Water Conservation calculation for Region from Table 2-22 of the 2010 UWMP.

(12) Demand w/Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

Source: 2010 UWMP.

6.2.3 Single Dry-Year Supplies and Demand

The water supplies and demand over the 2010 UWMP 40-year planning horizon were analyzed in the event of a single-dry year, similar to the drought that occurred in California in 1977. **Table 14**, Projected Single-Dry Year Supplies and Demands, summarizes the existing and planned supplies available to meet demand during a single-dry year. Base demand (demand without conservation) during dry years was assumed to increase by 10 percent. Demands also are shown with the urban demand reduction resulting from SBX7-7 water conservation objectives. As shown in **Table 14**, CLWA and the retail purveyors have adequate supplies to meet all service area existing and projected demands during a single-dry year through 2050.

In addition, please see Appendix C to the 2010 UWMP for the breakdown by retail purveyor of supplies available to meet demand over the 2010 UWMP 40-year planning horizon during a single-dry year. This information responds to the County DMS criteria for determining an acceptable level of water supply by retail purveyor (VWC) in a single-dry year.

Specifically, Appendix C of the 2010 UWMP, Tables C-4 and C-5 reflect the single-dry year existing and planned total water supplies broken down by retail purveyor, and Table C-6 compares single-dry year demands to total supplies by retail purveyor, and shows that in a single-dry year, VWC's total existing and planned supplies exceed demand from 2015 through 2050. These tables are reproduced in **Appendix 2** to this WSA — with the VWC demand and supplies yellow highlighted.

Table 14
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
EXISTING SUPPLIES								
Existing Groundwater[1]								
Alluvial Aquifer	20,300	20,250	20,200	21,050	21,050	21,025	21,000	20,650
Saugus Formation	20,400	20,400	20,400	20,400	20,400	20,400	20,400	20,400
Subtotal Groundwater	*40,700*	*40,650*	*40,600*	*41,450*	*41,450*	*41,425*	*41,400*	*41,050*
Recycled Water[2]	325	325	325	325	325	325	325	325
Imported Water[3]								
State Water Project[4]	11,900	11,000	10,000	9,100	9,100	9,100	9,100	9,100
Flexible Storage Accounts[5]	6,060	4,680	4,680	4,680	4,680	4,680	4,680	4,680
Buena Vista–Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water–Newhall	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Subtotal Imported	*30,567*	*28,287*	*27,287*	*26,387*	*26,387*	*26,387*	*26,387*	*26,387*
Banking Programs								
Rosedale–Rio Bravo[6]	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Semitropic[7]	15,000	15,000	—	—	—	—	—	—
Semitropic–Newhall[8]	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Subtotal Banking	*39,950*	*39,950*	*24,950*	*24,950*	*24,950*	*24,950*	*24,950*	*24,950*
Total Existing Supplies	**111,542**	**109,212**	**93,162**	**93,112**	**93,112**	**93,087**	**93,062**	**92,712**
PLANNED SUPPLIES								
Future Groundwater[9]								
Alluvial Aquifer	200	1,250	2,300	3,850	4,850	5,875	6,900	7,750
Saugus Formation (Restored Wells)	825	3,777	3,777	3,777	3,777	3,777	3,777	3,750
Saugus Formation (New Wells)	2,875	9,923	9,923	9,923	9,923	9,923	9,923	9,950
Subtotal Groundwater	*3,900*	*14,950*	*16,000*	*17,550*	*18,550*	*19,575*	*20,600*	*21,450*
Recycled Water[2]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs[10]	—	—	10,000	10,000	20,000	20,000	20,000	20,000
Total Planned Supplies	**4,875**	**17,675**	**31,225**	**35,325**	**48,825**	**53,350**	**57,875**	**62,425**
Total Existing and Planned Supplies	116,417	126,887	124,387	128,437	141,937	146,437	150,937	155,137

Table 14
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
	Demand (af)							
Demand (without conservation)[11]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
20X2020 Reduction[12]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[13]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[14]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand with Conservation[15]	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**

(1) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-5 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan. SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(2) Recycled water projections from Table C-4 and C-5 of the 2010 UWMP.

(3) The 2010 UWMP relied on DWR's 2009 Delivery Reliability Report; therefore, the water supply and demand data reflected above constitutes the best available information from an adopted plan.

(4) SWP Table A supplies are calculated by multiplying CLWA's Table A amount of 95,200 af by percentages of single-dry year deliveries projected to be available on Table 6-4 (7 percent) and Table 6-13 (11 percent) of DWR's 2009 Delivery Reliability Report. As suggested by DWR, SWP supplies for the 5-year increments between 2010 and 2030 are interpolated between these values.

(5) Includes both CLWA and Ventura County entities flexible storage accounts. Initial Term of agreement with Ventura County entities expires after 2015.

(6) CLWA has a maximum withdrawal capacity of 20,000 afy and a storage capacity of 100,000 AF. As of 6/1/2011, there is 100,000 AF of recoverable water.

(7) CLWA has 45,920 af of recoverable water as of 6/1/2011.

(8) Newhall has a maximum withdrawal capacity of 4,950 afy and a storage capacity of 55,000 af. As of December 31, 2013, there is 27,505 af of recoverable water. Delivery of stored water from the Newhall's Semitropic Water Banking and Exchange Program is available to VWC.

(9) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial aquifer and the Saugus Formation, including 3,777 afy of restored capacity from VWC Well 201 and approximately 10,000 afy of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1977 single dry-year levels identified in Table 3-8 of the 2009 Basin Yield Update. As indicated in Table 3-11 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

(10) Includes banking programs with 10,000 af of additional pumpback capacity by 2025 and a second additional 10,000 af by 2035.

(11) Demand w/o Conservation data from Table C-6 of the 2010 UWMP. Includes a 10-percent increase in demand during dry years.

(12) 20x2020 Reduction for the Region from Table 2-22 of the 2010 UWMP.

(13) Recycled Water Reduction for the Region from Table 2-22 of the 2010 UWMP; does not include demands from Honor Rancho.

(14) Reduction from Water Conservation calculation for Region from Table 2-22 of the UWMP.

(15) Demand with Conservation is Demand without Conservation minus Reduction from Water Conservation.

Source: 2010 UWMP.

6.2.4 Multiple Dry-Year Supplies and Demand

The water supplies and demand over the 2010 UWMP 40-year planning horizon were analyzed in the event of a four-year multiple-dry year event, similar to the drought that occurred in California during the years 1931 to 1934. **Table 15**, Projected Multiple-Dry Year Supplies and Demands, summarizes the existing and planned supplies available to meet demand during multiple-dry years. Base demand (demand without conservation) during dry years was assumed to increase by 10 percent. Demands also are shown with the urban demand reduction resulting from SBX7-7 conservation objectives. As shown in **Table 15**, CLWA and the retail purveyors have adequate supplies to meet all service area existing and projected demands during multiple-dry years through 2050.

In addition, please see Appendix C to the 2010 UWMP for the breakdown by retail purveyor of supplies available to meet demand over the 2010 UWMP 40-year planning horizon during multiple-dry years. This information responds to the County DMS criteria for determining an acceptable level of water supply by retail purveyor (VWC) in a multiple-dry years.

Specifically, Appendix C of the 2010 UWMP, Tables C-7 and C-8 reflect the multiple-dry year existing and planned total water supplies broken down by retail purveyor, and Table C-9 compares multiple-dry year demands to total supplies by retail purveyor. Table C-9 shows that in a multiple-dry year, VWC's total existing and planned supplies exceed demand from 2015 through 2050. These tables are reproduced in **Appendix 3** to this WSA — with the VWC demand and supplies yellow highlighted.

Table 15
Projected Multiple-Dry Year Supplies and Demands

	Supply (af)							
Water Supply Sources	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
EXISTING SUPPLIES								
Existing Groundwater[1]								
Alluvial Aquifer	20,425	20,425	20,425	21,825	21,825	21,825	21,825	21,325
Saugus Formation	19,700	19,700	19,700	19,700	19,700	19,700	19,700	19,700
Subtotal Groundwater	*40,125*	*40,125*	*40,125*	*41,525*	*41,525*	*41,525*	*41,525*	*41,025*
Recycled Water[2]	325	325	325	325	325	325	325	325
Imported Water[3]								
State Water Project[4]	32,900	32,900	33,000	33,000	33,000	33,000	33,000	33,000
Flexible Storage Accounts[5]	1,510	1,170	1,170	1,170	1,170	1,170	1,170	1,170
Buena Vista–Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water—Newhall	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Subtotal Imported	*47,017*	*46,677*	*46,777*	*46,777*	*46,777*	*46,777*	*46,777*	*46,777*
Banking Programs								
Rosedale–Rio Bravo[6]	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Semitropic[7]	11,500	11,500	—	—	—	—	—	—
Semitropic–Newhall[8]	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Subtotal Banking	*31,450*	*31,450*	*19,950*	*19,950*	*19,950*	*19,950*	*19,950*	*19,950*
Total Existing Supplies	**118,917**	**118,577**	**107,177**	**108,577**	**108,577**	**108,577**	**108,577**	**108,077**
PLANNED SUPPLIES								
Future Groundwater[9]								
Alluvial Aquifer	—	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation (Restored Wells)	2,375	1,625	1,500	1,400	1,275	1,125	1,000	875
Saugus Formation (New Wells)	2,250	10,325	10,450	10,550	10,675	10,825	10,950	11,075
Subtotal Groundwater	*4,625*	*12,950*	*13,950*	*14,950*	*15,950*	*16,950*	*17,950*	*18,950*
Recycled Water[2]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs[10]	—	—	7,500	7,500	15,000	15,000	15,000	15,000
Total Planned Supplies	**5,600**	**15,675**	**26,675**	**30,225**	**41,225**	**45,725**	**50,225**	**54,925**
Total Existing and Planned Supplies	**124,517**	**134,252**	**133,852**	**138,802**	**149,802**	**154,302**	**158,802**	**163,002**

Table 15
Projected Multiple-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
	Demand (af)							
Demand (without conservation)[11]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
20X2020 Reduction[12]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[13]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[14]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand with Conservation[15]	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**

[1] Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-12, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5 of the 2010 UWMP. SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

[2] Recycled water projections from Table C-7 and C-8 of the 2010 UWMP.

[3] The 2010 UWMP relied on DWR's 2009 Delivery Reliability Report; therefore, the water supply and demand data reflected above constitutes the best available information from an adopted plan.

[4] SWP Table A supplies are calculated by multiplying CLWA's Table A amount of 95,200 af by percentages of multiple-dry year deliveries projected to be available on Table 6-4 (34-36 percent) and Table 6-13 (28-32 percent) of DWR's 2009 Delivery Reliability Report. As suggested by DWR, SWP supplies for the 5-year increments between 2010 and 2030 are interpolated between these values.

[5] Includes both CLWA and Ventura County entities flexible storage accounts. Initial Term of agreement with Ventura County entities expires after 2015.

[6] CLWA has a maximum withdrawal capacity of 20,000 afy and a storage capacity of 100,000 af. As of 6/1/2011, there is 100,000 af of recoverable water.

[7] CLWA has 45,920 af of recoverable water as of 6/1/2011.

[8] Newhall Land has a maximum withdrawal capacity of 4,950 afy and a storage capacity of 55,000 af. As of December 31, 2013, there is 27,505 af of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is available to VWC.

[9] Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial aquifer and the Saugus Formation, including 3,777 afy of restored capacity from VWC Well 201 and approximately 10,000 afy of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1931-1934 multiple dry-year levels identified in Table 3-8 of the 2009 Basin Yield Update. As indicated in Table 3-12 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

[10] Includes banking programs with 10,000 af of additional pumpback capacity by 2025 and a second additional 10,000 af by 2035.

[11] Demand w/o Conservation data from Table C-9 of the 2010 UWMP. Includes a 10% increase in demand during dry years.

[12] 20x2020 Reduction for the Region from Table 2-22 of the 2010 UWMP.

[13] Recycled Water Reduction for the Region from Table 2-22 of the 2010 UWMP; does not include demands from Honor Rancho.

[14] Reduction from Water Conservation calculation for Region from Table 2-22 of the 2010 UWMP.

[15] Demand with Conservation is Demand without Conservation minus Reduction from Water Conservation.

Source: 2010 UWMP.

7.0 CONCLUSION

Based on the preceding analysis, this WSA report concludes that the total water supplies projected to be available to VWC during average/normal, single-dry, and multiple-dry years within a 20-year projection are sufficient to meet the projected demand associated with the Entrada South Project, in addition to existing and planned future uses, including agricultural and industrial uses, within the VWC service area.

APPENDIX 1

Table C-1
Average/Normal Year: Existing Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
EXISTING SUPPLIES[a]								
Existing Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
SCWD	10,500	10,500	10,500	11,500	11,500	11,500	11,500	11,500
VWC	11,675	11,675	11,675	11,675	11,675	11,675	11,675	11,675
Total	*24,000*	*24,000*	*24,000*	*25,000*	*25,000*	*25,000*	*25,000*	*25,000*
Saugus Formation								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	3,525	3,525	3,525	3,525	3,525	3,525	3,525	3,525
SCWD[d]	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
VWC	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
Total	*9,225*	*10,225*	*10,225*	*10,225*	*10,225*	*10,225*	*10,225*	*10,225*
Recycled Water[e]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	325	325	325	325	325	325	325	325
Total	*325*	*325*	*325*	*325*	*325*	*325*	*325*	*325*
Imported Water								
SWP Table A and Carryover[f]								
LACWWD 36[c]	1,656	1,943	2,217	2,489	2,688	2,901	3,091	3,269
NCWD	8,084	8,918	9,320	10,060	10,349	10,755	11,116	11,469
SCWD	23,918	24,263	24,268	23,963	24,541	24,979	25,369	25,787
VWC	24,442	22,776	21,795	20,888	19,822	18,765	17,825	16,875
Total	*58,100*	*57,900*	*57,600*	*57,400*	*57,400*	*57,400*	*57,400*	*57,400*
SWP Flexible Storage Accounts[g]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Buena Vista-Rosedale								
LACWWD 36[c]	325	375	450	500	525	575	625	650
NCWD	1,600	1,750	1,825	1,975	2,050	2,100	2,175	2,250

Table C-1
Average/Normal Year: Existing Water Supplies

		2015	2020	2025	2030	2035	2040	2045	2050
SCWD		4,675	4,775	4,775	4,725	4,825	4,900	4,975	5,050
VWC		4,400	4,100	3,950	3,800	3,600	3,425	3,225	3,050
	Total	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*
Nickel Water - Newhall Land									
VWC	*Total*	*1,607*	*1,607*	*1,607*	*1,607*	*1,607*	*1,607*	*1,607*	*1,607*
Banking Programs[g]									
Rosedale Rio-Bravo									
LACWWD 36[c]		0	0	0	0	0	0	0	0
NCWD		0	0	0	0	0	0	0	0
SCWD		0	0	0	0	0	0	0	0
VWC		0	0	0	0	0	0	0	0
	Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic									
LACWWD 36[c]		0	0	0	0	0	0	0	0
NCWD		0	0	0	0	0	0	0	0
SCWD		0	0	0	0	0	0	0	0
VWC		0	0	0	0	0	0	0	0
	Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic – Newhall Land									
VWC		0	0	0	0	0	0	0	0
	Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
TOTAL EXISTING SUPPLIES									
LACWWD 36[c]		1,981	2,318	2,667	2,989	3,213	3,476	3,716	3,919
NCWD		15,034	16,018	16,495	17,385	17,749	18,205	18,641	19,069
SCWD		41,943	42,888	42,893	43,538	44,216	44,729	45,194	45,687
VWC		45,299	43,833	42,702	41,645	40,379	39,147	38,007	36,882
	Total	**104,257**	**105,057**	**104,757**	**105,557**	**105,557**	**105,557**	**105,558**	**105,557**

Notes:
(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.
(b) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.
(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.
(d) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.
(e) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.
(f) SWP supplies are based on the Department of Water Resources "*2009 State Water Project Delivery Reliability Report.*"
(g) Not needed in average/normal years.

Source: 2010 UWMP, Appendix C

Table C-2
Average/Normal Year: Planned and Total Water Supplies

		2015	2020	2025	2030	2035	2040	2045	2050
PLANNED SUPPLIES[a]									
Future Groundwater[b]									
Alluvial Aquifer									
LACWWD 36[c]		0	0	0	0	0	0	0	0
NCWD		0	0	0	0	0	0	0	0
SCWD		0	0	0	0	0	0	0	0
VWC[d]		0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
	Total	-	*1,000*	*2,000*	*3,000*	*4,000*	*5,000*	*6,000*	*7,000*
Saugus Formation									
LACWWD 36[c]			500	500	500	500	500	500	500
NCWD			875	875	875	875	875	875	875
SCWD			0	0	0	0	0	0	0
VWC			0	0	0	0	0	0	0
	Total		*1,375*	*1,375*	*1,375*	*1,375*	*1,375*	*1,375*	*1,375*
Recycled Water[f]									
LACWWD 36[c][e]		0	50	50	50	50	50	50	50
NCWD		200	500	1,000	1,275	1,775	2,275	2,775	3,275
SCWD		100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC		675	1,675	2,675	4,175	5,675	7,675	9,675	11,875
	Total	*975*	*2,725*	*5,225*	*7,775*	*10,275*	*13,775*	*17,275*	*20,975*
Banking Programs[g]									
LACWWD 36[c]		0	0	0	0	0	0	0	0
NCWD		0	0	0	0	0	0	0	0
SCWD		0	0	0	0	0	0	0	0
VWC		0	0	0	0	0	0	0	0
	Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
TOTAL PLANNED SUPPLIES									
LACWWD 36[c]		500	550	550	550	550	550	550	550
NCWD		1,075	1,375	1,875	2,150	2,650	3,150	3,650	4,150
SCWD		100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC		675	2,675	4,675	7,175	9,675	12,675	15,675	18,875
	Total	**2,350**	**5,100**	**8,600**	**12,150**	**15,650**	**20,150**	**24,650**	**29,350**
PURVEYOR EXISTING AND PLANNED SUPPLIES									
LACWWD 36[c]		2,481	2,868	3,217	3,539	3,763	4,026	4,266	4,469
NCWD		16,109	17,393	18,370	19,535	20,399	21,355	22,291	23,219
SCWD		42,043	43,388	44,393	45,813	46,991	48,504	49,969	51,462

Table C-2
Average/Normal Year: Planned and Total Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
VWC	45,974	46,508	47,377	48,820	50,054	51,822	53,682	55,757
Total	**106,607**	**110,157**	**113,357**	**117,707**	**121,207**	**125,707**	**130,208**	**134,907**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production remains within the sustainable ranges identified in Table 3-7 of 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-10, existing and planned groundwater pumping remain within the basin operating plan shown on Table 3- 5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) Conversion of Newhall Land agricultural groundwater supplies to VWC M&I supplies.

(e) LACWWD 36 anticipates connecting a newly completed well in 2011.

(f) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(g) Not needed in average/normal years.

Source: 2010 UWMP, Appendix C

Table C-3
Average/Normal Year: Demands with SBX7-7 Reductions and Comparison to Total Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
WATER DEMANDS W/ AND W/O CONSERVATION[a]								
LACWWD 36[c]								
Demand w/o Conservation[c]	1,759	2,189	2,619	3,048	3,478	3,908	4,338	4,768
Anticipated Conservation Objective[d]	176	438	524	610	696	782	868	954
Reduction from Recycled Water[e]	0	50	50	50	50	50	50	50
Net Anticipated Water Conservation[f]	176	388	474	560	646	732	818	904
Demand w/ Conservation[g]	1,584	1,802	2,146	2,489	2,833	3,177	3,521	3,865
Existing and Planned Supplies	*2,481*	*2,868*	*3,217*	*3,539*	*3,763*	*4,026*	*4,266*	*4,469*
SBX7-7 Compliance Calculations								
NCWD								
Demand w/o Conservation[c]	12,571	14,246	15,922	17,598	19,273	20,949	22,624	24,300
20x2020 Reduction[h]	1,365	2,982	3,204	3,489	3,742	3,995	4,248	4,501
Reduction from Recycled Water[e]	200	500	1,000	1,275	1,775	2,275	2,775	3,275
Reduction from Water Conservation[i]	1,165	2,482	2,482	2,482	2,482	2,482	2,482	2,482
Demand w/ Conservation[j]	11,406	11,764	13,439	15,116	16,791	18,467	20,142	21,818
Existing and Planned Supplies	*16,109*	*17,393*	*18,370*	*19,535*	*20,399*	*21,355*	*22,291*	*23,219*
SCWD								
Demand w/o Conservation[c]	31,633	34,814	37,995	41,176	44,357	47,538	50,719	53,900
20x2020 Reduction[k]	3,524	7,557	8,067	8,576	9,085	9,595	10,104	10,614
Reduction from Recycled Water[e]	100	500	1,500	2,275	2,775	3,775	4,775	5,775
Reduction from Water Conservation[i]	3,424	7,057	7,057	7,057	7,057	7,057	7,057	7,057
Demand w/ Conservation[j]	28,209	27,757	30,938	34,119	37,300	40,481	43,662	46,843
Existing and Planned Supplies	*42,043*	*43,388*	*44,393*	*45,813*	*46,991*	*48,504*	*49,969*	*51,462*
VWC								
Demand w/o Conservation[c]	34,107	37,235	40,362	43,490	46,617	49,745	52,872	56,000
20x2020 Reduction[l]	3,962	8,648	9,372	10,095	10,819	11,542	12,266	12,990
Reduction from Recycled Water[e]	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Reduction from Water Conservation[i]	2,962	6,648	6,648	6,648	6,648	6,648	6,648	6,648
Demand w/ Conservation[j]	31,144	30,587	33,714	36,842	39,968	43,097	46,223	49,352
Existing and Planned Supplies	*45,974*	*46,508*	*47,377*	*48,820*	*50,054*	*51,822*	*53,682*	*55,757*

Table C-3
Average/Normal Year: Demands with SBX7-7 Reductions and Comparison to Total Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
REGIONAL SUMMARY								
Demand w/o Conservation[(c)]	80,070	88,484	96,898	105,312	113,726	122,140	130,554	138,968
Total 20x2020 Reduction	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Total Reduction from Recycled Water[(m)]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Total Reduction from Water Conservation	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation	**72,343**	**71,908**	**80,236**	**88,564**	**96,892**	**105,220**	**113,549**	**121,877**
TOTAL EXISTING AND PLANNED SUPPLIES	**106,607**	**110,157**	**113,357**	**117,707**	**121,207**	**125,707**	**130,208**	**134,907**

Notes:

(a) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies. Known parties potentially seeking annexation include Legacy/Stevenson Ranch Phase 5, Tapia Canyon and Tesoro Del Valle.

(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(c) Demand w/o Conservation from Table 2-2.

(d) LACWWD 36 conservation objective estimated at 20% of projected demand commencing 2020; see Table 2-21.

(e) Recycled water projections from Table 4-3.

(f) Net Anticipated Conservation for LACWWD 36 is Anticipated Conservation Objective minus Reduction from Recycled Water.

(g) Demand w/ Conservation for LACWWD 36 is Demand w/o Conservation minus Net Anticipated Conservation.

(h) NCWD 20x2020 Reduction from Table 2-16. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(i) Reduction from Water Conservation is 20x2020 Reduction minus Reduction from Recycled Water for 2015 and 2020; the quantity of water conservation remains at least at 2020 amounts through 2050.

(j) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

(k) SCWD 20x2020 Reduction from Table 2-18. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(l) VWC 20x2020 Reduction from Table 2-20. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(m) Recycled water reductions do not include demands from Honor Rancho.

Source: 2010 UWMP, Appendix C

APPENDIX 2

Table C-4
Single-Dry Year: Existing Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
EXISTING SUPPLIES[a]								
Existing Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	1,150	1,150	1,150	1,225	1,250	1,250	1,250	1,225
SCWD	8,150	8,150	8,150	8,150	8,150	8,150	8,150	8,150
VWC	11,000	10,950	10,900	11,675	11,650	11,625	11,600	11,275
Total	*20,300*	*20,250*	*20,200*	*21,050*	*21,050*	*21,025*	*21,000*	*20,650*
Saugus Formation								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	4,975	4,975	4,975	4,975	4,975	4,975	4,975	4,975
SCWD	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
VWC	11,925	11,925	11,925	11,925	11,925	11,925	11,925	11,925
Total	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*
Recycled Water[e]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	325	325	325	325	325	325	325	325
Total	*325*	*325*	*325*	*325*	*325*	*325*	*325*	*325*
Imported Water								
SWP Table A and Carryover[f]								
LACWWD 36[c]	405	436	440	444	468	499	522	543
NCWD	1,722	1,734	1,657	1,630	1,670	1,731	1,786	1,826
SCWD	6,171	5,892	5,208	4,736	4,720	4,710	4,701	4,696
VWC	3,602	2,938	2,694	2,290	2,242	2,161	2,091	2,036
Total	*11,900*	*11,000*	*9,999*	*9,100*	*9,100*	*9,101*	*9,100*	*9,101*
SWP Flexible Storage Accounts[g]								
LACWWD 36[c]	206	185	206	228	241	257	268	279
NCWD	877	738	776	838	859	890	918	939
SCWD	3,143	2,507	2,438	2,436	2,427	2,422	2,418	2,415
VWC	1,834	1,250	1,261	1,177	1,153	1,111	1,075	1,047
Total	*6,060*	*4,680*	*4,681*	*4,679*	*4,680*	*4,680*	*4,679*	*4,680*
Buena Vista-Rosedale								
LACWWD 36[c]	400	450	500	550	575	625	650	675
NCWD	1,650	1,800	1,900	2,025	2,075	2,150	2,225	2,250

Table C-4
Single-Dry Year: Existing Water Supplies

		2015	2020	2025	2030	2035	2040	2045	2050
SCWD		5,925	6,150	5,950	5,925	5,875	5,850	5,825	5,825
VWC		3,025	2,600	2,650	2,500	2,475	2,375	2,300	2,250
	Total	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*
Nickel Water - Newhall Land									
VWC	*Total*	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Banking Programs									
Rosedale Rio-Bravo[h]									
LACWWD 36[c]		775	900	1,000	1,075	1,125	1,200	1,250	1,275
NCWD		3,275	3,625	3,725	4,000	4,050	4,150	4,250	4,325
SCWD		11,750	12,275	11,725	11,575	11,400	11,300	11,200	11,125
VWC		4,200	3,200	3,550	3,350	3,425	3,350	3,300	3,275
	Total	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*
Semitropic[i]									
LACWWD 36[c]		510	594	0	0	0	0	0	0
NCWD		2,170	2,364	0	0	0	0	0	0
SCWD		7,778	8,035	0	0	0	0	0	0
VWC		4,541	4,007	0	0	0	0	0	0
	Total	*15,000*	*15,000*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic – Newhall Land[i]									
VWC									
	Total	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
TOTAL EXISTING SUPPLIES									
LACWWD 36[c]		2,296	2,565	2,146	2,297	2,409	2,581	2,690	2,772
NCWD		15,819	16,386	14,183	14,693	14,879	15,146	15,404	15,540
SCWD		46,417	46,509	36,971	36,322	36,072	35,932	35,794	35,711
VWC		47,009	43,752	39,862	39,799	39,752	39,429	39,173	38,690
	Total	**111,542**	**109,212**	**93,162**	**93,111**	**93,112**	**93,088**	**93,061**	**92,713**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown above. Existing pumping is consistent with Table 3-8 of the 2009 Groundwater Basin Yield Analysis for 1977 single-dry year. As indicated in Table 3-11, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(e) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(f) SWP supplies are based on the Department of Water Resources "2009 State Water Project Delivery Reliability Report."

(g) Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with Ventura County entities expires after 2015.

(h) CLWA has a maximum withdrawal capacity of 20,000 AFY and a storage capacity of 100,000 AF. As of 6/1/2011, there is 100,000 AF of recoverable water.

(i) CLWA has 45,920 AF of recoverable water as of 6/1/2011.

(j) Newhall Land has a maximum withdrawal capacity of 4,950 AFY and a storage capacity of 55,000 AF. As of 6/1/2011 there is 18,892 AF of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is assumed available to VWC.

Table C-4
Single-Dry Year: Existing Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050

Source: 2010 UWMP, Appendix C

Table C-5
Single-Dry Year: Planned and Total Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
PLANNED SUPPLIES[a]								
Future Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	200	250	300	850	850	875	900	750
VWC[d]	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Total	*200*	*1,250*	*2,300*	*3,850*	*4,850*	*5,875*	*6,900*	*7,750*
Saugus Formation								
LACWWD 36[c][e]	500	825	875	925	975	1,000	1,050	1,075
NCWD	1,400	2,950	3,025	3,150	3,200	3,275	3,325	3,400
SCWD	975	5,175	5,200	5,150	5,250	5,325	5,400	5,475
VWC (Restored Well)	825	3,777	3,777	3,777	3,777	3,777	3,777	3,750
VWC (New Wells)	-	973	823	698	498	323	148	-
Total	*3,700*	*13,700*	*13,700*	*13,700*	*13,700*	*13,700*	*13,700*	*13,700*
Recycled Water[f]								
LACWWD 36[c]	0	50	50	50	50	50	50	50
NCWD	200	500	1,000	1,275	1,775	2,275	2,775	3,275
SCWD	100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC	675	1,675	2,675	4,175	5,675	7,675	9,675	11,875
Total	*975*	*2,725*	*5,225*	*7,775*	*10,275*	*13,775*	*17,275*	*20,975*
Banking Programs[g]								
LACWWD 36[c]	0	0	440	488	1,028	1,097	1,147	1,193
NCWD	0	0	1,657	1,791	3,670	3,804	3,925	4,012
SCWD	0	0	5,208	5,205	10,374	10,351	10,332	10,321
VWC	0	0	2,694	2,516	4,928	4,749	4,596	4,474
Total	*0*	*0*	*10,000*	*10,000*	*20,000*	*20,000*	*20,000*	*20,000*
TOTAL PLANNED SUPPLIES								
LACWWD 36[c]	500	875	1,365	1,463	2,053	2,147	2,247	2,318
NCWD	1,600	3,450	5,682	6,216	8,645	9,354	10,025	10,687
SCWD	1,275	5,925	12,208	13,480	19,249	20,326	21,407	22,321

Table C-5
Single-Dry Year: Planned and Total Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
VWC	1,500	7,425	11,969	14,166	18,878	21,524	24,196	27,099
Total	**4,875**	**17,675**	**31,225**	**35,325**	**48,825**	**53,350**	**57,875**	**62,425**
PURVEYOR EXISTING AND PLANNED SUPPLIES								
LACWWD 36[(c)]	2,796	3,440	3,511	3,760	4,462	4,728	4,937	5,090
NCWD	17,419	19,836	19,865	20,909	23,524	24,500	25,429	26,227
SCWD	47,692	52,434	49,179	49,802	55,321	56,258	57,201	58,032
VWC	48,509	51,177	51,831	53,965	58,630	60,953	63,369	65,789
Total	**116,417**	**126,887**	**124,387**	**128,436**	**141,937**	**146,438**	**150,936**	**155,138**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation, including 3,777 AFY of restored capacity from VWC Well 201 and approximately 10,000 AFY of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1977 single dry-year levels identified in Table 3-8 of the 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-11, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3- 5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) Conversion of Newhall Land agricultural groundwater supplies to VWC M&I supplies.

(e) Includes 500 AFY from a newly completed well in 2011.

(f) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(g) Includes 10,000 AF of additional banking programs by 2025 and an additional 10,000 AF by 2035.

Source: 2010 UWMP, Appendix C

Table C-6
Single-Dry Year: Demands with SBX7-7 Reductions and Comparison to Total Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
WATER DEMANDS W/ AND W/O CONSERVATION[a]								
LACWWD 36[b]								
Demand w/o Conservation[c]	1,935	2,408	2,881	3,353	3,826	4,299	4,772	5,245
Anticipated Conservation Objective[d]	176	438	524	610	696	782	868	954
Reduction from Recycled Water[e]	0	50	50	50	50	50	50	50
Net Anticipated Water Conservation[f]	176	388	474	560	646	732	818	904
Demand w/ Conservation[g]	1,759	2,020	2,407	2,794	3,181	3,568	3,955	4,342
Existing and Planned Supplies	*2,796*	*3,440*	*3,511*	*3,760*	*4,462*	*4,728*	*4,937*	*5,090*
SBX7-7 Compliance Calculations								
NCWD								
Demand w/o Conservation[c]	13,828	15,671	17,514	19,358	21,200	23,044	24,886	26,730
20x2020 Reduction[h]	1,365	2,982	3,204	3,489	3,742	3,995	4,248	4,501
Reduction from Recycled Water[e]	200	500	1,000	1,275	1,775	2,275	2,775	3,275
Reduction from Water Conservation[i]	1,165	2,482	2,482	2,482	2,482	2,482	2,482	2,482
Demand w/ Conservation[j]	12,663	13,188	15,031	16,876	18,718	20,562	22,404	24,248
Existing and Planned Supplies	*17,419*	*19,836*	*19,865*	*20,909*	*23,524*	*24,500*	*25,429*	*26,227*
SCWD								
Demand w/o Conservation[c]	34,796	38,295	41,795	45,294	48,793	52,292	55,791	59,290
20x2020 Reduction[k]	3,524	7,557	8,067	8,576	9,085	9,595	10,104	10,614
Reduction from Recycled Water[e]	100	500	1,500	2,275	2,775	3,775	4,775	5,775
Reduction from Water Conservation[i]	3,424	7,057	7,057	7,057	7,057	7,057	7,057	7,057
Demand w/ Conservation[j]	31,372	31,238	34,737	38,236	41,736	45,235	48,734	52,233
Existing and Planned Supplies	*47,692*	*52,434*	*49,179*	*49,802*	*55,321*	*56,258*	*57,201*	*58,032*
VWC								
Demand w/o Conservation[c]	37,517	40,959	44,398	47,839	51,278	54,720	58,159	61,600
20x2020 Reduction[l]	3,962	8,648	9,372	10,095	10,819	11,542	12,266	12,990
Reduction from Recycled Water[e]	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Reduction from Water Conservation[i]	2,962	6,648	6,648	6,648	6,648	6,648	6,648	6,648
Demand w/ Conservation[j]	**34,555**	**34,310**	**37,750**	**41,191**	**44,630**	**48,072**	**51,511**	**54,951**
Existing and Planned Supplies	*48,509*	*51,177*	*51,831*	*53,965*	*58,630*	*60,953*	*63,369*	*65,789*
REGIONAL SUMMARY								
Demand w/o Conservation[c]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
Total 20x2020 Reduction	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Total Reduction from Recycled Water[m]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Total Reduction from Water Conservation	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**

Table C-6
Single-Dry Year: Demands with SBX7-7 Reductions and Comparison to Total Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
TOTAL EXISTING AND PLANNED SUPPLIES	**116,417**	**126,887**	**124,387**	**128,436**	**141,937**	**146,438**	**150,936**	**155,138**

Notes:

(a) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies. Known parties potentially seeking annexation include Legacy/Stevenson Ranch Phase 5, Tapia Canyon and Tesoro Del Valle.

(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(c) Demand w/o Conservation from Table 2-2. Includes a 10% increase in demand during dry years.

(d) LACWWD 36 conservation objective estimated at 20% of projected demand commencing 2020; see Table 2-21.

(e) Recycled water projections from Table 4-3.

(f) Net Anticipated Conservation for LACWWD 36 is Anticipated Conservation Objective minus Reduction from Recycled Water.

(g) Demand w/ Conservation for LACWWD 36 is Demand w/o Conservation minus Net Anticipated Conservation.

(h) NCWD 20x2020 Reduction from Table 2-16. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(i) Reduction from Water Conservation is 20x2020 Reduction minus Reduction from Recycled Water for 2015 and 2020; the quantity of water conservation remains at least at 2020 amounts through 2050.

(j) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

(k) SCWD 20x2020 Reduction from Table 2-18. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(l) VWC 20x2020 Reduction from Table 2-20. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(m) Recycled water reductions do not include demands from Honor Rancho.

Source: 2010 UWMP, Appendix C

APPENDIX 3

Table C-7
Existing Multiple-Dry Year: Existing Water Supplies

		2015	2020	2025	2030	2035	2040	2045	2050
EXISTING SUPPLIES[a]									
Existing Groundwater[b]									
Alluvial Aquifer									
LACWWD 36[c]		0	0	0	0	0	0	0	0
NCWD		1,125	1,125	1,125	1,200	1,200	1,200	1,200	1,175
SCWD		7,650	7,675	7,700	8,175	8,175	8,175	8,175	8,025
VWC		11,650	11,625	11,600	12,450	12,450	12,450	12,450	12,125
	Total	*20,425*	*20,425*	*20,425*	*21,825*	*21,825*	*21,825*	*21,825*	*21,325*
Saugus Formation									
LACWWD 36[c]									
NCWD		4,975	4,975	4,975	4,975	4,975	4,975	4,975	4,975
SCWD[d]		3,550	3,550	3,550	3,550	3,550	3,550	3,550	3,550
VWC		11,175	11,175	11,175	11,175	11,175	11,175	11,175	11,175
	Total	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*
Recycled Water[e]									
LACWWD 36[c]		0	0	0	0	0	0	0	0
NCWD		0	0	0	0	0	0	0	0
SCWD		0	0	0	0	0	0	0	0
VWC		325	325	325	325	325	325	325	325
	Total	*325*	*325*	*325*	*325*	*325*	*325*	*325*	*325*
Imported Water									
SWP Table A and Carryover[f]									
LACWWD 36[c]		1,117	1,278	1,423	1,592	1,691	1,801	1,895	1,968
NCWD		4,915	4,149	4,543	5,058	5,310	5,592	5,834	6,029
SCWD		18,006	16,666	16,406	16,492	16,519	16,542	16,574	16,601
VWC		8,862	10,807	10,628	9,858	9,479	9,065	8,697	8,401
	Total	*32,900*	*32,900*	*33,000*	*33,000*	*33,000*	*33,000*	*33,000*	*33,000*
SWP Flexible Storage Accounts[g]									
LACWWD 36[c]		51	45	50	56	60	64	67	70
NCWD		226	148	161	179	188	198	207	214
SCWD		826	593	582	585	586	586	588	589
VWC		407	384	377	350	336	321	308	298
	Total	*1,510*	*1,170*	*1,170*	*1,170*	*1,170*	*1,170*	*1,170*	*1,170*

Table C-7
Existing Multiple-Dry Year: Existing Water Supplies

		2015	2020	2025	2030	2035	2040	2045	2050
Buena Vista-Rosedale									
LACWWD 36[c]		400	450	500	550	575	625	650	675
NCWD		1,700	1,450	1,575	1,750	1,825	1,925	2,000	2,050
SCWD		6,250	5,800	5,650	5,675	5,675	5,650	5,650	5,650
VWC		2,650	3,300	3,275	3,025	2,925	2,800	2,700	2,625
	Total	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*
Nickel Water - Newhall Land									
VWC	*Total*	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Banking Programs									
Rosedale Rio-Bravo[h]									
LACWWD 36[c]		577	662	723	801	842	890	931	961
NCWD		2,540	2,150	2,308	2,545	2,643	2,763	2,865	2,944
SCWD		9,306	8,636	8,336	8,297	8,222	8,174	8,139	8,107
VWC		2,577	3,552	3,633	3,357	3,292	3,173	3,065	2,988
	Total	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*
Semitropic[i]									
LACWWD 36[c]		390	447	0	0	0	0	0	0
NCWD		1,718	1,450	0	0	0	0	0	0
SCWD		6,294	5,826	0	0	0	0	0	0
VWC		3,098	3,777	0	0	0	0	0	0
	Total	*11,500*	*11,500*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic – Newhall Land[j]									
VWC		4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
TOTAL EXISTING SUPPLIES									
LACWWD 36[c]		2,536	2,882	2,696	3,000	3,168	3,380	3,543	3,674
NCWD		17,200	15,447	14,687	15,707	16,142	16,654	17,080	17,387
SCWD		51,882	48,745	42,224	42,774	42,727	42,678	42,676	42,522
VWC		47,300	51,502	47,570	47,096	46,540	45,866	45,278	44,494
	Total	**118,917**	**118,577**	**107,177**	**108,577**	**108,577**	**108,577**	**108,577**	**108,077**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown above. Existing pumping is consistent with Table 3-8 of the 2009 Groundwater Basin Yield Analysis for 1931-1934 multiple dry-year levels. As indicated in Table 3-12, existing and planned

Table C-7
Existing Multiple-Dry Year: Existing Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050

groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(e) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(f) SWP supplies are based on DWR 2009 SWP Delivery Reliability Report.

(g) Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with Ventura County entities expires after 2015.

(h) CLWA has a maximum withdrawal capacity of 20,000 afy and a storage capacity of 100,000 af. As of 6/1/2011, there is 100,000 af of recoverable water.

(i) CLWA has 45,920 af of recoverable water as of 6/1/2011.

(j) Newhall Land has a maximum withdrawal capacity of 4,950 afy and a storage capacity of 55,000 af. As of 6/1/2011 there is 18,892 af of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is assumed available to VWC.

Source: 2010 UWMP, Appendix C

Table C-8
Multiple-Dry Year: Planned and Total Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
PLANNED SUPPLIES[a]								
Future Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC[d]	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Total	*0*	*1,000*	*2,000*	*3,000*	*4,000*	*5,000*	*6,000*	*7,000*
Saugus Formation								
LACWWD 36[c][e]	500	750	800	825	850	875	900	925
NCWD	1,250	3,875	3,950	4,050	4,075	4,125	4,175	4,225
SCWD	500	5,700	5,700	5,675	5,750	5,825	5,875	5,925
VWC (Restored Well)	2,375	1,625	1,500	1,400	1,275	1,125	1,000	875
VWC (New Wells)	0	0	0	0	0	0	0	0
Total	*4,625*	*11,950*	*11,950*	*11,950*	*11,950*	*11,950*	*11,950*	*11,950*
Recycled Water[f]								
LACWWD 36[c]	0	50	50	50	50	50	50	50
NCWD	200	500	1,000	1,275	1,775	2,275	2,775	3,275
SCWD	100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC	675	1,675	2,675	4,175	5,675	7,675	9,675	11,875
Total	*975*	*2,725*	*5,225*	*7,775*	*10,275*	*13,775*	*17,275*	*20,975*
Banking Programs[g]								
LACWWD 36[c]	0	0	323	362	769	819	861	895
NCWD	0	0	1,032	1,150	2,414	2,542	2,652	2,741
SCWD	0	0	3,729	3,748	7,509	7,519	7,534	7,546
VWC	0	0	2,416	2,240	4,309	4,120	3,953	3,819
Total	*0*	*0*	*7,500*	*7,500*	*15,000*	*15,000*	*15,000*	*15,000*
TOTAL PLANNED SUPPLIES								
LACWWD 36[c]	500	800	1,173	1,237	1,669	1,744	1,811	1,870
NCWD	1,450	4,375	5,982	6,475	8,264	8,942	9,602	10,241
SCWD	600	6,200	10,929	11,698	16,034	17,119	18,184	19,246
VWC	3,050	4,300	8,591	10,815	15,259	17,920	20,628	23,569

Table C-8
Multiple-Dry Year: Planned and Total Water Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
Total	**5,600**	**15,675**	**26,675**	**30,225**	**41,225**	**45,725**	**50,225**	**54,925**
PURVEYOR EXISTING AND PLANNED SUPPLIES								
LACWWD 36[(c)]	3,036	3,682	3,869	4,237	4,837	5,124	5,354	5,544
NCWD	18,650	19,822	20,670	22,182	24,406	25,596	26,682	27,628
SCWD	52,482	54,945	53,152	54,472	58,761	59,797	60,860	61,768
VWC	50,350	55,802	56,161	57,912	61,799	63,786	65,906	68,063
Total	**124,517**	**134,252**	**133,852**	**138,802**	**149,802**	**154,302**	**158,802**	**163,002**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation, including 3,777 afy of restored capacity from VWC Well 201 and approximately 10,000 afy of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1931-1934 multiple dry-year levels identified in Table 3-8 of the 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-12, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3- 5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) Conversion of Newhall Land agricultural groundwater supplies to VWC M&I supplies.

(e) Includes 500 afy from a newly completed well in 2011.

(f) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(g) Includes 10,000 af of additional banking programs by 2025 and an additional 10,000 af by 2035.

Source: 2010 UWMP, Appendix C

Table C-9
Multiple-Dry Year: Demands with SBX7-7 Reductions and Comparison to Total Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
WATER DEMANDS W/ AND W/O CONSERVATION[a]								
LACWWD 36[c]								
Demand w/o Conservation[c]	1,935	2,408	2,881	3,353	3,826	4,299	4,772	5,245
Anticipated Conservation Objective[d]	176	438	524	610	696	782	868	954
Reduction from Recycled Water[e]	0	50	50	50	50	50	50	50
Net Anticipated Water Conservation[f]	176	388	474	560	646	732	818	904
Demand w/ Conservation[g]	1,759	2,020	2,407	2,794	3,181	3,568	3,955	4,342
Existing and Planned Supplies	*3,036*	*3,682*	*3,869*	*4,237*	*4,837*	*5,124*	*5,354*	*5,544*
SBX7-7 Compliance Calculations								
NCWD								
Demand w/o Conservation[c]	13,828	15,671	17,514	19,358	21,200	23,044	24,886	26,730
20x2020 Reduction[h]	1,365	2,982	3,204	3,489	3,742	3,995	4,248	4,501
Reduction from Recycled Water[e]	200	500	1,000	1,275	1,775	2,275	2,775	3,275
Reduction from Water Conservation[i]	1,165	2,482	2,482	2,482	2,482	2,482	2,482	2,482
Demand w/ Conservation[j]	12,663	13,188	15,031	16,876	18,718	20,562	22,404	24,248
Existing and Planned Supplies	*18,650*	*19,822*	*20,670*	*22,182*	*24,406*	*25,596*	*26,682*	*27,628*
SCWD								
Demand w/o Conservation[c]	34,796	38,295	41,795	45,294	48,793	52,292	55,791	59,290
20x2020 Reduction[k]	3,524	7,557	8,067	8,576	9,085	9,595	10,104	10,614
Reduction from Recycled Water[e]	100	500	1,500	2,275	2,775	3,775	4,775	5,775
Reduction from Water Conservation[i]	3,424	7,057	7,057	7,057	7,057	7,057	7,057	7,057
Demand w/ Conservation[j]	31,372	31,238	34,737	38,236	41,736	45,235	48,734	52,233
Existing and Planned Supplies	*52,482*	*54,945*	*53,152*	*54,472*	*58,761*	*59,797*	*60,860*	*61,768*
VWC								
Demand w/o Conservation[c]	37,517	40,959	44,398	47,839	51,278	54,720	58,159	61,600
20x2020 Reduction[l]	3,962	8,648	9,372	10,095	10,819	11,542	12,266	12,990
Reduction from Recycled Water[e]	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Reduction from Water Conservation[i]	2,962	6,648	6,648	6,648	6,648	6,648	6,648	6,648
Demand w/ Conservation[j]	**34,555**	**34,310**	**37,750**	**41,191**	**44,630**	**48,072**	**51,511**	**54,951**
Existing and Planned Supplies	*50,350*	*55,802*	*56,161*	*57,912*	*61,799*	*63,786*	*65,906*	*68,063*

Table C-9
Multiple-Dry Year: Demands with SBX7-7 Reductions and Comparison to Total Supplies

	2015	2020	2025	2030	2035	2040	2045	2050
REGIONAL SUMMARY								
Demand w/o Conservation[(c)]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
Total 20x2020 Reduction	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Total Reduction from Recycled Water[(m)]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Total Reduction from Water Conservation	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**
TOTAL EXISTING AND PLANNED SUPPLIES	**124,517**	**134,252**	**133,852**	**138,802**	**149,802**	**154,302**	**158,802**	**163,002**

Notes:

(a) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies. Known parties potentially seeking annexation include Legacy/Stevenson Ranch Phase 5, Tapia Canyon and Tesoro Del Valle.

(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(c) Demand w/o Conservation from Table 2-2. Includes a 10% increase in demand during dry years.

(d) LACWWD 36 conservation objective estimated at 20% of projected demand commencing 2020; see Table 2-21.

(e) Recycled water projections from Table 4-3.

(f) Net Anticipated Conservation for LACWWD 36 is Anticipated Conservation Objective minus Reduction from Recycled Water.

(g) Demand w/ Conservation for LACWWD 36 is Demand w/o Conservation minus Net Anticipated Conservation.

(h) NCWD 20x2020 Reduction from Table 2-16. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(i) Reduction from Water Conservation is 20x2020 Reduction minus Reduction from Recycled Water for 2015 and 2020; the quantity of water conservation remains at least at 2020 amounts through 2050.

(j) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

(k) SCWD 20x2020 Reduction from Table 2-18. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(l) VWC 20x2020 Reduction from Table 2-20. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(m) Recycled water reductions do not include demands from Honor Rancho.

Source: 2010 UWMP, Appendix C

Appendix 5.21B

Technical Memorandum—Water Demand Projections for Entrada Village South

GSI Water Solutions, Inc.

May 16, 2014

GSI
Water Solutions, Inc.

Technical Memorandum

To: Alex Herrell – Newhall Land & Farming Co.

From: John Porcello – GSI Water Solutions, Inc.
Adrienne Lindsey – GSI Water Solutions, Inc.

Date: May 16, 2014

Re: Water Demand Projections for Entrada Village South

Introduction

This technical memorandum presents an update to water demand projections for the southern portion of the Entrada Village (herein referred to as Entrada Village South). Water demand projections have been prepared in the past for Entrada Village to support (1) water system planning activities by Valencia Water Company (VWC), which will provide water service to Entrada Village, and (2) the development of Environmental Impact Review (EIR) documents being prepared by the Newhall Land & Farming Company (NLF). Details regarding prior water demand projections for Entrada Village are provided by GSI (2010). Further updates to these projections were made in 2013 and 2014 for Entrada Village South, based on land use plans that were updated in 2013 for this particular 382-acre portion of the Entrada Village community. The water demand projections for Entrada Village South are the subject of this technical memorandum, followed by a discussion of the Best Management Practices (BMPs) for water conservation that NLF will implement into the design of the new buildings, landscaping, and other infrastructure that will be constructed as Entrada Village South is developed.

Water Demand Projection Methodology

Water demand projections for Entrada Village South were developed using the same methodology described in previous analyses for all of Entrada Village (GSI, 2010) and for the adjoining Newhall Ranch planned community (CH2M HILL, 1996 and 1999; GSI, 2008). This methodology is based on a water demand projection methodology developed by the Irvine Ranch Water District (IRWD, 1991).

Like the adjoining planned community of Newhall Ranch, Entrada Village is being designed with the goal of creating a water reuse system that will recycle (after treatment) virtually all the wastewater generated by the community. Under this approach, discharges to the Santa Clara River from water reclamation plants that treat wastewater generated inside Entrada Village will not occur or will be minor in volume and will occur only seasonally. The water demand projection tool categorizes a community's water demands as indoor (potable) demands, outdoor potable demands, and outdoor demands that can be met with nonpotable water. The tool defines the available supply of recycled water as being equal to the indoor potable water use. The tool also compares the nonpotable water demands with the available recycled water supply and, on a month-by-month basis, identifies how this supply can be used during various months as follows:

1. During the lowest-demand months, the amount of recycled water that either must be discharged to the Santa Clara River or is available as recycled water supply for other developments in the Santa Clarita Valley; and

2. During all other months, the amount of nonpotable demand that must be met by other water supplies.

As described by GSI (2008 and 2010), water demand projections are calculated using the following information:

1. **Land Use.** The current land use plan for Entrada Village South is directly specified in the water demand calculations, using information from Vesting Tentative Tract Maps (VTTMs) that have been submitted to Los Angeles County. Table 1 presents the land use information for Entrada Village South, including the details of the VTTM planning areas and product types that correspond to each land use category that is used in the water demand calculation tool. Table 2 presents this same information in the format that is used directly in the water demand calculation tool. The land use information shown collectively in these two tables consists of the acreage of each land use category, the number of attached and detached residential dwelling units, the occupancy rates and corresponding residential population, and the square footage of certain non-residential facilities.

2. **Residential Use of Potable Water.** For residential areas, the water demand calculations use the same rates of indoor and outdoor potable water consumption that were used in the prior water demand analysis for the entire Entrada Village (GSI, 2010).

    - **Indoor Use.** For residential areas, the water demand projection tool uses a per-capita potable water use rate of 75 gallons per capita per day (gpcpd) for attached residences and for the highest-density single-family residences. Mixed-use residences are assigned a rate of 70 gpcpd. Lower-density single-family residences are assigned rates ranging from 80 gpcpd to as much as 100 gpcpd (for estates).

    - **Outdoor Use.** Potable water will be the source of supply for outdoor residential water uses that occur outside of common areas, such as on single-family lots.

Potable water also will be used for certain outdoor needs in multi-family residential communities, such as filling swimming pools and washing cars, pavement, and outdoor surfaces. The water demand projection tool uses outdoor potable water use rates of 42 to 45 gpcpd for high-density and medium-density residential developments, and 50 to 60 gpcpd for low-density single-family housing (including estates).

3. **Nonresidential Use of Potable Water.** As described by GSI (2010), these water use rates are as follows:

   - **Indoor Use.** Indoor use rates for potable water range from 0.01 to 0.20 gallon per day per square foot for facilities with high occupancy during portions of the day, such as retail commercial facilities, business parks, and hotels. Hospitals and senior assisted living facilities are assigned indoor water use rates that reflect the multi-day occupancy of the residents in these facilities (500 and 100 gallons per day per bed, respectively). Schools are assigned an indoor potable use rate of 260 gallons per acre per day.

   - **Outdoor Use.** Potable water will be used outdoors for nonresidential uses that have the potential for human contact with the water (primarily swimming pools, wash water, and some landscape irrigation). The outdoor potable use rate is specified as 305 gallons per acre per day for industrial facilities, fire stations, hotels, and visitor-serving facilities (including the club houses at golf courses). Hospitals and senior assisted living facilities are assigned outdoor potable water use rates of 120 gallons per day per bed.

4. **Nonpotable Water Use.** The water demand calculations use revised rates of annual nonpotable water use, as determined by VWC and Dexter Wilson Engineering, Inc. (DWE), during a 2007 update of the recycled water master plan for VWC's service area (DWE, 2007). In Entrada Village and other nearby planned communities, nonpotable water will be used for irrigation of common-area landscaping. Common-area landscaping will be present in areas containing attached residential developments, nonresidential developments, recreational facilities, and irrigated slopes.[1] In order to provide conservative (high) projections of water use for planning purposes, the water demand calculations assume the following rates of nonpotable water use:

   - 6.7 feet per year (ft/yr) (equivalent to about 80 inches per year [in/yr]) for attached residential development, assuming 15 percent of the area containing these developments will be irrigated

   - 1.34 to 1.40 ft/yr (16 to 17 in/yr) for nonresidential development, assuming 25 percent of the area containing nonresidential development will be irrigated

[1] For lands that are designated as non-irrigated slopes, irrigation may occur temporarily to establish plantings on these slopes. Because this would occur during the early stages of development before Entrada Village South is fully built out, this use of water would not result in exceedance of the total projected water demand for Entrada Village South that is presented in this technical memorandum.

- 4.59 ft/yr (55 in/yr) for golf courses and water features
- 3.43 ft/yr (41 in/yr) for other recreational facilities and for parks
- 3.47 ft/yr (42 in/yr) for landscaping located on irrigated slopes and along arterial highways and easements

Results

Figure 1 shows the relationship among water demands, water supplies, wastewater generation, and recycled water use inside Entrada Village South under the land use plan that is specified in the most current (2013) VTTM for this 382-acre portion of the Entrada Village. The complete suite of calculations is contained in Attachment 1. The principal finding from the calculations is that total water demand in Entrada Village South is projected to be 1,143 acre-feet per year (AF/yr). Specific aspects of this water demand and the generation and use of recycled water inside Entrada Village South are as follows:

1. Potable water demand is projected to be 703 AF/yr.
2. Nonpotable water demand is projected to be 440 AF/yr.
3. The total demand in residential areas within Entrada Village South is projected to be 659 AF/yr. The residential areas collectively are projected to use 607 AF/yr of potable water (of which 379 AF/yr is for indoor use and 228 AF/yr is for outdoor use) and 52 AF/yr of nonpotable water (for additional outdoor uses).
4. The amount of wastewater generated by Entrada Village South is predicted to be 475 AF/yr, which is 67 percent of total potable water use and 100 percent of the indoor use of potable water. Of this 475 AF/yr of generated wastewater, 80 percent (379 AF/yr) is from residences, with the remaining 20 percent (96 AF/yr) being generated by nonresidential development. The annual wastewater volume of 475 AF/yr is equivalent to 0.424 million gallons per day (mgd).
5. Of the 475 AF/yr that flows to WRPs, 80 percent (378 AF/yr) is recycled for irrigation use within Entrada Village South, and the remaining 20 percent (97 AF/yr) is discharged to the Santa Clara River during winter (primarily from December through March) or available as recycled water supply for other areas during those months.

BMPs for Water Conservation

NLF will implement BMPs related to water-use efficiency into the design of new buildings, landscaping, and other infrastructure that will be constructed as Entrada Village South is developed. The water demand factors that are used in the water demand analysis are based on assessments in 2007 and earlier, and accordingly do not account for the reductions in per-capita and acreage-based rates of water use that will be achieved inside Entrada Village South under existing state and county water-use efficiency requirements and under measures being enacted inside VWC's service area. Following are summaries of state rules and local ordinances, and a description of water conservation and water use reduction activities and programs by VWC and other local water purveyors.

State Rules and Local Ordinances

A series of four laws were enacted by the state legislature from 2006 through 2009 to promote efforts to reduce water use state-wide in response to drought conditions and increasing population. These laws were accompanied by the passage of ordinances by state and local regulatory agencies to implement the legislation. Table 3 lists these laws and ordinances and identifies the entities and types of development activities to which they apply.

While three of the laws targeted specific uses, the fourth law (Senate Bill SBX7-7) is a much broader legislation that addresses urban water use on a state-wide scale. SBX7-7 requires the state to achieve a 20 percent reduction in urban per-capita water use by the end of 2020. In the Santa Clarita Valley, this is implemented in part by requiring the local water purveyors to establish in their Urban Water Management Plan demand-reduction targets and associated implementation programs involving Best Management Practices (BMPs) or Demand Management Measures (DMMs). Other implementation mechanisms that pertain to water-use reductions statewide and locally are the state's CALGreen building standards, a state model ordinance for water efficient landscaping, and two Los Angeles County (L.A. County) ordinances, each of which are discussed below.

California's Green Building Standards

CALGreen is the state's green buildings standards code. It is formally known as Title 24, Part 11, the California Green Building Standards Code. CALGreen identifies mandatory and voluntary provisions that apply to the planning, design, operation, construction, use, and occupancy of every newly constructed building or structure on a statewide basis. Certain provisions that are under the jurisdiction of the California Department of Housing and Community Development (HCD) apply to "low-rise residential" facilities, which are defined by CALGreen as "A building that is of Occupancy Group R and is three stories or less, or that is a one- or two-family dwelling or townhouse." (See HCD, 2010.) CALGreen also requires that each portion of a mixed occupancy building comply with the specific green building measures applicable to that occupancy. Therefore, if a building's design includes commercial and residential uses, both non-residential and residential provisions apply to appropriate portions of the building.

CALGreen was published in mid-2010 as part of the 2010 code adoption process and became effective on January 1, 2011. CALGreen is updated every 3 years. The 2013 California Building Standards Code, which includes the 2013 version of CALGreen, was published by the California Building Standards Commission on July 1, 2013 and becomes effective on January 1, 2014. This update includes changes to certain mandatory measures for residences, including for indoor and outdoor water uses. Table 4 summarizes the assemblage of water use standards that will be in effect on January 1, 2014.

California's Model Water Efficient Landscape Ordinance

In 2006, the California Assembly passed legislation (Assembly Bill [AB] 1881) which is known as the *Water Conservation in Landscaping Act of 2006*. AB 1881 requires cities and counties to develop and implement (1) guidelines for local landscape ordinances and water efficient landscape design, and (2) regulations and performance standards for energy efficient landscape materials (including controllers and soil moisture sensors). This legislation also required that water purveyors, after January 1, 2005, install separate water meters to measure the volume of water used exclusively for landscape purposes.

On September 10, 2010, the California Department of Water Resources (DWR) adopted its Model Water Efficient Landscape Ordinance (MWELO) in response to passage of AB 1881. Local agencies subsequently were required to adopt this ordinance or an alternative local ordinance by January 2010. At that time, the City of Santa Clarita notified DWR that it would adopt the state's MWELO, rather than develop its own ordinance (DWR, 2010). According to a recent report to the state legislature (DWR, 2010), L.A. County did not provide notification, most likely because it had already enacted ordinances in 2009 that specify water use efficiency requirements for landscapes and indoor water uses, as discussed below.

L.A. County Ordinances

On December 18, 2008, two L.A. County ordinances became effective that amend Title 21 (Subdivisions) and Title 22 (Planning and Zoning) of the Los Angeles County Code to:

- Establish drought-tolerant landscaping requirements for projects constructed after January 1, 2009 (ordinance number 2008-0064), and

- Establish green building development standards for projects constructed after January 1, 2009 (ordinance number 2008-0065)

The drought-tolerant landscaping ordinance requires that 75 percent of a lot or parcel's landscaped area contain native and/or non-native plants listed by the county as being drought-tolerant. The ordinance also specifies that no more than 25 percent of the total landscaped area on a lot or parcel can consist of turf. The county's list of drought-tolerant plants and turf is organized by ecological zones, as described in the county's drought-tolerant landscaping handbook (L.A. County, 2012). The Santa Clarita Valley is identified in the handbook as residing in *Zone 6 Inland Mountains (Grapevine, Castaic, Santa Clarita)*. For this zone and other zones in L.A. County, the handbook identifies the specific trees, vines, perennials, ground covers, hedges, decorative grasses, and turfs that meet the drought-tolerant landscaping

requirement. The ordinance applies to residential and non-residential properties, but provides exemptions for public recreational lawns, parks, orchards, and vegetable gardens. The ordinance also states that exemptions may be granted by the L.A. County Department of Public Works for landscaped areas constructed as part of stormwater low impact development facilities, and for manufactured cut or fill slopes that have gradients equal to or exceeding a slope of 3:1.

L.A. County's green building development standards specify the following regarding water conservation:

- **Outdoor Water Uses**: A smart irrigation controller shall be installed for any area of a lot that is landscaped for designated for future landscaping, and planting shall meet the requirements of the county's drought-tolerant ordinance.

- **Indoor Water Conservation**: All tank-type toilets installed in residential projects containing five or more dwelling units regardless of gross floor area, or in hotels/motels, lodging houses, non-residential, and mixed-use buildings with a gross floor area of at least 10,000 square feet shall be high-efficiency toilets that use no more than 1.28 gallons per flush.

Conservation and Water-Use-Reduction Activities by Valencia Water Company

VWC and the other water purveyors in the Santa Clarita Valley have long recognized the need to encourage their customers to use water wisely. Educational programs and customer incentives to reduce water have been in place for many years. VWC has employed a full-time water conservation coordinator since 2005, and has added two more conservation specialists since that time. VWC also utilizes consultant services to implement various programs, including water audits, landscape training, and public outreach. A list of key activities by VWC is contained in Table 5.

In 2006, VWC became a signatory to the California Urban Water Conservation Council (CUWCC) MOU, establishing a firm commitment to the implementation of BMPs or DMMs (demand management measures). In 2007, VWC coordinated the development and execution of an MOU with the other retail water purveyors to develop the Santa Clarita Valley Water Use Efficiency Strategic Plan (SCVWUESP [A&N Technical Services, 2008]). The SCVWUESP provided detailed information on available water use efficiency opportunities and defined concepts for program implementation, including a mix of recommended programs, a stakeholder engagement process, and funding mechanisms. While the plan focused on reducing existing demands, the plan also identified building ordinances as an essential tool for further increasing water use efficiency in new construction. The SCVWUESP developed a comprehensive list of new building standards beyond those contained in local ordinances at that time. Those standards identified design improvements in the water-use efficiency of plumbing fixtures that were estimated to capture 60 percent of the expected reduction in water demand envisions under the SCVWUESP. Several of the changes identified in the SWCWUESP are now captured by recent ordinances – in particular, the state's MWELO for landscaping (effective January 2010), the CALGreen Building Code (effective January 2011 and updated effective January 2014), and L.A. County's related ordinances (effective January 2009). VWC and the other purveyors in the

Santa Clarita Valley were implementing the majority of the SCVWUESP programs by 2009, including managing and financing the SCVWUESP programs.

As discussed in the local water purveyors' 2010 Urban Water Management Plan (KJC and others, 2011), VWC continues to expand its conservation programs and efforts in order to meet both its SBX7-7 and DMM requirements. On February 1, 2011 VWC changed its single volumetric billing rate structure to a tiered structure to support its WaterSMART Allocation program, which sets customer-specific allocations for all individually metered residential customers. The new rate structure has 5 tiers, with the highest-use tier having billing rates (per 100 cubic feet) that are about 2.5 times higher than the rate for the lowest-use tier. As part of this program VWC maintains an active website that provides its customers with information on conservation measures, links to other resources, and full details about its WaterSMART program. VWC is also committed to expanding recycled water usage in its service area, to offset potable water use for landscape irrigation.

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Table 1
2013 Land Use Details for Entrada Village South

Land Use Category	VTTM Planning Area	No. Of Units	Square Footage	Acreage	Product Type	Notes	Number of Dwellings					Acreage				
							SFD	Detached Condos	Total Detached	Attached	Total DU's	SFD	Detached Condos	Total Detached	Attached	Total DU's
Residential																
Low Medium (1.1 - 12.0 DU/ac)	SFD: PA-4, PA-5, PA-6, PA-7	517	—	74.4	SFD: PA-4 SFD Detached Condo - 178 DU / 22.3 ac PA-5 SFD 5,250 (50'x105') - 134 DU / 16.5 ac PA-6 SFD 6,050 (55'x110') - 115 DU / 19.4 ac PA-7 SFD 4,500 (45'x100') - 90 DU / 10.0 ac		339	178	517	0	517	52.4	22.0	74.4	0	74.4
Medium (12.1 - 30 DU/ac)	SFA: PA-9, PA-10,PA-11, PA-12, PA-13	1,057	—	51.3	SFA: PA-9 SFA Attached Condo - 255 DU / 11.1 ac PA-10 SFA Attached Condo - 280 DU / 7.7 ac PA-11 SFA Attached Condo - 208 DU / 10.3 ac PA-12 SFA Attached Condo - 120 DU / 10.5 ac PA-13 SFA Attached Condo - 194 DU / 15.6 ac		0	0	0	1,057	1,057	0.0	0.0	0.0	51.3	51.3
High (30+ DU/ac)		0	—	0.0			0	0	0	0	0	0.0	0.0	0.0	0	0.0
Mixed Use		0	—	0.0			0	0	0	0	0	0.0	0.0	0.0	0	0.0
Subtotal		**1,574**		**125.7**			**339**	**178**	**517**	**1,057**	**1,574**	**52.4**	**22.0**	**74.4**	**51.3**	**125.7**
Non-Residential																
Mixed Use		—														
Commercial	PA1-3 and PA-14	—	730,000	45.9	**PA1-3: 680,000 SF Total** Office: 400,000 SF Retail: 280,000 SF **PA-14: 50,000 SF Total** Office: 36,000 SF Retail: 14,000 SF											
Hotel		—	0	0.0	No hotel in Entrada South											
Recreation centers	PA-8	—	0	2.6	* SF not included on VTTM	Estimated at 6,000 sf incuding restrooms & pool storage										
Parks	PA-8	—	0	5.6	* SF not included on VTTM	Estimated at 1,000 sf restroom building										
Fire Station		—	0	0.0	No fire station in Entrada South											
School	PA-8	—	0	9.4	* SF not included on VTTM	Estimated at 75,000 sf										
Subtotal			**730,000**	**63.5**												
Miscellaneous																
Irrigated Slope				54.3	Measured flat; multiply by 1.12 slope factor	60.8 acres using the slope factor										
Wet Zone				2.1												
Roads/bridge				39.4	Includes access roads 3.6 ac and sidewalks 4.5 ac											
Non irrigated slope				0.9	Measured flat, add 1.12 slope factor	1.0 acres using the slope factor										
Debris basin				1.0												
Water quality				2.2												
Nat OS				64.6												
LDZ OS				0.0	Included in Parkways & Medians											
Trail OS				3.8	Concrete trail											
Parkways & medians				20.9	Includes all parkway-landscaped & flat-irrigated areas											
Drainage				3.9	Measured flat, add 1.12 slope factor	4.1 acres using the slope factor										
Subtotal				**193.1**												
GRAND TOTAL		**Units** **1,574**	**SF **** **730,000**	**Acreage** **382.3**												

Abbreviations: SFD = single-family detached, SFA = single-family attached, DU = dwelling unit
VTTM = Vesting Tentative Tract Map
ac = acres, sf = square feet

Prepared by GSI Water Solutions and
the Newhall Land Farming Company

Table 2
2013 Land Use Plan Statistics Used in the Water Demand Calculation Tool
Entrada Village South

Land Use	Has Water Demands?	Area (acres)			No. of Dwelling Units		
		Detached	Attached	Total	Detached	Attached	Total
Residential Development							
Estate	Yes	0.0	0.0	0.0	0	0	0
Low	Yes	0.0	0.0	0.0	0	0	0
Low Medium (Single-Family)	Yes	74.4	0.0	74.4	517	0	517
Medium (Detached Condos)	Yes	0.0	51.3	51.3	0	1,057	1,057
High (Attached Units)	Yes	0.0	0.0	0.0	0	0	0
Mixed Use	Yes	0.0	0.0	0.0	0	0	0
Subtotals		**74.4**	**51.3**	**125.7**	**517**	**1,057**	**1,574**
Nonresidential Development							
Mixed-Use Commercial							
Retail	Yes			0.00			
Office	Yes			27.40			
Commercial	Yes			18.50			
Business Park	Yes			0.0			
Visitor Serving	Yes			0.0			
Water Reclamation Plant	Yes			0.0			
Electrical Substation	No			0.0			
Fire Stations	Yes			0.0			
Hotel/Spa	Yes			0.0			
Sr. Assisted Living	Yes			0.0			
Golf Club House	Yes			0.0			
Schools	Yes						
Elementary (1)	Yes			9.4			
Middle (0)	Yes			0.0			
High (0)	Yes			0.0			
Subtotal				**55.3**			
Recreation, Arterials, Open Space							
Recreation							
Recreation Centers	Yes			2.6			
Neighborhood Parks	Yes			5.6			
Lake - Water	Yes			0.0			
Lake - Park Area	Yes			0.0			
Golf Course	Yes			0.0			
Arterial Highways							
Hardscape/Road Section	No			39.4			
Landscape Area	Yes			20.9			
Major Open Areas							
Natural Open Space	No			64.6			
River Corridor	No			0.0			
Non-Irrigated Slopes	No			0.9			
Irrigated Slopes, Wet Zones	Yes			56.4			
O.S. Drainage Facilities	No			7.1			
O.S. LDZ, O.S. Trail LDZ, and SD&SS easements	Yes			3.8			
Subtotal				**201.3**			
Totals				**382.3**	**517**	**1,057**	**1,574**

Updated May 2014 by GSI Water Solutions, Inc.

Table 3
State and Local Laws, Codes, and Other Requirements for Water-Use Efficiency Enacted Since 2006

Year	Who	Description	What	Applicable To	Compliance Date or Effective Date
2006	California State Assembly	AB 1881	Water Conservation in Landscaping Act of 2006	Local agencies (cities, counties, and/or water purveyors)	1/1/2010 compliance date
2007	California State Assembly	AB 715	Toilets and urinals	New sales and new installations	1/1/2014 effective date
2008	L.A. County	Drought-Tolerant Landscaping Ordinance	Plant selection requirements and turf limits	New construction	1/1/2009 effective date
2008	L.A. County	Green Building Ordinance	Green building standards, including indoor and outdoor water conservation and tree planting requirements (Ordinance 2008-0065)	New construction	1/1/2009 effective date
2009	California State Senate	SB 407	Toilets, urinals, showerheads, and interior faucets	Buildings constructed on or before January 1, 1994	1/1/2017 compliance date for single-family 1/1/2019 compliance date for multi-family residences and commercial properties
2009	California State Senate	SBX7-7	Reductions in Gallons per Capita per Day	Statewide water use	12/31/2020 compliance date
2010	California Department of Water Resources (DWR)	Updated Model Water Efficient Landscape Ordinance (MWELO)	Landscape irrigation (system design, scheduling, and application rates);	Landscapes that require a building or landscape permit	9/10/2010 DWR adoption date
2010	California Building Standards Commission	CALGreen Building Standards Code	Indoor and outdoor water use standards	New construction	1/1/2011 effective date
2013	California Building Standards Commission	Update to CALGreen Building Standards Code	Indoor and outdoor water use standards	New construction	1/1/2014 effective date

Abbreviations
SBX7 = Senate Bill during Extended Session 7 of the 2009 Session SB = Senate Bill AB = Assembly Bill DWR = California Department of Water Resources

Table 4
CALGreen Water Use Standards (Effective January 1, 2014)

Fixture	Standard
Toilets (Water Closets)	≤ 1.28 gal/flush
Urinals	≤ 0.5 gal/flush
Single showerheads	≤ 2.0 gpm @ 80 psi
Multiple showerheads	≤ 2.0 gpm @ 80 psi (per valve)
Lavoratory faucets in residences	≤ 1.5 gpm @ 60 psi
Lavoratory faucets in common areas	≤ 0.5 gpm @ 60 psi
Metering faucets	≤ 0.25 gallons per cycle
Kitchen faucets	≤ 1.8 gpm @ 60 psi
Clothes washers	10 percent below Title 20 standards
Residential dishwashers	≤ 5.8 gallons per cycle and ENERGY STAR certified
Commercial dishwashers	Variable (see Table A5.303.3 in 2010 CALGreen)
Smart irrigation controller	Weather-based or soil-moisture-based

Abbreviations
gal= gallons; gpm = gallons per minute; psi = pounds per square inch

Table 5
Water Conservation Activities by Valencia Water Company Since 2006

Year	Who	Description	What
2006	Valencia Water Co.	CUWCC MOU	Commitment to implement BMPs or DMMs
2008	Valencia Water Co. and other local water purveyors	Local purveyors' collective strategy for increasing water use efficiency	Santa Clarita Valley Water Use Efficiency Strategic Plan
2011	Valencia Water Co.	Revisions to billing rate structure	Switch from volumetric rate structure to tiered rate structure, to support VWC's WaterSMART Allocation program.
2011	Valencia Water Co. and other local water purveyors	2010 UWMP	Established urban water use targets for SBX7-7 (reductions in per-capita water use by the years 2015 and 2020); presented accordant demand estimates every 5 years for the period 2015 through 2050; and presented Demand Management Measures (DMMs) and recycled water usage plans that are designed to meet the SBX7-7 water use reduction targets. Identified landscape irrigation as providing the greatest opportunity to achieve the reductions.

Abbreviations
CUWCC = CaliforniaUrban Water Conservation Council MOU = Memorandum of Understanding
BMPs = Best Management Practices DMMs = Demand Management Measures
UWMP = Urban Water Management Plan

ATTACHMENT 1
WATER DEMAND CALCULATIONS (MAY 2014)
ENTRADA VILLAGE SOUTH

Table A-1
Land Use Plan Statistics
Entrada Village South

Land Use	Has Water Demands?	Area (acres)			Dwelling Units			
		Detached	Attached	Total	Detached	Attached	Total	
Residential Development								
Estate	Yes	0.0	0.0	0.0	0	0	0	
Low	Yes	0.0	0.0	0.0	0	0	0	
Low Medium (Single-Family)	Yes	74.4	0.0	74.4	517	0	517	
Medium (Detached Condos)	Yes	0.0	51.3	51.3	0	1,057	1,057	
High (Attached Units)	Yes	0.0	0.0	0.0	0	0	0	
Mixed Use	Yes	0.0	0.0	0.0	0	0	0	
Subtotals		**74.4**	**51.3**	**125.7**	**517**	**1,057**	**1,574**	
Nonresidential Development								
Mixed-Use Commercial								
Retail	Yes			0.00	Includes library			
Office	Yes			27.40	Mixed use office			
Commercial	Yes			18.50	Commercial retail			
Business Park	Yes			0.0	Industrial + office that is in the commercial category			
Visitor Serving	Yes			0.0	Visitor center			
Water Reclamation Plant	Yes			0.0	Newhall WRP			
Electrical Substation	No			0.0	Has no water use			
Fire Stations	Yes			0.0	Fire station(s)			
Hotel/Spa	Yes			0.0	Hotel/spa			
Sr. Assisted Living	Yes			0.0	Sr. Assisted Living			
Golf Club House	Yes			0.0	Golf club house			
Schools	Yes							
Elementary (1)	Yes			9.4				
Middle (0)	Yes			0.0				
High (0)	Yes			0.0				
Subtotal				**55.3**				
Recreation, Arterials, Open Space								
Recreation								
Recreation Centers	Yes			2.6	Recreation centers			
Neighborhood Parks	Yes			5.6	Park (community park)			
Lake - Water	Yes			0.0	Water feature			
Lake - Park Area	Yes			0.0	Assume this is in "Lake-Water" category.			
Golf Course	Yes			0.0	Irrigated. Excludes the club house.			
Arterial Highways								
Hardscape/Road Section	No			39.4	Not irrigated.			
Landscape Area	Yes			20.9	Landscape in parkways and medians			
Major Open Areas								
Natural Open Space	No			64.6				
River Corridor	No			0.0				
Non-Irrigated Slopes	No			0.9	Previously "Community Open Area".			
Irrigated Slopes, Wet Zones	Yes			56.4	Previously "Community Slopes".			
O.S. Drainage Facilities	No			7.1	Debris basins, water quality basins, drainage channels			
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	Yes			3.8	Previously "Ungraded Areas and Easements"			
Subtotal				**201.3**				
Totals				**382.3**	**517**	**1,057**	**1,574**	

New or changed land use category (compared with 1996 and 1999 water demand analyses)

HAND-INPUT DATA IN RED

Updated May 2014 by GSI Water Solutions, Inc.

Table A-2
Verification of Updated Population and Density
Entrada Village South

RESIDENTIAL LAND USE	Acreage	Dwelling Units		Occupancy p/DU	Population Estimate
		Detached	Attached		
Estate	0	0	0	3.40	0
Low	0	0	0	3.40	0
Low Medium (Single-Family)	74.4	517	0	3.40	1,758
Medium (Detached Condos)	51.3	0	1057	2.60	2,748
High (Attached Units)	0	0	0	2.60	0
Mixed Use	0	0	0	2.60	0
TOTAL	**126**	**517**	**1,057**		**4,506**

Average Occupancy

$$\frac{\text{Population}}{\text{Total Dwelling Units}} = \frac{4,506}{1,574} = \textbf{2.86 p/DU}$$

Updated May 2014 by GSI Water Solutions, Inc.
References the land use statistics input table.

Table B-1
Residential Development Potable Water Demand Factors
Entrada Village South

Land Use	Interior (gpcpd)	Local Exterior (gpcpd)	Persons per Dwelling Unit	POTABLE gpd/DU (Interior + Exterior)
Rural	100	60	3.40	544
Estate	100	60	3.40	544
Low	80	50	3.40	442
Low Medium (Single-Family)	75	45	3.40	408
Medium (Detached Condos)	75	45	2.60	312
High (Attached Units)	75	45	2.60	312
High	75	45	2.60	312
Mixed Use	70	42	2.60	291

Notes: gpcpd = gallons per capita per day.
The persons per dwelling unit for estates land use category reflects an additional 2 persons per dwelling unit to account for second units.

Updated May 2014 by GSI Water Solutions, Inc.

HAND-INPUT -- WATER USE FACTOR
HAND-INPUT -- OTHER DATA
New or changed land use category (compared with 1996 and 1999 water demand analyses)
= Not Used

Table B-2
Nonresidential Development Potable Water Demand Factors
Entrada Village South

Land Use	Interior Use		Interior Use	Exterior Use
	Units	Factor	(gpapd)	(gpapd)
Mixed-Use Commercial (Retail)	gpd/sq. ft.	0.01	100	0
Commercial (Retail)	gpd/sq. ft.	0.20	2,000	0
Commercial Recreation	gpapd	45.00	45	235
Mixed-Use Commercial (Office)	gpd/sq. ft.	0.05	763	0
Business Park (Office)	gpd/sq. ft.	0.05	3,000	0
Business Park (Industrial)	gpd/sq. ft.	0.20	3,050	305
Institutional	gpd/sq. ft.	0.20	3,050	305
Hotel/Spa	gpd/sq. ft.	0.20	6,000	305
Hospital	gpd/bed	500.00	6,000	120
Sr. Assisted Living	gpd/bed	100.00	6,000	120
Golf Club House	gpd/sq. ft.	0.01	3,050	305
Visitor Serving	gpd/sq. ft.	0.01	3,050	305
Water Reclamation Plant	gpapd	200.00	200	0
Electrical Substation	gpapd	0.00	0	0
Fire Stations	gpd/sq. ft.	0.20	3,050	305
Schools	gpd/student	4.00	260	0
Recreation Centers	gpapd	100.00	100	0
Neighborhood Parks	gpapd	100.00	100	0
Lake - Water	gpapd	0	0	0
Lake - Park Area	gpapd	0	0	0
Golf Course	gpapd	0	0	0
Hardscape/Road Section	gpapd	0	0	0
Landscape Area	gpapd	0	0	0
Natural Open Space	gpapd	0	0	0
River Corridor	gpapd	0	0	0
Non-Irrigated Slopes	gpapd	0	0	0
Irrigated Slopes, Wet Zones	gpapd	0	0	0
O.S. Drainage Facilities	gpapd	0	0	0
Undeveloped / Under Construction	gpapd	0	0	0

Notes: gpapd = Gallons per acre per day based on average square footage per acre
DU = dwelling unit

Table B-3
Nonpotable Water Demand Factors
Entrada Village South

Land Use	Percent Irrigable Land (a)	Annual Usage (ac-ft)	
		Per Gross Acreage (b)	Per Net Acreage
Residential			
Estate	15%	1.01	6.7
Low	15%	1.01	6.7
Low Medium (Single-Family)	15%	1.01	6.7
Medium (Detached Condos)	15%	1.01	6.7
High (Attached Units)	15%	1.01	6.7
High	15%	1.01	6.7
Mixed Use	15%	1.01	6.7
Nonresidential			
Mixed-Use Commercial (Retail)	25%	1.34	5.36
Commercial (Retail)	25%	1.34	5.36
Commercial Recreation	67%	3.618	5.4
Mixed-Use Commercial (Office)	25%	1.34	5.36
Business Park (Office)	25%	1.34	5.36
Business Park (Industrial)	25%	1.34	5.36
Institutional	25%	1.40	5.6
Hotel/Spa	25%	1.34	5.36
Hospital	25%	1.40	5.6
Sr. Assisted Living	25%	1.40	5.6
Golf Club House	0%	0.00	6.0
Visitor Serving	25%	1.40	5.6
Water Reclamation Plant	25%	1.12	4.48
Electrical Substation	0%	0.00	6.0
Fire Stations	25%	1.40	5.6
Schools	25%	1.40	5.6
Recreation Centers	100%	3.43	3.43
Recreation, Arterials, Open Space			
Neighborhood Parks	100%	3.43	3.43
Golf Course	100%	4.59	4.59
Lake (Water Feature)	100%	4.59	4.59
Arterial Highway Hardscape / Road Section	0%	0.00	0.00
Arterial Highway Landscaped Areas	100%	3.47	3.47
Natural Open Space	0%	0.00	0.00
River Corridor	0%	0.00	0.00
Non-Irrigated Slopes	0%	0.00	0.00
Irrigated Slopes, Wet Zones	100%	3.47	3.47
O.S. Drainage Facilities	0%	0.00	0.00
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	100%	3.47	3.47
Low Irrigated Agriculture	1.000	2.2	2.2
High Irrigated Agriculture	1.000	6.2	6.2

Notes:
(a) City of Irvine, ITAP TAZ Land Use Inventory and IRWD SAMPs.
(b) Water usage is based on the gross lot area.

Table C-1
Summary of Water Demands
Entrada Village South

Land Use	Water Demand (ac-ft/yr)		
	Potable	Nonpotable	Total
Residential Development			
Estate	0	0	0
Low	0	0	0
Low Medium (Single-Family)	237	0	237
Medium (Detached Condos)	370	52	422
High (Attached Units)	0	0	0
Mixed Use	0	0	0
Subtotals	**607**	**52**	**659**
Nonresidential Development			
Mixed-Use Commercial			
Retail (including library)	0	0	0
Office	25	37	62
Commercial (Retail)	66	25	91
Business Park (Office)	0	0	0
Business Park (Industrial)	0	0	0
Visitor Serving	0	0	0
Water Reclamation Plant	0	0	0
Electrical Substation	0	0	0
Fire Stations	0	0	0
Institutional	0	0	0
Hotel/Spa	0	0	0
Hospital	0	0	0
Sr. Assisted Living	0	0	0
Golf Club House	0	0	0
Schools	3	14	17
Subtotals	**94**	**76**	**170**
Recreation, Arterials, Open Space			
Recreation			
Recreation Centers	1	9	10
Neighborhood Parks	1	20	21
Lake - Water	0	0	0
Lake - Park Area	0	0	0
Golf Course	0	0	0
Arterial Highways			0
Hardscape/Road Section	0	0	0
Landscape Area	0	73	73
Major Open Areas			0
Natural Open Space	0	0	0
River Corridor	0	0	0
Non-Irrigated Slopes	0	0	0
Irrigated Slopes, Wet Zones	0	196	196
O.S. Drainage Facilities	0	0	0
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	0	14	14
Subtotals	**2**	**312**	**314**
Totals	**703**	**440**	**1,143**

Updated May 2014 by GSI Water Solutions, Inc.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table C-2 Summary of Potable and Reclaimed Water Demands Entrada Village South			
Land Use	**Potable**	**Reclaimed**	**Total**
Residential Development	607	52	659
Nonresidential Development	94	76	170
Recreation, Arterials, Open Space	2	312	314
Subtotal	**703**	**440**	**1,143**
Reclaimed Water Supply Generated by Indoor Potable Water Use	**475**		

Updated May 2014 by GSI Water Solutions, Inc.

Table C-3
Water Demand Calculations for Residential Development
Entrada Village South

Land Use	Acreage			Dwelling Units		Estimated Water Demand											
						Potable Use						Irrigation Use (Non-Potable)				Total Use	
	Total	Detached	Attached	Detached	Attached	Interior Use gpcpd (a)	Exterior Use gpcpd (b)	Occupancy p/DU (c)	Interior (ac-ft/yr)	Exterior (ac-ft/yr)	**Subtotal (ac-ft/yr)**	Irrigated Area (d)	Acreage Attached Units (Non-Potable Water)	Annual Use Rate (ac-ft/ac)	**Subtotal (ac-ft/yr)**	(ac-ft/yr)	Gallons Per Day Per Dwelling Unit
Estate	0.0	0.0	0.0	0	0	100	60	3.40	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	—
Low	0.0	0.0	0.0	0	0	80	50	3.40	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	—
Low Medium (Single-Family)	74.4	74.4	0.0	517	0	75	45	3.40	**148**	**89**	**237**	15%	0.0	6.7	**0**	**237**	409
Medium (Detached Condos)	51.3	0.0	51.3	0	1,057	75	45	2.60	**231**	**139**	**370**	15%	51.3	6.7	**52**	**422**	356
High (Attached Units)	0.0	0.0	0.0	0	0	75	45	2.60	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	—
Mixed Use	0.0	0.0	0.0	0	0	70	42	2.60	**0**	**0**	**0**	15%	0.0	6.7	**0**	**0**	—
Total Water Demands									**379**	**228**	**607**				**52**	**659**	
Per-Capita Use (gallons/person/day)									**75**	**45**	**120**				**11**	**131**	

Notes:
(a) gpcpd : gallons per capita per day.
Interior water uses include drinking, bathing, laundry, sanitation, etc.
(b) gpcpd : gallons per capita per day.
Exterior water uses include landscape irrigation, washing cars, filling swimming pools, etc.
(c) p/DU : persons per dwelling unit. The estates factor includes 2 persons per dwelling unit additional to account for second units.
(d) Irrigated areas include common areas, greenbelt irrigation within residential neighborhoods, etc.
Percentage is based on gross landscape area.

Source of occupancy and potable and irrigation use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
HAND-INPUT DATA IN RED

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)
This is calculated and could potentially serve as a calibration target (i.e., adjust various input variables until this number equals a desired value).

Table C-4
Water Demand Calculations for Nonresidential Development
Entrada Village South

Land Use	Acreage (a)	Floor Space (sq. ft.)	Estimated Water Demand: Potable Use: Interior Use (b)	Exterior Use gpapd (c)	Interior (ac-ft/yr)	Exterior (ac-ft/yr)	Subtotal (ac-ft/yr)	Irrigation Use (Non-Potable): Irrigated Area (d)	Annual Use (ac-ft/ac): Per Gross Acreage	Per Net Acreage	Subtotal (ac-ft/yr)	Total (ac-ft/yr)	Units	No. of Units	Gallons Per Day Per Unit
Mixed-Use Commercial															
Retail (including library)	0.00	0	0.01	0	0	0	0	25%	1.34	5.36	0	0	TSF	0	0
Office	27.40	436,000	0.05	0	25	0	25	25%	1.34	5.36	37	62	TSF	436	127
Commercial (Retail)	18.50	294,000	0.20	0	66	0	66	25%	1.34	5.36	25	91	TSF	294	276
Business Park (Office)	0.00	0	0.05	0	0	0	0	25%	1.34	5.36	0	0	TSF	0	0
Business Park (Industrial)	0.00	0	0.20	305	0	0	0	25%	1.34	5.36	0	0	TSF	0	0
Visitor Serving	0.00	0	0.01	305	0	0	0	25%	1.40	5.60	0	0	TSF	0	0
Water Reclamation Plant	0.00	0	0.20	0	0	0	0	25%	1.12	4.48	0	0	TSF	0	0
Electrical Substation	0.00	0	0.00	0	0	0	0	0%	0.00	6.00	0	0	TSF	0	0
Fire Stations	0.00	0	0.20	305	0	0	0	25%	1.40	5.60	0	0	TSF	0	0
Institutional	0.00	0	0.20	305	0	0	0	25%	1.40	5.60	0	0	TSF	0	0
Hotel/Spa	0.00	0	0.20	305	0	0	0	25%	1.34	5.36	0	0	ROOM	100	0
Hospital	0.00	0	500	120	0	0	0	25%	1.40	5.60	0	0	TSF	0	0
Sr. Assisted Living	0.00	0	100	120	0	0	0	25%	1.40	5.60	0	0	ROOM	0	0
Golf Club House	0.00	0	0.01	305	0	0	0	0%	0.00	6.00	0	0	TSF	0	0
Schools							0								
Elementary (1)	9.40	N/A	260	0	3	0	3	25%	1.40	5.60	14	17	STUDENTS	900	16.9
Middle (0)	0.00	N/A	260	0	0	0	0	25%	1.40	5.60	0	0	STUDENTS	0	0.0
High (0)	0.00	N/A	260	0	0	0	0	25%	1.40	5.60	0	0	STUDENTS	0	0.0
Total Water Demands					94	0	94				76	170			

Notes:
(a) The acreage used in the calculations is the actual floor area ratio acres as supplied by the Newhall Ranch Company.
(b) Interior water uses include drinking and sanitation.
Units are in gallons per day per square foot for the commercial, business park, visitor serving, water reclamation plant, institutional, hotel/spa, and fire station land uses.
Units are in gallons per day per acre for the water treatment plant, electrical substation, and school land uses.
Units are in gallons per day per bed for the hospital and Sr. Assisted Living land use categories.
(c) Potable water is used for outdoor uses that have potential human contact (e.g., swimming pools, wash water, some landscape irrigation).
gpapd : gallons per acre per day. For hospitals and Sr. Assisted Living, the units are gpapd per bed.
(d) Percentage is based on gross landscape area.
Irrigated areas include common areas and greenbelt irrigation.

Source of potable and irrigation use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
HAND-INPUT DATA IN RED

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)
This is calculated and could potentially serve as a calibration target (i.e., adjust various input variables until this number equals a desired value).

Table C-5
Water Demand Calculations for Recreation, Arterial, and Open Space Land Uses
Entrada Village South

Land Use	Acreage	Estimated Water Demand						
		Potable Use		Non-Potable Use (Irrigation Only)				
		Potable Use gpapd (a)	Subtotal (ac-ft/yr)	Irrigated Area (b)	Annual Use (ac-ft/ac) Per Gross Acreage	Annual Use (ac-ft/ac) Per Net Acreage	Subtotal (ac-ft/yr)	Total (ac-ft/yr)
Recreation								
Recreation Centers	2.6	100	1	100%	3.43	3.43	9	10
Neighborhood Parks	5.6	100	1	100%	3.43	3.43	20	21
Lake - Water	0.0	0	0	100%	4.59	4.59	0	0
Lake - Park Area	0.0	0	0	100%	4.59	4.59	0	0
Golf Course	0.0	0	0	100%	4.59	4.59	0	0
Arterial Highways								
Hardscape/Road Section	39.4	0	0	0%	0	0	0	0
Landscape Area	20.9	0	0	100%	3.47	3.47	73	73
Major Open Areas								
Natural Open Space	64.6	0	0	0%	0	0	0	0
River Corridor	0.0	0	0	0%	0	0	0	0
Non-Irrigated Slopes	0.9	0	0	0%	0	0	0	0
Irrigated Slopes, Wet Zones	56.4	0	0	100%	3.47	3.47	196	196
O.S. Drainage Facilities	7.1	0	0	0%	0	0	0	0
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	3.8	0	0	100%	3.47	3.47	14	14
Total Water Demands			2				312	314

Notes:
(a) gpapd = gallons per acre per day.
(b) Area is estimated as a percentage of gross area .

Source of potable and irrigation use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
HAND-INPUT DATA IN RED

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-1 Summary of Wastewater Generation Entrada Village South	
Land Use	**Wastewater (ac-ft/yr)**
Residential Development	
Estate	0
Low	0
Low Medium (Single-Family)	148
Medium (Detached Condos)	231
High (Attached Units)	0
Mixed Use	0
Subtotal	**379**
Nonresidential Development	
Mixed-Use Commercial	
Retail (including library)	0
Office	25
Commercial (Retail)	66
Business Park (Office)	0
Business Park (Industrial)	0
Visitor Serving	0
Water Reclamation Plant	0
Electrical Substation	0
Fire Stations	0
Institutional	0
Hotel/Spa	0
Hospital	0
Sr. Assisted Living	0
Golf Club House	0
Schools	
Elementary (1)	3
Middle (0)	0
High (0)	0
Subtotal	**94**
Recreation, Arterials, Open Space	
Recreation Centers	1
Neighborhood Parks	1
Lake - Water	0
Lake - Park Area	0
Golf Course	0
Arterial Highways	
Hardscape/Road Section	0
Landscape Area	0
Major Open Areas	
Natural Open Space	0
River Corridor	0
Non-Irrigated Slopes	0
Irrigated Slopes, Wet Zones	0
O.S. Drainage Facilities	0
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	0
Subtotal	**2**
Total Wastewater Generated	**475**
Wastewater generation is based on IRWD water demand factors.	

Updated May 2014 by GSI Water Solutions, Inc.

New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-2
Wastewater Generation Calculations for Residential Development (a)
Entrada Village South

Land Use	Dwelling Units				Wastewater Generated	
	Total Area (acres)	Detached Units	Attached Units	Occupancy (p/DU) (c)	Ave. Rate (gpcpd) (b)	Total (ac-ft/year)
Estate	.0	0	0	3.40	100	**0**
Low	.0	0	0	3.40	80	**0**
Low Medium (Single-Family)	74.4	517	0	3.40	75	**148**
Medium (Detached Condos)	51.3	0	1,057	2.60	75	**231**
High (Attached Units)	.0	0	0	2.60	75	**0**
Mixed Use	.0	0	0	2.60	70	**0**
Total Wastewater Generated						**379**

Notes:
(a) Wastewater generation is based on IRWD interior water demand factors.
(b) gpcpd : gallons per capita per day.
Interior water uses include drinking, bathing, laundry, sanitation, etc.
(c) p/DU : persons per dwelling unit.

Source of occupancy and potable use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-3
Wastewater Generation Calculations for Nonresidential Development (a)
Entrada Village South

Land Use	Area		Wastewater Generated	
	Net Acres	Floor Space (sq. ft.)	Ave. Rate (gpd/sq. ft.) (b)	Total (ac-ft/yr)
Mixed-Use Commercial				
Retail (including library)	0.0		0.01	**0**
Office	27.4	436,000	0.05	**25**
Commercial (Retail)	18.5	294,000	0.20	**66**
Business Park (Office)	0.0		0.05	**0**
Business Park (Industrial)	0.0		0.20	**0**
Visitor Serving	0.0		0.01	**0**
Water Reclamation Plant	0.0		0.20	**0**
Electrical Substation	0.0		0.00	**0**
Fire Stations	0.0		0.20	**0**
Institutional	0.0		0.20	**0**
Hotel/Spa	0.0		0.20	**0**
Hospital	0.0		500	**0**
Sr. Assisted Living	0.0		100	**0**
Golf Club House	0.0		0.01	**0**
Schools				
Elementary (1)	9.4	N/A	260	**3**
Middle (0)	0	N/A	260	**0**
High (0)	0	N/A	260	**0**
Total Wastewater Generated				**94**

Notes:
(a) Wastewater generation is based on IRWD interior water demand factors
(b) Interior water uses include drinking and sanitation.
Units are in gallons per day per square foot for the commercial, business park, visitor serving, water reclamation plant, institutional, hotel/spa, and fire station land uses.
Units are in gallons per day per acre for the water treatment plant, electrical substation, and school land uses.
Units are in gallons per day per bed for the hospital and Sr. Assisted Living land use categories.

Source of potable use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table D-4
Wastewater Generation Calculations for Recreation, Arterial, and Open-Space Land Uses (a)
Entrada Village South

Land Use	Area	Wastewater Generated	
	Acres	Ave. Rate (gpapd) (b)	Total (ac-ft/yr)
Recreation			
Recreation Centers	2.6	100	1
Neighborhood Parks	5.6	100	1
Lake - Water	0.0	0	0
Lake - Park Area	0.0	0	0
Golf Course	0.0	0	0
Arterial Highways			
Hardscape/Road Section	39.4	0	0
Landscape Area	20.9	0	0
Major Open Areas			
Natural Open Space	64.6	0	0
River Corridor	0.0	0	0
Non-Irrigated Slopes	0.9	0	0
Irrigated Slopes, Wet Zones	56.4	0	0
O.S. Drainage Facilities	7.1	0	0
O.S. LDZ, O.S. Trail LDZ, SD&SS easements	3.8	0	0
Total Wastewater Generated			**2**

Notes:
(a) Wastewater generation is based on IRWD interior water demand factors.
(b) gpapd = gallons per acre per day.

Source of potable use data: Irvine Ranch Water District 1991 Water Master Plan

Updated May 2014 by GSI Water Solutions, Inc.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table E-1
Nonpotable Irrigated Acreage
Entrada Village South

		Nonresidential		Recreation, Arterials, Open Space		Total
Land Use	**Acreage**	**Land Use**	**Acreage**	**Land Use**	**Acreage**	
Estate	0.0	Mixed-Use Commercial		Recreation		
Low	0.0	Retail (including library)	0.0	Recreation Centers	2.6	
Low Medium (Single-Family)	0.0	Office	6.9	Neighborhood Parks	5.6	
Medium (Detached Condos)	7.7	Commercial (Retail)	4.6	Lake - Water	0.0	
High (Attached Units)	0.0	Business Park (Office)	0.0	Lake - Park Area	0.0	
Mixed Use	0.0	Business Park (Industrial)	0.0	Golf Course	0.0	
		Visitor Serving	0.0	Arterial Highways		
		Water Reclamation Plant	0.0	Hardscape/Road Section	0.0	
		Electrical Substation	0.0	Landscape Area	20.9	
		Fire Stations	0.0	Major Open Areas		
		Institutional	0.0	Natural Open Space	0.0	
		Hotel/Spa	0.0	River Corridor	0.0	
		Hospital	0.0	Non-Irrigated Slopes	0.0	
		Sr. Assisted Living	0.0	Irrigated Slopes, Wet Zones	56.4	
		Golf Club House	0.0	O.S. Drainage Facilities	0.0	
		Schools		O.S. LDZ, O.S. Trail LDZ, SD&SS easements	3.8	
		Elementary (1)	2.4			
		Middle (0)	0.0			
		High (0)	0.0			
Total Irrigated	**7.7**		**13.8**		**89.3**	**110.8**
Total Acreage	**125.7**		**55.3**		**201.3**	**382.3**
Percent Irrigated	**6%**		**25%**		**44%**	**29%**

Updated May 2014 by GSI Water Solutions, Inc.

References the land use statistics input table.
New or changed land use category (compared with 1996 and 1999 water demand analyses)

Table F-1
Entrada Village South Monthly Operations
Updated May 2014 by GSI Water Solutions, Inc.

Monthly Distribution of Demand From UC Extension

Monthly Demand		(% of Annual)	
Month	Days/Mo	Interior	Exterior
J	31	8.49%	3.77%
F	28	7.67%	5.09%
M	31	8.49%	6.57%
A	30	8.22%	9.10%
M	31	8.49%	10.56%
J	30	8.22%	11.36%
J	31	8.49%	14.11%
A	31	8.49%	12.93%
S	30	8.22%	10.23%
O	31	8.49%	7.51%
N	30	8.22%	5.01%
D	31	8.49%	3.77%
		100%	100%

Potable Demand (Ac-Ft per Month)		
	Interior	Exterior
	40	9
	36	12
	40	15
	39	21
	40	24
	39	26
	40	32
	40	29
	39	23
	40	17
	39	11
	40	9
	475	228
check:	475	228
		703

Total Demands (Ac-Ft per Month)			
Month	Potable Demand	Nonpotable Demand	Total
J	49	17	66
F	48	22	70
M	55	29	84
A	60	40	100
M	64	46	111
J	65	50	115
J	73	62	135
A	70	57	127
S	62	45	107
O	57	33	90
N	50	22	72
D	49	17	66
	703	440	1,143

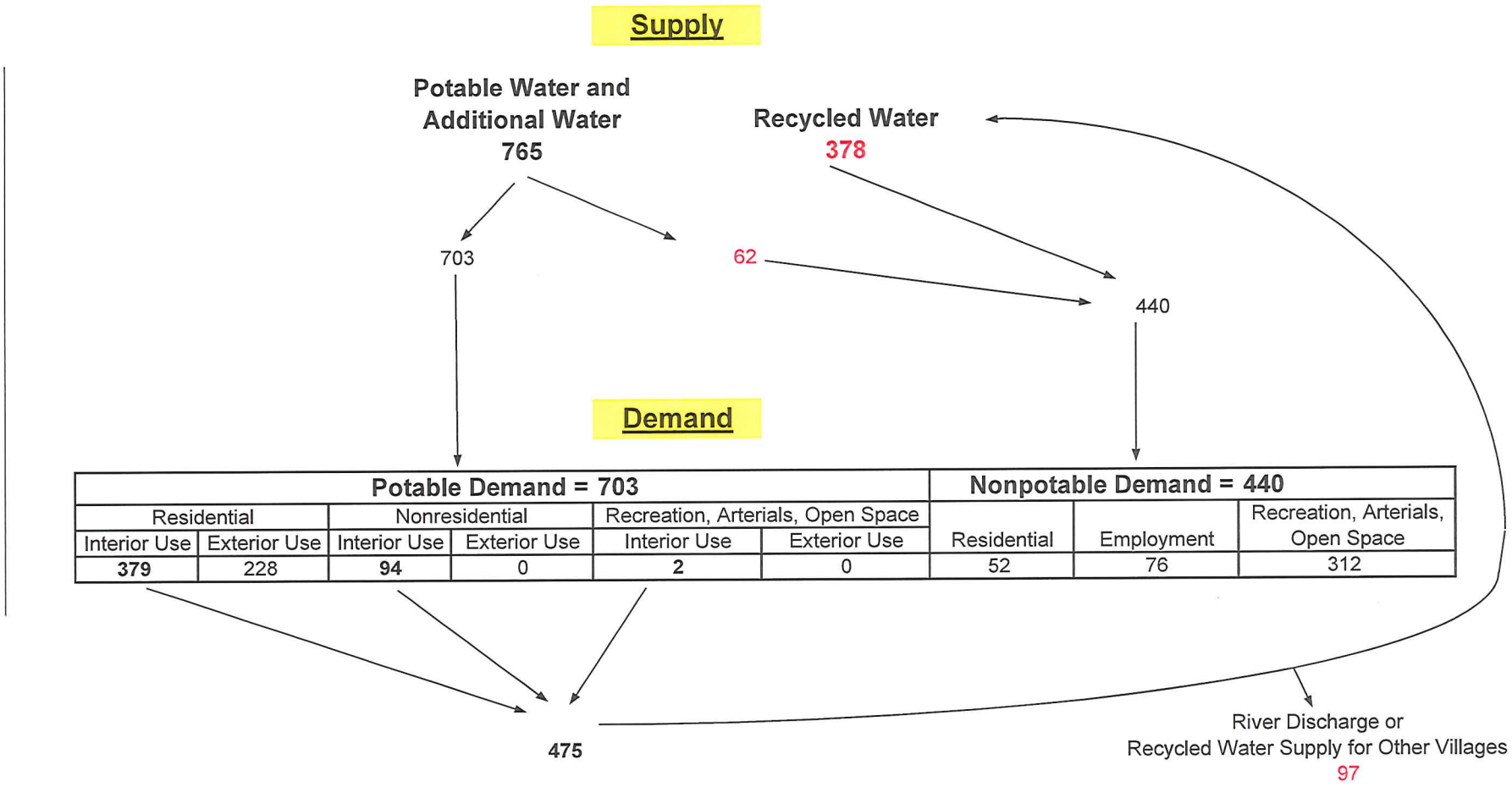
Recycled Water to Nonpotable				Numbers used for Fig 8	
Month	Recycled Water Supply	Nonpotable Demand	Net		
J	40	17	-24	40	17
F	36	22	-14	36	22
M	40	29	-11	40	29
A	39	40	1	39	40
M	40	46	6	40	46
J	39	50	11	39	50
J	40	62	22	40	62
A	40	57	17	40	57
S	39	45	6	39	45
O	40	33	-7	40	33
N	39	22	-17	39	22
D	40	17	-24	40	17
Totals	475	440	-35		
Sum of Negative = Discharged To River			-97		
Sum of Positive = Water Needed for Nonpotable Use			62		
	39.58333333				

Potable Water Use (Ac-Ft per Month)			
Month	Nonpotable Demand	Potable Demand	Total
J	0	49	49
F	0	48	48
M	0	55	55
A	1	60	61
M	6	64	71
J	11	65	76
J	22	73	94
A	17	70	86
S	6	62	68
O	0	57	57
N	0	50	50
D	0	49	49
Total	62	703	765
		Check:	765 OKAY

ETO values based on Bullettin 1922.
HAND-INPUT DATA IN RED

1.37
1.85
2.39
3.31
3.84
4.13
5.13
4.7
3.72
2.73
1.82
1.37
36.36

Figure 1
Entrada Village South Water Balance
All units in acre-feet/year



Note: The 62 ac-ft of additional water supply could be provided from the Valencia WRP or other available supplies.

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Printed 5/16/2014

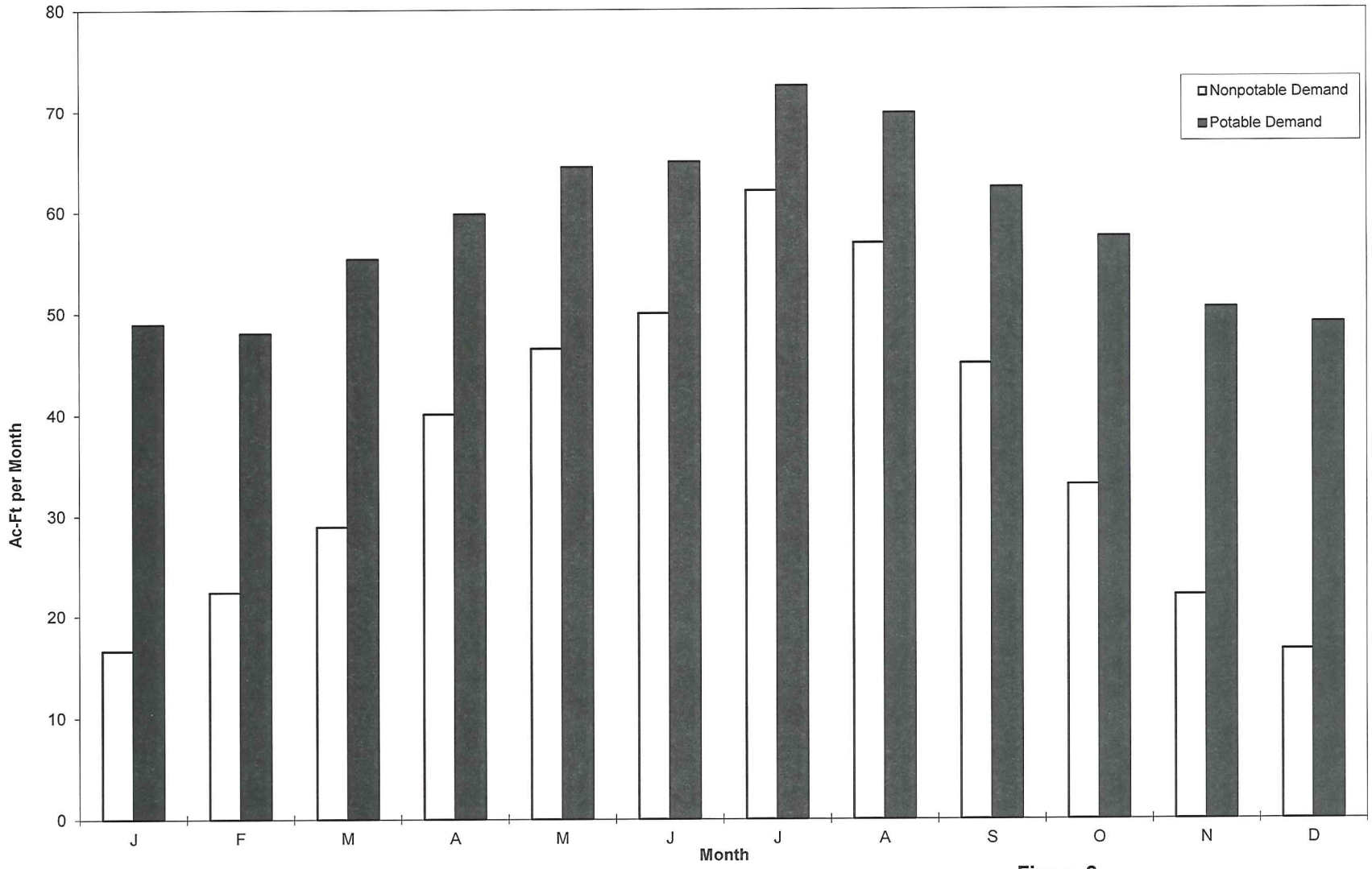


Figure 2
Total Monthly Water Demands
Entrada Village South

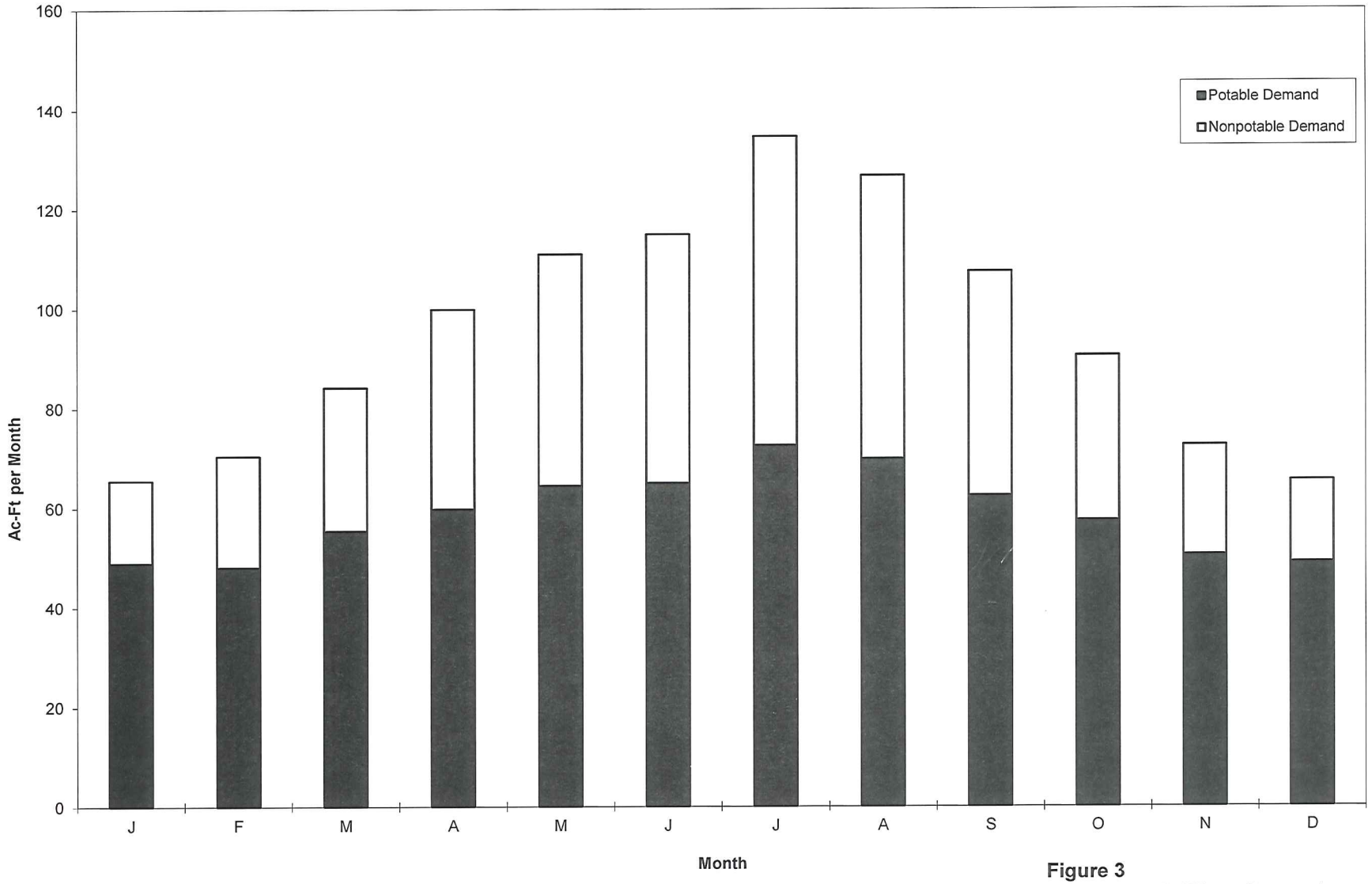
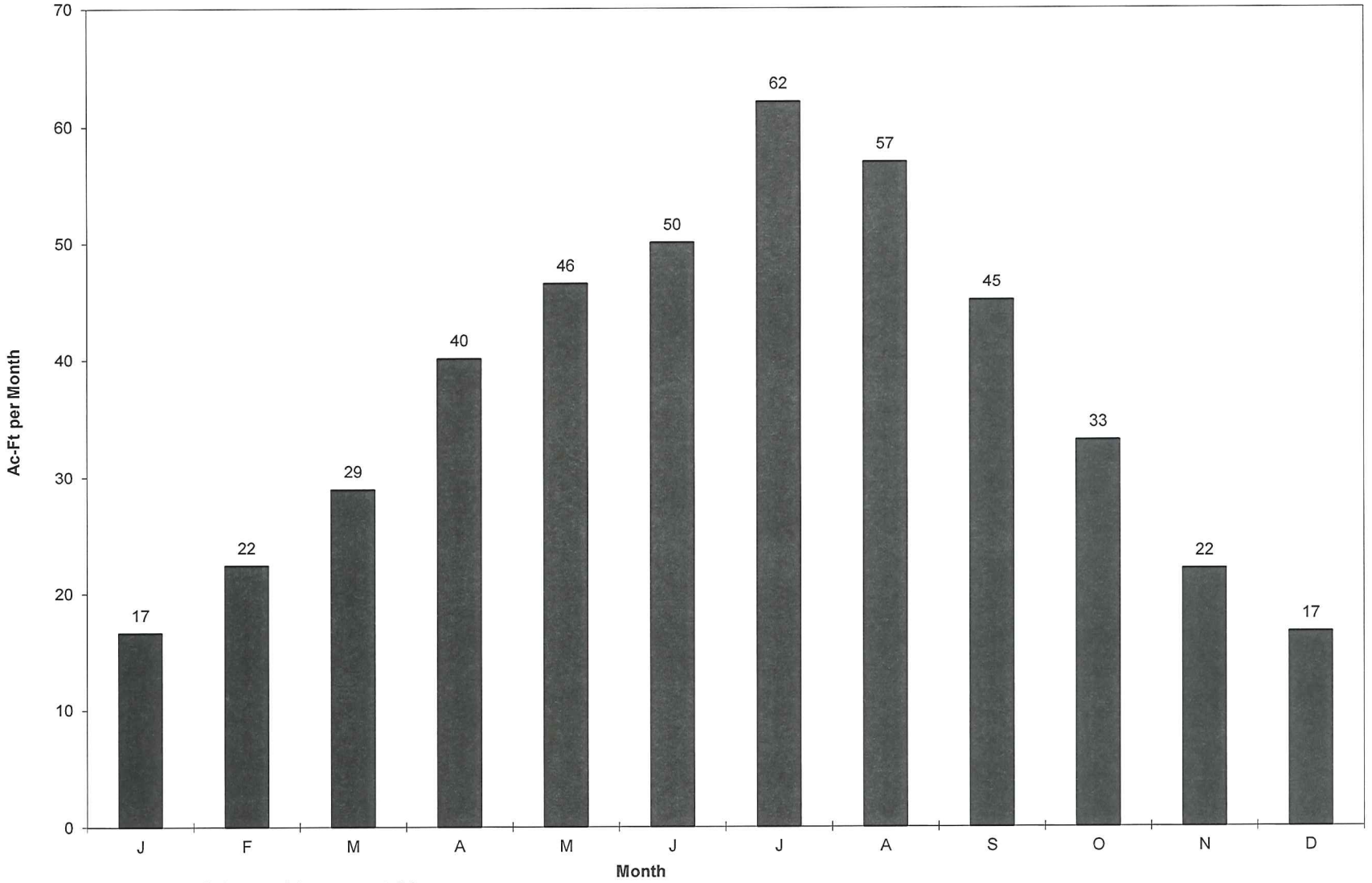
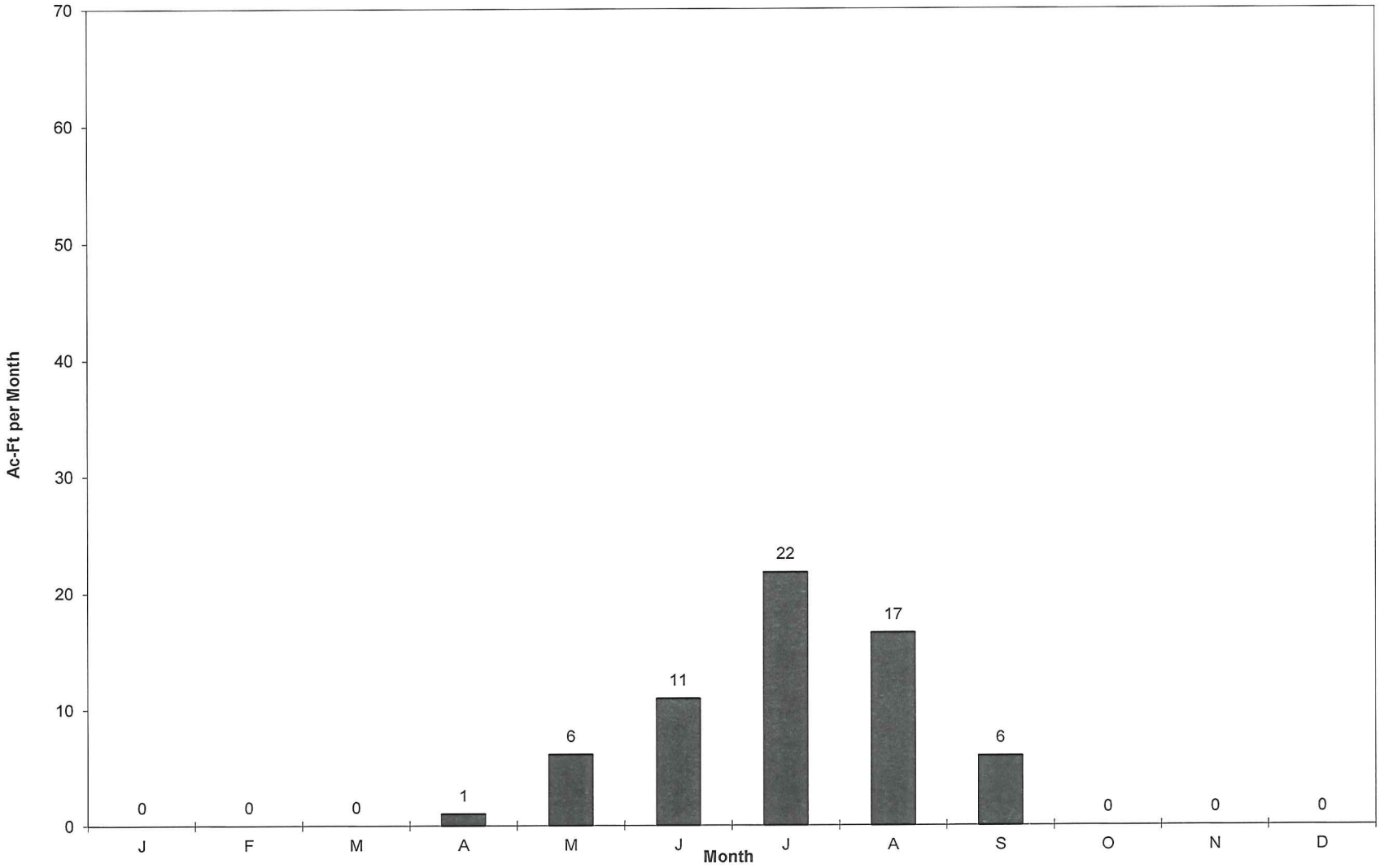


Figure 3
Total Monthly Water Demands
Entrada Village South



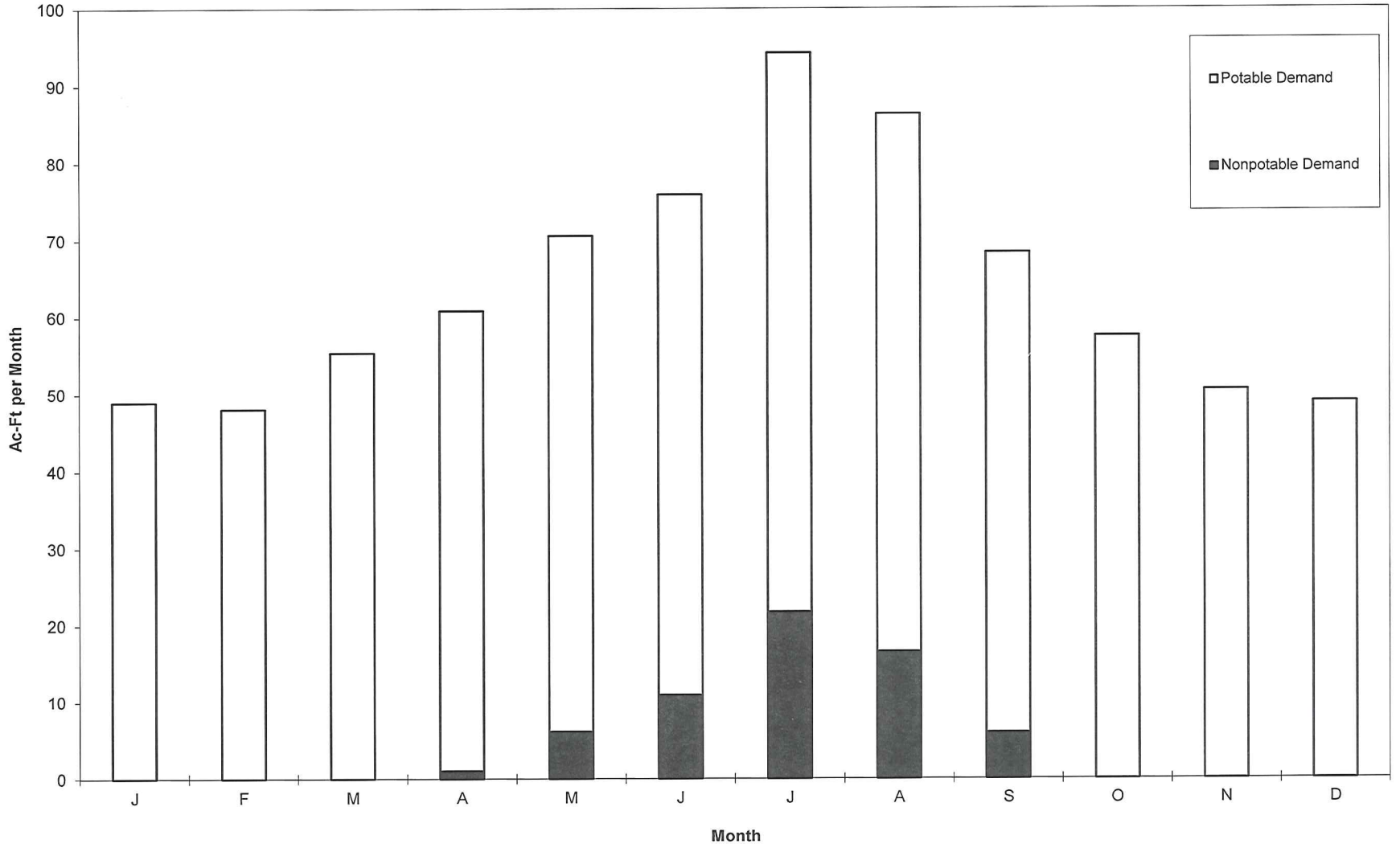
Note: Annual demand for nonpotable water is 440 ac-ft per year.

Figure 4
Monthly Nonpotable Water Demands
Entrada Village South



Note: Total additional water required is 62 ac-ft per year (from other nonpotable or potable sources).

Figure 5
Outdoor Water Demand Not Met By Nonpotable Water Generated By Entrada Village South



Note:
Annual supply from sources other than the recycled water flows generated by the Entrada Village South is 765 ac-ft per year. These supplies consist of supplies other than the recycled water generated within Entrada Village South. See Figure 1.

Figure 6
Uses of Potable and Other Nonpotable Water Supplies
Entrada Village South

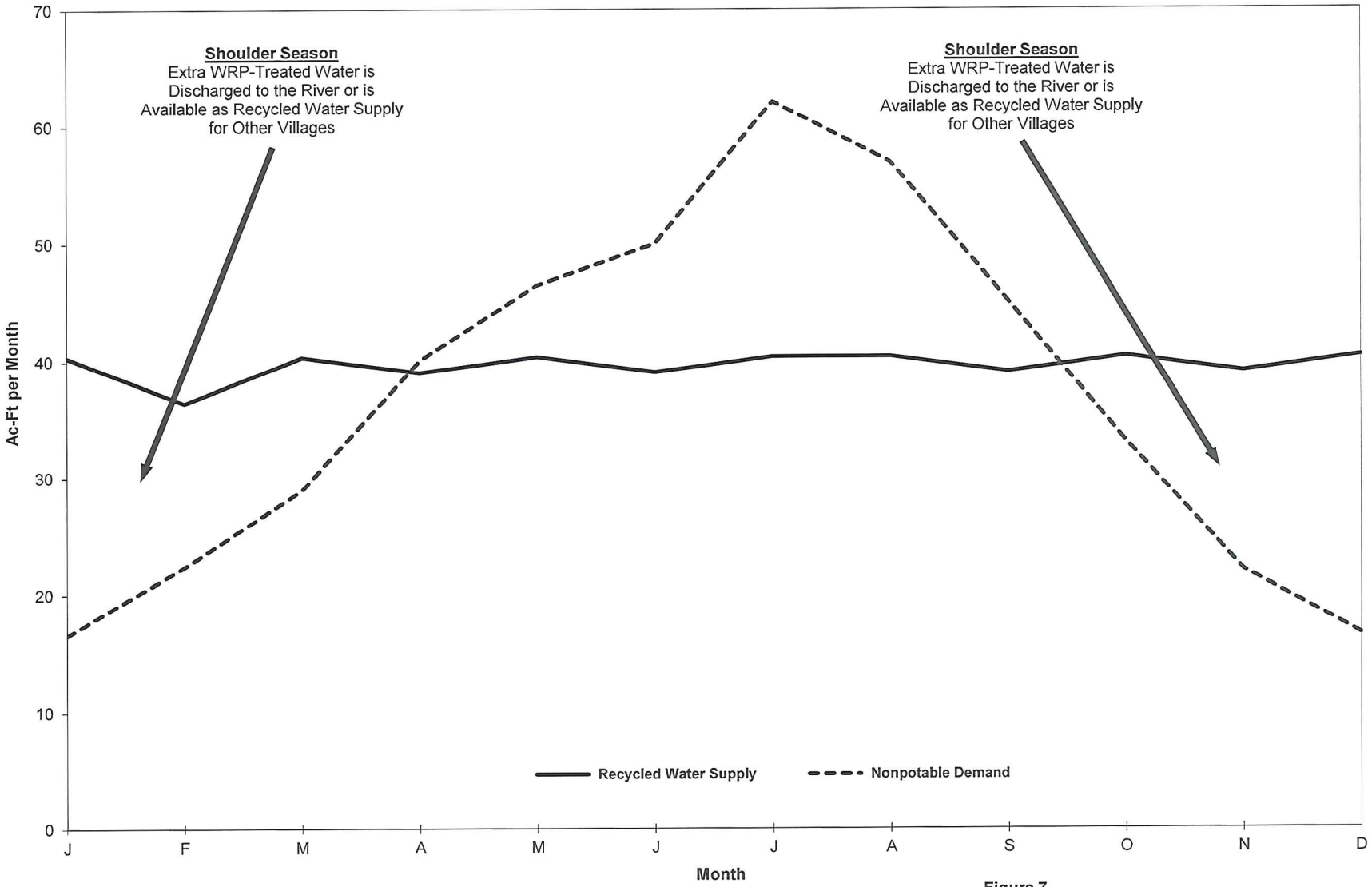
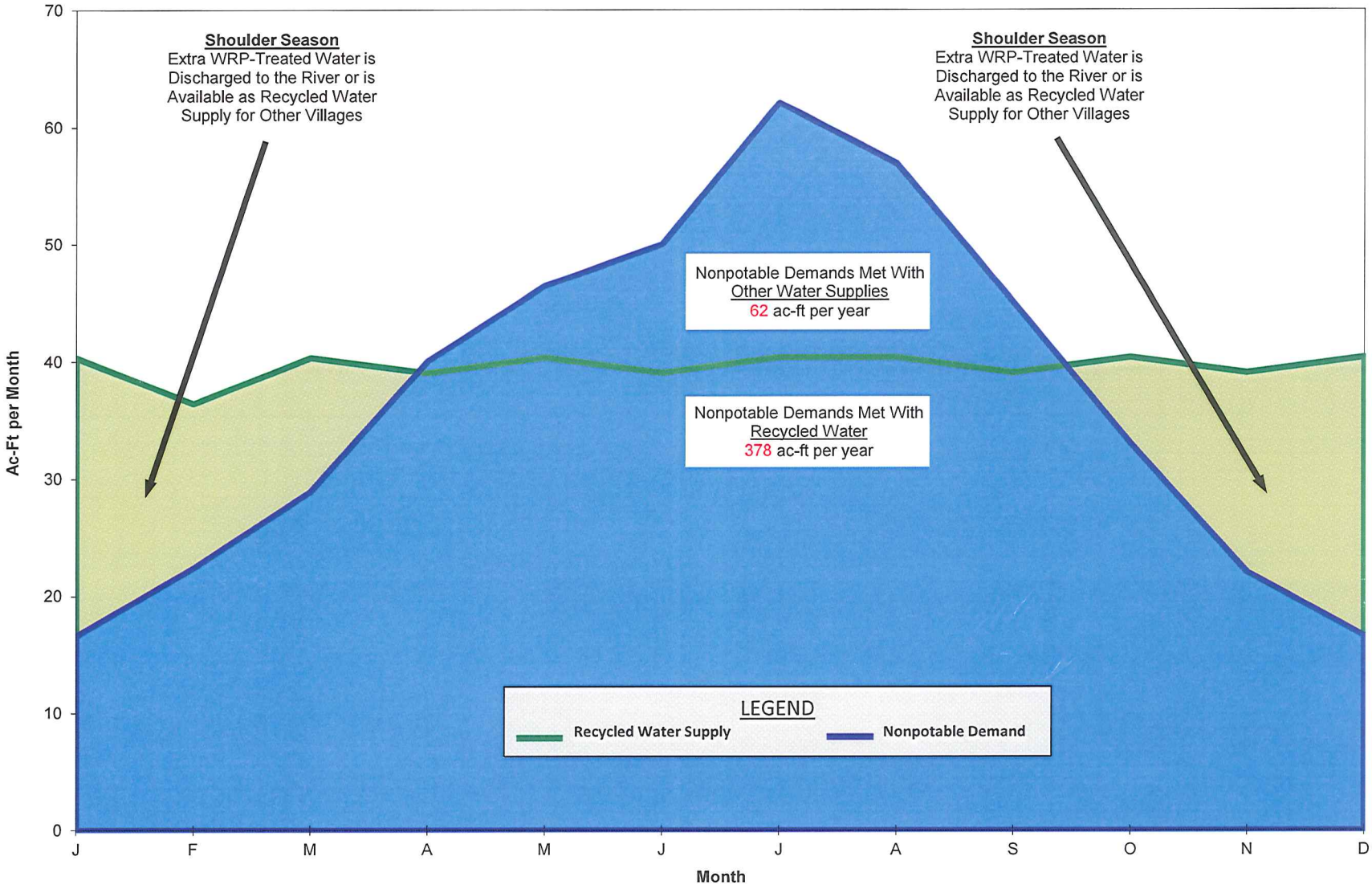


Figure 7
Comparison of Recycled Water Supply and Nonpotable Water Demands
Entrada Village South



Note: Total amount of WRP-treated water discharged to the Santa Clara River (or available as recycled water supply to other villages) is 97 ac-ft per year.

Figure 8
Recycled Water System Operations
Entrada Village South

Appendix 5.21C

Water Supply and Demand Technical Report

Cardno ENTRIX

February 2015

Water Supply and Demand Technical Report

Entrada South

3109018600

Cardno
Shaping the Future

Document Information

Prepared for	The Newhall Land and Farming Company
Project Name	Entrada South
Project Number	3109018600
Project Manager	Lorraine Woodman
Date	Revised February 2015

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Acronyms

µg/L	micrograms per liter
af	acre-feet
afy	acre-feet per year
Basin Plan	The Los Angeles Regional Water Quality Control Board Basin Plan
Bay-Delta Plan	Water Quality Control Plan for the Bay-Delta
Buena Vista	Buena Vista Water Storage District
CAT	Climate Action Team
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLWA	Castaic Lake Water Agency
Council	Delta Stewardship Council
County	County of Los Angeles
CPUC	California Public Utilities Commission
Delta	Sacramento-San Joaquin Delta
DMS	Development Monitoring System
DPH	California Department of Public Health
DPS	distinct population segment

DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
GHG	greenhouse gas
gpcpd	gallons per capita per day
gpm	gallons per minute
GSA	groundwater sustainability agencies
GSP	groundwater sustainability plans
HAA5	haloacetic acids
I-5	Interstate 5
KCWA	Kern County Water Agency
LACWWD 36	Los Angeles County Waterworks District □36
maf	million acre-feet
MCL	maximum contaminant level
mgd	million gallons per day
mg/L	milligrams per liter
MOU	Memorandum of Understanding
MTBE	methyl tertiary-butyl ether
NCWD	Newhall County Water District
NMFS	National Marine Fisheries Service
Project	Entrada South mixed-use planned community
RFI	Redmediation Financial, Inc.
Rosedale-Rio Bravo	Rosedale-Rio Bravo Water Storage District
SCAG	Southern California Association of Governments
SCLLC	Santa Clarita LLC
SCVSD	Santa Clarita Valley Sanitation District of Los Angeles County
SCWD	CLWA Santa Clarita Water Division
SOC	non-volatile synthetic organic compound
SWP	State Water Project
State Water Board State	Water Resources Control Board
taf	thousand acre-feet
THM	trihalomethanes
TMDL	Total Maximum Daily Load
TTHMs	total trihalomethanes
USFWS	U.S. Fish and Wildlife Service

UWMP	Urban Water Management Plan
VOC	volatile organic compound
VWC	Valencia Water Company
WRP	water reclamation plant

1 Introduction

This water supply and demand technical report is to be used for the proposed Entrada South mixed-use planned community (Project). The Project applicant is The Newhall Land and Farming Company (Applicant or Newhall). The County of Los Angeles (County) is the lead agency because the Project site is situated within the jurisdictional boundary of unincorporated Los Angeles County in the Santa Clarita Valley. The County is overseeing preparation of the Environmental Impact Report (EIR) for the Project.

Castaic Lake Water Agency (CLWA) is the wholesale public water agency for the Santa Clarita Valley. The CLWA water service area includes four retail water purveyors: (a) CLWA's Santa Clarita Water Division (SCWD), (b) Newhall County Water District (NCWD), (c) Los Angeles County Waterworks District 36, and (d) Valencia Water Company (VWC). CLWA and these four retail purveyors coordinate the management of imported water, local groundwater, and recycled water to meet water demands in the Santa Clarita Valley. Specifically, CLWA and the four retail purveyors evaluate the long-term water demands within the broader CLWA service area based on Los Angeles County and City of Santa Clarita plans and proposed development projects; and compare County and City plans and projects against existing and projected water supplies (CLWA 2011). This water demand and supply data are incorporated into the Urban Water Management Plan (UWMP) for the Santa Clarita Valley. Each of the purveyors also works closely with property owners and developers in their service areas to ensure that they have the necessary infrastructure to provide water service (CLWA 2011).

VWC is the operator of the public water system that would provide water to the Project site. The VWC service area is located within CLWA's broader service area.

This report provides current information about the water supplies and demands within the Santa Clarita Valley. It will be used as a technical report for the Project EIR. The report also will be used to help ensure compliance with both the California Environmental Quality Act (CEQA) and the County General Plan Development Monitoring System (DMS), as it relates to water supplies. (The purpose of the County's DMS is to ensure that new development in Urban Expansion Areas, like the Santa Clarita Valley, pay for the public services it generates.)

Based on the information presented herein, this report concludes that VWC's water system has access to sufficient existing and planned water supplies to meet the Project's water demand, and existing and other projected future demands, including agriculture and manufacturing uses, within VWC's service area, which is part of the broader CLWA service area.

1.1 Project Location

The Project is located west of Interstate 5 (I-5) within the Santa Clarita Valley area of northwestern unincorporated Los Angeles County. The Project is classic in-fill development surrounded by existing and approved development, including Magic Mountain Theme Park and the Valencia Commerce Center to the north, the Valencia Industrial Center and the City of Santa Clarita across the I-5 to the east, the Westridge planned community to the south, and the approved Mission Village community within the Newhall Ranch Specific Plan to the west. Figure 1-1, Regional Location, depicts the regional setting of the Project. Figure 1-2, Vicinity Map, illustrates the Project site and its vicinity.

1.2 Project Description

The Project is the proposed development of a mixed-use planned community located on approximately 501 acres in unincorporated Los Angeles County (Project site). The Project site includes about 382 acres within the proposed Entrada South tract map area (Vesting Tentative Tract Map No. 53295). The tract map area would comprise 1,574 residential homes, including 339 single-family and 1,235 multi-family residences, and 730,000 square feet of commercial/retail uses (295,000 sq. ft.) and office uses (435,000

sq.ft.). The proposed facilities and infrastructure needed to facilitate development include a 9.4-acre elementary school, 5.6-acre public neighborhood park, two private recreation centers within 2.9 acres, 101.7 acres of open space, and a 27.2-acre spineflower preserve. Other Project tract map amenities include trails/paseos, roads, and supporting water, sewer, drainage, and associated utilities.

The Project also would include off-site improvements needed to develop the tract map area (External Map improvements). The External Map improvements include: (1) areas within the Newhall Ranch Specific Plan needed for utility, road, and grading uses; (2) a portion of the Westridge development area to serve as the location of the Project water tank site; (3) portions of Westridge Parkway, Media Center Drive, and Commerce Center Drive; and (4) linear property situated along the east edge of the Magic Mountain Amusement Park for drainage improvements.

At build-out, total water demand for the Project is estimated to be approximately 1,143 acre-feet per year (afy), which includes a potable water demand of 703 afy and a non-potable water demand of 440 afy (GSI 2013).

1.2.1 Potable Water Infrastructure System

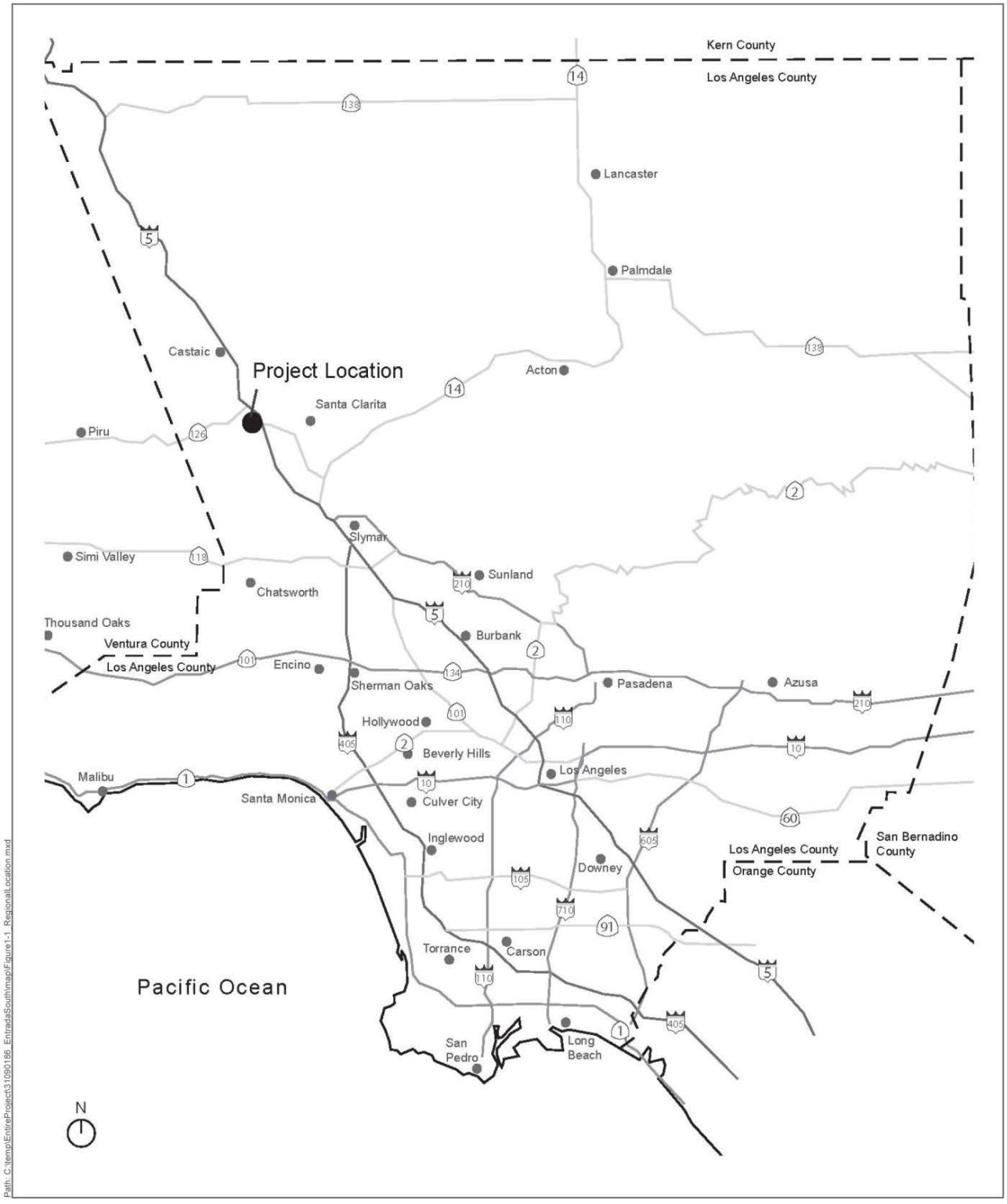
As shown in Figure 1-3, Project Potable Water System, the Project's potable water system would consist of a network of water lines, water tanks, booster pumps, and pressure reducing vales. Water storage for the Project would be provided by a proposed 4 million gallon reservoir tank to be constructed on an existing tank site pad located adjacent to Westridge Parkway to the south of the Project's tract map site. This water tank would be located adjacent to an existing 4 million gallon water tank.

As shown, the Project would be located within VWC's Zones II and III water pressure zones. The portion of the site lying within VWC's Zone II would be served by the existing 4 million gallon reservoir tank and the proposed 4 million gallon reservoir tank. The portion of the site lying within VWC's Zone III would be served by an expanded booster station located next to the Zone II tanks. VWC has reviewed the proposed water infrastructure, and after consultation, has determined there would be sufficient delivery capacity to serve potable water to the Project (pers. comm., Abercrombie 2014c, 2014d).

1.2.2 Recycled Water Infrastructure System

Currently, recycled water is available from the Valencia WRP, located along The Old Road, just north of the Project Site. In addition, VWC presently delivers recycled water purchased from CLWA for irrigation of the golf course and other properties within the existing Westridge community, located immediately south of the Project Site. VWC has consulted with Dexter Wilson Engineering, reviewed plans to utilize CLWA's existing pump station and existing Zone II recycled water lines from the Valencia WRP, and identified points of connection to supply recycled water for irrigation purposes to the Project Site. Figure 1-4, Project Recycled Water System, depicts the Project's proposed recycled water system.

The Project Site is located within VWC's Zones II through IV recycled water pressure zones. As shown in Figure 1-4, existing recycled water lines within The Old Road, Magic Mountain Parkway, and Westridge Parkway would be the connection points to serve the Project Site. In addition, Project booster pumps and pressure reducing valves would be provided to connect the three pressure zones within the Project Site and provide service within the different zones. Based on consultation with VWC, the existing and proposed recycled water infrastructure would have sufficient delivery capacity to meet the recycled water needs of the Project (pers. comm., Abercrombie 2014c, 2014d).



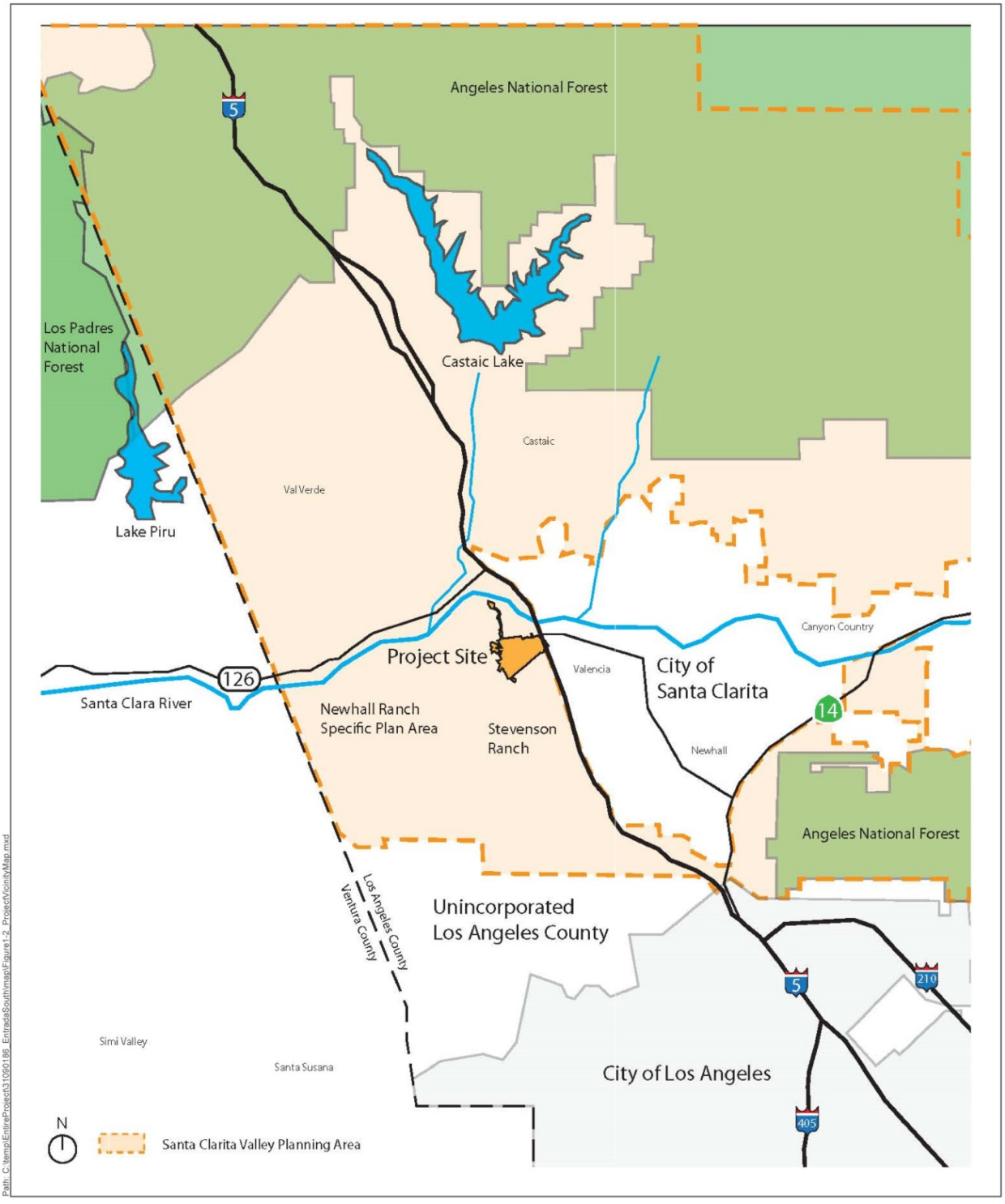
Source: Google Earth 2013

Date: 4/30/2014

ENTRADA SOUTH

Figure 1-1

Regional Location



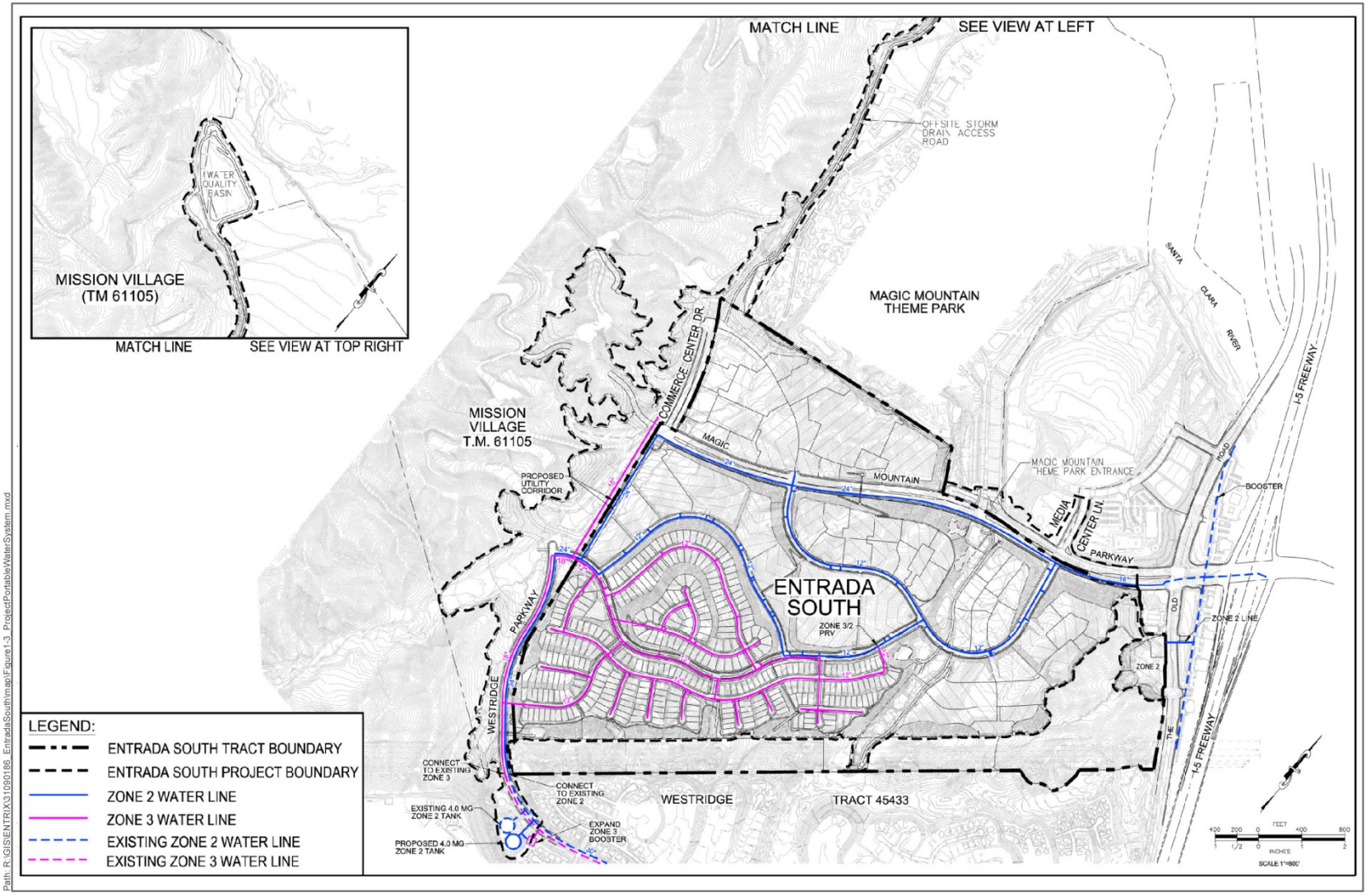
Source: Google Earth 2013; Santa Clarita Valley Area Plan Update (Los Angeles County Department of Regional Planning 2012)

Date: 4/30/2014

ENTRADA SOUTH

Figure 1-2

Project Vicinity

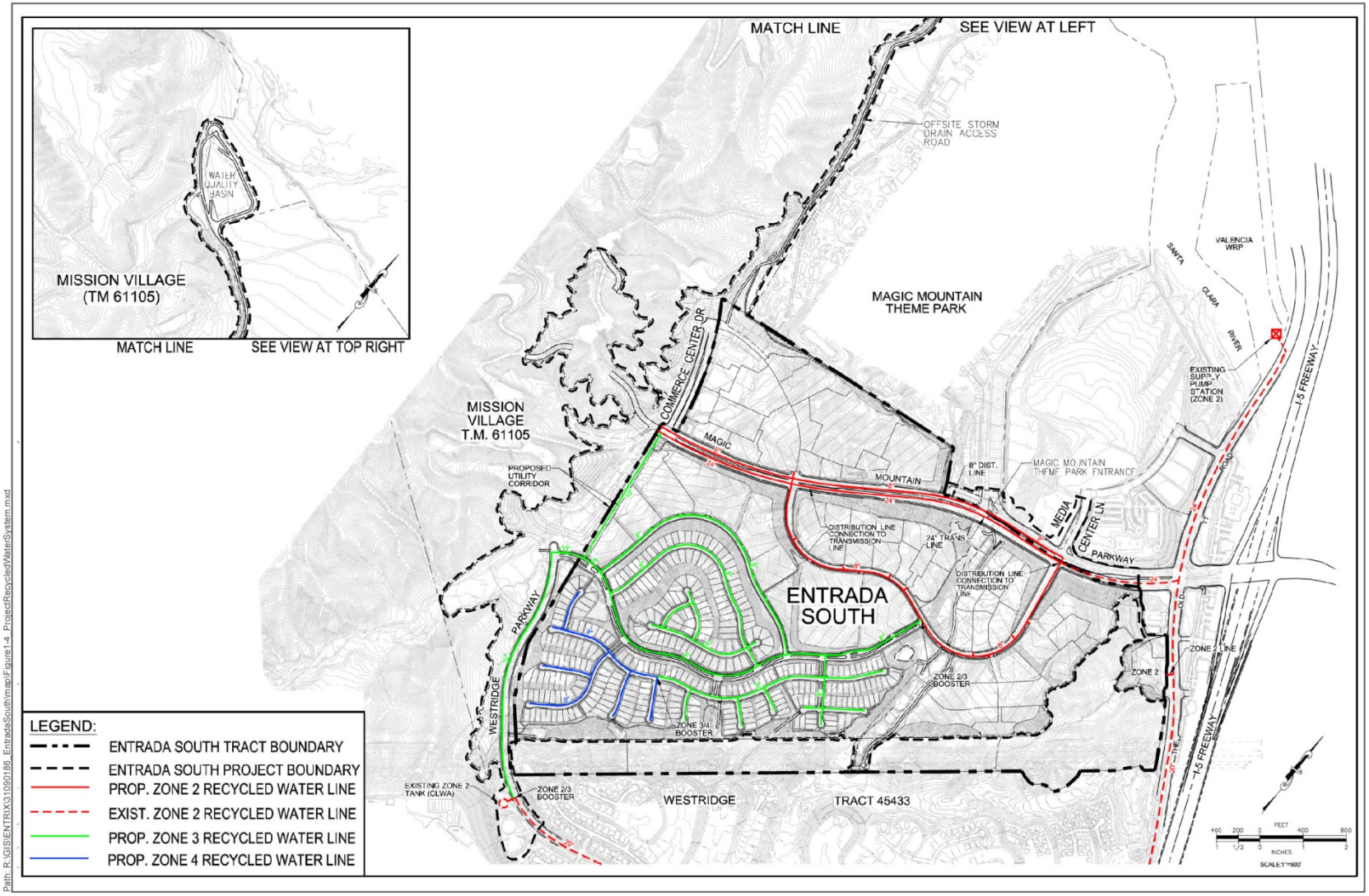


Source: Alliance Land Planning and Engineering, 2015

ENTRADA SOUTH

Figure 1-3

Project Potable Water System



Source: Alliance Land Planning and Engineering, 2015

ENTRADA SOUTH

Figure 1-4

Project Recycled Water System

2 Existing Conditions

Numerous factors affect water usage/demand and sources of supply to meet demand. Primary factors include climate/weather, climate change, area demographics and population, economic conditions, and environmental and regulatory constraints. Each of these factors is described below.

2.1 Climate

The Santa Clarita Valley is characterized as having a generally semi-arid climate. Summers are dry with temperatures reaching 110°F, while winter temperatures reach as low as 20°F. The region is subject to wide variations in annual precipitation (CLWA 2011). Historically, intermittent periods of below-average precipitation typically have been followed by periods of above-average precipitation in a cyclical pattern, with each wetter or drier period typically lasting from 1 to 5 years. Long-term average precipitation at that gauge is 17.7 inches (1931–2012). In general, periods of below average precipitation have been longer and more moderate than periods of above-average precipitation. Recently, the periods from 1971 to 1976, 1984 to 1991, and 1999 to 2003 have been drier than average; the periods from 1977 to 1983, 1992 to 1996, and 2004 to 2005 have been wetter than average. More recently, the dry or below average period that started in 2006 continued through 2014, with all but 2 years (2008 and 2010) having below average rainfall. Average rainfall in 2012, 2013, and 2014 was significantly below average with about 9.0, 3.7, and 6.51 inches, respectively. In 2013, the lowest amount of precipitation since 1931 was recorded. (Find the Best 2014, LSCE 2014). During these overall drier-than-average conditions, water demand in 2007 through 2010 was below that projected in the 2005 Urban Water Management Plan (UWMP) (2005), and actual demand in 2011 was below the short-term projection in the 2010 Water Report (LSCE 2011).

Climatic conditions can adversely affect water supplies. For example, in mid-January 2014, Governor Edmund G. Brown, Jr. declared a statewide drought emergency due to record dry conditions and an extremely low Sierra snowpack. In addition, on January 31, 2014, the California Department of Water Resources (DWR) announced that the 29 agencies which contract with the Department for State Water Project (SWP) supplies (including CLWA) would receive zero percent of their 2014 water allocations unless precipitation and changes in water storage levels warrant an increased allocation. On April 18, 2014, the allocations were increased to 5 percent.

In February 2014, in response to Governor Brown's declaration, the Santa Clarita Valley Water Committee, whose members comprise CLWA, the City of Santa Clarita, Los Angeles County, and all four retail water purveyors, announced a local water supply alert triggering a set of water conservation measures to reduce overall local water consumption by 20 percent (CLWA 2014a). On July 15, 2014, the State Water Resources Control Board (State Board) approved an emergency regulation for statewide urban water conservation (intended to reduce outdoor urban water use). The emergency regulation stays in effect for 270 days, unless extended by the State Board due to ongoing drought conditions. In August 2014, the Santa Clarita Valley Water Committee, consistent with the State Board, adopted a Water Conservation Action Plan. The prohibited activities listed in the Action Plan are mandatory, and include washing any driveways or sidewalks with a hose; runoff caused by over-irrigating landscape; washing a motor vehicle using a hose without a shut-off nozzle; non-recirculating fountains and decorative features. Restrictions on outdoor irrigation also were identified.

2.2 Climate Change

A topic of growing concern for water planners and managers is global climate change and its potential effects on California's future water supplies (CLWA 2011).

In June 2005, Governor Arnold Schwarzenegger issued Executive Order S-3-05, which established the following greenhouse gas (GHG) emission reduction targets for California: (a) reduce GHG emissions to 2000 levels by 2010; (b) reduce GHG emissions to 1990 levels by 2020; and (3) reduce GHG emissions to 80 percent below 1990 levels by 2050. It also required biennial reports on climate change impacts in several areas, including impacts associated with water resources (CLWA 2011).

The *California Water Plan Update 2005,* prepared by DWR, contained the first-ever assessment of potential climate change impacts in a California Water Plan. Volume 1, Chapter 4 of the Water Plan, *Preparing for an Uncertain Future* (DWR 2005), lists the potential impacts of global climate change, based on more than a decade of scientific studies on the subject.

In response to Executive Order S-3-05, DWR prepared a report entitled, *Progress on Incorporating Climate Change into Management of California's Water Resources*, in July 2006. That report demonstrated how various analytical tools could be used to address issues related to climate change (CLWA 2011).

The Climate Action Team (CAT) was also formed in response to Executive Order S-3-05. To help unify analysis across topic areas, the CAT worked with scientists from the California Applications Program's California Climate Change Center to select a set of future climate projections to be used for analysis. In the assessment, *Using Future Climate Projections to Support Water Resources Decision Making in California* (Climate Projections Report), the CAT selected six different global climate change models to evaluate climate change impacts, assuming two different greenhouse gas emission levels (a high end and a low end), for a total of 12 scenarios. The results of the study indicated that climate change already has been observed; in the last 100 years air temperatures have risen about 1 degree Fahrenheit and there has been a documented greater variance in precipitation, with greater extremes in both heavy flooding and severe droughts. Another key finding is that increases in air temperature are expected to have significant impacts on watersheds that traditionally receive at least some of their precipitation in the form of snow. The report provides an overview of the advances that DWR has made since the 2006 report toward using future climate projection information to support decision making by quantifying possible impacts to water resources for a range of climate scenarios (DWR 2009b).

With mean temperatures predicted to increase globally and regionally and more extremes in flooding and droughts, climate change poses several issues related to the availability and reliability of imported SWP water supplies. Reduction of snowpack patterns (the source of the SWP's water supply in Lake Oroville) and changes in hydrologic patterns, sea level, rainfall intensity, and statewide water demands are all possible should climate change prove to be increasing over time. Computer models (such as CALVIN) have been developed to show water planners what types of effect climate change could have on water supply. DWR has committed to continue to update and refine these models based on ongoing scientific data collection, and to incorporate this information into future California Water Plans, so that agencies like CLWA and the retail purveyors can plan accordingly.

The 2009 update of DWR's California Water Plan also evaluated multiple future climate condition scenarios. These changing hydrological conditions could affect future planning efforts, which are typically based on historic conditions. Due to changes in temperature and precipitation, the 2009 California Water Plan identified probable effects, including decreases in snowpack, greater extremes in flooding and droughts, increased sea level rise, and increased water demand (DWR 2009a).

In addition, the California Water Plan Update 2013 (DWR 2013a), which is in draft form as of this writing, provides updated information on climate change in order to evaluate climate change effects on California's water resources and water systems. The Update 2013 also identifies and recommends statewide regional climate adaptation and other strategies to support statewide decisions in this arena. It also assesses the reliability of management options to reduce the potential for future statewide water shortages.

Both the 2009 and 2011 State Water Project Delivery Reliability Reports, prepared by DWR (2009 and 2011 SWP Delivery Reliability Reports; DWR 2009, 2012) update estimates of the current and future SWP delivery reliability and incorporates regulatory requirements for the SWP and the federal Central Valley Project operations in accordance with U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Biological Opinions. Estimates of future SWP reliability also reflect potential effects of climate change and its effects on the state's water resources, particularly the SWP's ability to deliver water.

The SWP Delivery Reliability Reports are issued every 2 years and are intended to assist SWP contractors in assessing the delivery reliability of the SWP component of their overall water supplies. The stability and reliability of SWP water deliveries can be threatened by physical factors affecting facilities or water quality anywhere in the SWP system. The Sacramento-San Joaquin Delta (Delta) is particularly vulnerable. For the SWP, climate change has the potential to simultaneously affect availability of source water, ability to convey water, and users' demands for water.

The 2013 SWP Delivery Reliability Report continues DWR's efforts to assess the effects on the SWP from climate change, including decreased water availability with reduced snowpack, increased SWP water demands, and sea level rise (DWR 2014, Chapter 3). The updated 2013 report also presents estimates of the SWP's delivery reliability for future conditions (2033), and these estimates reflect hydrologic changes that could result from climate change and sea level rise (DWR 2014b, Chapter 6).

2.3 Area Demographics—Population

The *2010 UWMP* (2010 UWMP), jointly prepared by CLWA and the four retail purveyors, describes historic and current water demands and the methodology used to project future demands within the CLWA service area (CLWA 2011). Water demand is divided into demographic sectors such as residential, industrial/construction, commercial, institutional/government, and agriculture customers, and for environmental and other uses, such as fire protection and landscaping.

Since there are only four retail purveyors in the CLWA service area, there is close coordination and exchange of data between CLWA, the purveyors, and Los Angeles County and City of Santa Clarita staff representatives (CLWA 2011). The purveyors maintain demand data to ensure they have an adequate water supply and the necessary infrastructure to provide water service. Each of the four retail purveyors also provided existing and projected water demands within their respective service areas based on customer type and deliveries (by acre-feet [af]) for 2010 through 2050 for the 2010 UWMP.

The adopted UWMP also provides historical population estimates based on data from the Southern California Association of Governments (SCAG), the California Department of Finance, and the U.S. Census Bureau, as prescribed by DWR (CLWA 2011). SCAG is responsible for providing and updating land use planning and demographic forecasts for Los Angeles County. Total demand trend on water supplies within the Santa Clarita Valley is expected to continue to rise because of population, economic activity, environmental and water quality needs, and regulatory requirements.

Based on the adopted UWMP, total population in the CLWA service area in 2050 is projected at approximately 512,000 residents and is estimated to grow at an average annual rate of about 1.5 percent over the 40-year planning period from 2010 to 2050. The UWMP's population estimate is consistent with population build-out projections developed through One Valley One Vision, a joint planning effort between Los Angeles County and the City of Santa Clarita (CLWA 2011) resulting in the Santa Clarita Valley Area Plan (Los Angeles County Department of Regional Planning. 2012) and the City of Santa Clarita General Plan (City of Santa Clarita 2011).

2.4 Economic Conditions

During an economic recession, there is a major downturn in development and a subsequent slowing of the projected demand in water (CLWA 2011). The projections in the adopted UWMP do not attempt to

forecast recessions or reductions in water demand due to such economic conditions. Instead, such conditions are accounted for over the course of the lengthy 40-year planning horizon of the UWMP, and the fact that UWMPs must be updated every 5 years in accordance with the California Urban Water Management Planning Act. Therefore, no speculation is made about existing or future downturns in economic conditions affecting the Santa Clarita Valley.

2.5 Environmental Regulatory Constraints

The Delta provides important habitat for fish species listed as threatened or endangered under either the federal Endangered Species Act or the California Endangered Species Act, or both. Several resource agencies have taken action to protect these species. Regulatory requirements based on recent Biological Opinions issued by USFWS and NMFS are particularly important to the coordinated operations of the SWP and the Central Valley Project[10]. These Biological Opinions include terms that affect the SWP's water delivery reliability primarily by restricting SWP pumping levels under certain conditions in the Delta (DWR 2014b). The SWP operational restrictions set forth in the Biological Opinions continue to be imposed and were used by DWR in the analysis supporting the 2009, 2011, and 2013 SWP Delivery Reliability Reports (DWR 2009, 2012 and 2014b).

In December 2010, Judge Oliver W. Wanger issued a decision in the *Consolidated Delta Smelt Cases* invalidating most of the 2008 delta smelt Biological Opinion and eliminating several of the criteria that reduced SWP water supply. The federal court decision was appealed to the U.S. Court of Appeal for the Ninth Circuit, and the Ninth Circuit issued its decision in March 2014.

The Ninth Circuit decision upheld the 2008 Biological Opinion for the delta smelt prepared by USFWS for the combined operations of the SWP and Central Valley Projects, both of which supply water to agricultural and other uses throughout California. The Biological Opinion found that the two projects would jeopardize the delta smelt, currently listed as an endangered fish species, and therefore imposed restrictions on the operations of the two projects. The Ninth Circuit reversed much of the district court's decision (by Judge Oliver W. Wanger), which had found that the restrictions in the Biological Opinion were scientifically unsupported and in violation of the federal Endangered Species Act (*San Luis & Delta-Mendota Water Authority v. Jewell*, No. 11-15871 (9th Cir. Mar. 13, 2014)).[11] On January 12, 2015,the U.S. Supreme Court refused to grant review of the Ninth Circuit decision; thus, the March 13, 2014 ruling by the Ninth Circuit remains intact. However, it should be emphasized that, despite the delta smelt litigation, DWR used the SWP operational restrictions set forth in the Biological Opinion in its SWP delivery reliability analysis for its 2009, 2011, and 2013 SWP Delivery Reliability Reports. (DWR 2009, 2012, 2014b).

[10] The California Department of Fish and Game, now called the Department of Fish and Wildlife, issued consistency determinations for the federal Biological Opinions under section 2080.1 of the California Fish and Game Code. The consistency determinations stated that the Biological Opinions were consistent with the California Endangered Species Act. The consistency determinations allowed incidental take of species listed under both the federal Endangered Species Act and the California Endangered Species Act to occur during SWP and Central Valley Project operations without requiring DWR or the U.S. Bureau of Reclamation to obtain separate state-issued Incidental Take Permits.

[11] The Ninth Circuit upheld one aspect of the lower district court decision with respect to the National Environmental Policy Act (NEPA) claims. The Ninth Circuit held that the Bureau of Reclamation (Bureau), and not the USFWS, is the federal agency obligated to evaluate the environmental impacts of implementing the Biological Opinion in order to comply with NEPA. The Ninth Circuit affirmed the district court's decision remanding to the Bureau with directions to complete an Environmental Impact Statement evaluating the effects of its adoption and implementation of the Biological Opinion, including analysis of implementation of the Biological Opinion relative to people and the economy. (*Ibid.*)

2.6 Water Agencies of the Santa Clarita Valley

2.6.1 Castaic Lake Water Agency

CLWA, a wholesale public water agency contracts with DWR to acquire, sell, and distribute SWP water to the retail water purveyors in the Santa Clarita Valley. CLWA's authority also includes: (1) acquiring water from the state; (2) distributing such water wholesale through a transmission system to be acquired or constructed by CLWA; (3) recycling water; (4) selling water at retail within certain boundaries; and (5) exercising other related powers[12].

The CLWA service area comprises approximately 195 square miles (124,800 acres) in Los Angeles and Ventura counties. CLWA serves incorporated and unincorporated areas in, or adjacent to, the Santa Clarita Valley. Most of this area, including the incorporated cities, is within the geographic boundary of Los Angeles County, but it also extends into a small portion of eastern Ventura County. The CLWA service area includes largely urban areas, such as the City of Santa Clarita, other smaller communities, and rural areas. Figure 2-1, Castaic Lake Water Agency Service Area and Valencia Water Company Boundary, depicts the CLWA service area (CLWA 2011).

Adequate planning for, and the procurement of, a reliable water supply is a fundamental function of the CLWA and the local retail purveyors. CLWA's water supply is composed of wholesale imported water, groundwater, and recycled water (CLWA 2011).

CLWA obtains its water supply for wholesale purposes principally from the SWP and has a water supply contract with DWR for 95,200 afy of SWP Table A Amount. "Table A" is a term used in SWP water supply contracts. The "Table A Amount" is the maximum amount of water to which a SWP contractor has a contract right to request for delivery each year of the highest priority water available under the SWP contractor's water supply contract. (It is specified in Table A of the contract.). The Table A Amount is not equivalent to actual deliveries of water in any given year, and the water actually available for delivery in any given year may be an amount *less* than the SWP contractor's Table A Amount, depending upon hydrologic conditions, the amount of water in storage, the operational constraints, requirements imposed by regulatory agencies to meet environmental water needs, the amount of water requested by other SWP contractors, climatic conditions, and other factors. As discussed below, CLWA maintains other non-SWP imported supplies, such as water from the Buena Vista Water Storage District (Buena Vista) and Rosedale-Rio Bravo Water Storage District (Rosedale-Rio Bravo) (11,000 afy) and the Yuba County Water Agency (850 af in critically dry years).

CLWA is able to meet approximately one-half of the Valley's urban demand with imported water; however, as noted, the availability of SWP supply is variable and can fluctuate from year-to-year depending on precipitation, regulatory and legislative restrictions, and operational conditions (CLWA 2011). SWP supply is also subject to significant restrictions in dry years.

The West Branch of the California Aqueduct terminates at Castaic Lake, from which CLWA receives its SWP water. SWP water from Castaic Lake is treated, filtered, and disinfected at CLWA's Earl Schmidt Filtration Plant and Rio Vista Water Treatment Plant, which have a combined treatment capacity of 122 million gallons per day (mgd). Treated water is delivered from the treatment plants to each of the four retail purveyors through a distribution network of pipelines and turnouts. Currently, CLWA delivers water to the four retail purveyors through 26 potable water turnouts (LSCE 2012). CLWA and the retail purveyors meet the balance of their water demands with local groundwater and recycled water.

CLWA and the retail purveyors have evaluated the long-term water demands within the CLWA service area based on applicable County and City plans, and have compared these demands against existing and potential water supplies. Results indicate that as the Santa Clarita Valley's water demands utilize

[12] See California Water Code Appendix sections 103-1, 103-15.

increased proportions of imported water supplies, conjunctive use, water conservation, water transfers, recycled water, and water banking will become increasingly more important water management elements for CLWA's long-term water supply strategy (CLWA 2011).

2.6.2 Retail Water Suppliers

As stated above, four retail water purveyors provide water service to most residents of the Santa Clarita Valley. A description of the service areas of the purveyors is provided below.

LACWWD 36 service area encompasses approximately 6,600 acres in the Hasley Canyon area and the unincorporated community of Val Verde. LACWWD 36 obtains its water supply from CLWA and from local groundwater. Prior to 2012, LACWWD 36 received its full water supply from a connection to the CLWA's Castaic Conduit; however, beginning in 2012 that supply was reduced to about one-third of the overall water supply. The remainder is groundwater pumped from the Saugus Formation.

NCWD service area includes portions of the City of Santa Clarita and unincorporated portions of the County in the communities of Newhall, Canyon Country, Valencia, and Castaic. The District supplies water from local groundwater and CLWA imported water. (LSCE 2014).

CLWA's SCWD service area includes portions of the City of Santa Clarita and unincorporated portions of the County in the communities of Canyon Country, Newhall, and Saugus. SCWD supplies water from local groundwater and CLWA imported water. (LSCE 2014).

VWC service area includes a portion of the City of Santa Clarita and unincorporated portions of the County in the communities of Castaic, Newhall, Saugus, Stevenson Ranch, and Valencia. VWC supplies water from local groundwater and CLWA imported water and delivers a small amount of recycled water for non-potable use (LSCE 2014).

As of 2013, the retail purveyors provide water to about 71,550 service connections in the Santa Clarita Valley (LSCE 2014). Table 2-1 shows the breakdown of service connections for each purveyor.

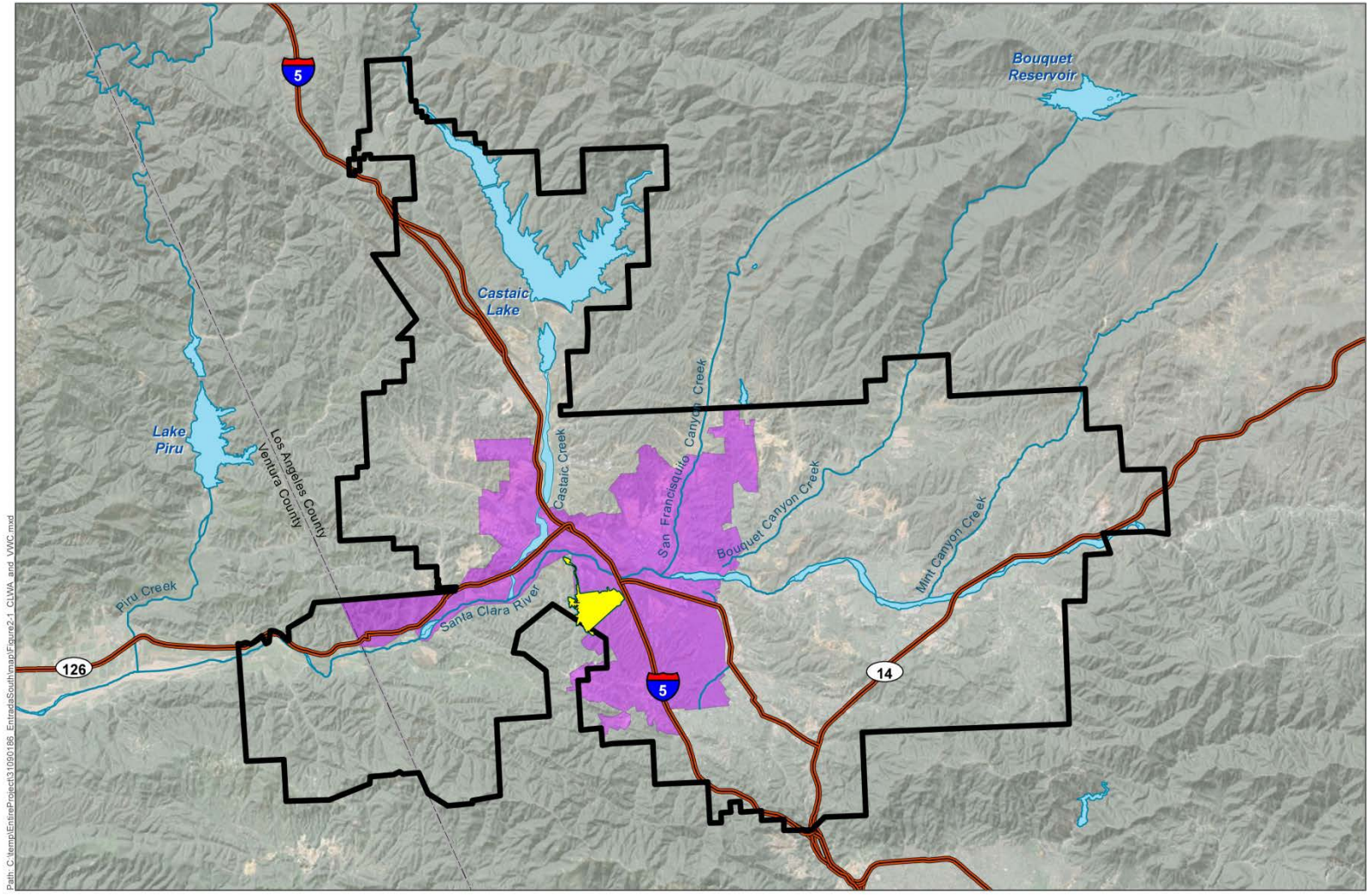
Table 2-1 Retail Water Purveyor Service Connections for the Santa Clarita Valley

Retail Water Purveyor	Connections
CLWA SCWD	29,700
LACWWD 36	1,350
NCWD	9,700
VWC	30,800
Total	**71,550**

Source: 2013 Santa Clarita Valley Water Report (June 2013; LSCE 2014)

2.6.3 Retail Water Agency Serving Project Site

The Project would be served by VWC because VWC's service area currently includes the proposed Project. As stated above, CLWA and the four retail purveyors coordinate the management of imported water, local groundwater, and recycled water to meet water demands in the Santa Clarita Valley (CLWA 2011). VWC's service area is shown in Figure 2-1, Castaic Lake Water Agency Service Area and Valencia Water Company Boundary.


Bouquet Reservoir
Castaic Lake
Lake Piru
Los Angeles County
Ventura County
Castaic Creek
San Francisquito Canyon Creek
Bouquet Canyon Creek
Mint Canyon Creek
Piru Creek
Santa Clara River
5
126
14
Path: C:\temp\EntireProject\3109018\6_EntradaSouth\map\Figure2-1_CLWA_and_VWC.mxd
0 1 2 4
Miles
N
1 in = 3 miles
Date: 4/30/2014
Source: 2012 Santa Clarita Valley Water Report
Legend
Valencia Water Company Boundary
Castaic Lake Water Agency Service Area
Project Area
Cardno ENTRIX
ENTRADA SOUTH
Figure 2-1
Castiac Lake Water Agency Service Area and Valencia Water Company Boundary

3 Regulatory Setting

The following are the applicable laws and regulations that affect water supplies statewide and those that affect the Santa Clarita Valley specifically.

3.1 Federal Regulations

3.1.1 Safe Drinking Water Act

The Safe Drinking Water Act (42 U.S.C. □ 300F et seq.) grants the U.S. Environmental Protection Agency (EPA) the authority to set drinking water standards. Drinking water standards apply to public water systems, which include the Valencia Water Company system. There are two categories of drinking water standards: (a) the National Primary Drinking Water Regulations and (b) the National Secondary Drinking Water Regulations. The National Primary Drinking Water Regulations are legally enforceable standards that apply to public water systems and protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in water. The National Secondary Drinking Water Regulations are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water.

3.2 State Regulatory Framework

3.2.1 Safe Drinking Water Act

The state Safe Drinking Water Act (Health & Saf. Code, □□ 116270, et seq.) was passed to build on and strengthen the federal Act. The state Act authorizes the state□s Department of Public Health (DPH) to protect the public from contaminants in drinking water by establishing maximum contaminant levels (MCLs) that are at least as stringent as those developed by the U.S. EPA under the federal Act.

3.2.2 California Water Code

The California Water Code contains provisions that control almost every consideration of water and its use. Division 2 of the California Water Code provides that the State Water Resources Control Board must consider and act upon all applications for permits to appropriate waters. Division 6 of the Water Code controls conservation, development, and utilization of the state water resources, and Division 7 addresses water quality protection and management.

California is divided into nine regions governed by Regional Water Quality Control Boards, which implement and enforce provisions of the California Water Code and the federal Clean Water Act under the oversight of the State Water Resources Control Board. Their chief regulatory focus is the protection of surface and groundwater quality. The Los Angeles Regional Water Quality Control Board (Region 4) is the Board with regulatory jurisdiction over the Project site.

3.2.3 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Water Code, □□ 13000 et seq.) establishes the principal California legal and regulatory framework for water quality control, and is embodied in the Water Code. The Water Code authorizes the State Water Resources Control Board to implement the provisions of the federal Clean Water Act.

3.2.4 Water Conservation Act of 2009

The Water Conservation Act (Water Code □10608, SB X7-7) requires all water suppliers to increase water use efficiency. This legislation sets an overall goal of reducing per capita urban water use compared to 2009 use, by 20 percent by December 31, 2020. The state must make incremental progress towards this

goal by reducing per capita water use by at least 10 percent on or before December 31, 2015. Each urban retail water supplier must develop urban water use targets and an interim urban water use target by July 1, 2011. Effective 2016, retail water supplies that do not meet the water conservation requirements established by the law will not be eligible for state water grants or loans.

Agricultural water suppliers also are required to implement efficient water management practices, including adoption of agricultural management plans by December 31, 2012, and updated plans by December 31, 2015, and every 5 years thereafter. Effective 2013, agricultural water suppliers not in compliance with these planning requirements are not eligible for state water grants or loans.

3.2.5 California Urban Water Management Planning Act

The California Urban Water Management Planning Act (Water Code, □□ 10610-10656) requires every urban water supplier that provides water to 3,000 or more customers, or provides over 3,000 afy, to make every effort to ensure the appropriate level of reliability in its water service to meet the needs of its customers during normal, dry, and multiple-dry years. The Act requires reliability information be reported in the UWMP, which must be updated every 5 years, and describes the required contents of a UWMP, as well as how urban water suppliers should adopt and implement UWMPs.

State and local agencies and the public frequently use UWMPs to determine if agencies are planning adequately to reliably meet water demands in various service areas. As such, UWMPs serve as an important element in documenting water supply availability and reliability for purposes of complying with state laws, SB 610 and SB 221, which link water supply sufficiency to certain land-use development project approvals.

The UWMP provides information on water usage/demand, water supply sources, and water reliability planning within a specified water agency service area. It also provides groundwater information; water quality data over the planning horizon; and water management tools that maximize local resources and minimize imported water supplies. The UWMP also evaluates the reliability of water supplies within the specified service area, including a water shortage contingency plan and development of a plan in case of an interruption of water supplies.

3.2.6 Water Supply Assessments and Written Verifications of Water Supply

Effective January 1, 2002, state legislation was enacted to improve the link between water supply and land use planning. Senate Bill 610 (SB 610; Water Code, □□ 10910 et seq.) requires the preparation of a water supply assessment for projects within cities and counties that propose to construct 500 or more residential units or other uses that generate the equivalent amount of water demand. SB 610 provides that when environmental review of certain development projects is required, the water system that is to serve the development must complete a water supply assessment. The water supply assessment evaluates water supplies that are or will be available in normal, single-dry, and multiple-dry years during a 20-year planning horizon, and determines whether such supplies can meet existing and planned future demands, including the demand associated with a proposed project.

Senate Bill 221 (SB 221; Gov. Code, □□ 66455.3 and 66473.7) requires a city, county, or local agency to include a condition to any tentative subdivision map that a sufficient water supply must be available to serve the subdivision. The term "sufficient water supply" is defined as the total water supplies available during normal, single-dry, and multiple-dry years within a 20-year planning horizon that would meet the proposed subdivision project's estimated water demand, and the demand from existing and planned future water uses (including agricultural and industrial uses) within the specified service area. SB 221 also requires verification of projected water supplies to be based on entitlement contracts, capital outlay programs, and regulatory permits and approvals.

Urban water suppliers can take advantage of a provision that allows them to use their UWMP as a foundational document in completing SB 610 Water Supply Assessments and SB 221 Water Verifications.

3.2.7 Delta Plan

The Sacramento-San Joaquin Delta Reform Act (Water Code, § 85000, *et seq*.) established the Delta Stewardship Council (Council) with the primary goal of developing and implementing an enforceable, long-term management plan for the Delta. The Delta Plan's coequal goals of providing a more reliable water supply for California while restoring the Delta ecosystem are the foundation of all State water management policies. No water rights decisions or water contracts that directly or indirectly impact the Delta are made without consideration of these coequal goals (DWR 2014).

The Delta Plan contains a set of regulatory policies that will be enforced by the Council's appellate authority and oversight. It also contains priority recommendations, which are non-regulatory but call out actions essential to achieving the coequal goals. The Delta Plan lays out 14 regulatory policies and 73 recommendations that start the process of addressing current and predicted ecological, flood management, water quality, and water supply reliability challenges. As required by statute, the Delta Plan adopts a science-based adaptive management strategy to manage decision making in the face of uncertainty (Water Code, § 85308(f)). The law requires that the Delta Plan be updated every 5 years, and each update is intended to build on an evolving base of knowledge, direct near- and mid-term actions, and preserve and protect longer-term opportunities.

For a state or local agency to determine whether its proposed plans, programs, or projects are covered actions under the Delta Plan and, therefore, subject to the regulatory provisions in the plan, it must start with the Delta Reform Act, which defines a "covered action" as a plan, program, or project that (a) will occur, in whole or in part, within the boundaries of the Delta or Suisun Marsh; (b) will be carried out, approved, or funded by the state or a local public agency; (c) is covered by one or more provisions of the Delta Plan; and (d) will have a significant impact on the achievement of one or both of the coequal goals or the implementation of government-sponsored flood control programs to reduce risks to people, property, and state interests in the Delta (Water Code § 85057.5(a)) (DWR 2014).

The Delta Reform Act requires State and local actions that fit the definition of a "covered action" to be consistent with the policies included in the Delta Plan. Only certain activities qualify as covered actions, and the Delta Reform Act establishes specific criteria and exclusions. Early consultation with Council staff is encouraged and intended to help make this determination (DWR 2014). Entrada South is not a covered action under the Delta Plan.

3.2.8 Bay Delta Water Quality Control Plan

The State Water Board is in the process of reviewing and updating its *2006 Water Quality Control Plan for the Bay-Delta* (Bay-Delta Plan). The State Water Board updates the Bay-Delta Plan in order to protect beneficial uses of water for municipal, industrial, agricultural, and fish and wildlife. The plan identifies beneficial water uses, water quality objectives in order to protect those uses, and an implementation program to achieve objectives. There are four phases to the update identified by the State Water Board. Phase 1 involves updating San Joaquin River flow and southern Delta water quality requirements included in the Bay-Delta Plan, while Phase 2 addresses any changes to protect beneficial uses not specified in Phase 1. Phase 3 involves changes to water rights and other measures to implement changes from phases 1 and 2. Phase 4 involves developing and implementing flow objectives for Delta tributaries outside the Bay-Delta Plan updates.

The State Board released a draft final objectives and Substitute Environmental Document supporting potential changes to flow and water quality objectives included in Phase 1 for the Bay-Delta Plan on May 3, 2013. A revised draft Substitute Environmental Document is in process, but its release date has not been determined. The entire process is expected to be complete with the development of flow objectives and associated implementation plans for six to nine Sacramento-San Joaquin Delta priority tributaries by June 2018. Any changes to the Bay-Delta Plan must be approved by the State Water Board and the Office of Administrative Law before becoming effective (State Water Board 2013).

3.2.9 Groundwater Management Act

Assembly Bill 3030 (AB 3030; Water Code, □□ 10750-10756) provides a systematic procedure for an existing local agency to develop a groundwater management plan. The law provides such an agency with the powers of a water replenishment district, including the power to raise revenue for the payment of facilities to manage the groundwater basin (extraction, recharge, conveyance, quality).

3.2.10 Groundwater Monitoring

Groundwater monitoring (Water Code, □ 10920, SBX7 6) requires that local agencies monitor the elevation of their groundwater basins to help better manage the resource during both normal water years and drought conditions. Specifically, this law:

- requires DWR to establish a priority schedule for the monitoring of groundwater basins and the review of groundwater elevation reports, and to make recommendations to local entities to improve the monitoring programs.
- requires DWR to assist local monitoring entities with statutory compliance.
- allows local entities to determine regionally how best to set up their groundwater monitoring program, crafting the program to meet their local circumstances.
- provides that if the local agencies fail to implement a monitoring program and/or fail to provide the required reports, DWR may implement the groundwater monitoring program for that region.
- provides that failure to implement a monitoring program will result in the loss of eligibility for state grant funds by the county and the agencies responsible for performing the monitoring duties.

3.2.11 Water Diversion and Use□Funding

Water Diversion and Use (Water Code, □ 5100, SBX7 8) improves accounting of the location and amounts of water being diverted by revising exemptions from the water diversion reporting requirements under current law. Additionally, this law appropriates existing bond funds for various activities to benefit the Delta ecosystem and secure the reliability of the state□s water supply, and to increase staffing at the State Water Resources Control Board to manage the duties of this statute. Specifically, this law:

- provides a stronger accounting of water diversion and use in the Delta by removing an exemption from reporting water use by in-Delta water users.
- redefines the types of diversions that are exempt from the reporting requirement.
- assesses civil liability and monetary penalties on diverters that fail to submit the required reports, and for willful misstatements, and/or tampering with monitoring equipment.
- appropriates $546 million from Propositions 1E and 84, in the following manner:
    - $250 million (Proposition 84) for integrated regional water management grants and expenditures for projects to reduce dependence on the Delta;
    - $202 million ($32 million Proposition 84 and $170 million Proposition 1E) for flood protection projects in the Delta to reduce the risk of levee failures that would jeopardize water conveyance;
    - $70 million (Proposition 1E) for stormwater management grants; and
    - $24 million (Proposition 84) for grants to local agencies to develop or implement Natural Community Conservation Plans.
- appropriates $3.75 million from the Water Rights Fund to the State Water Resources Control Board for staff positions to manage the duties in this bill relating to water diversion reporting, monitoring, and enforcement.

3.2.12 California Water Plan

The California Water Code section 10004-10013 describes the components and characteristics of the California Water Plan. The plan addresses the coordinated control, protection, conservation, development, and utilization of the state's water resources.

Section 10004 states that DWR must:

- update the California Water Plan on or before December 31, 2003, and every 5 years thereafter.
- establish an advisory committee to assist in updating the California Water Plan.
- release a preliminary draft of the Water Plan, as updated, upon request, to interested persons and entities throughout the state for their review and comments.
- include in the Water Plan a discussion of the potential advantages and disadvantages of each strategy and an identification of all federal and state permits, approvals, or entitlements that are anticipated to be required in order to implement the various components of the strategy.
- conduct a study to determine the amount of water needed to meet the state's future needs and to recommend programs, policies, and facilities to meet those needs.

Section 10005 states that:

- DWR, or at DWR's request, the California Water Commission, shall conduct a series of hearings with interested persons, organizations, local, state, and federal agencies, and representatives of the diverse geographical areas and interests of the state.
- DWR must give notice by mail of the hearing to persons and entities which have requested notice and have provided their name and address to the department.

Section 10008-9 expresses legislative findings that:

- agreements that provide for the transfer of water from the federal Central Valley Project to public entities supplying water for domestic or irrigation use offer potential benefits to California's hard-pressed farmers and to California's water-dependent urban areas.

Section 10011 states:

- at least one public hearing will be conducted to solicit comments.
- the Water Plan must include a discussion of various alternatives for improving and protecting current uses of the Sacramento-San Joaquin Delta.

Section 10013 states:

- DWR, as a part of the preparation of DWR's Bulletin 160-03, shall include in the California Water Plan a report on the development of regional and local water projects within each hydrologic region of the state.

3.2.13 Water Conservation Projects Act

California's requirements for water conservation are codified in the Water Conservation Projects Act of 1985 (California Water Code, §§ 11950-11954), which encourages local agencies and private enterprise to implement water conservation and reclamation projects.

3.2.14 California Drinking Water Standards

State drinking water standards are based on federal standards and are listed in Title 22 of the California Code of Regulations. The California Department of Public Health administers the state drinking water standards.

3.2.15 California Water Recycling Standards

The California Legislature has developed state requirements for the production, discharge, distribution, and use of recycled water. These requirements are contained in the California Code of Regulations, Title 22, Division 4, Chapter 3, Reclamation Criteria, sections 60301 through 60475, and Title 17. The California Department of Public Health administers the state recycling water standards.

3.2.16 California Plumbing Code

The Plumbing Code (California Code of Regulations, Title 24, Part 5) applies to all construction and establishes minimum requirements to safeguard public health, safety, and welfare through regulation of structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, adequate lighting and ventilation, and energy conservation.

3.2.17 California Green Building Standards Code

The California Green Building Standards Code, commonly referred to as the CALGreen Code, is set forth in CCR Title 24, Part 11, and establishes voluntary and mandatory standards pertaining to the planning and design of sustainable site development and water conservation, among other issues. Under the CALGreen Code, all water closets (i.e., flush toilets) are limited to 1.28 gallons per flush, and urinals are limited to 0.5 gallon per flush. In addition, maximum flow rates for faucets are established as follows: 2.0 gallons per minute (gpm) at 80 pounds per square inch (psi) for showerheads; 1.5 gpm at 60 psi for residential lavatory faucets; and 1.8 gpm at 60 psi for kitchen faucets.

3.2.18 California Groundwater Legislation

In September 2014, Governor Brown signed three companion bills (Senate Bill 1168, Assembly Bill 1739, and Assembly Bill 1319), resulting in the enactment of the Sustainable Groundwater Management Act. The Act applies to groundwater basins in California and provides a comprehensive groundwater sustainability management program. The Act is inapplicable to adjudicated groundwater basins (except for annual reporting), and low and very low priority basins, though the new law encourages such basins to adopt groundwater sustainability plans. It also exempts high and medium priority groundwater basins if the local agency can demonstrate that the basin is already being sustainably managed pursuant to current management or operation activities.

The new law, effective January 31, 2015, requires DWR to prioritize groundwater basins as either high or medium priority and to adopt regulations authorizing local □groundwater sustainability agencies□(GSA) to prepare and adopt □groundwater sustainability plans□(GSPs). Those basins that are subject to overdraft conditions must adopt a GSP by January 31, 2020, and those basins that are not in overdraft must be managed by a GSP by January 31, 2022. If a local agency has not formed a GSA by June 30, 2017, the State Board may designate the basin as probationary and adopt an interim sustainability plan and impose cost recovery.

The GSPs can require, among other things, groundwater well registration, measurement of groundwater extractions, and the filing of annual reports; it can also impose well spacing requirements, extraction limits, and extraction allocations. The completed GSP must be submitted to DWR for review, and DWR must evaluate the plan within 2 years of its submission and issue a plan assessment, including recommended corrective actions.

The new law requires a city or county planning agency, before adopting or substantially amending a general plan, to consider GSPs or other related plans or programs. The overall goal of the new law is to achieve groundwater sustainability in high and medium priority basins over the long-term.

Proposition 1, California s most recent $7.5 billion water bond, was placed on the November 2014 ballot, passed by a wide margin by California voters, and created the 2014 Water Quality, Supply, and Infrastructure Act. This new law provides financial support for the recently passed Sustainable Groundwater Management Act, and implements the three objectives of the California Water Action Plan: reliable water supplies, restoration of important species and habitat, and water infrastructure.

3.3 Regional Regulations

3.3.1 Castaic Lake Water Agency's Adopted Groundwater Management Plan

CLWA has adopted a Groundwater Management Plan (GWMP) that contains four management objectives, or goals, for the basin, including: (a) development of an integrated surface water, groundwater and recycled water supply to meet existing and projected demands for municipal, agricultural and other water uses; (b) assessment of basin conditions to determine a range of operational yield values that use local groundwater conjunctively with supplemental SWP supplies and recycled water to avoid groundwater overdraft; (c) preservation of groundwater quality, and active characterization and resolution of groundwater contamination problems, including perchlorate; and (d) preservation of interrelated surface water resources, which includes managing groundwater in a manner that does not adversely impact surface and groundwater discharges or quality to downstream basins.

The GWMP includes a collaborative and integrated approach to several of the aspects of water resource management. United Water Conservation District in Ventura County manages surface water and groundwater resources in seven groundwater basins, all located in Ventura County. CLWA, the retail purveyors, and United Water have: (a) integrated their database management efforts; (b) developed and utilized a numerical groundwater flow model for analysis of groundwater basin yield and containment of groundwater contamination; and (c) continued to monitor and report on the status of basin conditions, and on geologic and hydrologic aspects of the overall stream-aquifer system.

The adopted GWMP includes 14 elements intended to accomplish the basin management objectives listed above. In summary, the plan elements include:

- monitoring of groundwater levels, quality, production and subsidence.
- monitoring and management of surface water flows and quality.
- determination of basin yield and avoidance of overdraft.
- development of regular and dry-year emergency water supply.
- continuation of conjunctive use operations.
- long-term salinity management.
- integration of recycled water.
- identification and mitigation of soil and groundwater contamination, including involvement with other local agencies in investigation, cleanup, and closure.
- development and continuation of local, state and federal agency relationships.
- groundwater management reports.
- continuation of public education and water conservation programs.
- identification and management of recharge areas and wellhead protection areas.
- identification of well construction, abandonment, and destruction policies.
- provisions to update the groundwater management plan.

Ongoing work related to the GWMP and UWMP planning efforts have produced the 2005 Basin Yield Report and the 2009 Basin Yield Update. The primary determinations made in those reports are that: (a) both the Alluvial aquifer and the Saugus Formation are sustainable sources at the operational groundwater plan yields referenced in the Santa Clarita Valley UWMPs over the next 25 years; (b) the yields are not overstated and will not deplete or "dry up" the groundwater basin; and (c) there is no need to reduce the yields shown in the 2010 UWMP. Additionally, the 2005 Basin Yield Report and the 2009 Basin Yield Update conclude that neither the Alluvial aquifer nor the Saugus Formation is in an overdraft condition, or projected to become overdrafted.

3.4 County Regulatory Framework

3.4.1 County Development Monitoring System

Introduction. The County General Plan includes provisions known as the Development Monitoring System (DMS) to give the County planning agency — the Regional Planning Commission and/or Department of Regional Planning — information about the existing capacity of available specified public services in the four major Urban Expansion Areas of the General Plan (Antelope Valley, Santa Clarita Valley, Malibu/Santa Monica mountains, and East San Gabriel Valley).[13] The primary purpose of DMS is to ensure that new development in Urban Expansion Areas will occur in a manner consistent with stated DMS policies and will pay for the expansion costs that it generates.

To accomplish this purpose, the DMS is used to determine the availability of certain public services, including water service, on an individual and cumulative basis; analyze the expansion costs to certain public service providers; and work towards ensuring that the expansion costs of new development are paid for by that development.

To ensure new development is located in close proximity to services and existing development, DMS states that in no event is the proposed development to be located beyond one mile of an existing development or service. Also, DMS states that new development is to be located within, generally, five miles of commercial services and job opportunities.

The DMS involves basically two procedures: (1) data gathering and management, and (2) evaluation of urban development applications (case processing). Each procedure is described in the County's DMS. For example, the DMS updating of data occurs at the data gathering and management procedural step, not during the case processing step. During the separate case processing step, the updating of specified public services and capacities occurs during both the CEQA-required Initial Study phase and the appropriate environmental document preparation process.

The DMS analysis is incorporated into the environmental review procedures set forth in CEQA. For example, if the Initial Study indicates that a project's infrastructure or public service needs can be met, then a no significant impact determination can be made. If, however, the Initial Study indicates that a project's infrastructure for public services is not adequate, or may not be adequate, then a potential significant impact determination is made; the appropriate environmental document is prepared (an EIR, Negative Declaration, or Mitigated Negative Declaration); and mitigation is proposed for such public service impacts as allowed by both DMS and CEQA. The mitigation may include redesign, reduction of units, financing of the expansion costs of any service extension, or financing of public services needed for the proposed new development.

The DMS criteria/methodology to be applied for infrastructure, access, and environmental factors associated with a development application are those set forth in DMS under the heading "DMS Criteria and Methodology." This criteria/methodology must be employed in the DMS analysis. However, under

[13] See Resolution of the Board of Supervisors of the County of Los Angeles Relating to Plan Amendment Case No. SP 86-173, adopted on March 21, 1987.

DMS, outside service providers can only be encouraged to use DMS criteria/methodology in their planning and programming efforts. Accordingly, those agencies may make available service/capacity data to the County in service provider planning documents that provide equivalent service/capacity data as required by the DMS criteria/methodology.

If the proposed project meets the DMS criteria, or equivalent data, it must be found in compliance with DMS. If the proposed project does not meet the DMS criteria or equivalent data, mitigation measures must be considered and applied prior to any approval. If the application of the mitigation measures brings the proposed project into conformance with the policies set forth in DMS, then the County planning agency may approve the project, making appropriate findings. If the mitigation measures are not sufficient, or if the mitigation measures or alternatives are not feasible, the County planning agency must deny the project or approve the project, even if there are significant impacts to DMS-related infrastructure, provided a statement of overriding considerations is made and specific findings are adopted. However, in the event overriding considerations are made relative to DMS-related infrastructure, the required findings by the County planning agency must be approved or confirmed by the Board of Supervisors.

Project Subject to DMS. The Project is located within the Santa Clarita Valley, an Urban Expansion Area within DMS, and includes a subdivision map application (VTTM 53295). Therefore, the Project is subject to a County DMS analysis or its equivalent.

DMS Infrastructure Service Provisions. The Entrada South Initial Study provided general information concerning the availability of water service and determined that an EIR would be required. This technical report has been prepared to support the water service section of the Draft EIR for the Entrada South Project and will be included in the appendix to that EIR. This technical report provides up-to-date water supply, demand, and service information based in part on data provided by the Santa Clarita Valley water providers (i.e., CLWA and the four retail purveyors).

DMS Access Provisions. As stated above, DMS includes analysis of the access factors associated with a development project in an Urban Expansion Area. Under DMS, where applicable, a project must be located within reasonable proximity to commercial development and job opportunities (generally within five (5) miles) and served by an acceptable level of road service. If it is determined that the project is not located in proximity to commercial and employment facilities, mitigation measures set forth in DMS must be considered and applied prior to any approval of the project.

As applied, the Project satisfies the DMS access requirements because the site is located nearly adjacent to the Six Flags Magic Mountain Amusement Park, and within one quarter mile from Castaic Junction and the Valencia Commerce Center, and approximately one quarter mile from the Valencia Industrial Park. All of these existing development areas are served by County or other public services and provide substantial commercial services and job opportunities.

The DMS build-out scenario would entail build-out of the near-term subdivision projects listed in the County s DMS plus the Project. However, for purposes of this analysis, this technical report will rely on broader water demand data provided by CLWA and the four retail purveyors, which is contained in the adopted UWMP and the 2012 Santa Clarita Valley Water Report (June 2013). This water demand data is used in lieu of a DMS build-out scenario because:

1. the data are provided by CLWA and the four retail purveyors that serve water to the Santa Clarita Valley and those agencies/entities are the service providers that provide the County with water demand/supply data as referenced in the County DMS.
2. the data are considered current and the best available information from CLWA and the purveyors.
3. the data provide water service and capacity information, and County staff consider the information to be equivalent to the data called for in the County s DMS as it relates to water supplies.

4. the data are based on a comparison of the historical and projected population data for areas served by the retail purveyors in the Santa Clarita Valley (representing the total CLWA service area) to the population projections from the County and City of Santa Clarita's joint planning effort for the Santa Clarita Valley, One Valley One Vision — and those projections generally align with one another.
5. the data encompass a broader cumulative development scenario than is provided by the County's DMS data; and this more conservative approach ensures that all cumulative water demand within the Santa Clarita Valley is accounted for when assessing water supplies and demand for the broader CLWA service area, which encompasses the service areas of VWC and the three other retail purveyors in the Valley.

As they relate to water supplies, the DMS criteria provide that the County planning agency (Regional Planning Commission and/or Department of Regional Planning) must determine if a project will be provided with an acceptable level of water supply and must base its determination upon the following data:

1. the current water consumption (or demand) in acre-feet or gallons within the service area boundaries.
2. the current capacity of the service provider to supply water (in afy).
3. the deficit or surplus within the service provider's area, calculated by determining the difference between capacity and usage (demand).
4. the anticipated usage (demand) of water by new development on a per unit basis.
5. the programmed schedule of the service provider to expand its capacity in the future.

3.4.2 County of Los Angeles Resolution and Ordinances

In August 2008, the County Board of Supervisors declared a countywide water supply and conservation alert and (1) urged the County residents, businesses, local water purveyors, and cities to intensify water conservation efforts to achieve an overall reduction in water demand of 15 to 20 percent; (2) directed all County departments to evaluate water usage and immediately implement conservation measures to reduce consumption by a target amount of 10 percent; (3) urged local water purveyors and cities to accelerate and intensify public outreach campaigns; (4) urged cities to update and adopt water wasting ordinances and prepare for enforcement of the ordinances, if necessary; and (5) encouraged County residents to follow 10 easy tips to reduce their water consumption.[14]

In response to this directive, the Board readopted such provisions in the Los Angeles County Code, imposing water conservation requirements for the Los Angeles County area, such as prohibiting the wash down of driveways and sidewalks, limiting the hours and duration of watering any lawn or landscaping, and prohibiting water runoff into adjoining streets. In addition, the Los Angeles County Code includes regulations for designing, installing, and maintaining water-efficient landscapes in new projects.

In November 2008, the County Board of Supervisors also adopted a Green Building Program, in part to improve design and construction techniques that promote water conservation. The Green Building Program, originally codified in Titles 21 and 22 of the County Code, included a Green Building Standards Ordinance, Drought-Tolerant Landscaping Ordinance, and Low Impact Development (LID) Ordinance, which collectively required water-efficient construction techniques and appliances, the use of drought-tolerant plants, and the preservation of watersheds, drainage paths, water supplies, and natural resources through compliance with development standards identified in the LID Standards Manual and Green

[14] A Resolution of the Board of Supervisors of the County of Los Angeles, California, Declaring a Countywide Water Supply and Conservation Alert, adopted August 5, 2008.

Building and Sustainability Guidelines for the County of Los Angeles. In 2013, in response to mandates set forth in the CALGreen Code, the County adopted the Los Angeles County Green Building Standards Code (Title 31), which adopts and incorporates by reference specified provisions of the 2013 CALGreen Code.[15] The purpose of Title 31 is to facilitate sustainability via planning and design, as well as water efficiency and conservation, among other issues. Title 31 also references County Code Chapter 12.84, which provides LID requirements that address water conservation. Title 31 is currently being revised to provide clarity for the development community, ensure consistency with the State and other local agencies, and advance sustainable construction standards in the County.

3.4.3 Santa Clarita Valley Area Plan: One Valley One Vsion

Los Angeles County's One Valley One Vision Area Plan provides analysis and mitigation measures for water supply impacts associated with build-out of the Area Plan. The mitigation measures are restated below and would be required as applicable, per a determination by the County of Los Angeles.

MM3.13-1 (Policy LU 4.5.2): Encourage the provision of usable open space that is accessible to employees and visitors, and discourage the provision of large areas of water-consuming landscaping that are not usable or accessible.

MM3.13-2 (Policy LU 4.5.3): Promote the inclusion of state-of-the-art technology within business complexes for telecommunications, heating and cooling, water and energy conservation, and other similar design features.

MM3.13-3 (Policy LU 7.2.1): Monitor growth, and coordinate with water districts as needed to ensure that long-range needs for potable and reclaimed water will be met.

MM3.13-4 (Policy LU 7.2.2): If water supplies are reduced from projected levels due to drought, emergency, or other unanticipated events, take appropriate steps to limit, reduce, or otherwise modify growth permitted by the General Plan in consultation with water districts to ensure adequate long-term supply for existing businesses and residents.

MM3.13-5 (Policy LU 7.2.3): Require that all new development proposals demonstrate a sufficient and sustainable water supply prior to approval.

MM3.13-6 (Policy LU 7.4.1): Require the use of drought tolerant landscaping, native California plant materials, and evapotranspiration (smart) irrigation systems.

MM3.13-7 (Policy LU 7.4.2): Require the use of low-flow fixtures in all non-residential development and residential development with five or more dwelling units, which may include but are not limited to water conserving shower heads, toilets, waterless urinals and motion-sensor faucets, and encourage use of such fixtures in building retrofits as appropriate.

MM3.13-8 (Policy CO 1.1.1): In making land use decisions, consider the complex, dynamic, and interrelated ways that natural and human systems interact, such as the interactions between energy demand, water demand, air and water quality, and waste management.

MM3.13-9 (Policy CO 4.1.1): In coordination with applicable water suppliers, adopt and implement a water conservation strategy for public and private development.

MM3.13-10 (Policy CO 4.1.2): Provide examples of water conservation in landscaping through use of low water use landscaping in public spaces such as parks, landscaped medians and parkways, plazas, and around public buildings.

[15] The County's 2008 ordinances are being repealed, and the more recently adopted Title 31 requirements will apply to this Project.

MM3.13-11 (Policy CO 4.1.3): Require low water use landscaping in new residential subdivisions and other private development projects, including a reduction in the amount of turf-grass.

MM3.13-12 (Policy CO 4.1.4): Provide informational materials to applicants and contractors on the Castaic Lake Water Agency's Landscape Education Program, and/or other information on xeriscape, native California plants, and water-conserving irrigation techniques as materials become available.

MM3.13-13 (Policy CO 4.1.5): Promote the use of low-flow and/or waterless plumbing fixtures and appliances in all new nonresidential development and residential development of five or more dwelling units.

MM3.13-14 (Policy CO 4.1.6): Support amendments to the building code that would promote upgrades to water and energy efficiency when issuing permits for renovations or additions to existing buildings.

MM3.13-15 (Policy CO 4.1.7): Apply water conservation policies to all pending development projects, including approved tentative subdivision maps to the extent permitted by law. Where precluded from adding requirements by vested entitlements, encourage water conservation in construction and landscape design.

MM3.13-16 (Policy CO 4.1.8): Upon the availability of non-potable water services, discourage and consider restrictions on the use of potable water for washing outdoor surfaces.

MM3.13-17 (Policy CO 4.2.1): In cooperation with the Sanitation District and other affected agencies, expand opportunities for use of recycled water for the purposes of landscape maintenance, construction, water recharge, and other uses as appropriate.

MM3.13-18 (Policy CO 4.2.2): Require new development to provide the infrastructure needed for delivery of recycled water to the property for use in irrigation, even if the recycled water main delivery lines have not yet reached the site, where deemed appropriate by the reviewing authority.

MM3.13-19 (Policy CO 4.2.3): Promote the installation of rainwater capture and gray water systems in new development for irrigation, where feasible and practicable.

MM3.13-20 (Policy CO 4.2.5): Participate and cooperate with other agencies to complete, adopt, and implement an Integrated Regional Water Management Plan to build a diversified portfolio of water supply, water quality, and resource stewardship priorities for the Santa Clarita Valley.

MM3.13-21 (Policy CO 4.2.6): Require that all new development proposals demonstrate a sufficient and sustainable water supply prior to approval.

MM3.13-22 (Policy CO 8.3.3): Promote energy efficiency and water conservation upgrades to existing non-residential buildings at the time of major remodel or additions.

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4 Water Supplies

The principal components of the Santa Clarita Valley water supply are imported water from the SWP, other imported water from Kern County, and local groundwater from the Alluvial aquifer and the Saugus Formation. Since 2003, these water supplies have been augmented by the initiation of CLWA deliveries of recycled water. In addition, CLWA has storage programs that are planned for use during drier years when imported supplies are limited. These storage programs improve reliability of the CLWA/purveyor supplies by enabling existing supplies that are not needed in wetter years to be stored for use in drier years. CLWA also funds a capital improvement plan to provide facilities and additional water supplies needed to firm-up imported water supplies in dry years. While these firming supplies do not increase the overall supply available to meet service area demand, they enhance reliability of the water supplies available to the retail purveyors within the broader CLWA service area in a given year (LSCE 2014). Each of these water sources is discussed in this Section 4.

4.1 Wholesale (Imported) Water Supplies

Since imported SWP water is one of CLWA's sources and, therefore, would be purchased by VWC as part of the water supplies available to the Project, it is discussed in detail below.

4.1.1 State Water Project

CLWA obtains the majority of its imported water supplies from the SWP, which is owned and operated by DWR. CLWA is one of 29 SWP contractors holding long-term water supply contracts with DWR. SWP water originates as rainfall and snowmelt in the Feather River watershed in northern California.

The SWP depends on a complex system of dams, reservoirs, power plants, pumping plants, canals, and aqueducts to deliver water from northern California to central and southern areas. Although initial transportation facilities were essentially completed in 1973, other facilities have since been built, and still others are either under construction or are planned to be built, as needed. The SWP facilities include 30 dams; 29 pumping and generating plants; 5 hydroelectric power plants; and about 701 miles of open canals and pipelines. Figure 4-1, Primary SWP Water Delivery Facilities, shows the names and locations of the primary SWP water delivery facilities. Water from rainfall and snowmelt runoff is stored in SWP conservation facilities and delivered via SWP transportation facilities to water agencies and districts in the southern California, Central Coastal, San Joaquin Valley, South Bay, North Bay, and Upper Feather River areas (DWR 2012).

Situated on Feather River tributaries in Plumas County, three small reservoirs—Lake Davis, Frenchman Lake, and Antelope Lake—are the northernmost SWP facilities. Downstream from these lakes lies Lake Oroville, which conserves water from the Feather River watershed. Created by Oroville Dam, Lake Oroville is the project's largest storage facility with a capacity of about 3.5 million af.

Releases from Lake Oroville flow down the Feather River into the Sacramento River, which drains the northern portion of California's great Central Valley. The Sacramento River flows into the Delta, comprising 738,000 acres of land interlaced with channels that receive runoff from 40 percent of the State's land area. The SWP, federal Central Valley Project, and local agencies all divert water from the Delta.

Source: DWR 2013c

Date: 4/30/2014

ENTRADA SOUTH

Figure 4-1

Primary SWP Water Delivery Facilities

In the southern Delta, water is pumped into the 444-mile-long California Aqueduct at the Clifton Court Forebay by the Banks Pumping Plant (or by agreement with the U.S. Bureau of Reclamation, at the Central Valley Project's Tracy Pumping Plant). From the southern Delta facilities, water in the California Aqueduct travels along the west side of the San Joaquin Valley and is delivered or stored in San Luis Reservoir, the SWP's main storage facility south of the Delta. Water is conveyed via the California Aqueduct to the urban region of the Bay area, and south of San Luis Reservoir, to the primarily agricultural regions in the San Joaquin Valley and the primarily urban regions of the Central Coast and southern California. Water is diverted from the California Aqueduct and delivered directly to the central and southern San Joaquin Valley at various locations along the California Aqueduct. The California Aqueduct traverses the west side of the San Joaquin Valley, and water is pumped through a series of four pumping plants (Dos Amigos, Buena Vista, Teerink, and Chrisman) before reaching the Edmonston Pumping Plant. The Edmonston Pumping Plant pumps water over the Tehachapi Mountain Range, and the California Aqueduct then divides into the East Branch and the West Branch. Water intended for use by CLWA is conveyed through the West Branch to Quail and Pyramid lakes and then to Castaic Lake, the terminus for the West Branch (DWR 2012).

4.1.1.1 *SWP Water Supply Contracts — SWP Water Supplies*

Table A Water

In the early 1960s, DWR began entering into individual SWP water supply contracts with urban and agricultural public agencies (SWP contractors) located throughout northern, central, and southern California (CLWA 2011). Each SWP contractor's water supply contract contains a "Table A" exhibit that lists the maximum amount of contract water supply, or "Table A water," an agency may request each year throughout the life of the contract.

Since 1968, DWR has monitored and recorded annual precipitation and runoff, because precipitation, snowpack, and the rate and amount of snowmelt help determine how much water the SWP can deliver in any given year (DWR 2014). The current combined maximum Table A Amount is 4,172 thousand acre-feet per year (taf/year). Of this amount, 4,133 taf/year is the maximum Table A water available for delivery from the Delta (DWR 2014). The maximum Table A Amount is the basis for apportioning water supply and costs to the SWP contractors. Once the total amount of water to be delivered is determined for a given year, all available water is allocated in proportion to each contractor's annual maximum SWP Table A Amount (DWR 2014). Thus, Table A amounts do not necessarily represent actual water deliveries, but rather a means to calculate each contractor's proportionate share of the total amount of SWP water available in a given year.

Table A water is given first priority for delivery over other types of SWP water. Each contractor has some flexibility in managing the Table A supply allocated to it in a given year. A contractor may take delivery of that supply for direct use or storage within its service area, store that water outside its service area for later withdrawal and use within its service area, or carry over a portion of that supply for storage on an as-available-basis in SWP reservoirs, for delivery the following year (CLWA 2011).

CLWA has an annual SWP Table A Amount of 95,200 af through its water supply contract with DWR (CLWA 2011). This Table A Amount is a maximum and does not reflect the actual amount of water available to CLWA from the SWP, which varies from year-to-year.

CLWA's original SWP water supply contract with DWR was amended in 1966 for a maximum annual Table A Amount of 41,500 af. In 1991, CLWA purchased an additional 12,700 af of annual Table A Amount from the Devil's Den Water District in Kern County. In March 1999, CLWA purchased another 41,000 af of annual Table A Amount from the Wheeler Ridge-Maricopa Water Storage District by way of an amendment to its water supply contract. The amended water supply contract between CLWA and DWR reflects these changes (CLWA-DWR Water Supply Contracts 2003).

Other Types of SWP Water

Each long-term water supply contract describes several types of SWP water that are available to SWP contractors to supplement their Table A water: (a) Article 21 water; (b) carryover water; and (c) turnback pool water (DWR 2014, Chapter 2).

Article 21 water (so named because it is described in Article 21 of the water supply contracts) is water that SWP contractors may receive on a short-term basis in addition to their Table A water, if they request it. Article 21 water is used by many SWP contractors to help meet demands when Table A allocations are less than 100 percent. The availability and delivery of Article 21 water cannot interfere with normal SWP operations (DWR 2014, Chapter 2).

Carryover water is SWP water that is allocated to a SWP contractor and approved for delivery to that contractor in a given year, but not used by the end of the year. This water is exported from the Delta, but instead of being delivered to the SWP contractor, it is stored in the SWP's share of the San Luis Reservoir, when space is available, for the contractor to use in the following year (DWR 2014, Chapter 2).

SWP contractors also may offer a portion of their Table A water that has been allocated in the current year and exceeds their needs to a "turnback pool," where another contractor may purchase it. Contractors that sell their extra Table A water in a turnback pool receive payments from contractors that buy this water through the turnback pool (DWR 2014, Chapter 2).

The availability of Article 21 water and turnback pool water is uncertain. When available, these supplies provide additional water that CLWA may be able to use, either directly to meet demands or for later use after storage in its groundwater banking programs. To the extent CLWA is able to make use of these supplies when available, CLWA may be able to improve the reliability of its SWP supplies beyond the amounts reflected in the adopted UWMP for the Santa Clarita Valley (CLWA 2011).

While not specifically provided for in the SWP water supply contracts, in single-dry years, DWR has created dry year water purchase programs for contractors needing additional supplies. Through these programs, water is purchased by DWR from willing sellers in areas that have available supplies and is then sold by DWR to contractors willing to purchase those supplies. The availability of these supplies is uncertain. However, CLWA's access to these supplies when they are available would enable it to improve the reliability of its dry-year supplies beyond the amounts reflected in the adopted UWMP (CLWA 2011).

As part of CLWA's water supply contract with DWR, CLWA has access to a portion of the storage capacity of Castaic Lake. This "flexible storage account" allows CLWA to utilize up to 4,684 af of the storage in Castaic Lake. Any of this amount that CLWA borrows must be replaced by CLWA within 5 years of its withdrawal. CLWA manages this storage by keeping the account full in normal and wet years and then delivering that stored amount (or a portion of it) during dry periods. The account is refilled during the next year that adequate SWP supplies are available to CLWA to do so (CLWA 2011).

In 2005, CLWA negotiated with the Ventura County SWP contractor agency to obtain the use of its flexible storage account. This transaction allows CLWA access to another 1,376 af of storage in Castaic Lake. CLWA access to this additional storage is available on a year-to-year basis through 2015. While it is expected that CLWA and Ventura County will extend the existing flexible storage agreement beyond the 2015 term, it is not assumed to be available beyond 2015 in the adopted UWMP (CLWA 2011).

4.1.1.2 *Factors Affecting SWP Table A Supplies*

While Table A identifies the maximum amount of Table A water a SWP contractor may request, the amount of SWP water actually available and allocated to SWP contractors each year is dependent on a number of factors and can vary and be reduced significantly from year-to-year. The primary factors affecting SWP water delivery reliability include the availability of water at the source of supply in northern

California, regulatory restrictions on SWP operations, and the effects of climate change[16]. Uncertainty also exists because of the potential for interruptions in conveying SWP supplies from the Delta (e.g., earthquakes, Delta levee failure). DWR and other agencies are engaged in ongoing efforts to reduce risks to the Delta and enhance emergency response capabilities[17].

DWR accounts for the various factors affecting and reducing SWP water delivery reliability in its computer modeling, which simulates the expected SWP deliveries under estimated existing and future conditions. Specifically, DWR calculates the water delivery reliability of the SWP using the CalSim-II computer model, which simulates existing and future operations of the SWP (DWR 2014, Chapter 3). DWR's modeling is based on 82 years of historical data (water years 1922-2003), rainfall, and runoff, and the data have been adjusted to reflect 2013 current and future levels of development in the source areas. The resulting data is are used to forecast the probable amount of water available to the SWP under current and future conditions (with the effects of climate change factored into the modeling for future conditions) (DWR 2014b, Chapter 3).

DWR's most current published estimate of SWP delivery reliability is found in the 2013 State Water Project Delivery Reliability Report (DWR 2014b). As used by DWR, the term "water delivery reliability" refers to the annual amount of SWP water that can be expected to be delivered with a certain frequency, or in other words, the probability that a certain amount of water will be delivered by the SWP in a given year.

4.1.1.3 *SWP Table A Supply Assessment*

The State Water Project Delivery Reliability Report, prepared every 2 years by DWR as part of the Monterey Amendments settlement agreement, informs SWP contractors, city and county planning departments, regional and metropolitan planning departments, and the public about key factors important to the operation of the SWP and the reliability of its water deliveries. Commencing in 2002, DWR has prepared and disseminated reliability reports for 2002, 2005, 2007, 2009, 2011, and 2013 (DWR 2014, Chapter 1). The reliability reports are used for water planning purposes. For example, CLWA used DWR's 2009 reliability report and DWR's estimates of SWP water delivery reliability in preparing and adopting the 2010 UWMP for the Santa Clarita Valley.

The 2013 reliability report is the most current report, and includes DWR's estimates of SWP water delivery reliability under both existing (2013) and future (2033) conditions (DWR 2014, Chapters 5 and 6). According to the 2013 reliability report, many of the same challenges to SWP operations that were identified in the 2011 reliability report remain; for example, like the 2011 report, the 2013 report shows reductions in SWP Delta exports and Table A deliveries due to the operational restrictions imposed on the SWP by Biological Opinions issued by USFWS in December 2008 and NMFS in June 2009, and Delta water quality and flow restrictions from the State Water Resources Control Board's water quality control plan for the Delta. Estimates of future reliability also reflect potential effects of climate change and sea level rise.

4.1.1.4 *DWR Analysis Results*

Estimated Percentage of Table A Deliveries (2009 and 2013)

According to the 2010 UWMP for the Santa Clarita Valley, which relied on the 2009 reliability report, DWR estimates that the SWP can deliver a total Table A supply of 60 percent of the total maximum Table A

[16] Please refer to the State Water Project Delivery Reliability Report 2013, Chapter 3, for a detailed discussion of the factors affecting estimates of existing and especially future SWP water delivery reliability. In addition, the 2010 UWMP for the Santa Clarita Valley summarizes various factors that combine to affect and reduce SWP water delivery reliability (see 2010 UWMP, Section 3). Also, please see Appendix D to the 2010 UWMP for a more detailed discussion of these factors.

[17] Please refer to the State Water Project Delivery Reliability Report 2013, Chapter 3, for an in-depth discussion of the actions being taken by DWR and other agencies to reduce risks to the Delta and enhance emergency response capabilities.

Amounts on a long-term average basis under both current (2009) and future (2029) conditions. In the worst-case single-dry year, DWR estimates that the SWP can deliver a total Table A supply of 7 percent of the total maximum Table A Amounts under current conditions, and 11 percent under future conditions. During multiple year dry periods, DWR estimates that the SWP can deliver a total Table A supply averaging 34-36 percent of the total maximum Table A Amounts under current conditions and 28-32 percent under future conditions (CLWA 2011, Section 3, Water Resources).

As updated by the 2013 reliability report, DWR estimates that for all contractors combined, the SWP can deliver a total Table A supply of 62 percent of the total maximum Table A Amounts on a long-term average basis under current (2013) conditions, and 58 percent under future (2033) conditions. In the worst-case single-dry year, DWR estimates that the SWP can deliver a total Table A supply of 12 percent of the total maximum Table A Amounts under current conditions, and 11 percent under future conditions. During multiple year dry periods, DWR estimates that the SWP can deliver a total Table A supply averaging 28-31 percent of the total maximum Table A amounts under current conditions and 24-31 percent under future conditions (DWR 2014, Chapters 5 and 6).

Estimated Table A Demands and Deliveries (2009, 2011, and 2013)

In 2009, the estimated Table A demand ranged between 3,007 and 4,115 thousand acre-feet (taf), with an average of 3,711 taf (DWR 2012). Estimated annual demands for 2011 were essentially the same as calculated for 2011; annual demand was estimated between 3,043 and 4,120 taf, with an average of 3,722 taf (DWR 2009, 2012). As estimated for the 2013 SWP Delivery Reliability Report (2014b), annual demands for SWP Table A water are 4,132 taf under existing conditions. The 2013 Report assumes that the maximum SWP Table A Amount is requested (i.e., demanded) each year. This represents a different approach than the 2011 Report, which did not assume maximum demand. Because SWP contractors have been requesting the full amount in recent years, the 2013 Report was updated to more accurately reflect the trend in demand. Estimated annual demands for deliveries of SWP Table A water ranged from between 2,043 and 4,120 taf per year in the 2011 Report, with an average of 3,722 taf (DWR 2014b).

The annual average, maximum, and minimum estimates of SWP Table A deliveries from the Delta for existing conditions, as calculated for the 2009, 2011 SWP Delivery Reliability Reports were similar, but they changed somewhat in the 2013 report. For 2011, the delivery range was between 377 to 3,363 taf with an average estimated delivery of 2,524 taf. This is just slightly greater than in 2009 (DWR 2012). For 2013, the estimated delivery range is from 495 taf and 3,996 taf. The likelihood that more than 2,000 taf/year of Table A water will be delivered is now 79 percent, as opposed to 82 percent with the 2011 Report. The distribution of delivery ranges has also changed since the 2011 SWP Delivery Reliability Report due to the increased Table A demand assumed in the 2013 SWP Delivery Reliability Report and because it does not assume variable Table demands for existing conditions (DWR 2014b).

Table 4-1 presents estimates of SWP Table A water deliveries under current (2013) conditions during possible drought conditions and compares them with the corresponding delivery estimates calculated for the 2009 and 2011 SWP Delivery Reliability Reports. Droughts are analyzed using the historical drought-period precipitation and runoff patterns from 1922 through 2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling. For reference, the worst multi-year drought during this period of record was the 1929 to 1934 drought, although the brief drought of 1976 to 1977 was more intensely dry. The results of modeling existing conditions for potential drought-year scenarios indicate that SWP Table A water deliveries during dry years can be expected to range from between 380 and 1,573 taf/year (DWR 2012).

Table 4-2 presents estimates of SWP Table A water deliveries under current conditions during possible wet conditions and compares them with corresponding delivery estimates calculated for the 2009 and 2011 SWP Delivery Reliability Reports. Wet periods for 2009, 2011, and 2013 are analyzed using historical precipitation and runoff patterns from 1922 to 2003 as a reference, while accounting for existing conditions during those years (e.g., land use, water infrastructure). For reference, the wettest single year

on record was 1983. The results of modeling existing conditions for potential wet periods indicate that estimated SWP Table A water deliveries during wet years now can be expected to range between 3,086 and 3,996 taf/year (DWR 2014b).

Tables 4-1 and 4-2 also show the expected deliveries to CLWA under each of the scenarios shown, based on its Table A Amount of 95,200 afy.

Table 4-1 Average and Dry-Period SWP Table A Deliveries under Current Conditions (taf) and Resulting Deliveries to CLWA (afy)

	SWP Table A Delivery (Percent of Maximum Table A Amount)[1, 2]					
	Long-term Average	Single Dry Year (1977)	2-Year Drought (1976-1977)	4-Year Drought (1931-1934)	6-Year Drought (1987-1992)	6-Year Drought (1929-1934)[3]
2009 Report[4]	2,483 (60□)	302 (7□)	1,496 (36□)	1,402 (34□)	1,444 (35□)	1,398 (34□)
2011 Report	2,524 (61□)	380 (9□)	1,573 (38□)	1,454 (35□)	1,462 (35□)	1,433 (35□)
2013 Report	2,553 (62□)	495 (12□)	1,263 (31□)	1,263 (31□)	1,176 (28□)	1,260 (30□)
CLWA Table A Delivery (2013)	59,024	11,424	29,512	29,512	26,656	28,560

Notes:

[1] Maximum Table A Amount is 4,133 thousand acre-feet/year (taf/yr).

[2] The water available under different hydrologic conditions is based on the historical precipitation and runoff patterns from 1922-2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling.

[3] For reference, the worst multi-year drought on record was the 1929-1934 drought, although the brief drought of 1976-1977 was more intensely dry.

[4] The 2009 reliability report results are shown here because that was the report utilized in the most current 2010 UWMP for the Santa Clarita Valley.

Source: 2009, 2011, and 2013 SWP Delivery Reliability Reports (DWR 2009, 2012, and 2014b)

Table 4-2 Average and Wet-Period SWP Table A Deliveries under Current Conditions (taf) and Resulting Deliveries to CLWA (afy)

	SWP Table A Delivery (Percent of Maximum Table A Amount) [1, 2]					
	Long-term Average	Single Wet Year (1983)	2-Year Wet (1982-1983)	4-Year Wet (1980-1983)	6-Year Wet (1978-1983)	10-Year Wet (1978-1987)
2009 Report[3]	2,483 (60□)	2,813 (68□)	2,935 (71□)	2,817 (68□)	2,817 (68□)	2,872 (67□)
2011 Report	2,524 (61□)	2,886 (70□)	2,958 (72□)	2,872 (69□)	2,873 (70□)	2,833 (69□)
2013 Report	2,553 (62□)	3,996 (97□)	3,880 (94□)	3,501 (85□)	3,361 (81□)	3,086 (75□)
CLWA Table A Delivery (2013)	59,024	92,344	89,488	80,920	77,112	71,400

Notes:

[1] Maximum Table A Amount is 4,133 thousand acre-feet/year (taf/yr).

[2] The water available under different hydrologic conditions is based on the historical precipitation and runoff patterns from 1922-2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling.

[3] The 2009 reliability report results are shown here because that was the report utilized in the most current 2010 UWMP for the Santa Clarita Valley.

Source: 2009, 2011, and 2013 SWP Delivery Reliability Reports (DWR 2009, 2012, and 2014b)

Article 21 Water (2009, 2011, and 2013)

Article 21 water is only available if several conditions are met: (1) excess water is flowing through the Delta; (2) the SWP contractor can use the surplus water or store it in the contractor's own system; and (3) delivering this water will not interfere with SWP Table A allocations, other SWP deliveries, or SWP operations (DWR 2012). As stated in the 2013 SWP Delivery Reliability Report, essentially no Article 21 water is estimated to be delivered from May through October. In the late fall and winter (November though April), maximum monthly deliveries range from 92 to 245 taf/month (DWR 2014b).

Although deliveries of SWP Article 21 water are smaller during dry years than during wet ones, opportunities exist to deliver SWP Article 21 water during multiyear drought periods. As modeled, deliveries in dry years are often small (less than 5 taf); however, longer drought periods can include several years that support Article 21 deliveries. Annual average Article 21 estimates for drought periods of 4 and 6 years vary significantly and can approach the long-term average annuall estimate, as show in Table 4-3.

Table 4-4 shows the estimates of deliveries of SWP Article 21 water during wet periods under existing conditions. Estimated deliveries in wet years are approximately 2.3 to 5 times larger than the average existing conditions delivery of SWP Article 21 water. Due to the uncertainty in availability of Article 21 water, supplies of this type of SWP water are not included in CLWA□s UWMP and it is not know exactly what effect changes in these deliveries would have on CLWA□s water supply.

Table 4-3 Average and Dry-Period Article 21 Deliveries under Current Conditions (taf)

	Long-term Average	Single Dry Year (1977)	2-Year Drought (1976-1977)	4-Year Drought (1931-1934)	6-Year Drought (1987-1992)	6-Year Drought (1929-1934)
2009 Report	85	2	6	142	10	98
2011 Report	76	3	5	69	9	49
2013 Report	58	10	13	46	11	35

Source: 2011 and 2013 SWP Delivery Reliability Report (DWR 2009, 2012, and 2014b)

Table 4-4 Average and Wet-Period Article 21 Water Deliveries under Current Conditions (taf)

	Long-term Average	Single Wet Year (1983)	2-Year Wet (1982-1983)	4-Year Wet (1980-1983)	6-Year Wet (1978-1983)	10-Year Wet (1978-1987)
2009 Report	85	853	659	379	273	230
2011 Report	76	608	533	307	225	207
2013 Report	58	333	265	196	135	152

Source: 2011 and 2013 SWP Delivery Reliability Report (DWR 2009, 2012, and 2014b)

4.1.1.5 *Future SWP Water Delivery Reliability*

As stated in the 2013 SWP Delivery Reliability Report, future demands for SWP Table A water are assumed to be the maximum possible annual amount, which is 4,133 taf. There is no assumed variation in demand as a result of different annual precipitation and runoff conditions; it is assumed that by 2033, the maximum amount of SWP Table A water will be requested every year. The SWP Table A water demands under future conditions, as presented in the 2013 SWP Delivery Reliability Report, are also assumed to be the maximum amount of 4,133 taf/year.

The maximum possible delivery of SWP Table A water, 4,133 taf/year, is not reached under future conditions. Currently, there is a 57 percent likelihood that 2,000 to 3,500 taf of SWP Table A water will be delivered under the future-conditions scenario (DWR 2014b). This is less than the 2011 estimate of 70 percent (SDWR 2012).

Table 4-5 presents estimates from the 2013 SWP Delivery Reliability Report of future SWP Table A water deliveries during possible drought conditions and compares them with the corresponding delivery estimates calculated for the 2009 and 2011 SWP Delivery Reliability Reports. Drought scenarios for future conditions in the 2009, 2011, and 2013 SWP Delivery Reliability Reports are analyzed using the historical drought-period precipitation and runoff patterns from 1922 to 2003 as a reference, while accounting for future conditions, respectively (e.g., land use, climate change). The results of modeling future conditions under potential drought-year scenarios indicate that estimated dry-year SWP deliveries can be expected to range between 453 and 1,263 taf/year (DWR 2014).

Tables 4-5 and 4-6 also show the expected deliveries to CLWA under each of the scenarios shown, based on its Table A Amount of 95,200 afy.

Table 4-5 Average and Dry-Period SWP Table A Deliveries under Future Conditions (taf) and Resulting Deliveries to CLWA (afy)

	SWP Table A Delivery (Percent of Maximum Table A Amount)[1, 2]					
	Long-term Average	Single Dry Year (1977)	2-Year Drought (1976-1977)	4-Year Drought (1931-1934)	6-Year Drought (1987-1992)	6-Year Drought (1929-1934)
2009 Report[3]	2,487 (60□)	458 (11□)	1,570 (38□)	1,431 (35□)	1,308 (32□)	1,480 (36□)
2011 Report	2,465 (60□)	441 (11□)	1,457 (35□)	1,401 (34□)	1,226 (30□)	1,365 (33□)
2013 Report	2,400 (58□)	453 (11□)	978 (24□)	1,263 (31□)	1.055 (26□)	1.251 (30□)
CLWA Table A Delivery (2013)	55,216	10,472	22,848	29,512	24,752	28,560

Notes:

[1] Maximum Table A Amount is 4,133 thousand acre-feet/year (taf/yr).

[2] The water available under different hydrologic conditions is based on the historical precipitation and runoff patterns from 1922-2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling.

[3] The 2009 reliability report results are shown here because that was the report utilized in the most current 2010 UWMP for the Santa Clarita Valley.

Source: 2009, 2011, and 2013 SWP Delivery Reliability Reports (DWR 2009, 2012, and 2014b).

Table 4-6 presents estimates from the 2013 SWP Delivery Reliability Report of future SWP Table A water deliveries during a wet year and compares them with the corresponding delivery estimates calculated for the 2009 and 2011 SWP Delivery Reliability Reports. Wet periods were modeled for the 2009, 2011, and 2013 SWP Delivery Reliability Reports using historical precipitation and runoff patterns from 1922 to 2003 as a reference and accounting for future conditions, such as land use and climate change. The results of modeling future conditions for potential wet periods indicate that estimated SWP Table A water deliveries during wet years can be expected to range between yearly averages of 2,900 and 4,068 taf/year.

Table 4-6 Average and Wet-Period SWP Table A Deliveries under Future Conditions (taf) and Resulting Deliveries to CLWA (afy)

	SWP Table A Delivery (Percent of Maximum Table A Amount)[1, 2]					
	Long-term Average	Single Wet Year (1983)	2-Year Wet (1982-1983)	4-Year Wet (1980-1983)	6-Year Wet (1978-1983)	10-Year Wet (1978-1987)
2009 Report[3]	2,487 (60□)	3,990 (97□)	3,843 (93□)	3,401 (82□)	3,250 (79□)	2,975 (72□)
2011 Report	2,466 (60□)	4,063 (98□)	3,908 (95□)	3,396 (82□)	3,248 (79□)	2,972 (72□)
2013 Report	2,400 (58□)	4,068 (98□)	3,945 (95□)	3,333 (81□)	3,191 (77□)	2,900 (70□)
CLWA Table A Delivery (2013)	55,216	93,296	90,440	77,112	73,304	66,640

Notes:

[1] Maximum Table A Amount is 4,133 thousand acre-feet/year (taf/yr).

[2] The water available under different hydrologic conditions is based on the historical precipitation and runoff patterns from 1922-2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling.

[3] The 2009 reliability report results are shown here because that was the report utilized in the most current 2010 UWMP for the Santa Clarita Valley.

Source: 2009, 2011, and 2013 SWP Delivery Reliability Reports (DWR 2009, 2012, and 2014b).

4.1.2 SWP Constraints

4.1.2.1 *Global Climate Change Constraints*

DWR has worked to improve its ability to respond quickly and effectively to simultaneous levee failures on multiple islands within the Delta. The *Delta Emergency Operations Plan Concept Paper* released in April 2007 (DWR 2007 as cited in DWR 2012) was the initial product of this effort. To enhance the State□s ability to prepare for, respond to, and recover from a catastrophic Delta levee failure, DWR subsequently began development of the Delta Flood Emergency Preparedness, Response, and Recovery Program. This program is intended to supplement DWR□s emergency operations plan (DWR 2012).

Reduced Snowpack. Climate change is expected to cause warmer storms resulting in less snowfall at lower elevations and reducing total snowpack. Since snowpack is a major source of annual water storage, this reduction is a cause of concern for California water planning. The DWR projects that by 2050, the Sierra snowpack will experience a 25 to 40 percent reduction from its historical average. Reduced early-spring snowpack in the Sierra Nevada and increased precipitation falling as rain instead of snow would cause the snow to melt earlier in the year and over fewer days than observed historically. Snowmelt provides an annual average of 15 million af of water, released slowly from April to July each year. Most of California□s infrastructure was designed to capture this low spring runoff and deliver it during the drier summer and fall months (DWR 2009a).

Increased air temperatures are expected to change the amount and timing of annual runoff. The fraction of runoff that occurs during the traditional period of April through July was examined for the base and the increased air temperature scenarios analyzed in DWR□s Climate Projections Report (DWR 2009b). The fraction of runoff that occurs from April through July decreases through time for all scenarios (including the base scenario), and it also decreases as air temperatures increase. This indicates that snowmelt is occurring before April 1 and that the fraction of snowmelt that occurs before April 1 will increase as air temperatures increase. More winter runoff and less spring/summer runoff due to increasing temperatures would affect the availability of water for pumping by the SWP in summer months (DWR 2012). Regions that rely heavily on surface water could be affected as runoff becomes more variable and more demand is placed on groundwater (DWR 2009a).

Climate change is also expected to reduce the SWP's median reservoir carryover storage (DWR 2012). Carryover water acts as a backup or savings account that can be utilized during water shortage periods. A reduction in carryover water will result in decreased flexibility of the SWP system during dry and critical years. The following is a further description of potential climate change impacts on water supplies:

Greater Drought and Flooding Extremes. California's drought periods could be extended and worsened by climate change. During droughts California has historically depended upon groundwater, however because dry conditions may be exacerbated by climate change, more efficient groundwater management will be needed. Climate change may also increase the state's flood risk due to higher peak flows and a shift in more intense winter precipitation. Along with changes in snowpack and accelerated snowmelt discussed earlier, scientists are projecting greater storm intensity, which would result in more direct runoff and flooding. Increased flooding could potentially cause more damage to the already vulnerable levee system as well (DWR 2009a).

Sea Level Rise. Peer-reviewed studies estimate a sea level rise of 4 to 16 inches by 2050 and between 7 and 55 inches by 2100 along the California coast. Even a rise at the lower end of these estimates poses an increase in storm surge and flooding risk for coastal residents and infrastructure, including wastewater treatment plants. Rising sea levels will put increased pressure on fragile levees and threatens water quality (DWR 2009a).

Increased pressure on the Delta's levee system could cause breaches and threaten SWP exports. Sea level rise is expected to cause salt water to reach further inland, which would increase saltwater intrusion into coastal aquifers and result in groundwater that is unsuitable for water supply or irrigation. This reduction in available groundwater would likely cause increases in demands for surface water from the SWP. Another concern is that sea level rise could require the SWP to release additional amounts of stored freshwater to maintain water quality standards in the Delta in response to saltwater intrusion (DWR 2012).

Delta Levee Failure. The Delta is protected by levees built about 150 years ago. The levees are vulnerable to failure because most original levees were built with soils dredged from nearby channels and were never engineered. Additionally, Delta islands have been subsiding, and in some places the land has sunk to 20 feet below sea level. This puts extra pressure on the Delta's levees, which must hold back water constantly rather than only during peak-flow periods. Climate change is causing sea level to rise, increasing pressure on Delta levees even further (DWR 2012).

Most islands in the Delta have flooded at least once over the past 100 years. For example, on June 3, 2004, a huge dry-weather levee failure occurred without warning on Upper Jones Tract in the south Delta, inundating 12,000 acres of farmland with about 160,000 af of water. Because many Delta islands are below sea level, deep and prolonged flooding could occur during a levee failure event, which could disrupt the quality and use of Delta water (DWR 2012).

Levee failure can result from the combination of high river inflows, high tide, and high winds; however, levees can also fail in fair weather, even in the absence of a flood or seismic event, in a "sunny day event." Damage caused by rodents, piping (in which a pipe-like opening develops below the base of the levee), or foundation movement could cause sunny-day levee breaches. A breach of one or more levees and island flooding may affect Delta water quality and SWP operations. Depending on the hydrology and the size and locations of the breaches and flooded islands, a large amount of salt water may be pulled into the interior Delta from Suisun and San Pablo bays. When islands are flooded, DWR may need to drastically decrease or even cease SWP Delta exports to evaluate the distribution of salinity in the Delta and avoid drawing saltier water toward the pumps (DWR 2012).

Increased SWP Water Demands. Precipitation and temperature both influence the demand for outdoor landscaping and irrigated agriculture. Due to increased temperatures caused by climate change, water demands for these activities could increase. Outdoor water use is a large component of Santa Clarita Valley water demands, and lower spring rainfall increases the need to apply irrigation water to crops.

Warmer temperatures may also increase rates of crop evapotranspiration, which will lead to an increase in water demand. Increased evaporation from surface reservoirs is also an effect of warmer temperatures (CLWA 2011). Reduced soil moisture and surface flow will disproportionately affect the environment and other water users that rely heavily on annual rainfall, including rainfed agriculture, livestock grazing on non-irrigated land, and recreation (DWR 2009a).

Effects on Groundwater. The *Analysis of Groundwater Supplies and Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, August 2009* (2009 Basin Yield Update) (LSCE & GSI 2009) used climate change modeling to analyze potential impacts of climate change on the yield of the basin and the related groundwater supply. While future conditions cannot be projected with any degree of certainty, the results of simulating basin response to the 2008 Groundwater Operating Plan[18] under a range of potential climate change trends give rise to the following observations:

- For the broad range of climate change possibilities that was analyzed, the 2008 Operating Plan would appear to be both sustainable and, with the same physical constraints to full pumping in the eastern part of the basin as have otherwise been experienced, achievable over the UWMP planning horizon of 20 to 25 years.
- The range of potential climate change impacts extends from a possible wet trend to a possible dry trend over the long term. The trends that range from an approximate continuation of historical average precipitation, to something wetter than that, would appear to result in continued sustainability of the 2008 Operating Plan, again with intermittent constraints on full pumping in the eastern part of the basin. The potential long-term dry trend arising out of climate change would be expected to decrease local recharge to the point that lower and declining groundwater levels would render the 2008 Operating Plan unsustainable.

Beyond the short-term planning horizon, greater uncertainty exists because global climate models use different emissions scenarios.

Models also become increasingly uncertain over time due to difficulty in predicting the many physical processes that affect climate into the future. As a result, for time periods beyond the UWMP planning horizon, some models predict long-term drying and subsequent sustained declines in groundwater levels, which would result in a smaller local groundwater supply over time, while other models predict hydrologic conditions similar to or wetter than those that have been historically observed, in which case the 2008 Operating Plan can be considered sustainable, with some local issues relative to actual pumping capability at certain times (mainly in the Alluvium at the eastern end of the Valley) (LSCE & GSI 2009).

4.1.2.2 *Environmental Constraints*

The Delta is an essential part of the SWP conveyance system, and pumping is regulated to protect the many uses of the Delta. The Bay Delta Conservation Plan, which is currently in development, could affect SWP delivery reliability in the future.

The Bay Delta Conservation Plan is being prepared by a group of local water agencies, environmental and conservation organizations, state and federal agencies, and other interest groups. When complete, the Bay Delta Conservation Plan is expected to provide the basis for the issuance of endangered species permits for the operation of the state and federal water projects. The plan would be implemented over the next 50 years. The heart of the plan is a long-term conservation strategy that sets forth actions needed for a healthy Delta. The plan establishes a Habitat Conservation Plan and a Natural Community Conservation Plan to restore and manage the Delta ecosystem, which is the main water supply conduit for 25 million people from Alameda County to San Diego County and large parts of California's agricultural economy. The plan is part of larger state and federal efforts to bolster water conservation,

[18] See Section 4.3.1.3 of this report for more detail on the groundwater operating plan.

storage, and water sources to help meet the water needs of California. It would be included as part of the Delta Plan.

The draft Bay Delta Conservation Plan and accompanying Environmental Impact Report and Environmental Impact Statement (EIR/EIS) were released in December 2013, initiating a formal public comment period for both documents that will end in April 2014. After public comment consideration, state and federal agencies will complete the review process and determine the most appropriate conservation and water conveyance plan for adoption and permitting. The plan will enable the state to make significant progress toward achieving the co-equal goals of securing California s water supply and restoring the Delta ecosystem. A decision to proceed with the program will not be made until the report is final (Office of the Governor 2013).

4.1.2.3 *Regulatory and Litigation Constraints*

SWP water exports for users south of the Banks and Tracy pumping plants are currently limited by a series of water quality and operational constraints, governed primarily by the State Water Resources Control Board (State Water Board) Water Right Decision 1641 (D-1641), as amended. D-1641 was adopted by the State Water board in 1999; prior to that time, SWP water exports from the Delta were limited by the State Water Board s Water Right Decision 1485 (adopted in 1978), Order Water Right (WR) 95-6 (adopted in 1995), and Order WR 98-09 (adopted in 1998).

In addition, DWR has acknowledged constraints on the SWP system due to federal court litigation, *Natural Resources Defense Council v. Kempthorne*, 506 F.Supp.2d 322 (E.D. Cal. 2007) (*Wanger* decision - Delta smelt); *Pacific Coast Federation of Fishermen's Associations, et al. v. Gutierrez, et al.*, No. 06-CV- 00245-OWW-GSA (E.D. Cal. 2008) (*Wanger* decision - Chinook salmon/steelhead), and two Biological Opinions addressing the effects of the proposed coordinated operations of the Central Valley Project and SWP.

The 2008 Biological Opinion, issued by USFWS, addressed the effects of the Central Valley Project/SWP operations on the threatened Delta smelt and its designated habitat (USFWS 2008). The 2009 Biological Opinion, issued by NMFS, addressed the effects of the Central Valley Project/SWP operations on the federally listed Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, green sturgeon, and Southern Resident killer whales, and the designated critical habitats of the salmon, steelhead, and sturgeon (NMFS 2009). (The status of the federal court litigation and the two biological opinions is provided below.)

4.1.2.4 *State/Federal Court Litigation*

Watershed Decision

State and federal court litigation has had an impact upon the availability and reliability of imported SWP supplies. For example, in October 2006, plaintiff Watershed Enforcers filed a lawsuit in Alameda County Superior Court alleging that DWR was not in compliance with the California Endangered Species Act and did not have the required state incidental take permit to protect the Delta smelt as part of DWR s pumping operations at the Harvey O. Banks Pumping Plant located near the town of Tracy (*Watershed Enforcers, et al. v. California Department of Water Resources, et al.* Alameda County Superior Court No. RG06292124). In April 2007, the court agreed with plaintiff and ordered a shutdown of pumping from the Delta if appropriate permits could not be obtained in 60 days. In May 2007, DWR filed an appeal of the trial court s decision, which automatically stayed the decision pending the outcome of the appeal. At the same time, DWR entered into a Memorandum of Understanding (MOU) with the California Department of Fish and Game (CDFG, now known as CDFW) to jointly work with the appropriate federal agencies to develop a Biological Opinion that complies with the California Endangered Species Act. During preparation of the new Biological Opinion, DWR committed itself to actions related to protecting the Delta smelt and other species through adaptive management provisions. DWR and CDFW have completed an

agreement regarding the consistency determination under the California Endangered Species Act that would allow for incidental take based on the new biological opinion (DWR and CDFG 2010).

2007 Wanger Decision – Delta Smelt

The *Wanger* decisions also have affected imported SWP supplies. On February 16, 2005, the USFWS issued its Biological Opinion, determining that the operations and criteria for the Central Valley Project and SWP would not result in jeopardy to the Delta smelt. On May 20, 2005, the Natural Resources Defense Council and others filed a supplemental complaint in federal court against USFWS, challenging the adequacy of the 2005 Biological Opinion. On July 6, 2006, in light of new information, the U.S. Bureau of Reclamation, operator of Central Valley Project, requested that USFWS reinitiate consultation on the operations plan and criteria for the Central Valley Project. Notwithstanding the request for reinitiation of consultation, the parties proceeded with the litigation and, on May 25, 2007, the U.S. District Court for the Eastern District, the Honorable Oliver W. Wanger, presiding, found that the 2005 Biological Opinion was inadequate and that the no-jeopardy determination was arbitrary, capricious, and contrary to the law.[19]

On August 31, 2007, Judge Wanger announced an initial ruling, which outlined an operational plan calling for reductions in water supplies to protect the Delta smelt. The Court specified that reduced operations would last until the fall of 2008, while federal agencies develop a revised Biological Opinion for Delta smelt that will ensure the SWP's and Central Valley Project's compliance with the requirements of the federal Endangered Species Act.

On December 14, 2007, Judge Wanger issued a final court order, which curtailed Delta pumping to protect the Delta smelt. The range of reduced operations is consistent with earlier estimates made by DWR following the Court's initial ruling in August 2007. Following Judge Wanger's final ruling, DWR performed additional modeling and analysis of the impacts of the *Wanger* Decision on Delta pumping. According to DWR, the final ruling will primarily affect export pumping between January and June 2008, when juvenile Delta smelt are at greatest risk of entrainment in pumps. Further, DWR has stated that the actual impact on SWP water supply will depend on a number of factors, including the locations where adult smelt spawn and off-spring hatch, levels of precipitation for the year, and water temperatures affecting how quickly the fish migrate. The Court's restrictions on SWP/Central Valley Project operations lasted until the fall of 2008, while the revised Biological Opinion for Delta smelt was completed (2008 Biological Opinion).

2008 Wanger Decision – Chinook Salmon/Steelhead

U.S. District Court Judge Oliver W. Wanger also invalidated a 2004 Biological Opinion issued by NMFS. The 2004 NMFS Biological Opinion determined that, pursuant to section 7 of the federal Endangered Species Act, the operations of the Central Valley Project/SWP would not jeopardize the continued existence of three listed Delta fish species protected under the federal Endangered Species Act, namely, the Sacramento River winter-run and Central Valley spring-run Chinook salmon, the Central Valley steelhead, and green sturgeon. Judge Wanger invalidated this Biological Opinion, relying on several of the factual findings made by NMFS in that opinion. Judge Wanger also faulted the Biological Opinion for, among other issues, failing to adequately analyze the impact of the operations plan on the critical habitat of the three species (Wanger Decision 2008).

After Judge Wanger's ruling, the court held hearings in June and July 2008 on possible remedies; however, no further remedies were imposed beyond the curtailments already issued with respect to the Delta smelt in the prior 2007 *Wanger* Decision.

[19] The 2007 *Wanger* decision (*Natural Resources Defense Council v. Kempthorne*, 506 F.Supp.2d 322 (E.D. Cal. 2007))

2010 Wanger and Ninth Circuit Decisions

In December 2010, Judge Wanger invalidated most of the 2008 Biological Opinion and remanded it to USFWS for further consideration[20]. In doing so, Judge Wanger overruled most of the 2008 Biological Opinion and invalidated several of the criteria that reduced SWP's water supply. As stated above, the case was appealed to the U.S. Court of Appeal for the Ninth Circuit, and the Ninth Circuit issued its decision in March 2014 (*San Luis & Delta-Mendota Water Authority v. Jewell*, No. 11-1587 (9th Cir. Mar. 13, 2014). On January 12, 2015,the U.S. Supreme Court refused to grant review of the Ninth Circuit decision; thus, the March 13, 2014 ruling by the Ninth Circuit remains intact. The practical effects of the Ninth Circuit decision include potential decreased water exports and deliveries from the combined operations of the SWP and Central Valley Project. DWR continues to account for those effects in estimating SWP Delta exports and Table A deliveries in the 2009, 2011, and 2013 SWP Delivery Reliability Reports. The estimates contained in those reports reflect the SWP operational restrictions imposed by the 2008 and 2009 Biological Opinions (DWR 2012).

Effect of Monterey Amendment EIR Litigation on SWP CLWA Water Supplies

CLWA's water allocations from the SWP are governed by annual hydrology and the terms of the long-term water supply contract that CLWA's predecessor entered with DWR in 1963. Historically, DWR and the SWP contractors periodically amended the SWP contracts to adjust to changing conditions and new circumstances that were not envisioned when the contracts were executed. In 1994, DWR and the SWP contractors (including CLWA) engaged in mediated negotiations in a broader attempt to update management of the SWP and settle water allocations disputes arising under the long-term SWP water supply contracts that were executed in the 1960s.

The negotiations grew into an omnibus revision to the contracts known as the Monterey Amendment. The Monterey Amendment had several principle objectives: (1) resolve conflicts and disputes among SWP contractors regarding water allocations; (2) restructure and clarify SWP water allocation procedures and deliveries in times of shortage and surplus; (3) reduce financial pressures on agricultural contractors; (4) adjust the SWP's financial rate structure to more closely match revenues with needs; (5) facilitate water management practices and water transfers that improve reliability and flexibility of SWP water supplies in conjunction with contractors other local supplies; (6) resolve legal and institutional issues related to groundwater storage of SWP water; and (7) transfer 20,000 acres in Kern County known as the Kern Fan Element to local water agencies to facilitate development of a locally operated groundwater bank.

After execution of the Monterey Amendment by DWR and a majority of the SWP contractors (including CLWA), the environmental group Planning and Conservation League filed suit in December of 1995 seeking to invalidate the Monterey Amendment and its environmental impact report (EIR) prepared under the California Environmental Quality Act (CEQA). That lawsuit ultimately ended in a court-approved settlement agreement in 2003. The settlement provided, among other things, that DWR would prepare a new EIR for the Monterey Amendment, the previously approved and executed Monterey Amendments would remain in effect for 27 SWP contractors, and DWR would implement the Monterey Amendment in operating the SWP while it prepared the new EIR.

On February 1, 2010, DWR certified the new EIR. On May 4, 2010 DWR's Director certified the EIR and decided to continue implementing the Monterey Amendment. On June 3, 2010, two petitioner groups filed separate lawsuits seeking to invalidate the Monterey Amendment and the related transfer of the Kern Fan

[20] The 2010 Wanger ruling (Delta Smelt Consolidated Cases, No. 09-CV-00407-OWW-DLB; No. 09-CV-00480-OWW-GSA; No. 09-CV-00422-OWW-GSA; No. 09-CV-00631-OWW-DLB; and No. 09-CV-00892-OWW-DLB [E.D. Cal. 2010]).

Element based on alleged violation of CEQA.[21] The trial court held a bifurcated trial that culminated in a December 2012 finding that petitioners' reverse validation actions seeking to invalidate the Monterey Amendment and Kern Fan Element transfer were barred by the statute of limitations.

The trial court proceeded to hear briefing on the remaining CEQA claims and issued a ruling in January 2014 finding that DWR's new EIR for the Monterey Amendment complied with CEQA in all respects except for its analysis of the future impacts of the operations of the local Kern Water Bank that was developed by local water agencies on the Kern Fan Element land transferred as part of the Monterey Amendment. In October 2014, the trial court issued its ruling addressing the remedy under CEQA.

In terms of the remedy, the trial court found that the use and operation of the Kern Water Bank was severable from the remainder of the Monterey Amendment project; that severance will not prejudice complete and full compliance with CEQA; and that the remainder of the Monterey Amendment project is in compliance with CEQA. Further, the trial court found that the prior project approvals should remain in place pending preparation of an adequate EIR and that DWR (as the lead agency) and the Kern Water Bank Authority (as the responsible agency) must make a new determination whether to continue the use and operation of the Kern Water Bank, after compliance with CEQA. The trial court did not enjoin the use and operation of the Kern Water Bank pending CEQA compliance. Nonetheless, the trial court made clear that the scope of the additional environmental review should include all potential groundwater, water quality, and other impacts associated with the operation of the Kern Water Bank.

This remedy will not affect the amount of water CLWA annually receives from the SWP. This conclusion is based on several factors. First, the trial court ruling does not invalidate the Monterey Amendment project, nor limit or restrict its implementation in terms of SWP operations or water supply deliveries — all of which is consistent with the previous *PCL* litigation (*Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892), which found much more serious CEQA violations (*i.e.*, wrong lead agency), but did not invalidate the Monterey Amendment project, nor limit or restrict SWP operations or water supply deliveries. Also, the December 2012 court ruling barring petitioners' action to invalidate the Monterey Amendment project and Kern Fan Element property transfer through a reverse validation action confirms that neither DWR nor the SWP contractors will be required to set aside their approval of the Monterey Amendment project. The trial court's remedy is consistent with the prior December 2012 court ruling.

Moreover, the trial court's remedy does not enjoin the Kern Water Bank operations while the additional CEQA analysis is being performed; therefore, SWP operations and water deliveries to CLWA would be unaffected, and SWP operations are independent from operations of the separate Kern Water Bank facilities by the local entity that owns and operates it.

4.1.2.5 *Implications of Regulatory/Litigation Constraints*

The Biological Opinion litigation and the actions taken by the regulatory agencies have serious implications on imported water supplies throughout California.

There have been short-term water supply availability effects as a result of the litigation and regulatory agency activities. The 2008 USFWS and 2009 NMFS Biological Opinions also have resulted in an approximately 12 to 15 percent reduction in SWP exports from the Delta (in addition to reductions from prior regulatory actions) and the reduced pumping requirements are currently in effect. Although it would be speculative to quantify future changes resulting from the pending and possible future regulatory actions or policy decisions, it is reasonable to assume that Delta water exports and supplies could be further reduced.

[21] *Central Delta Water Agency et al. v. Department of Water Resources et al.* (Sacramento Superior Court Case No. 34-2010-80000561), *Rosedale-Rio Bravo Water Storage District et al. v. Department of Water Resources* (Sacramento Superior Court Case No. 34-2010-80000703).

4.1.2.6 *Executive/Legislative Response*

In 2009, the Legislature responded to actual and potential water supply constraints.

The Sacramento-San Joaquin Delta Reform Act established the framework for development of the Delta Plan and its coequal goals of enhancing water supply reliability while restoring the Delta ecosystem. The legislative action also included steps to increase water efficiency through aggressive water conservation measures applicable to both urban and agricultural water suppliers (California Water Conservation Act/SB X7-7). Further, the legislative package requires local agencies to monitor the elevation of their groundwater basins to help better manage the resource during normal water years and drought conditions. The legislation also requires the State Water Resources Control Board to develop new flow criteria for the Delta ecosystem to protect public trust resources. The State Board has adopted interim flow criteria for the Delta that call for significantly increased flows into and through the Delta, particularly during the winter and spring months. The criteria were transmitted to the Delta Stewardship Council for consideration in the Delta Plan. The plan includes setting a deadline for the State Board to update flow criteria which the State Board is legally required to do to ensure adequate water for the Delta ecosystem.

The Bay Delta Conservation Plan is also a part of California s overall water management portfolio. It is being developed as a 50-year habitat conservation plan with the goals of restoring the Delta ecosystem and securing California water supplies. The plan would secure California s water supply by building new water delivery infrastructure and operating the system to improve the ecological health of the Delta.

The plan is made up of specific actions, called conservation measures, to improve the Delta ecosystem. The plan includes 22 conservation measures aimed at improving water operations, protecting water supplies and water quality, and restoring the Delta ecosystem within a stable regulatory framework. As the Delta ecosystem improves in response to the implementation of the conservation measures, water operations would become more reliable, offering secure water supplies in California.

On October 31, 2013, at the direction of Governor Brown, the California Natural Resources Agency, California Environmental Protection Agency (EPA), and California Department of Food and Agriculture released a public review draft California Water Action Plan for how to manage the state s water supplies in response to several challenges including scarcity/drought, declining water quality, floods, supply disruptions, and the need to provide for native fish species and their habitat. The draft report sets forth a 5-year plan for improving water supplies to communities and farms, protecting wildlife species and habitat, and making the state s water delivery systems more resilient (California Natural Resources Agency et al. 2013).

4.2 Other Imported Supplies and Treatment

CLWA also receives non-SWP imported water through the terminus of the West Branch of the California Aqueduct at Castaic Lake. Water supplies (whether derived from local or imported water supplies) require treatment (filtration and disinfection) prior to distribution. CLWA operates two water treatment plants, the Earl Schmidt Filtration Plant located near Castaic Lake, and the Rio Vista Water Treatment Plant located in Saugus. CLWA produces water that meets drinking water standards set by the U.S. EPA and the California Department of Public Health.

In 2011, CLWA completed the expansion of the Rio Vista Treatment Plant from 30 mgd treatment capacity to 66 mgd (LSCE 2012). Eventually, its capacity is planned to be increased to 90 mgd as demands for treated water increase. The Earl Schmidt Plant operates at a treatment capacity of 56 mgd. The current combined capacity of the two treatment plants is 122 mgd (LSCE 2012).

Historically composed of only SWP Table A Amount, CLWA s imported water supplies now consist of a combination of SWP water and imported water acquired from Kern County. This diversity in supply helps

CLWA respond to dry year conditions through water banking programs where imported water could be stored or exchanged during wet years and withdrawn in dry years (CLWA 2011).

The following supplies are available to CLWA and the retail purveyors. (For a summary of the existing and planned water supplies available for the CLWA service area, please refer to the tables in Section 4.6.)

4.2.1 Buena Vista/Rosedale-Rio Bravo Water Acquisition Project

In early 2007, CLWA finalized a Water Acquisition Agreement with the Buena Vista Water Storage District (Buena Vista) and Rosedale-Rio Bravo in Kern County. Under this program, Buena Vista's high-flow Kern River entitlements (and other acquired waters that may become available) are captured and recharged within Rosedale-Rio Bravo's service area on an ongoing basis. CLWA receives 11,000 afy of these supplies (in all water year types) either through direct delivery of water to the California Aqueduct via the Cross Valley Canal or by exchange of Buena Vista's and Rosedale-Rio Bravo's SWP supplies. CLWA began taking delivery of this supply in 2007. All imported water is delivered through SWP facilities to Castaic Lake. Then, from Castaic Lake, the water is treated at either CLWA's Earl Schmidt Filtration Plant or Rio Vista Water Treatment Plant and delivered to the retail water purveyors through transmission lines owned and operated by CLWA (CLWA 2011).

4.2.2 Nickel Water

The Newhall Land and Farming Company has secured 1,607 af of water under contract with Nickel Family LLC in Kern County. The source is 100 percent reliable on a year-to-year basis and not subject to the annual fluctuations that can occur to the SWP during dry-year conditions. The Nickel water is part of a 10,000 af quantity of annual water supply that Nickel obtained from Kern County Water Agency (KCWA) in 2001 pursuant to an agreement between Nickel, KCWA, and Olcese Water District. Under that agreement, Nickel has the right to sell the 10,000 afy to third parties both within or outside Kern County. The water would be delivered through the KCWA and the SWP system. A point of delivery agreement between the CLWA and DWR would be required to transmit the water between the KCWA and CLWA service areas. CLWA added this supply to the 2010 UWMP updated water supply/demand tables to reflect current information (see Tables 4-15 through 4-17 in Section 4.6). The 2010 UWMP anticipated that this water supply will be available to the VWC.

4.2.3 Yuba Accord Agreement

As stated in the 2012 Santa Clarita Valley Water Report (June 2013), in 2008, CLWA entered into the Yuba Accord Agreement, which allows for the purchase of water from the Yuba County Water Agency through DWR to 21 SWP contractors (including CLWA) and the San Luis and Delta-Mendota Water Authority. Up to 850 af of non-SWP supply is available to CLWA in critically dry years. Under certain hydrologic conditions, additional water may be available to CLWA from this program. CLWA elected not to purchase any water from this source in 2013 (LSCE 2014).

4.2.4 Two-for-One Exchange Programs

In 2011, CLWA executed a two-for-one water exchange program with Rosedale-Rio Bravo where CLWA can recover 1 acre-foot of water for each 2 af delivered (less losses). In 2011, CLWA delivered 15,602 af to the program and in 2012 delivered another 3,969 af. After program losses, CLWA has 9,509 af of recoverable water. This program is at capacity (LSCE 2014). CLWA also opened a two-for-one water exchange program with the West Kern Water District in Kern County and delivered 5,000 af in 2011, resulting in a recoverable total of 2,500 af. No water was withdrawn from or contributed to the exchange programs in 2013(LSCE 2014). These programs were not in place at the time the 2010 UWMP was adopted; and, therefore, are not reflected in the analysis of available supplies in that document. They provide additional water that is available for use in the CLWA service area, however, and increase the overall reliability of CLWA's supplies.

As shown in Table 4-7, with the 35 percent Table A allocation and other imported water supplies, including 49,916 af of carryover from 2012, CLWA had a total available supply of 94,236 af in 2013. The largest amount was delivered to the purveyors (43,281 af), sold to west Kern County agricultural water districts (22,000 af) and sold to San Luis Water District (6,000 af), and Devil's Den (628 af), leaving 21,482 af of Table A Amount available for carryover to 2014 (LSCE 2014).

Table 4-7 CLWA Imported Water Supply and Disposition (af)

Supply		
Net 2012 SWP Carryover to 2013[1]		49,916
Buena Vista/Rosedale-Rio Bravo		11,000
Yuba Accord Water		0
2013 Article 21 Water		0
2013 Final SWP Table A Allocation[2]		33,320
Total 2012 Imported Water Supply		**94,236**
Disposition		
Purveyor Deliveries		43,281
CLWA SCWD	*20,059*	
Valencia Water Company	*18,249*	
Newhall County Water District	*4,488*	
Los Angeles County WWD 36	*485*	
Deliveries to Devil's Den		628
CLWA/DWR/Purveyor Metering[3]		845
Rosedale – Rio Bravo Water Banking and Exchange Program		0
Rosedale – Rio Bravo Water Two-for-One Exchange Program		0
West Kern Water District Two-for-One Exchange Program		0
West Kern County Agricultural Water Districts Sale[4]		22,000
San Luis Water District Sale[5]		6,000
2013 Table A Carryover to 2014[6]		21,482
Total 2013 Imported Water Disposition		**94,236**

[1] Total 2012 carryover available in 2013 was 49,916 af; of that amount 28,434 af was used by CLWA, based on final DWR delivery accounting. The difference is available for future use.
[2] Final 2013 allocation was 35% of CLWA's Table A Amount of 95,200 af.
[3] Reflects meter reading differences.
[4] Sale of 11,000 af of Buena Vista/Rosedale-Rio Bravo water and 7,177 af of SWP Table A, and 3,823 af of carryover water to West Kern County agricultural water districts.
[5] Sale of 11,000 af of Buena Vista/Rosedale-Rio Bravo water in the Rosedale-Rio Bravo Water Banking and Exchange
[6] Total 2013 Table A and previous years' carryover to 2014.
Source: 2013 Santa Clarita Valley Water Report (LSCE 2014)

4.3 Groundwater

4.3.1 Santa Clarita Valley Groundwater Resources

This section evaluates the groundwater resources of the Santa Clarita Valley basin area.

4.3.1.1 *Santa Clara River Valley East Subbasin — Basin No. 4-4.07*

The groundwater basin, identified in DWR's Bulletin 118 as the Santa Clara River Valley East Subbasin (Basin No. 4-4.07), is composed of two aquifer systems – the Alluvium (also referred to as the Alluvial aquifer) and Saugus Formation. The Alluvium generally underlies the Santa Clara River and its tributaries, and the Saugus Formation underlies practically the entire Upper Santa Clara River area (LSCE 2014).

The basin area encompasses about 654 square miles composed of flat valley land (about 6 percent of the total area) and hills and mountains (about 94 percent of the total area) (LSCE 2014). The Santa Clara River and its tributaries flow intermittently within the basin area. The principal tributaries in the Santa Clarita Valley are Castaic Creek, San Francisquito Creek, Bouquet Creek, and the South Fork of the Santa Clara River. In addition to tributary inflow, the Santa Clara River receives treated wastewater discharge from the Saugus and Valencia Water Reclamation Plants (WRPs), which are operated by the SCVSD (LSCE 2014).

Figure 4-2, Santa Clara River Valley East Subbasin, illustrates the mapped extent of the basin and its relationship to the CLWA service area and the two existing WRPs in the Valley. The mapped basin boundary approximately coincides with the outer extent of the Alluvium and Saugus Formation. Figure 4-3, Upper Santa Clara River Hydrologic Area, depicts the hydrologic area of the basin in relation to the Project.

Within an aquifer, the amount of groundwater in storage is the total volume of water that exists in underground storage at a particular time and that could become readily available for extraction by wells (Slade 2002). The Alluvium generally underlies the Santa Clara River and its tributary drainages to maximum depths of about 200 feet. The Alluvium and its tributary drainages have a total area of approximately 16,410 acres (or about 25.6 square miles) (Slade 1986).

Groundwater within the Alluvium occurs under unconfined (water table) conditions; therefore, the amount of groundwater in storage is constantly changing and is strongly influenced by local rainfall and recharge (highly variable factors in southern California). The amount of groundwater in storage within the Alluvium has varied considerably over the past approximate 60 to 70 years as the local climate has experienced periods of higher than average rainfall (wet years) and lower than average rainfall (dry years) (Slade 2002).

For example, in April 1945, at the end of a 10-11 year period of above-average rainfall, groundwater elevations were at their highest recorded levels, and the amount of groundwater in storage was calculated to be approximately 201,000 af. Conversely, in November 1965, at the end of a severe 21-year dry period, groundwater levels in the Alluvium were at their lowest recorded levels, and the amount of groundwater in storage in the Alluvium was calculated at approximately 107,000 af. In the fall of 1985, groundwater in storage was approximately 176,400 af (Slade 2002; Slade 1986, Table 8).

To update the Slade 1986 report, Slade re-calculated the amount of groundwater in storage within the Alluvium based on water level data for the spring 2000 (a period for which widespread water level data were available) (Slade 2002). Groundwater in storage within the Alluvium was calculated at about 161,000 af (Slade 2002, Table 4.4). The above data represents the best available information concerning the amount of groundwater in storage within the Alluvium (DWR 2006).

The Saugus Formation underlies a large portion of the Santa Clara River Valley area of Los Angeles County, to depths from approximately 1,500 feet to about 5,000 feet. The Saugus Formation's total surface area is approximately 37,390 acres (or about 58.42 square miles) (Slade 1988). The amount of groundwater in storage within the Saugus Formation is approximately 1,650,000 af (Slade 2002).

Groundwater in both the Alluvium and Saugus Formation is recharged from several sources. The Alluvium is recharged chiefly by infiltration of runoff waters in the Santa Clara River and its tributaries, with additional natural recharge from percolation of rainfall to the Valley floor and subsurface inflow.

Additional recharge is from percolation of excess irrigation water applied to urban landscaping and of reclaimed water discharged into the Santa Clara River from upstream water reclamation plants.

Recharge to the Saugus Formation is primarily from infiltration of rainfall on the exposed formation and percolation of water from the overlying Alluvium. Discharge from the aquifer system is through pumping for municipal supply and agricultural irrigation purposes and outflow to the Santa Clara River in the western portion of the basin (DWR 2006).

Prior to 1980, local groundwater pumped from the Alluvium and Saugus Formation was the sole source of water supply in the Santa Clarita Valley. Since 1980, local groundwater supplies have been supplemented with imported SWP water supplies, which were augmented in 2007 by CLWA's acquisition of additional imported water from the Buena Vista in Kern County and Rosedale-Rio Bravo Water Storage District. Since 2003, CLWA's imported water supplies have been augmented further by deliveries from CLWA's recycled water program (LSCE 2014).

4.3.1.2 *Groundwater Basin Yield*

The groundwater basin's yield is based on the concept that pumping can vary from year-to-year within operational ranges that are based on long-term historic pumping records and groundwater modeling data. This operational yield allows for increased groundwater use in dry periods and increased recharge during locally wet periods, thereby, collectively ensuring that the basin is adequately replenished through various wet/dry cycles (LSCE 2014).

The reports supporting the basin yield were completed by Richard C. Slade, a consulting engineer with expertise in groundwater hydrology. In 2002, Slade completed the *2001 Update Report* Hydrogeologic *Conditions in the Alluvial and Saugus Formation Aquifer Systems* (Slade 2002), which updated the analysis of the hydrogeologic conditions of the Alluvial and Saugus Formation aquifer systems from his earlier reports (Slade 1986 and 1988). The 2001 Update report included the following findings relative to groundwater supply:

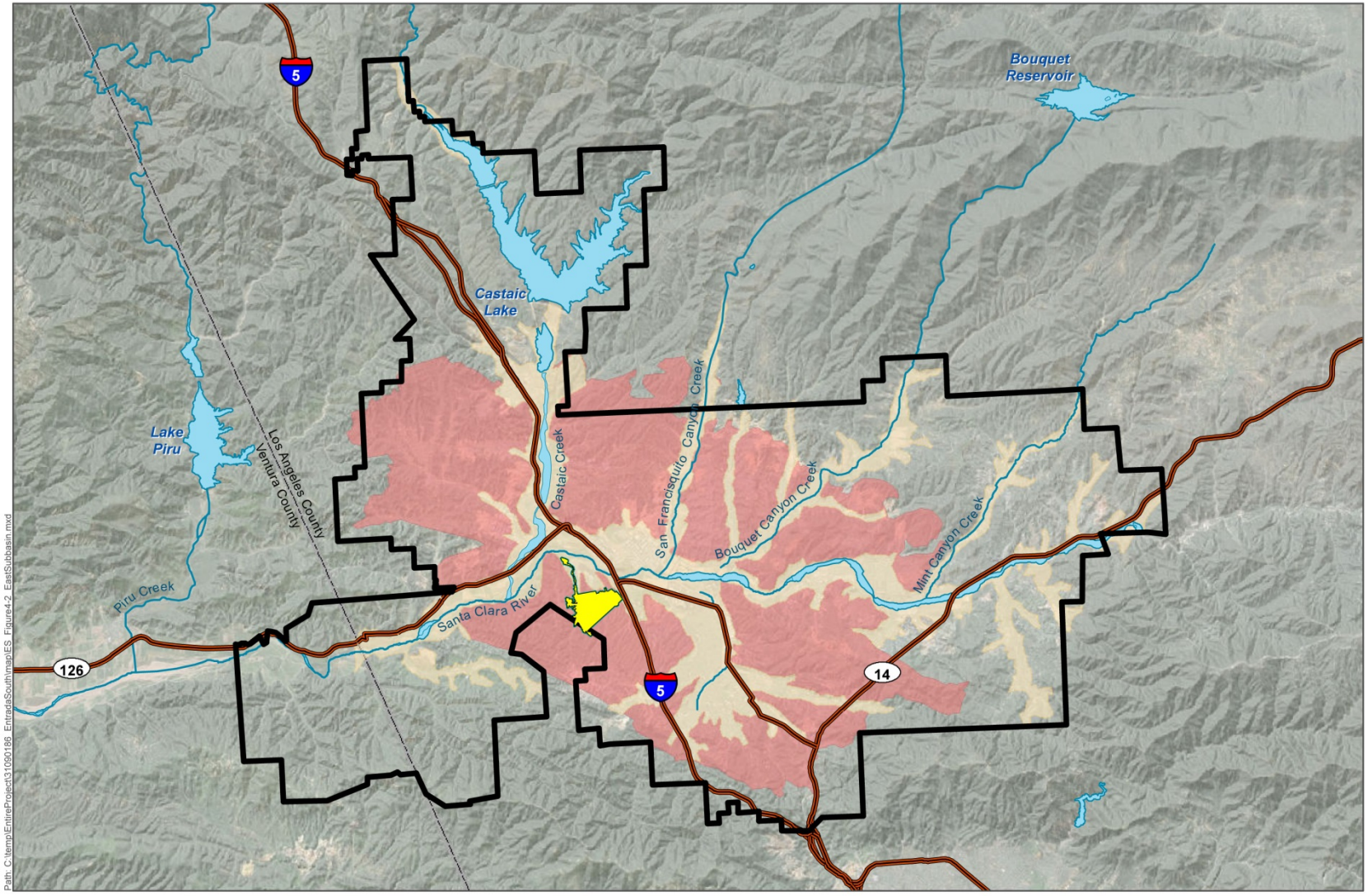
(a) analysis of historical groundwater levels and production indicates that there have been no conditions that would be illustrative of groundwater overdraft;

(b) the utilization of operational yield (as opposed to perennial yield) as a basis for managing groundwater production would be more applicable in this basin to reflect the fluctuating utilization of groundwater in conjunction with imported SWP water;

(c) the operational yield of the Alluvium would typically be 30,000 to 40,000 afy for wet and normal rainfall years, with an expected reduction into the range of 30,000 to 35,000 afy in dry years; and

(d) the operational yield of the Saugus Formation would typically be in the range of 7,500 to 15,000 afy on a long-term basis, with possible short-term increases during dry periods into a range of 15,000 to 25,000 afy, and to 35,000 afy if dry conditions continue.

CLWA and the four purveyors utilized the above data in completing the 2000 and 2005 versions of the Santa Clarita Valley UWMPs. Both UWMPs relied on the above data to formulate a cooperative "groundwater operating plan" for the basin, which is described in further detail below.


Bouquet Reservoir
Castaic Lake
Lake Piru
Los Angeles County
Ventura County
Castaic Creek
San Francisquito Canyon Creek
Bouquet Canyon Creek
Mint Canyon Creek
Piru Creek
Santa Clara River
5
126
14
Path: C:\temp\EntireProject\31090186_EntradaSouth\mapES_Figure4-2_EastSubbasin.mxd
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Miles
N
1 in = 3 miles
Date: 5/21/2014
Source: 2012 Santa Clarita Valley Water Report
Legend
Project Area
Castaic Lake Water Agency Service Area
Aluvium
Saugus Formation
Cardno ENTRIX
ENTRADA SOUTH
Figure 4-2
Santa Clara River Valley East
Groundwater Basin -- East Subbasin

Kern County
Ventura County
Kern County
Los Angeles County
Frazier Park
W Avenue D
70th St W
60th St W
Caswell
Pine Canyon Rd
Lake Hughes
Lake Hughes Rd
General Wm J Fox
Afld Airport
Lancaster
QUARTZ HILL
Palmdale Prod Flt Test
Instl Af Plt 42 Airport
Palmdale
Littlerock
Lockwood Valley Rd
Los Angeles County
Ventura County
San Francisquito Canyon Rd
Bouquet Canyon Rd
Sierra Hwy
Soledad Canyon Rd
Acton
Castaic
Santa Clarita
Valencia
Newhall
Pico
Piru
Ojai
Oak View
FILLMORE
SANTA PAULA
MOORPARK
Simi Valley
Somis
Camarillo
Oxnard Airport
CAMARILLO
Thousand Oaks
Oxnard
PORT HUENEME
Point Mugu Nas
El Camino Real
Newbury Park
Westlake Village
CALABASAS
AGOURA HILLS
Ventura Fwy
Pacific Coast Hwy
Malibu
Rivera
Topanga
Mulholland Hwy
Woodland Hills
Canoga Park
Tarzana
Encino
Sherman Oaks
North Hollywood
Van Nuys
Airport
Reseda
Winnetka
Northridge
North Hills
Chatsworth
Granada Hills
Pacoima
Sylmar
SAN FERNANDO
Foothill Blvd
Foothill Fwy
Sunland
Tujunga
Mission Hills
Panorama City
Sun Valley
Verdugo City
La Crescenta
Bob Hope
Airport
Montrose
ALTADENA
LA CANADA FLINTRIDGE
Burbank
Glendale
Pasadena
Studio City
Universal City
SOUTH PASADENA
ALHAMBRA
WEST HOLLYWOOD
Wilshire Blvd
Pacific Palisades
BEVERLY HILLS
BRENTWOOD
CULVER CITY
Los Angeles
SANTA MONICA
Santa Monica Muni Airport
Venice
Marina Del Rey
Playa del Rey
Los Angeles Intl Airport
LENNOX
EL SEGUNDO
Northrop Fld
HAWTHORNE
HUNTINGTON PARK
MAYWOOD
BELL
SOUTH GATE
BELL GARDENS
CUDAHY
LYNWOOD
COMPTON
Norwalk
PICO RIVERA
WHITTIER
SOUTH WHITTIER
SANTA FE SPRINGS
LA MIRADA
ROSEMEAD
MONTEREY PARK
SOUTH EL MONTE
MONTEBELLO
LA PUENTE
El Monte
ElMonte Airport
SAN MARINO
TEMPLE CITY
BALDWIN PARK
ARCADIA
MONROVIA
DUARTE
SIERRA MADRE
Mount Wilson
Angeles Crest Hwy
Path: C:\temp\EntireProject\31090186_EntradaSouth\map\Figure4-3_USCRHydrologicArea.mxd
0 2.5 5 10
Miles
N
1 in = 10 miles
Date: 4/30/2014
Source: USGS, National Hydrography Dataset
Legend
Upper Santa Clara River Hydrologic Area
Project Area
ENTRADA SOUTH
Figure 4-3
Upper Santa Clara River Hydrologic Area

4.3.1.3 *Groundwater Operating Plan*

The groundwater component of overall water supply in the Valley is derived from a groundwater operating plan developed by CLWA and the retail purveyors over the last 15 years to meet water demands (municipal, agricultural, and small domestic), while maintaining the basin in a sustainable condition, (i.e., no long-term depletion of groundwater or interrelated surface water). As stated, the groundwater operating plan is based on the concept that pumping can vary from year-to-year to allow increased groundwater use in dry periods and increased recharge during wet periods. This ensures that the groundwater basin is adequately replenished through various wet/dry cycles. As described in the Groundwater Management Plan, the operating yield concept has been quantified as ranges of annual pumping volumes to capture year-to-year pumping fluctuations in response to both hydrologic conditions and customer demand (CLWA 2011).

The groundwater operating plan is summarized below in Table 4-8, Groundwater Operating Plan for the Santa Clarita Valley. The plan addresses both the Alluvium and Saugus Formation.

Table 4-8 Groundwater Operating Plan for the Santa Clarita Valley

Aquifer	Groundwater Production (af)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

Source: 2009 Basin Yield Update (LSCE and GSI 2009), 2010 UWMP (CLWA 2011), 2012 Santa Clarita Valley Water Report (June 2013) (LSCE 2014)

The operating plan for the Alluvial aquifer involves pumping in a given year, based on local hydrologic conditions in the eastern Santa Clara River watershed. Pumping ranges between 30,000 and 40,000 afy during normal/average and above-normal rainfall years. However, due to hydrogeologic constraints in the eastern part of the basin, pumping is reduced to between 30,000 and 35,000 afy after the first dry year and the multiple locally-dry years thereafter (CLWA 2011; LSCE 2014).

The operating plan for the Saugus Formation involves pumping in a given year and is tied directly to the availability of other water supplies, particularly from the SWP. During normal/average year conditions within the SWP system, Saugus pumping ranges between 7,500 and 15,000 afy. Planned dry-year pumping ranges between 15,000 and 25,000 afy during a drought year and can increase to between 21,000 and 25,000 afy if SWP deliveries are reduced for two consecutive years and between 21,000 and 35,000 afy if SWP deliveries are reduced for three consecutive years. Such pumping is followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 afy, to further enhance the effectiveness of natural recharge processes that cause groundwater levels and storage volumes to recover after the higher pumping during dry years (CLWA 2011; LSCE 2014). For reference to the groundwater operating plan historical and projected groundwater pumping by retail water purveyor for 2002 through 2012, please refer to Table 4-9, Historical Groundwater Production by the Retail Water Purveyors, and Table 4-10, Projected Groundwater Production (Normal Year), below.

In 2013, the total groundwater amount pumped from the Alluvial aquifer was 36,900 af, and 9,000 af was pumped from the Saugus Formation (LSCE 2014).

Table 4-9 Historical Groundwater Production by the Retail Water Purveyors

Basin Name	Groundwater Pumped (af)[1]										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Santa Clara River Valley East Subbasin											
CLWA Santa Clarita Water Division											
- Alluvium	9,513	6,424	7,146	12,408	13,156	10,686	11,878	10,077	10,607	10,195	10,192
- Saugus Formation	0	0	0	0	0	0	0	0	0	0	0
LA County Waterworks District □36											
- Alluvium	0	0	380	343	0	0	0	0	0	0	0
- Saugus Formation	0	0	0	0	0	0	0	0	0	0	794
Newhall County Water District											
- Alluvium	981	1,266	1,582	1,389	2,149	1,806	1,717	1,860	2,323	3,216	2,631
- Saugus Formation	3,395	2,513	3,739	3,435	3,423	3,691	4,195	3,868	4,173	4,389	4,081
Valencia Water Company											
- Alluvium	11,603	11,707	9,862	12,228	11,884	13,140	14,324	12,459	13,054	12,775	12,770
- Saugus Formation	965	1,068	1,962	2,513	2,449	2,367	1,770	2,836	2,995	265	302
Total	***26,457***	***22,978***	***24,671***	***32,316***	***33,061***	***31,690***	***33,884***	***31,100***	***33,152***	***30,840***	***30,770***
- Alluvium	22,097	19,397	18,970	26,368	27,189	25,632	27,919	24,396	25,984	26,186	25,593
- Saugus Formation	4,360	3,581	5,701	5,948	5,872	6,058	5,965	6,704	7,168	4,654	5,177
□ of Total Municipal Water Supply	**39□**	**34□**	**34□**	**46□**	**45□**	**35□**	**45□**	**44□**	**52□**	**48□**	**44□**

Notes:
[1] Pumping for municipal and industrial uses only. Does not include pumping for agricultural and miscellaneous uses.

Source: 2012 Santa Clarita Valley Water Report (June 2013) (LSCE 2013)

Table 4-10 Projected Groundwater Production (Normal Year)

Basin Name	Range of Groundwater Pumping (af)[1,2,3]							
	2015	2020	2025	2030	2035	2040	2045	2050
Santa Clara River Valley East Subbasin								
LACWWD 36								
Alluvium	0	0	0	0	0	0	0	0
Saugus Formation	500	500	500	500	500	500	500	500
NCWD								
Alluvium	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
Saugus Formation	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400
SCWD								
Alluvium	10,500	10,500	10,500	11,500	11,500	11,500	11,500	11,500
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
VWC								
Alluvium	11,675	12,675	13,675	14,675	15,675	16,675	17,675	18,675
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
Total Purveyor								
Alluvium	**24,000**	**25,000**	**26,000**	**28,000**	**29,000**	**30,000**	**31,000**	**32,000**
Saugus Formation	**10,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**
Agricultural and Other[4]								
Alluvium	14,500	13,500	12,500	10,100	9,100	8,100	7,100	6,600
Saugus Formation	900	900	900	900	900	900	900	900
Total Basin								
Alluvium	**38,500**	**38,500**	**38,500**	**38,100**	**38,100**	**38,100**	**38,100**	**38,600**
Saugus Formation	**11,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**

Notes:
[1] The range of groundwater production capability for each purveyor varies based on a number of factors, including each purveyor's capacity to produce groundwater, the location of its wells within the Alluvium and Saugus Formation, local hydrology, availability of imported water supplies and water demands.

[2] To ensure sustainability, the purveyors have committed that the annual use of groundwater pumped collectively in any given year will not exceed the purveyors' operating plan as described in the 2005 Basin Yield Report and the 2009 Basin Yield Update, and reported annually in the Santa Clarita Valley Water Reports. As noted in the discussion of the purveyors' operating plan for groundwater in Table 3-6 of the 2005 UWMP, the "normal" year quantities of groundwater pumped from the Alluvium and Saugus Formation are 30,000 to 40,000 afy and 7,500 to 15,000 afy, respectively.

[3] The distribution of pumping does not represent a formal allocation of water resources among the retail purveyors.

[4] Agricultural and other small private well pumping, including Newhall Land, Robinson Ranch Golf Course, Wayside Honor Rancho, Valencia Golf Course and proposed Palmer Golf Course.

Source: 2010 UWMP (CLWA 2011)

4.3.1.4 *Update to Groundwater Basin Yield*

In 2004, CLWA and the purveyors assisted in developing a numerical groundwater flow model for use in analyzing the response of the groundwater basin to long-term operation at the operational yields used in the 2000 UWMP. That groundwater flow model was used in 2005 to analyze the sustainability of groundwater supplies in both the Alluvium and the Saugus Formation, utilizing a long-term (78 year) hydrologic period. The model used this period to examine groundwater basin response to variations in groundwater pumping. The pumping variations used in the modeling were based on the CLWA/purveyor groundwater operating plan.

In terms of this plan, CLWA and the purveyors acknowledge that the groundwater basin in the Valley is unadjudicated, meaning that none of the purveyors have adjudicated water rights that dictate their water supply. Absent cooperation and coordination between CLWA and the purveyors, a purveyor's available groundwater supply would be limited only by the purveyor's ability to access the groundwater supplies. Therefore, to ensure sustainability, CLWA and the purveyors have committed that the annual use of groundwater pumped collectively in any given year will not exceed the CLWA/purveyor groundwater operating plan, as described above.

Utilizing the pumping ranges reflected in the groundwater operating plan, the model projections of groundwater levels, groundwater storage, and surface water flows show the basin to respond in a long-term sustainable manner, with no chronic depletion of groundwater levels, storage, or stream flows.

The analysis of groundwater sustainability was summarized in the 2005 Basin Yield Report (CH2M Hill and LSCE 2005), which included the following findings:

(a) the groundwater basin historically has been, and continues to be, in good operating condition and not in a state of overdraft, based on the best available data.

(b) the CLWA/purveyor groundwater operating plan is sustainable over varying hydrologic conditions, because it is feasible to intermittently exceed a long-term average yield for one or more years without creating long-term adverse impacts to the groundwater aquifer system or the Santa Clara River.

(c) The CLWA/purveyor groundwater operating plan for the Alluvium and the Saugus Formation can be used for long-term water supply purposes. In particular, although increased pumping from the Saugus Formation during dry periods can be expected to cause short-term declines in groundwater levels, it is not projected to cause permanent declines in groundwater discharges or stream flow and that Saugus groundwater levels can be expected to recover to pre-drought conditions when pumping is reduced in subsequent wet to normal years.

(d) The strategy around which the CLWA/purveyor groundwater operating plan was designed is viable on a long-term basis (i.e., maximize the use of the Alluvial aquifer and imported water during years of average or above-average availability of these supplies, and limit use of the Saugus Formation during these periods, then temporarily increase Saugus pumping during years when SWP supplies are significantly reduced because of dry-year conditions).

(e) the historical observations of basin conditions and the model simulations together support the historical and ongoing confidence that groundwater can continue to be a sustainable source of water supply under the CLWA/purveyor groundwater operating plan.

In April 2009, the purveyors in Santa Clarita Valley determined that an updated analysis was needed to further assess groundwater development potential and possible augmentation of the CLWA/purveyor groundwater operating plan, partly in preparation for the 2010 UWMP, and partly in response to uncertainties associated with future SWP delivery reliability (LSCE 2013). As a result, the *Analysis of Groundwater Supplies and Groundwater Basin Yield* (2009 Basin Yield Update) was completed (LSCE and GSI 2009).

The primary objective of the 2009 Basin Yield Update was to evaluate the planned utilization of groundwater by the Santa Clarita Valley purveyors, while considering potential impacts on traditional supplemental water supplies from the SWP, and recognizing ongoing pumping by others for agricultural and other private water supply. This objective also included the sustainability of the groundwater resources and the physical ability to extract groundwater at desired rates.

Another objective of the 2009 Basin Yield Update was to investigate and describe potential impacts of expected climate change on the groundwater basin and its yield.

The 2009 Basin Yield Update analyzed, with the numerical groundwater flow model, two groundwater operating plans: (1) a 2008 Operating Plan to reflect currently envisioned pumping rates and distribution throughout the Valley, including fluctuations through wet/normal and dry years, to achieve a desired amount of water supply that, in combination with anticipated supplemental water supplies, can meet existing and projected water demands in the Valley; and (2) potential Operating Plan that envisions potentially increased utilization of groundwater during both wet/normal and dry years (LSCE and GSI 2009).

The 2009 Basin Yield Update determined that the 2008 Operating Plan will not cause detrimental short- or long-term effects to the groundwater and surface water resources in the Valley; and, therefore, is sustainable. Consistent with actual operating experience and empirical observations of historical basin response to groundwater pumping, the 2008 Operating Plan can be expected to have local difficulty in achieving the amount of Alluvial pumping called for in the eastern end of the basin during locally dry periods. This condition would be particularly evident if several decades of predominantly below-normal rainfall years were to occur in the future such as occurred during much of the 5 decades from the mid-1920s through the mid-1970s. In other words, while the basin as a whole can sustain the pumping encompassed in the 2008 Operating Plan, local conditions in the Alluvium in the eastern end of the basin can be expected to repeat historical groundwater level declines during dry periods, necessitating a reduction in desired Alluvial aquifer pumping due to decreased well yield and associated actual pumping capacity. The modeling analysis also indicated that reductions in pumping from the Alluvial aquifer can be made up by redistributing pumping in an equivalent amount in other parts of the basin without disrupting basin-wide sustainability or local pumping capacity. (For the Saugus Formation, the modeling analysis indicates that this aquifer can sustain the pumping that is encompassed in the 2008 Operating Plan.)

Model simulations were conducted to validate Alluvial aquifer pumping redistribution assumptions. Model simulations of the 2008 Operating Plan, with pumping redistribution, indicates that westerly redistribution of 1,600 afy of Alluvial pumping from the eastern end of the basin would help, but not eliminate, the lack of achievability. The model simulation also showed that the residual unachievable pumping in the east end of the basin, about 4,500 afy, could be redistributed to other areas of the basin with minimal impact on groundwater levels. In this case, total Alluvial pumping in the basin could remain near the upper end of the 2008 Operating Plan range of 30,000 to 35,000 afy. Conversely, absent any additional efforts to redistribute pumping, the total Alluvial pumping capacity during extended dry periods would likely fall toward the lower end of the 2008 Operating Plan range (toward 30,000 afy) (LSCE and GSI 2009).

Alluvium

Adequacy of Supply. As stated in the adopted UWMP, the three retail water purveyors with Alluvial wells and pumps used for municipal water supply (NCWD, SCWD, and VWC) have a combined pumping capacity from active wells of nearly 42,000 gallons per minute (gpm), which translates into a current full-time Alluvial source capacity of approximately 67,000 afy. Alluvial pumping capacity from all the active municipal supply wells is summarized in Table 4-11, Active Municipal Groundwater Source Capacity–Alluvial Aquifer Wells. The locations of the various municipal Alluvial wells throughout the basin are illustrated in Figure 4-4, Locations of the Municipal Alluvial Wells Throughout the Basin**.**

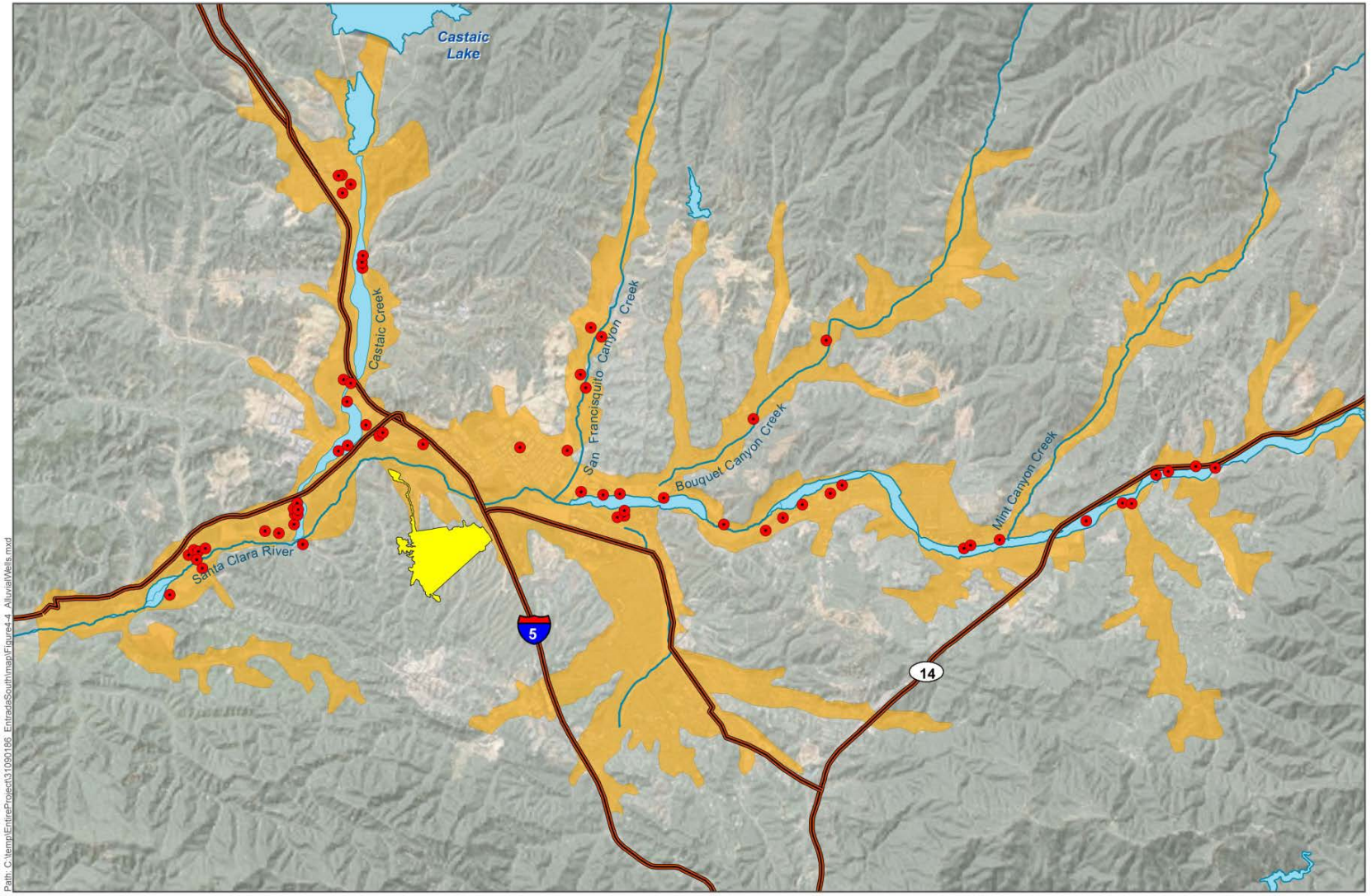
In terms of adequacy and availability, the combined active Alluvial groundwater source capacity of municipal wells, approximately 67,000 afy, is more than sufficient to meet the current and potential future municipal, or urban, component of groundwater supply from the Alluvium, which in the near term is about 24,000 to 26,000 afy of the total planned Alluvial pumping of 30,000 to 40,000 afy. The higher individual and cumulative pumping capacities are primarily for operational reasons (i.e., to meet daily and other fluctuations average day to maximum day and peak hour system demands). As noted above, the balance of Alluvial pumping in the operating plan is for agricultural and other non-municipal pumping, including small private wells (CLWA 2011).

Table 4-11 Active Municipal Groundwater Source Capacity–Alluvial Aquifer Wells

Well		Pump Capacity (gpm)	Max Annual Capacity (af)	Normal Year Production[1] (af)	Dry Year Production[1] (af)
NCWD					
	Castaic 1	650	1,040	350	250
	Castaic 2	450	720	100	100
	Castaic 4	270	430	100	0
	Castaic 7	1,450	2,330	300	200
	Pinetree 1	300	480	150	0
	Pinetree 3	550	880	350	300
	Pinetree 4	400	640	300	200
	Pinetree 5	550	880	300	200
	NCWD Subtotal	***4,620***	***7,400***	***1,950***	***1,250***
SCWD					
	Clark	600	960	700	700
	Guida	1,000	1,610	1,300	1,200
	Honby	950	1,530	1,000	700
	Lost Canyon 2	850	1,370	300	0
	Lost Canyon 2A	825	1,330	300	0
	Mitchell 5A	950	1,530	500	200
	Mitchell 5B	700	1,120	800	300
	N. Oaks Central	1,275	2,050	850	700
	N. Oaks East	950	1,530	800	700
	N. Oaks West	1,300	2,290	800	700
	Sand Canyon	1,050	1,690	200	0
	Santa Clara	1,500	2,420	1,200	1,200
	Sierra	1,500	2,420	1,100	700
	Valley Center	1,200	1,930	1,200	1,200
	SCWD Subtotal	***14,650***	***23,580***	***11,050***	***8,300***
VWC					
	Well D	1,050	1,690	880	880
	Well E-15	1,400	2,250	800	800
	Well N	1,250	2,010	650	650
	Well N7	2,500	4,030	1,160	1,160
	Well N8	2,500	4,030	1,160	1,160
	Well Q2	1,200	1,930	1,100	1,100
	Well S6	2,000	3,220	1,000	1,000
	Well S7	2,000	3,220	500	500
	Well S8	2,000	3,220	500	500
	Well T7	1,200	1,930	750	750
	Well U4	1,000	1,610	800	800
	Well U6	1,250	2,010	800	800
	Well W9	800	1,290	1,000	1,000
	Well W10	1,500	2,420	800	800
	Well W11	1,000	1,610	950	950
	VWC Subtotal	***22,650***	***36,470***	***12,850***	***12,850***
Total Purveyors		**41,920**	**67,450**	**25,850**	**22,400**

Note:
[1] Production amounts simulated in the updated Basin Yield analysis (LSCE & GSI 2009).

Source: 2010 UWMP (CLWA 2011)


Castaic Lake
Castaic Creek
San Francisquito Canyon Creek
Bouquet Canyon Creek
Mint Canyon Creek
Santa Clara River
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Date: 4/29/2014
Source: 2012 Santa Clarita Valley Water Report
Legend
Alluvial Well
Project Area
Alluvium
ENTRADA SOUTH
Figure 4-4
Alluvial Well Locations

Sustainability. Depending on the period of available data, the history of groundwater levels in the Alluvium shows the same general picture: recent (last 30 years) groundwater levels have exhibited historic highs; in some locations, intermittent dry-period declines occur, resulting from use of some groundwater from storage, followed by wet-period recoveries (and associated refilling of storage space). On a long-term basis, whether over the last 30 years since importation of supplemental SWP water, or over the last 40 to 50 years (since the 1950s to 1960s), the Alluvium shows no chronic trend toward decreasing water levels and storage, and thus shows no symptoms of water level-related overdraft. Consequently, pumping from the Alluvium has been and continues to be sustainable, and well within the operational yield of that aquifer on a long-term average basis (LSCE 2014).

Saugus Formation

Adequacy of Supply. The three retail water purveyors with Saugus wells (NCWD, SCWD, and VWC) have a combined pumping capacity from active wells of nearly 17,000 gpm, which translates into a full-time Saugus source capacity of about 27,000 afy. Saugus pumping capacity from all the active municipal supply wells is summarized in Table 4-12. Municipal Groundwater Source Capacity–Saugus Formation Wells, below; the locations of the various active municipal Saugus wells are illustrated on Figure 4-5, Location of the Municipal Saugus Wells Throughout the Basin, below. These capacities include two Saugus wells contaminated by perchlorate (Saugus 1 and 2), which were recently returned to service with treatment facilities for use of the treated water for municipal supply under permit from the State Department of Public Health. The capacities also reflect the most recent replacement well, VWC's Well 207. Excluded from these capacities is VWC Well 201, which was affected by the detection of perchlorate in 2011. This well represents a total of 2,400 gpm of pumping capacity (for a dry-year production capacity of 3,777 afy). VWC has removed Well 201 from service (CLWA 2011), and continues to explore options to replace the capacity from Well 201.

In terms of adequacy and availability, the combined active Saugus groundwater source capacity of municipal wells of 27,000 afy is more than sufficient to meet the planned use of Saugus groundwater in normal years of 7,500 to 15,000 afy. This currently active capacity is more than sufficient to meet water demands, in combination with other sources.

In order to supplement near term dry-year supplies, VWC Well 201 could readily be brought back into service by utilizing treatment technologies used in the Santa Clarita Valley. In October 2005, VWC Well Q2 was restored to service, 6 months after perchlorate was detected in the well (in April 2005). In addition, in 2005 no third-party funding initially was available to pay for the cost of putting the well back into service; VWC negotiated a separate agreement with the Whittaker-Bermite property owners to pay for the cost. However, in May 2007, the perchlorate litigation settlement agreement was executed, which established a "Rapid Response Fund" to treat additional wells that could be become impacted by perchlorate.

When the capacity of the VWC Well 201 is restored or replaced, the Saugus Formation groundwater source capacity of municipal wells would be increased to 31,000 afy. To accommodate longer-term dry-year needs, additional Saugus wells are planned by 2020 and expected to have a combined capacity of 10,000 afy (CLWA 2011).

Sustainability. The overall groundwater operating plan (Table 4-8) and specific distribution of Saugus pumping (Table 4-12) were found to produce sustainable Saugus groundwater conditions based on the following: (1) long-term stability of groundwater levels, with no sustained declines; (2) groundwater levels slightly below historic Saugus levels, in response to greater long-term utilization of the Saugus, and (3) maintenance of sufficiently high Saugus groundwater levels to ensure achievement of planned individual pumping capacities (Table 4-12). Thus, the groundwater operating plan for the Saugus, with fairly low pumping in wet/normal years and increased pumping through dry periods, reflects sustainable groundwater supply rates (CLWA 2011).

Table 4-12 Municipal Groundwater Source Capacity – Saugus Formation Wells

Well		Pump Capacity (gpm)	Max. Annual Capacity (af)	Normal Year Production[1] (af)	Dry Year Production[1] (af)
NCWD					
	12	2,400	3,870	1,765	2,494
	13	2,250	3,630	1,765	2,494
	NCWD Subtotal	*4,650*	7,500	3,530	4,988
VWC					
	159	500	800	50	50
	160	2,000	3,220	500	830
	205	2,700	4,350	1,211	4,038
	206	2,500	4,030	1,175	3,500
	207	2,500	4,030	1,175	3,500
	VWC Subtotal	10,200	16,430	4,111	11,918
SCWD					
	Saugus 1	1,100	1,770	1,772	1,772
	Saugus 2	1,100	1,770	1,772	1,772
	SCWD Subtotal	2,200	3,540	3,544	3,544
	Total Purveyors	**17,050**	**27,470**	**11,185**	**20,450**

Note:

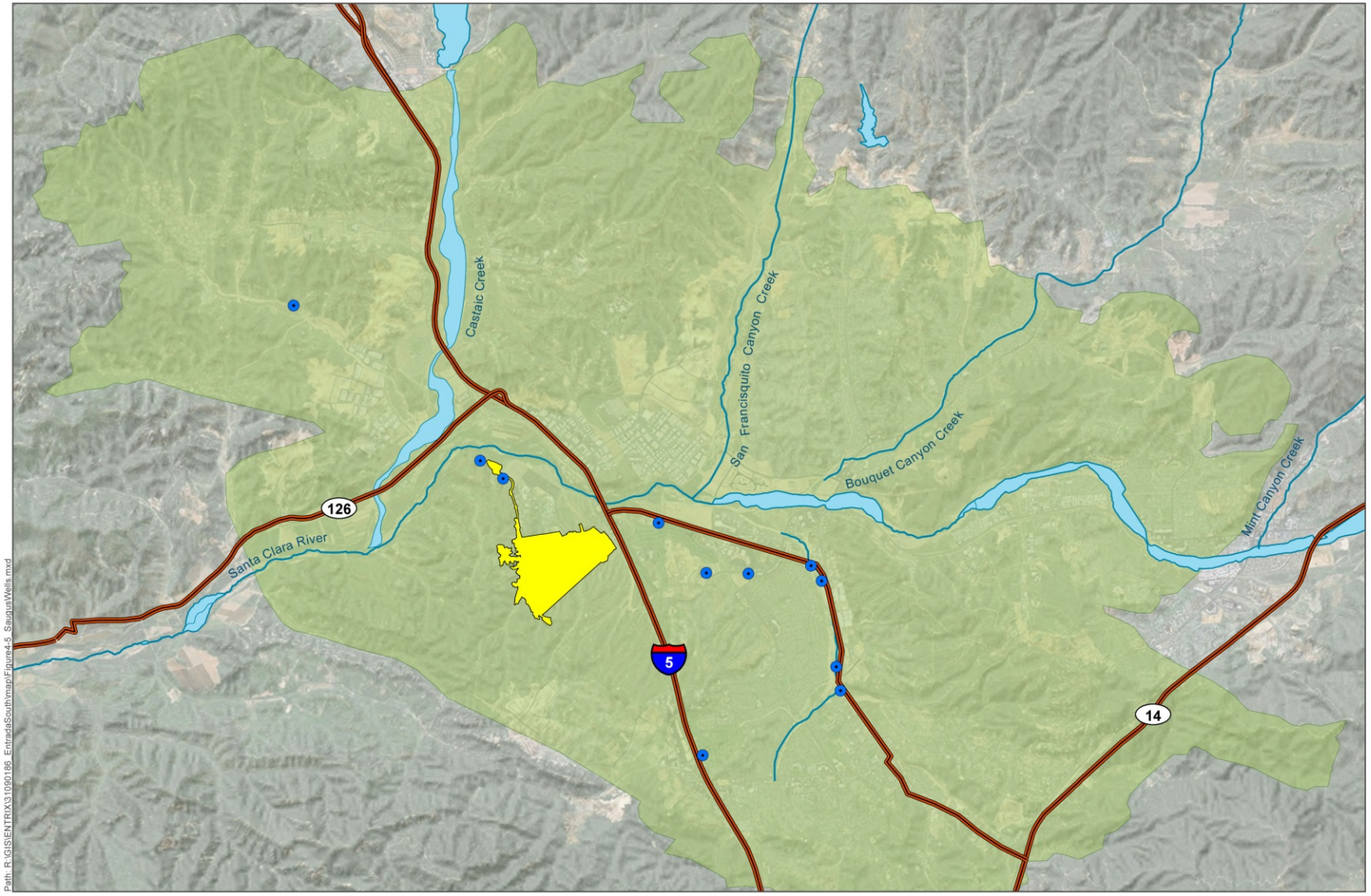
Production amounts simulated in the Basin Yield Update (LSCE & GSI 2009).

Source: 2010 UWMP (CLWA 2011)

4.3.2 Groundwater Banking Programs

As stated in the 2010 UWMP, with recent developments in conjunctive use and groundwater banking, significant opportunities exist to improve water supply reliability for CLWA (CLWA 2011). Conjunctive use is the coordinated operation of multiple water supplies to achieve improved supply reliability. Most conjunctive use concepts are based on storing surface supplies in groundwater basins in times of surplus for withdrawal and use during dry periods when surface water supplies would likely be reduced.

For the Santa Clarita Valley, groundwater banking programs involve storing available SWP and other imported water supplies during wet years in groundwater basins. Water is stored either directly by surface spreading or injection, or indirectly by supplying surface water to farmers for their use in lieu of their intended groundwater pumping. During water shortages, the stored water is pumped out and conveyed through the California Aqueduct to CLWA as the banking partner, or used by the farmers in exchange for their surface water allocations, which are delivered to CLWA as the banking partner through the California Aqueduct.


Castaic Creek
San Francisquito Canyon Creek
Bouquet Canyon Creek
Mint Canyon Creek
Santa Clara River
126
5
14
Path: R:\GIS\ENTRIX\31090186_EntradaSouth\map\Figure4-5_SaugusWells.mxd
0 0.5 1 2
Miles
N
1 in = 1 mile
Date: 5/1/2014
Source: 2012 Santa Clarita Valley Water Report
Legend
Saugus Well
Project Area
Saugus Formation
ENTRADA SOUTH
Figure 4-5
Saugus Well Locations

CLWA has entered into four groundwater banking and water exchange programs with, in aggregate, more than 150,000 af of recoverable water outside the local groundwater basin. The first component of CLWA's groundwater banking program is the result of two agreements between CLWA and Semitropic Water Storage District whereby, over the terms of the two agreements, CLWA can withdraw up to 45,920 af of SWP Table A water that it stored in Semitropic to meet Santa Clarita Valley demands when needed in dry years (45,920 af is the net recoverable balance after originally banking 24,000 af in 2002 and 32,522 af in 2003, and withdrawing 4,950 af in 2009 for delivery in 2009 and 2010). In April 2011, Semitropic and CLWA extended the original agreements by 10 years to 2022/2024 (LSCE 2014).

The second component of CLWA's groundwater banking program is with Rosedale-Rio Bravo in Kern County. This program, the Rosedale-Rio Bravo Water Storage District Water Banking and Exchange Program, has a recoverable total of 100,000 af in storage (LSCE 2014).

The third and fourth components of CLWA's groundwater program are the two-for-one banking plans that CLWA initiated with Rosedale-Rio Bravo and West Kern Water District in 2011 that now have a total of 12,009 af of recoverable water (LSCE 2014).

These groundwater banking programs allow CLWA to firm up the imported water component in the Valley by storing surplus SWP and other water in wet years in groundwater basins outside the Santa Clarita Valley. This allows recovery and importation of that water as needed in dry years to maintain a greater overall amount of imported water to be used conjunctively with local groundwater, further supporting the sustainable use of local groundwater at the rates in the groundwater operating plan (LSCE 2014).

4.3.3 Groundwater Recharge Assessment Methodology

Geosyntec Consultants utilized an assessment methodology to account for aquifer system recharge from the following three sources: (a) recharge from precipitation occurring over pervious Project areas; (b) recharge occurring below infiltrating low impact development (LID) best management practices (BMPs); and (c) recharge derived from irrigation of agricultural or landscaped areas of the watershed.

The change in groundwater recharge was estimated using the Project's water quality model output in combination with the recharge estimate methods described below. The existing condition consists of non-irrigated pervious areas and irrigated agricultural areas; and the Project condition consists of impervious areas, non-irrigated pervious areas, LID BMP recharge areas, and irrigated landscaped areas. The total Project recharge volume was estimated for the existing and Project conditions by adding recharge from the above three sources. The difference between these volumes was calculated as equivalent to the change in the amount of groundwater recharge due to the Project.

4.3.3.1 *Precipitation-Based Recharge in Pervious Watershed Areas*

Precipitation-based recharge occurs when the vadose zone (an aeration area above the water table) is saturated during rainfall and the infiltrated rainfall is recharged to available subsurface groundwater aquifers.

The proportion of average annual losses that is recharged over the long term is estimated to be 25 percent. This recharge estimate is derived from the calibration of the continuous groundwater flow model and the calibration update and accounts for the local climate patterns of the Santa Clara River Valley. This estimate is intended to represent a long-term average value, accounting for the combined effect of dry years and wet years. The actual proportion of groundwater recharge could vary from zero in very dry years to much greater than 25 percent in wet years.

Water quality model runoff results for pervious areas were isolated from runoff occurring from impervious areas to obtain the amount of losses associated with pervious areas. The 25 percent recharge estimate was applied to the average annual total losses to obtain the average annual volume recharged from the pervious areas for the existing condition as well as the proposed condition. The proposed condition model

used to estimate precipitation-based recharge does not incorporate BMPs in order to allow for calculation of recharge from pervious areas only.

4.3.3.2 *Recharge in LID BMPs*

Recharge under infiltrating LID BMPs was calculated similarly to precipitation-based recharge. To isolate the LID BMP-attributed recharge, the difference between the water quality model average annual runoff output for the proposed condition without BMPs and with BMPs was used as an estimate of average annual losses that occur in the LID BMPs. The proportion of average annual losses that is recharged was estimated as 100 percent of this value. The deep percolation was assumed to be equal to the total losses because, unlike an undeveloped parcel of land, the ponded water present in the LID water quality facility during and after a storm provides a driving head such that water migrating past the root zone is likely to continue migrating deeper. The Project water quality model was run with and without BMPs to obtain the estimate of recharge below the proposed Project BMPs.

4.3.3.3 *Irrigation-Derived Recharge*

Irrigation-derived recharge occurs when landscaped areas become saturated and irrigation water is not retained in the vadose zone. This is related to the irrigation efficiency. Irrigation efficiency can be optimized by accounting for landscape palette evapotranspirative properties as well as climate information; however, no irrigation system can account for these factors perfectly. Project landscaped areas are expected to be irrigated very efficiently, but a small amount of irrigation-derived recharge is likely to occur. Existing irrigation efficiency over agricultural areas has been analyzed and found to be less efficient than proposed landscape irrigation.

Irrigation-derived recharge will be estimated by area-weighting land-use based irrigation recharge estimates for specific land use areas in the Project watershed, for the existing and proposed Project conditions. Table 4-13, Irrigation-Derived Recharge Estimates for Project Land Uses, summarizes land use-based values used to develop the area-weighted estimate of total recharge.

Table 4-13 Irrigation-Derived Recharge Estimates for Project Land Uses

Land Use	Recharge	
	inches/year	af/acre/yr
Commercial	1	.083
Education	1	.083
Multi-Family Residential	2.2	.183
Single-Family Residential	2.2	.183
Parks (landscaped)	2.2	.183
Open Space (landscaped)	2.2	.183
Open Space (not landscaped)	0	0
Transportation (roads)	0	0
Irrigated Agriculture1	28.8	2.4

Notes:

[1] Applies to existing conditions only. The analysis in those references indicated that approximately 37 percent of the irrigation water applied to Newhall Ranch areas becomes groundwater recharge; the total recharge estimate per year is based on recent average application rates of irrigation water (6.5 acre-ft/acre/year).

Source: Geosyntec 2014

4.4 Recycled Water

As shown in Tables 4-14 through 4-17 in Section 4.6, existing local supplies have been augmented by the initiation of recycled water deliveries from CLWA's recycled water program since 2003. CLWA currently has a contract with the SCVSD for 1,700 afy of recycled water. Recycled water is available from two water reclamation plants (WRPs) operated by SCVSD. This supply is available in an average/normal year, a single-dry year, and in each year of a multiple-dry year period. Recycled water enhances reliability by providing an additional source of supply and allows for more efficient utilization of CLWA's groundwater and imported water supplies.

4.4.1 Recycled Water Sources

Recycled water is available from the Saugus WRP and Valencia WRP, which are operated by the SCVSD within the CLWA service area. The Saugus WRP has a current treatment capacity of 6.5 mgd (7,280 afy), and no future expansion is possible due to space limitations. The Valencia WRP has a current capacity of 21.6 mgd (24,192 afy). To accommodate long-term growth, SCVSD has planned a 6 mgd expansion of the Valencia plant as reflected in SCVSD's 2015 Santa Clarita Valley Joint Sewerage System Facilities Plan and certified EIR (SCVSD 1998). With this expansion, the capacity of the Valencia WRP would be increased to 27.6 mgd (30,912 afy), which SCVSD expects to be needed by 2035. Thus, the total planned treatment capacity for both existing WRPs is 34.1 mgd (38,197 afy). Based on the Recycled Water Master Plan, reuse of the tertiary treated water from these two plants is anticipated to be 15.5 mgd (17,400 afy) by year 2030. Since the planning horizon for the 2010 UWMP extends to 2050, supplies in the Recycled Plan projected to be available by year 2030 have been assumed to be available through 2050 and beyond (CLWA 2011).

4.4.2 Recycled Water Planning and Use

In 2002, CLWA completed an updated Draft Recycled Water Master Plan (LSCE 2013), and CLWA and the retail purveyors prepared a Program Environmental Impact Report (PEIR) covering the various options for a recycled water system as outlined in the Master Plan, which the CLWA Board certified the PEIR in March 2007.

CLWA has completed a portion of its Recycled Water Recycled Master Plan, and this initial phase is planned to ultimately deliver up to 1,700 afy of recycled water. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips. In 2011, recycled water deliveries were 373 af, generally consistent with recycled water deliveries that have ranged between about 300 and nearly 500 afy over the past 9 years. In 2013, approximately 400 af of recycled water was used for irrigation purposes (LSCE 2014). The full buildout of the first phase was deferred due to lack of funding available to expand the recycled water distribution system, but is scheduled to be constructed from July 2020 to July 2121. This phase would extend the existing system southward from the intersection of Valencia Boulevard and The Old Road, south along Rockwell Canyon Road to the intersection of Orchard Village Road and Lyons Avenue, serving irrigation customers along its proposed alignment. Connecting all of the identified customers would likely take another 2 years to complete. The new demand at that time is estimated to be approximately 1,100 afy, in addition to the existing demand of about 400 afy (pers. comm. Ford 2014).

CLWA and the retail purveyors also are designing two additional phases of the Recycled Water Master Plan, which each include a demand of 500 afy and collectively would take water from the Saugus WRP and distribute it to identified users to the north, across the Santa Clara River and then to the west and the east, including service to Santa Clarita Central Park. The environmental documentation for these phases was completed in July 2011 (LSCE 2014). Construction to connect to the Vista Canyon project on the east side would take place from January 2018 to March 2019. Construction to connect all identified users to the Saugus WRP would take place from January 2023 to March 2025 (pers. comm. Ford 2014).

CLWA's recycled water program is expected to ultimately recycle up to 17,400 afy of treated (tertiary) wastewater, and 5,400 afy is expected to be available from the Newhall Ranch development; thus, up to 22,800 af of treated (tertiary) wastewater is eventually expected to be available that is suitable for reuse on golf courses, landscaping, and other non-potable uses, and infrastructure. Implementation of the recycled water system is expected to occur over an approximately 36-year period from the present (CLWA 2011). Tables 4-14 through 4-17 in Section 4.6 show the existing and planned supplies of recycled water in 5-year increments through 2050.

4.4.3 Limitations on the Use of Recycled Water

The use of wastewater effluent is limited by various state water laws, codes, and court decisions. These regulatory limitations are described in greater detail in CLWA's Recycled Water Master Plan.[22]

CLWA is currently approved to use 1,700 afy of recycled water. The SCVSD will need to assess the issues of water rights and protection of biological resources relative to sections 1210 and 1211 of the Water Code as CLWA's recycled water program expands (CLWA 2011).

As discussed in the 2010 UWMP, the initial list of potential recycled water users was reduced by evaluating the potential users that would be most expensive to serve until potential users totaled approximately 17,400 af. The unit cost to serve each user was calculated using the capital costs for pipelines, reservoirs, and pump stations, as well as operational costs for pumping. The areas retained for recycled water service have costs ranging from $120 to $5,000 per afy. Areas eliminated from service had costs as high as $13,000 per afy. However, only two of the proposed phases in the Recycled Water Master Plan had costs above $1,000 per afy. In addition, the Newhall Ranch Specific Plan will require about 5,400 afy. The resulting proposed recycled water service area encompasses a large portion of CLWA's western service area.

The total potential annual recycled water demand identified in the Recycled Water Master Plan that is cost effective to serve is approximately 22,800 afy. Of this total, 21,300 afy is projected use by purveyor customers. Based in part on these cost considerations, the 2010 UWMP concludes that potential demand for recycled water is equal to supplies (see Table 4-5 in CLWA 2011).

4.5 Reliability Planning

As shown above, CLWA and the retail purveyors have implemented a number of projects that are part of an overall program to provide the facilities needed to firm up imported water supplies during dry years. These involve water conservation, surface and groundwater storage, water transfers and exchanges, water recycling, additional short-term pumping from the Saugus Formation, and increasing CLWA's imported supply. This overall strategy is designed to meet increasing water demands while ensuring a reasonable degree of supply reliability. Part of the overall water supply strategy is to provide a blend of groundwater and imported water to area residents to ensure consistent quality and reliability of service. The actual blend of imported water and groundwater in any given year and location in the Valley is an operational decision and varies over time due to source availability and operational capacity of purveyor and CLWA facilities. The goal is to conjunctively use the available water resources so that the overall reliability of water supply is maximized while utilizing local groundwater at a sustainable rate (LSCE 2014).

The available water supplies and demands for CLWA's service area were analyzed in the 2010 UWMP to assess the region's ability to satisfy demands during the following variable periods: (1) an average water year, (2) single-dry year, and (3) multiple-dry years. The 2010 UWMP summary tables show that existing

[22] The 2010 UWMP includes more information regarding the Recycled Water Master Plan, including its implementation plan (see Section 4, Recycled Water).

and planned supplies are available to meet existing and projected demand under all such conditions for the projected planning period through 2050.

While many of the Santa Clarita Valley's available supply sources have some variability, the variability in SWP supplies has the largest effect on overall supply reliability. In any given year, SWP supplies may be reduced due to dry weather conditions or regulatory factors. During such an occurrence, the remaining water demands in the CLWA service area are planned to be met by a combination of alternate supplies such as return water from CLWA's accounts in the Semitropic Groundwater Storage Program and the Rosedale-Rio Bravo Water Banking and Exchange Program, deliveries from CLWA's flexible storage account in Castaic Lake Reservoir, local groundwater pumping, short-term water exchanges, and participation in DWR's dry-year water purchase programs.

Groundwater banking and conjunctive use offer significant opportunities to improve water supply reliability for CLWA. During dry periods, or when imported water supply availability is reduced, banked water can be recovered from groundwater storage to replace, or firm up, the imported water supply deliveries. Conjunctive use is the purposeful integrated use of surface water and groundwater supplies to maximize water supply from the two sources (LSCE 2014). The Santa Clarita Valley is typical in terms of water management in southern California; local groundwater supplies are used to a greater extent when imported supplies are less available due to dry conditions in the north, and larger amounts of imported water supplies are used during periods when northern California has wetter conditions. CLWA and the purveyors have been conjunctively utilizing local groundwater and imported water since SWP water was imported to the Santa Clarita Valley beginning in 1980. SWP and other imported water supplies have supplemented the overall supply of the Santa Clarita Valley, which previously depended solely on local groundwater supplies (CLWA 2011).

Drought periods may affect available water supplies in any single year, but usually do not last longer than 3 consecutive years. Hydrologic conditions vary from region to region throughout the state. Dry conditions in northern California affecting SWP supply may not affect local groundwater and other supplies in southern California, and the reverse situation can also occur (as it did in 2002 and 2003). For this reason, CLWA and the purveyors have emphasized developing a water supply portfolio that is diverse, especially in dry years. Diversity of supply is considered a key element of reliability, giving CLWA and the purveyors the ability to draw on multiple sources of supply to ensure reliable service during dry years, as well as during normal and wet years (LSCE 2014).

As described below, CLWA has entered into four groundwater banking and water exchange programs and has, in aggregate, almost 158,000 af of recoverable water outside the local groundwater basin, which is available during drought conditions. The first component of CLWA's groundwater banking program is the result of two 10-year agreements between CLWA and Semitropic Water Storage District whereby CLWA can withdraw up to 45,920 af of SWP Table A water that it stored in Semitropic's groundwater bank to meet the Santa Clarita Valley demands when needed in dry years (45,920 af is the net recoverable balance after originally banking 24,000 af in 2002 and 32,522 af in 2003, and withdrawing 4,950 af in 2009 for delivery in 2009 and 2010). In April 2011, CLWA and Semitropic Water Storage District extended the original agreements by ten years to 2022/2024.

The second component of the banking program, the long-term Rosedale-Rio Bravo Water Storage District and Buena Vista Water Storage District water banking and exchange program in Kern County, has a recoverable total of 100,000 af in storage (including 6,031 af delivered in 2012, less contractual losses).

The third and fourth components are the two-for-one banking programs that CLWA initiated in 2011 that now have a total of 12,009 af of recoverable water (LSCE 2014).

Following the recovery of 9,900 af (with delivery of 1,650 af in 2009, 3,300 af in 2010, and 4,950 af in 2014), the banked excess 2002 and 2003 SWP Table A water in Semitropic represents nearly 36,000 af of recoverable water for drought water supply. In addition, the banked excess SWP Table A water in 2005 and 2006, augmented by banked water acquired through the Buena Vista/Rosedale-Rio Bravo Water

Acquisition Agreement in 2005, 2006, 2007, 2010, 2011, and 2012, along with a recovery of 5,400 af anticipated for 2014 represent a total of 94,600 af of recoverable water for drought water supply from the Rosedale-Rio Bravo Banking and Exchange Program. Most recently, the new 2-for-1 water exchange programs provide an additional approximately 10,000 af of dry-year supply, which accounts for an anticipated recovery of 2,000 af from the West Kern Water District program in 2014. The total recoverable water in all the Kern County storage banks is now about 141,000 af (LSCE 2014).

The reliability planning associated with each water source available to CLWA is discussed below.

4.5.1 State Water Project Table A

The 2013 State Water Project Delivery Reliability Report projects that long-term SWP delivery reliability will remain similar to the 2011 estimate for average year hydrology. Specifically, under existing conditions, the average annual delivery of Table A water is estimated at 1 percent more than the 2011 report; under future conditions, the average annual delivery is estimated at 2 percent less than the 2011 report. CLWA and the purveyors have assessed the impact of the 2013 SWP Delivery Reliability Report on the CLWA/purveyor water supply, and have determined that current anticipated supplies are available to meet existing and projected demands through the year 2050 consistent with the 2010 UWMP (pers. comm., Marks 2014b; pers. comm., Abercrombie 2014b).

A planning effort to increase long-term supply reliability for both the SWP and Central Valley Project is taking place through the Bay Delta Conservation Plan. While the plan's proposed conveyance facilities would increase SWP supply reliability, that increase is not included in the 2010 UWMP.

4.5.2 Groundwater

Groundwater supplies from the Alluvial aquifer are planned to be in the range of 30,000 to 40,000 afy in average years and 30,000 to 35,000 afy in dry years; supplies from the Saugus Formation are projected to be 7,500 to 15,000 afy in average years and 15,000 to 35,000 afy in dry years. The 2009 Basin Yield Update found pumping in those ranges to be sustainable (LSCE and GSI 2009). The current Alluvial pumping capacity is sufficient to achieve the planned Alluvial groundwater supply; nonetheless, VWC plans to develop future capacity through construction of municipal supply wells to replace existing agricultural wells for planned developments. Also, existing Saugus pumping capacity is sufficient to achieve about 27,000 afy (Table 4-12), or about 77 percent of the upper end of the Saugus operating plan. CLWA and the retail purveyors plan to restore capacity lost from VWC's Well 201, and establish future Saugus pumping capacity (from new wells) to achieve the full range of the Saugus operating plan (CLWA 2011).

Also, existing and planned groundwater supplies used in the 2010 UWMP generally include the pumping rates, within the operating plan ranges, that were analyzed in the 2009 Basin Yield Update. They tend toward the upper ends of the ranges except for normal year Saugus pumping, which is closer to mid-range of the Saugus operating plan. For the multiple-dry year period, pumping from the Saugus Formation would be governed by the groundwater operating plan summarized in Table 4-8, with average pumping over the 4-year dry period of about 21,500 afy. Total projected Alluvial and Saugus pumping, including pumping by the purveyors and by agricultural and other users, in each year type remains within the pumping ranges in the groundwater operating plan (CLWA 2011).

4.5.3 Recycled Water

Recycled water is available from the Saugus WRP and Valencia WRP. Recycled water is also anticipated to be produced by the Newhall WRP for the Newhall Ranch Specific Plan development. Overall, the recycled water program is expected to ultimately deliver up to 22,800 afy of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping, and other non-potable uses. Of this total, 21,300 afy is projected use by purveyor customers. This supply would be available in an average year, a single-dry year, and in each year of a multiple-dry year period (CLWA 2011).

4.5.4 Flexible Storage Account

CLWA plans to use this supply only in dry years. CLWA has access to 4,684 af of the storage capacity of Castaic Lake, as well as an additional 1,376 af of storage available through 2015. For the single-dry year condition, the entire amount would be used. For the multiple-dry year condition, the entire amount would be used sometime during the 4-year period, so the average annual supply during that period would be one-fourth of the total. Any water withdrawn would be replaced in intervening average and wet years and, therefore, would be available again for use in the next dry year (CLWA 2011).

4.5.5 Buena Vista-Rosedale

Buena Vista and Rosedale-Rio Bravo, both member districts of KCWA, have jointly developed a program that provides a firm water supply of 11,000 afy and a water banking component. This supply program provides a firm annual water supply available every year based on existing and longstanding Kern River water rights, which is delivered by exchange of Buena Vista's and Rosedale-Rio Bravo's SWP Table A supplies (CLWA 2011).

4.5.6 Nickel Water-Newhall Land

This supply is similar to the Buena Vista-Rosedale supply both in regard to its source (Kern River water rights) and level of reliability. The supply from this program is 1,607 afy of firm supply, which is available in every year. It was acquired by The Newhall Land and Farming Company to supplement groundwater and recycled water sources of supply for the Newhall Ranch Specific Plan, which is in the CLWA service area. In the 2010 UWMP, it is anticipated that this water supply will be available to VWC (CLWA 2011).

4.5.7 Semitropic Banking Program

CLWA plans to use this supply only in dry years. For the single dry year, CLWA assumed that competition among Semitropic's banking partners for use of return facilities would limit CLWA's supply to about one-third of the storage available, or about 15,000 af. For the multiple-dry year period, it was assumed that the entire amount would be accessible and used sometime during the 4-year period; so the average annual supply during that period would be one-fourth of the total available, or about 11,500 af. Under the agreements for this program, including the agreement for the 10-year time extension, the stored water must be withdrawn within 20 years of when it was stored. Therefore, it was assumed that this supply is available to CLWA only through 2023 (CLWA 2011).

4.5.8 Semitropic Banking Program-Newhall Land

Like Nickel water, this banking program was entered into by The Newhall Land and Farming Company to firm up the reliability of the water supply for the Newhall Ranch Specific Plan, which is in the CLWA service area. The storage capacity of this program is 55,000 af. As of December 31, 2012, Newhall Land has 26,059 af stored in this program. This supply will be available to VWC, but VWC plans to use this supply only in dry years. For the single-dry year, supplies were assumed at the program's maximum withdrawal capacity of 4,950 afy. For the multiple-dry year period, supplies in each year of the dry period were assumed at the program's maximum withdrawal capacity of 4,950 afy, and additional supplies were assumed to be banked during wetter years to allow withdrawal of this amount (CLWA 2011).

4.5.9 Rosedale-Rio Bravo Banking Program

CLWA has reached the program's maximum storage capacity, with 100,000 af currently available for withdrawal. CLWA plans to use this supply only in dry years. For the single-dry year, supplies were assumed at the program's maximum withdrawal capacity of 20,000 af. For the multiple-dry year period, it was assumed that supplies would average at least 15,000 afy over the dry period and that additional supplies would be banked during wetter years to allow withdrawal of at least this amount (CLWA 2011).

4.5.10 Yuba Accord Agreement

Under the 2008 Yuba Accord Agreement, CLWA has up to 850 af of available non-SWP supply in critically dry years. Under certain hydrologic conditions, CLWA may be able to receive additional water from this program.

4.5.11 Two-For-One Exchange Program

In 2011, CLWA opened a two-for-one water exchange program with the Rosedale-Rio Bravo Water Storage District in Kern County. After CLWA deliveries and accounting for program losses, CLWA has 9,509 af of recoverable water from that program. This program is at capacity (LSCE 2014). In addition, in 2011, CLWA opened a second two-for-one water exchange program with the West Kern Water District in Kern County. After a CLWA delivery and accounting for program losses, CLWA has 2,500 af of recoverable water from that program. Because these programs were not in place at the time the 2010 UWMP was adopted, they reflect additional firming supplies totaling 12,009 af of recoverable water, which is over and above that reflected in the 2010 UWMP.

4.6 Recap of Current and Planned Water Supplies and Banking Programs

Collectively, CLWA and the four retail purveyors have existing water supplies that include wholesale (imported) supplies, local groundwater, recycled water, and water from existing groundwater banking programs. Planned supplies include new groundwater production as well as additional banking programs. These existing and planned supplies are summarized in Table 4-14. Diversity of supply allows CLWA and the retail purveyors the option of drawing on multiple sources of supply in response to changing conditions, such as varying weather patterns (average/normal years, single-dry years, multiple dry years), fluctuations in delivery amounts of SWP water, natural disasters, perchlorate-impacted wells, and other factors.

Additional tables are provided below that address available water supplies in the Santa Clarita Valley in normal/average years, single-dry years, and multiple-dry years over a 40-year planning horizon. As shown in the tables below, CLWA and the four retail purveyors have adequate supplies to meet CLWA service area existing and projected demands during normal, single-dry, and multiple-dry years throughout the 40-year planning period (CLWA 2011).

Table 4-14 Summary of Current and Planned Water Supplies and Banking Programs[1]

Water Supply Sources	Supply (af)								
	2010	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies									
Existing Groundwater[2]									
Alluvial Aquifer	24,385	24,000	24,000	24,000	25,000	25,000	25,000	25,000	25,000
Saugus Formation[3]	6,725	9,225	10,225	10,225	10,225	10,225	10,225	10,225	10,225
Total Groundwater	**31,110**	**33,225**	**34,225**	**34,225**	**35,225**	**35,225**	**35,225**	**35,225**	**35,225**
Recycled Water[4] **Total Recycled**	**325**	**325**	**325**	**325**	**325**	**325**	**325**	**325**	**325**
Imported Water									
State Water Project[5]	58,300	58,100	57,900	57,600	57,400	57,400	57,400	57,400	57,400
Flexible Storage Accounts[6]	6,060	6,060	4,680	4,680	4,680	4,680	4,680	4,680	4,680
Buena Vista - Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Total Imported	**76,967**	**76,767**	**75,187**	**74,887**	**74,687**	**74,687**	**74,687**	**74,687**	**74,687**
Existing Banking Programs[7]									
Rosedale - Rio Bravo	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Semitropic	15,000	15,000	15,000	–	–	–	–	–	–
Semitropic - Newhall Land	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Total Banking	**39,950**	**39,950**	**39,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**
Planned Supplies									
Future Groundwater[8]									
Alluvial Aquifer	–	–	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation	–	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Total Groundwater	–	**1,375**	**2,375**	**3,375**	**4,375**	**5,375**	**6,375**	**7,375**	**8,375**
Recycled Water[9] **Total Recycled**	–	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs **Total Banking**	–	–	–	**10,000**	**10,000**	**20,000**	**20,000**	**20,000**	**20,000**

Notes:

[1] The values shown under "Existing Supplies" and "Planned Supplies" are projected to be available in average/normal years. The values shown under "Existing Banking Programs" and "Planned Banking Programs" are the maximum capacity of program withdrawals.

[2] Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-

4 and 3-5 of the 2009 Groundwater Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

[3] SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

[4] Represents recycled water being delivered in 2010 with existing facilities. CLWA currently has 1,700 afy under contract.

[5] SWP supplies are based on DWR's "*2009 State Water Project Delivery Reliability Report*."

[6] Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with Ventura County entities expires after 2015.

[7] Supplies shown are annual amounts that can be withdrawn and would typically be used only during dry years.

[8] Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial aquifer and the Saugus Formation. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production remains within the sustainable ranges identified in Table 3-8 of the Groundwater Basin Yield Update. As indicated in Table 3-10 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

[9] See Table 4-3 of the 2010 UWMP. Total Purveyor Recycled Water less Existing Recycled Supply.

Source: 2010 UWMP (CLWA 2011)

Table 4-15 summarizes the water suppliers' supplies available to meet demands over the 40-year planning period during an average/normal year. As presented in the table, the water suppliers' water supply is broken down into existing and planned water supply sources, including wholesale (imported) water, local supplies, and banking programs. Demands are shown with and without the urban demand reduction resulting from SBX7-7 water conservation objectives.

Table 4-15 Projected Average/Normal Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies								
Existing Groundwater[1]								
Alluvial Aquifer	24,000	24,000	24,000	25,000	25,000	25,000	25,000	25,000
Saugus Formation[2]	9,225	10,225	10,225	10,225	10,225	10,225	10,225	10,225
Total Groundwater	**33,225**	**34,225**	**34,225**	**35,225**	**35,225**	**35,225**	**35,225**	**35,225**
Recycled Water[3]	325	325	325	325	325	325	325	325
Imported Water[4]								
State Water Project[5]	58,100	57,900	57,600	57,400	57,400	57,400	57,400	57,400
Flexible Storage Accounts	–	–	–	–	–	–	–	–
Buena Vista - Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Total Imported	**70,707**	**70,507**	**70,207**	**70,007**	**70,007**	**70,007**	**70,007**	**70,007**
Banking Programs[6]								

Rosedale-Rio Bravo	–	–	–	–	–	–	–	–
Semitropic	–	–	–	–	–	–	–	–
Semitropic - Newhall Land	–	–	–	–	–	–	–	–
Total Banking	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Total Existing Supplies	**104,257**	**105,057**	**104,757**	**105,557**	**105,557**	**105,557**	**105,557**	**105,557**
Planned Supplies								
Future Groundwater[7]								
Alluvial Aquifer	–	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Total Groundwater	**1,375**	**2,375**	**3,375**	**4,375**	**5,375**	**6,375**	**7,375**	**8,375**
Recycled Water[3]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs[6]	–	–	–	–	–	–	–	–
Total Planned Supplies	**2,350**	**5,100**	**8,600**	**12,150**	**15,650**	**20,150**	**24,650**	**29,350**
Total Existing and Planned Supplies	**106,607**	**110,157**	**113,357**	**117,707**	**121,207**	**125,707**	**130,207**	**134,907**
Demand (w/o conservation)[8]	80,070	88,484	96,898	105,312	113,726	122,140	130,554	138,968
20X2020 Reduction[9]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[10]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[11]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w Conservation[12]	**72,343**	**71,908**	**80,236**	**88,564**	**96,892**	**105,220**	**113,549**	**121,877**

Notes:

[1] Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

[2] SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

[3] Recycled water projections from Table 4-3 of the 2010 UWMP.

[4] The 2010 UWMP relied on DWR s 2009 State Water Project Delivery Report ; therefore, the water supply and demand data reflected above constitutes the best available information from an adopted plan.

[5] SWP Table A supply is approximately 60-61 (rounded) of CLWA s maximum Table A Amount of 95,200 af.

[6] Not needed in average/normal years.

[7] Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor s production objectives in the Alluvial aquifer and the Saugus Formation. As indicated in Table 3-10 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

[8] Demand w/o Conservation data from Table 2-2 of the 2010 UWMP.

[9] 20x2020 Reduction for the Region from Table 2-22 of the 2010 UWMP.
[10] Recycled Water Reduction for the Region from Table 2-22 of the 2010 UWMP; does not include demands from Honor Rancho.
[11] Reduction from Water Conservation calculation for Region from Table 2-22 of the 2010 UWMP.
[12] Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.
Source: 2010 UWMP (CLWA 2011)

The water supplies and demands for the water suppliers over the 40-year planning period were analyzed in the event that a single-dry year occurs, similar to the drought that occurred in California in 1977. Table 4-16 summarizes the existing and planned supplies available to meet demands during a single-dry year. Base demand (demand without conservation) during dry years was assumed to increase by 10 percent. Demands are also shown with the urban demand reduction resulting from SBX7-7 water conservation objectives (CLWA 2011).

Table 4-16 Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies								
Existing Groundwater[1]								
Alluvial Aquifer	20,300	20,250	20,200	21,050	21,050	21,025	21,000	20,650
Saugus Formation	20,400	20,400	20,400	20,400	20,400	20,400	20,400	20,400
Total Groundwater	**40,700**	**40,650**	**40,600**	**41,450**	**41,450**	**41,425**	**41,400**	**41,050**
Recycled Water[2]	325	325	325	325	325	325	325	325
Imported Water[3]								
State Water Project[4]	11,900	11,000	10,000	9,100	9,100	9,100	9,100	9,100
Flexible Storage Accounts[5]	6,060	4,680	4,680	4,680	4,680	4,680	4,680	4,680
Buena Vista - Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Total Imported	**30,567**	**28,287**	**27,287**	**26,387**	**26,387**	**26,387**	**26,387**	**26,387**
Banking Programs								
Rosedale - Rio Bravo[6]	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Semitropic[7]	15,000	15,000	–	–	–	–	–	–
Semitropic - Newhall Land[8]	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Total Banking	**39,950**	**39,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**
Total Existing Supplies	**111,542**	**109,212**	**93,162**	**93,112**	**93,112**	**93,087**	**93,062**	**92,712**

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
Planned Supplies								
Future Groundwater[9]								
Alluvial Aquifer	200	1,250	2,300	3,850	4,850	5,875	6,900	7,750
Saugus Formation (Restored Wells)	825	3,777	3,777	3,777	3,777	3,777	3,777	3,750
Saugus Formation (New Wells)	2,875	9,923	9,923	9,923	9,923	9,923	9,923	9,950
Total Groundwater	**3,900**	**14,950**	**16,000**	**17,550**	**18,550**	**19,575**	**20,600**	**21,450**
Recycled Water[2]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs[10]	–	–	10,000	10,000	20,000	20,000	20,000	20,000
Total Planned Supplies	**4,875**	**17,675**	**31,225**	**35,325**	**48,825**	**53,350**	**57,875**	**62,425**
Total Existing and Planned Supplies	**116,417**	**126,887**	**124,387**	**128,437**	**141,937**	**146,437**	**150,937**	**155,137**
Demand (w/o conservation)[11]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
20X2020 Reduction[12]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[13]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[14]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w Conservation[15]	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**

Notes:

[1] Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-11 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan. SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

[2] Recycled water projections from Table 4-3 of the 2010 UWMP.

[3] The 2010 UWMP relied on DWR's "2009 State Water Project Delivery Report"; therefore, the water supply and demand data reflected above constitutes the best available information from an adopted plan.

[4] SWP Table A supplies are calculated by multiplying CLWA's Table A amount of 95,200 af by percentages of single-dry year deliveries projected to be available on Table 6-4 (7) and Table 6-13 (11) of DWR's "State Water Project Delivery Reliability Report 2009." As suggested by DWR, SWP supplies for the 5-year increments between 2010 and 2030 are interpolated between these values.

[5] Includes both CLWA and Ventura County entities flexible storage accounts. Initial Term of agreement with Ventura County entities expires after 2015.

[6] CLWA has a maximum withdrawal capacity of 20,000 AFY and a storage capacity of 100,000 AF. As of 6/1/2011, there is 100,000 AF of recoverable water.

[7] CLWA has 45,920 AF of recoverable water as of 6/1/2011.

[8] Newhall Land has a maximum withdrawal capacity of 4,950 afy and a storage capacity of 55,000 af. As of December 31, 2012, there are 26,059 af of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is available to VWC.

[9] Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor s production objectives in the Alluvial

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050

aquifer and the Saugus Formation, including 3,777 afy of restored capacity from VWC Well 201 and approximately 10,000 afy of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1977 single dry-year levels identified in Table 3-8 of the 2009 Basin Yield Update. As indicated in Table 3-11 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

[10] Includes banking programs with 10,000 af of additional pumpback capacity by 2025 and a second additional 10,000 af by 2035.

[11] Demand w/o Conservation data from Table 2-2 of the 2010 UWMP. Includes a 10 percent increase in demand during dry years.

[12] 20x2020 Reduction for the Region from Table 2-22 of the 2010 UWMP.

[13] Recycled Water Reduction for the Region from Table 2-22 of the 2010 UWMP; does not include demands from Honor Rancho.

[14] Reduction from Water Conservation calculation for Region from Table 2-22 of the UWMP.

[15] Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

Source: 2010 UWMP (CLWA 2011).

The water supplies and demands for the water suppliers over the 40-year planning period were analyzed in the event that a 4-year multiple-dry year event occurs, similar to the drought that occurred during the years 1931 to 1934. Table 4-17 summarizes the existing and planned supplies available to meet demands during multiple-dry years. Base demand during dry years was assumed to increase by 10 percent. Demands are also shown with the urban demand reduction resulting from SBX7-7 water conservation objectives (CLWA 2011).

Table 4-17 Projected Multiple-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies								
Existing Groundwater[1]								
Alluvial Aquifer	20,425	20,425	20,425	21,825	21,825	21,825	21,825	21,325
Saugus Formation	19,700	19,700	19,700	19,700	19,700	19,700	19,700	19,700
Total Groundwater	**40,125**	**40,125**	**40,125**	**41,525**	**41,525**	**41,525**	**41,525**	**41,025**
Recycled Water[2]	325	325	325	325	325	325	325	325
Imported Water[3]								
State Water Project[4]	32,900	32,900	33,000	33,000	33,000	33,000	33,000	33,000
Flexible Storage Accounts[5]	1,510	1,170	1,170	1,170	1,170	1,170	1,170	1,170
Buena Vista - Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050
Total Imported	**47,017**	**46,677**	**46,777**	**46,777**	**46,777**	**46,777**	**46,777**	**46,777**
Banking Programs								
Rosedale - Rio Bravo[6]	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Semitropic[7]	11,500	11,500	–	–	–	–	–	–
Semitropic - Newhall Land[8]	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Total Banking	**31,450**	**31,450**	**19,950**	**19,950**	**19,950**	**19,950**	**19,950**	**19,950**
Total Existing Supplies	**118,917**	**118,577**	**107,177**	**108,577**	**108,577**	**108,577**	**108,577**	**108,077**
Planned Supplies								
Future Groundwater[9]								
Alluvial Aquifer	–	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation (Restored Wells)	2,375	1,625	1,500	1,400	1,275	1,125	1,000	875
Saugus Formation (New Wells)	2,250	10,325	10,450	10,550	10,675	10,825	10,950	11,075
Total Groundwater	**4,625**	**12,950**	**13,950**	**14,950**	**15,950**	**16,950**	**17,950**	**18,950**
Recycled Water[2]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975
Banking Programs[10]	–	–	7,500	7,500	15,000	15,000	15,000	15,000
Total Planned Supplies	**5,600**	**15,675**	**26,675**	**30,225**	**41,225**	**45,725**	**50,225**	**54,925**
Total Existing and Planned Supplies	**124,517**	**134,252**	**133,852**	**138,802**	**149,802**	**154,302**	**158,802**	**163,002**
Demand (w/o conservation)[11]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
20X2020 Reduction[12]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[13]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[14]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w Conservation[15]	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**

Notes:

[1] Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Basin Yield Update, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-12, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5. SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

Water Supply Sources	Supply (af)							
	2015	2020	2025	2030	2035	2040	2045	2050

[2] Recycled water projections from Table 4-3 of the 2010 UWMP.

[3] The 2010 UWMP relied on DWR's 2009 State Water Project Delivery Report; therefore, the water supply and demand data reflected above constitutes the best available information from an adopted plan.

[4] SWP Table A supplies are calculated by multiplying CLWA's Table A amount of 95,200 af by percentages of multiple-dry year deliveries projected to be available on Table 6-4 (34-36) and Table 6-13 (28-32) of DWR's State Water Project Delivery Reliability Report 2009. As suggested by DWR, SWP supplies for the 5-year increments between 2010 and 2030 are interpolated between these values.

[5] Includes both CLWA and Ventura County entities flexible storage accounts. Initial Term of agreement with Ventura County entities expires after 2015.

[6] CLWA has a maximum withdrawal capacity of 20,000 afy and a storage capacity of 100,000 af. As of 6/1/2011, there is 100,000 af of recoverable water.

[7] CLWA has 45,920 af of recoverable water as of 6/1/2011.

[8] Newhall Land has a maximum withdrawal capacity of 4,950 afy and a storage capacity of 55,000 af. As of December 31, 2012, there are 26,059 af of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is available to VWC.

[9] Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial aquifer and the Saugus Formation, including 3,777 afy of restored capacity from VWC Well 201 and approximately 10,000 afy of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1931-1934 multiple dry-year levels identified in Table 3-8 of the 2009 Basin Yield Update. As indicated in Table 3-12 of the 2010 UWMP, existing and planned groundwater pumping remain within the groundwater operating plan.

[10] Includes banking programs with 10,000 af of additional pumpback capacity by 2025 and a second additional 10,000 af by 2035.

[11] Demand w/o Conservation data from Table 2-2 of the 2010 UWMP. Includes a 10 percent increase in demand during dry years.

[12] 20x2020 Reduction for the Region from Table 2-22 of the 2010 UWMP.

[13] Recycled Water Reduction for the Region from Table 2-22 of the 2010 UWMP; does not include demands from Honor Rancho.

[14] Reduction from Water Conservation calculation for Region from Table 2-22 of the 2010 UWMP.

[15] Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

Source: 2010 UWMP (CLWA 2011)

5 Water Quality

Existing water quality conditions for urban water uses in the CLWA service area are documented in annual Santa Clarita Valley Water Quality Reports (also referred to as Consumer Confidence Reports). An annual Water Quality Report is provided prior to July 1 to all Santa Clarita Valley residents who receive water from one of the four local retail water purveyors in the CLWA service area. Each report includes detailed information in about the results of quality testing of the groundwater and treated SWP water supplied to the residents of the Santa Clarita Valley (CLWA 2014b). Water quality regulations are constantly changing as contaminants that are typically not found in drinking water are discovered and new standards are adopted. In addition, existing water quality standards are becoming more stringent in terms of allowable levels in drinking water. However, all groundwater produced by the retail water purveyors in the Santa Clarita Valley meets or exceeds stringent drinking water quality regulations set by U.S. EPA, the Department of Public Health (DPH), and continuing oversight of the CPUC (CLWA 2014b).

The quality of water supplies in the Santa Clarita Valley met or exceeded all of the drinking water quality standards. For detailed results of the most recently available water quality tests performed by CLWA and the purveyors, please refer to *The Santa Clarita Valley 2014 Water Quality Report* (CLWA 2014b).

CLWA receives and treats surface water from the SWP and other imported sources, and sells the water (wholesale) to the four local retail purveyors. The purveyors combine local groundwater with treated imported water from CLWA for delivery to their customers. (LACWWD 36 currently exclusively takes imported water from CLWA, but anticipates bringing a groundwater well into production soon). The quality of water received by individual customers will vary depending on whether they receive imported water, groundwater, or a blend. Some receive only imported water at all times, while others receive only groundwater. Others may receive water from different wells at different times, different blends of well and imported water at other times, and only imported water at yet other times. These times may vary over the course of a day, a week, or a year (CLWA 2014b).

5.1 Groundwater Quality

Given that a source of potable water for the Project could be a blend of imported water and groundwater, local groundwater quality is an important consideration.

The groundwater basin has two sources of groundwater□the Alluvial aquifer whose quality is primarily influenced by rainfall and stream flow, and the Saugus Formation, which is a much deeper aquifer and recharged primarily by rainfall and deep percolation from the partially overlying Alluvium.

Local groundwater does not have microbial water quality problems. Parasites, bacteria, and viruses are filtered out as the water percolates through the soil, sand, and rock on its way to the aquifer. Even so, disinfectants are added to local groundwater when it is pumped by wells to protect public health. Local groundwater has very little total organic carbon and generally has very low concentrations of bromide, minimizing potential for disinfection by products formation. Taste and odor problems from algae are not an issue with groundwater. The mineral content of local groundwater is very different from SWP water. The groundwater is □hard,□and it has high concentrations of calcium and magnesium (approximately 250 to 600 milligrams per liter (mg/L) total hardness as calcium carbonate, $CaCO_3$). Groundwater may contain higher concentrations of nitrates and chlorides when compared to SWP water (CLWA 2011). However, the groundwater of the Alluvial aquifer and the Saugus Formation consistently meets drinking water standards set by U.S. EPA and DPH.

5.1.1 Alluvium Saugus Formation

Groundwater quality is a key factor in assessing the Alluvium as a municipal and agricultural water supply. Groundwater quality details and long-term conditions, examined by integration of individual records from several wells completed in the same aquifer materials and in close proximity to each other, have been discussed in previous annual Santa Clarita Valley Water Reports and in the 2010 UWMP. In summary, water quality in the Alluvium exhibits no long-term overall trends, most notably, no decline in Alluvial groundwater quality that exceeds historical conditions. Periodic fluctuations have occurred in some parts of the basin, where groundwater quality has varied with precipitation and stream flow. During dry periods, low streamflow and recharge results in increased mineral concentrations and during wet periods, high streamflow and recharge result in decreased mineral concentrations. The presence of long-term consistent water quality patterns, although intermittently affected by wet and dry cycles, supports the conclusion that the Alluvial aquifer remains a viable ongoing water supply source in terms of groundwater quality (LSCE 2014).

As discussed above for the Alluvium, groundwater quality is a key factor in assessing the Saugus Formation as a municipal and agricultural water supply. Integration of individual records from several Saugus wells has been used to examine general water quality trends. Based on those records, water quality in the Saugus Formation has not historically exhibited the precipitation-related fluctuations seen in the Alluvium. Based on available data over the last 50 years, groundwater quality in the Saugus has exhibited a slight overall increase in dissolved mineral content. Since 2000, several wells within the Saugus Formation have exhibited an additional increase in dissolved mineral content, similar to short-term changes in the Alluvium, possibly as a result of recharge to the Saugus Formation from the Alluvium. Since 2005, however, these levels have been steadily dropping or remaining constant. Dissolved mineral concentrations in the Saugus Formation remain below the secondary (aesthetic) upper Maximum Contaminant Level (MCL). Groundwater quality within the Saugus will continue to be monitored to ensure that degradation to the long-term viability of the Saugus as a component of overall water supply does not occur (LSCE 2014).

5.1.1.1 *Perchlorate*

Perchlorate is a regulated drinking water contaminant in California, with an MCL of 6 micrograms per liter (µg/L). Perchlorate has been a water quality concern in the Santa Clarita Valley since 1997. At that time, the state of California conducted tests on a number of municipal water wells owned by CLWA s SCWD, NCWD, and VWC, located near the former Whittaker-Bermite facility. These and subsequent tests detected perchlorate in four of the purveyors deep Saugus Formation municipal wells: NCWD-11, SCWD Saugus 1, SCWD Saugus 2, and VWC-157. These four wells were removed from active service, and NCWD-11 and VWC-157 have not been used for drinking water supplies since 1997. Saugus 1 and Saugus 2 resumed production in 2011 with the completion of the perchlorate treatment facility.

In November 2002, perchlorate was detected in a fifth municipal well; in this case, a shallow Alluvial aquifer well — SCWD Stadium — also located near the former Whittaker-Bermite site. In April 2005, perchlorate was detected in another shallow Alluvial supply well — VWC Q2. In 2006, perchlorate was detected in low concentrations in another Saugus well (NCWD s Well NC-13), near one of the originally impacted Saugus wells. In August 2010, perchlorate was detected further downgradient in an eighth well in the Saugus Formation, Valencia s Well 201. While the initial detection was below the MCL, the well was immediately taken out of active supply service.

The source of the perchlorate is believed to be from the former Whittaker-Bermite site given the proximity of the six impacted wells to the property, the fact that both groundwater and surface water flows from the property to the six wells, and that the former facility is believed to have utilized perchlorate in its manufacturing operations.

5.1.1.2 *Litigation and Settlement Agreements*

In November 2000, CLWA, NCWD, SCWD, and VWC (collectively, Plaintiffs) filed a complaint in federal court against past owner Whittaker, and current owners Santa Clarita LLC (SCLLC) and Remediation Financial, Inc. (RFI) (collectively, Defendants), asserting that perchlorate released from the Whittaker-Bermite site contaminated some of Plaintiffs' water production wells. In July 2003, the federal court found that Defendants were liable for response costs under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[23].

In September 2003, the parties entered into an interim settlement agreement that stayed litigation to allow the parties to, among other things, develop an engineering solution to contain and abate the groundwater contamination and negotiate a final settlement agreement. As a condition for staying litigation activities, Defendants were required to reimburse CLWA for past monitoring and investigation costs and fund the development of the engineering solution. While the parties developed a groundwater abatement/ containment plan, they were unable to reach a final settlement agreement. The interim settlement agreement expired on January 31, 2005.

In July 2004, Defendants SCLLC and RFI filed a petition for chapter 11 bankruptcy protection and the pending litigation was halted under automatic stay bankruptcy provisions. The SCLLC and RFI bankruptcy filing complicated settlement negotiations because any proposed settlement offer that involved SCLLC and RFI insurance proceeds — a substantial and important source of settlement funds — required bankruptcy court approval.

After several rounds of negotiation, on April 19, 2005, Plaintiffs and Defendants reached an agreement in principle on damages that was subject to Defendants reaching a settlement funding agreement with their insurance carriers.

During the settlement process, VWC informed Defendants of the perchlorate contamination found in VWC's Well Q2. Whittaker agreed to provide $500,000 for the installation of a wellhead treatment unit. All capital as well as operating and maintenance costs for this treatment unit were funded by insurance companies representing the current and past owners of the property. Utilizing these funds, VWC installed a perchlorate removal system utilizing ion exchange technology. Six months after the initial detection of perchlorate, Well Q2 was returned to active service (on October 12, 2005). Subsequently in October 2007, DPH approved VWC's request to remove the treatment system as a result of 2 years of continuous operation without detection of perchlorate. Currently, Well Q2 remains in operation without any requirement for wellhead treatment.

In May 2007, CLWA and the purveyors announced a settlement of their lawsuit. CLWA and the purveyors estimate this settlement provides up to $100 million to be used for remediation. The underlying litigation was dismissed in August 2007.[24]

The Settlement Agreement provides funding to construct replacement wells, pipelines, and a treatment plant to remove perchlorate. The Settlement Agreement also provides funds to operate and maintain the treatment system for up to 30 years, which is estimated to cost as much as $50 million over the life of the project. The treatment plant has been designed by CLWA and the Settlement Agreement provides $1.7 million to reimburse CLWA for past expenditures. In addition, a $10 million "rapid response fund" will be established to allow the purveyors to treat wells that could become impacted by perchlorate contamination in the future. VWC received a total of $3.5 million under the Settlement Agreement, which

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23 Castaic Lake Water Agency v. Whittaker Corporation, 272 F.Supp.2d 1053 (Cal. C.D. 2003)

24 Please refer to the following documents for further information: (1) Castaic Lake Water Agency Litigation Settlement Agreement (CLWA 2007), (2) Order Granting Joint Motion for Court Approval, Good Faith Settlement Determination and Entry of Consent Order July 16, 2007, and (3) Stipulation to Dismiss Plaintiffs' Claims and Defendants' Counterclaim, August 20, 2007.

included $2.5 million for past environmental claims and $1 million to close and abandon Well V-157 and drill replacement Well V-206.

Following the settlement, VWC and the other purveyors entered into two MOUs. These MOUs were necessary to implement the various obligations under the Settlement Agreement. The first MOU sets forth the rights among the purveyors to receive payments pursuant to the Settlement Agreement and clarifies project administration, which includes such things as project modification, future perchlorate detections, monitoring, payment of ongoing legal fees, dispute resolution, and other provisions described in the Settlement Agreement. The second MOU sets forth the operational plan and financial arrangements to deliver certain quantities of groundwater from the perchlorate treatment system and a future replacement well field that in total, would restore the water supply capacity impacted by perchlorate to SCWD and NCWD.

5.1.1.3 *Impacted Well Capacity*

The detection of perchlorate in Santa Clarita Valley groundwater supplies has raised concerns over the reliability of those supplies; in particular, the Saugus Formation where six wells have been impacted as a result of perchlorate. Planning and implementation of perchlorate remediation, and restoration of impacted well capacity, have been substantially completed. While work continues, non-impacted production facilities and new or restored wells can be relied upon for the quantities of water projected to be available from the Alluvial aquifer and Saugus Formation. CLWA, the retail water purveyors, California Department of Toxic Substances Control (DTSC), and the U.S. Army Corps of Engineers continue to work closely on perchlorate remediation, to reasonably ensure a prompt response to any significant changes in conditions (Appendix I of CLWA 2011).

The small group of wells that have been impacted by perchlorate represented a temporary loss of well capacity within the CLWA service area. Of the eight wells where perchlorate has been detected, only one well is currently out of service and the other seven have been either treated and remain in service, or have been replaced by new wells. Table 5-1 shows the status of all eight wells. CLWA and the purveyors developed an implementation plan to restore this well capacity. The plan includes the CLWA groundwater containment, treatment, and restoration project to prevent further downstream migration of perchlorate, the treatment of water extracted as part of that containment process, and the recovery of lost local groundwater production from the Saugus Formation.

As of October 2013, all Alluvial municipal supply wells continue to be in active supply service; all wells are sampled in accordance with drinking water regulations; and perchlorate has not been detected (CLWA 2014b). Similarly, as of October 2013, all Saugus Formation municipal supply wells are in active service (except VWC Well 201, which is expected to be restored to service in 2015). Those wells also are regularly sampled in accordance with drinking water regulations; and perchlorate has not been detected. (LSCE 2014; and CLWA 2014b).

Table 5-1 Status of Perchlorate Impacted Wells

Year Detected	Purveyor Well	Groundwater Aquifer	Action Taken	Status
1997	SCWD Saugus 1	Saugus	DPH approved return of well to service in January 2011; well in active service utilizing approved perchlorate treatment in compliance with the requirements of CLWA's amended water-supply permit.	In Service
1997	SCWD Saugus 2	Saugus	DPH approved return of well to service in January 2011; well in active service utilizing approved perchlorate treatment in compliance with the requirements of CLWA's amended water-supply permit.	In Service
1997	VWC Well 157	Saugus	Sealed and capacity replaced by new well.	Replaced
1997	NCWD Well 11	Saugus	Out of service, but a portion of its capacity has been replaced by a combination of imported water from CLWA and treated water from CLWA's Saugus Perchlorate Treatment Facility through a SWP turn-out.	Replaced
2002	SCWD Stadium Well	Alluvium	Sealed and capacity replaced by new well.	Replaced
2005	VWC Well Q2	Alluvium	Taken out of active water supply service, and wellhead treatment approved by DPH and installed to remove perchlorate. After 2 years of operation with no perchlorate detection, DPH approved removal of wellhead treatment in 2007; well remains in active service with no perchlorate detection.	In Service
2006	NCWD Well NC-13	Saugus	DPH approved annual monitoring; results always have been below the detection limit for reporting; well remains in service.	In Service
2010	VWC Well 201	Saugus	Well 201 is currently out of service pending additional monitoring and evaluation of remediation alternatives. Well capacity is not included in active groundwater sources delineated in Table 3-9 of the 2010 UWMP. VWC plans to actively seek remediation under the Settlement Agreement and either restore the impacted well capacity through wellhead treatment or replace the capacity with a new well.	Out of Service

Source: 2012 Santa Clarita Valley Water Report (June 2013) (LSCE 2013)

5.1.1.4 *Environmental Oversight Agreement/Saugus Perchlorate Treatment Facility*

In February 2003, DTSC and the impacted purveyors entered into a voluntary cleanup agreement entitled *Environmental Oversight Agreement*. Under the Agreement, DTSC is providing review and oversight of the response activities being undertaken by the Purveyors related to the detection of perchlorate in the impacted wells. Under the Agreement's Scope of Work, the impacted purveyors prepared a work plan for sampling the production wells, a report on the results and findings of the production well sampling, a draft Human Health Risk Assessment, a draft Remedial Action Workplan, an evaluation of treatment technologies and an analysis showing the integrated effectiveness of a project to restore impacted pumping capacity, extract perchlorate-impacted groundwater from two Saugus wells for treatment, and control the migration of perchlorate in the Saugus Formation.

The Final Interim Remedial Action Plan for containment and extraction of perchlorate was completed and approved by DTSC in January 2006. Design and construction of the treatment facilities and pipelines to

implement the pump and treat program and to also restore inactivated municipal well capacity was completed in May 2010. Water from Saugus 1 and Saugus 2 was initially treated and discharged into the Santa Clara River. DPH issued an amendment to CLWA's operating permit in December 2010, and the wells were placed back in water supply service on January 25, 2011. The cost of the system is covered under the 2007 Settlement Agreement, which protects the public from paying for the remediation costs.

As part of the operation of CLWA's Saugus Perchlorate Treatment Facility, numerous monitoring tests are performed on a continuous basis to ensure the safety of the treated water leaving the new facility. Perchlorate samples are collected semi-weekly at several locations, including at the Saugus 1 and Saugus 2 wells. The samples are analyzed at different frequencies for numerous other constituents, including chlorate, perchlorate, chloride, nitrate, nitrite and sulfate. In addition, samples are analyzed for microbiological growth and radiological and volatile organic compounds (LSCE 2013). In 2012, 3,071 af of groundwater was pumped from Saugus 1 and Saugus 2, and in 2013, 3,108 af of groundwater was pumped. After treatment for perchlorate removal, the groundwater was blended with treated imported water and delivered to purveyors through the CLWA distribution system. In October 2011, with this additional production at Saugus 1 and 2, the purveyors continue to have sufficient pumping capacity to meet the planned normal range of Saugus pumping as described in the 2010 UWMP. Restoration of VWC's Well V201 to service by 2015 will also increase available production capacity from the Saugus Formation (LSCE 2013, 2014).

The development and implementation of the cleanup plan for the Whittaker-Bermite site and the impacted groundwater is still being coordinated among CLWA, the impacted purveyors, Whittaker, DTSC, and the U.S. Army Corps of Engineers. DTSC is the lead agency responsible for regulatory oversight of the former Whittaker-Bermite site.

Under the direction of DTSC, Whittaker has submitted a comprehensive site-wide remediation plan for the contaminants of concern in soil and groundwater detected on the property. In 2009, a Draft Remedial Action Plan was submitted to DTSC for Operable Units 2 through 6 that is focused on soil remediation. The plan contains a number of recommended technologies to remove contaminants from the soil, in addition to a proposed clean-up schedule for the site. Whittaker also has completed a Draft Operable Unit 7 Feasibility Study to identify and select treatment technologies for both on-site and off-site groundwater. On December 31, 2008, DTSC approved the work plan for "Pilot Remediation of Saugus Aquifer Containment and Remediation," and the first phase of the work plan was completed in 2013 (LSCE 2014).

In summary, work continues on multiple tasks to address groundwater contaminated by perchlorate stemming from past manufacturing activities on the former Whittaker-Bermite site. CLWA and the local retail purveyors have restored or replaced the production capacity of the perchlorate-impacted supply wells (except for VWC Well 201, which is expected to be returned to water service in 2015), and they continue to work on the objectives of containing the downgradient migration of perchlorate.

The basin groundwater model estimated that perchlorate-contaminated groundwater would be contained and captured by pumping Saugus 1 and 2. Ultimately, however, the "pump and treat" program was delayed for about 6 years until it was finally operational in December 2010. The delays are attributable to the combination of litigation, settlement, permitting, and construction, which deferred actual implementation of the containment program. That time, combined with the preceding 7 years since perchlorate first impacted water supply wells, resulted in a greater risk of downgradient migration of perchlorate in the Saugus Formation, which is interpreted to be the primary reason for the recent detection of perchlorate in VWC Well 201. However, that possibility was addressed in the Settlement Agreement. It includes provisions for providing treatment to wells that are impacted by perchlorate not contained or captured by the original containment program (Appendix I CLWA 2011).

5.1.1.5 *Treatment Technology*

Effective technologies exist to treat perchlorate in water in order to meet drinking water standards. Single-pass ion exchange is the most common treatment method for perchlorate removal because it has been

proven at full-scale to be simple and relatively low cost (Water Research Foundation 2011). For the Saugus Formation, CLWA and the purveyors, in cooperation with a technical group, selected the single-pass ion exchange treatment technology because it does not generate a concentrated perchlorate waste stream that would require additional treatment before discharge to a sanitary sewer or a brine line (if one is available). This technology incorporates an active resin (a material that attracts perchlorate molecules) that safely removes the perchlorate from water. The resin is contained in pressure vessels and the water is pumped through the vessel. The resin is eventually replaced with new resin after a period of time. The old resin is removed and transported by truck to an approved waste disposal site. This technology is robust and reliable for use in drinking water systems. DPH has approved operation of the perchlorate treatment plants currently in operation at the following locations:

- La Puente Valley Water District (2,500 gpm)
- San Gabriel Valley Water Company, El Monte (7,800 gpm)
- California Domestic Water Company, Whittier (5,000 gpm)
- City of Riverside (2,000 gpm)
- West San Bernardino Water District, Rialto (2,000 gpm)
- City of Rialto (2,000 gpm)
- City of Colton (3,500 gpm)
- Fontana Union WC (5,000 gpm)
- City of Pomona (10,000 gpm)
- Valencia Water Company (1,700 gpm)
- CLWA Santa Clarita Water Division (2,400 gpm)

Based on (1) the results of CLWA's investigation of perchlorate removal technologies; (2) the technical group's evaluation; and (3) DPH approval of single-pass ion exchange for treatment in other settings, CLWA and the retail purveyors have implemented the single-pass ion exchange treatment technology for restoration of impacted well capacity at Saugus 1 and Saugus 2. The same single-pass ion exchange wellhead treatment is being considered for installation at the recently impacted VWC Well 201 to restore that impacted Saugus well capacity. (Appendix I of the 2010 UWMP [CLWA 2011]).

5.1.2 Other Groundwater Pollutants of Concern

Research conducted on the effects on groundwater from stormwater infiltration by Pitt et al. (1994) indicates that the potential for contamination is dependent on a number of factors, including the local hydrogeology and the chemical characteristics of the pollutants of concern. Chemical characteristics that influence the potential for groundwater impacts include high mobility (low absorption potential), high solubility fractions, and abundance in runoff and dry weather flow. As a class of constituents, trace metals tend to adsorb onto soil particles and are filtered out by the soils. This has been confirmed by extensive data collected beneath stormwater detention/retention ponds in Fresno (conducted as part of the Nationwide Urban Runoff Program) that showed trace metals tended to be adsorbed in the upper few feet in the bottom sediments. Bacteria are also filtered out by soils. More mobile constituents, such as chloride and nitrate, have a greater potential for infiltration.

The pollutants of concern for the groundwater quality analysis are those that are anticipated or that have the potential to be generated by the land uses within the Santa Clarita Valley. The pollutants specific to each land use have been identified based on water quality data collected in Los Angeles County. Pollutants generated by land uses in the Santa Clarita Valley have the potential to impact groundwater via

infiltration of runoff, direct infiltration of irrigation water and stormwater, exfiltration or seepage from sewers or stormwater drains, and direct discharges of treated wastewater to the Santa Clara River.

5.1.2.1 *Nitrate*

Nitrate□nitrite-N is a pollutant of concern for purposes of evaluating groundwater quality impacts based upon the potential use of nitrogen fertilizers and the high mobility of nitrates in groundwater.

5.1.2.2 *Bacteria*

The Los Angeles Regional Water Quality Control Board Basin Plan (Basin Plan)[25] contains numeric criteria for bacteria in drinking water sources. Bacteria are not highly mobile in groundwater and are easily removed through filtration in soils (for example, as with septic tank discharges). Bacteria in stormwater originating from pets and wildlife is not expected to exceed the numeric criteria and, therefore, is not a pollutant of concern.

5.1.2.3 *Taste and Odor*

The Basin Plan contains a narrative objective for taste and odors that cause a nuisance or adversely affect beneficial uses. Undesirable tastes and odors in groundwater may be a nuisance and may indicate the presence of a pollutant(s). Odor associated with water can result from natural processes, such as the decomposition of organic matter or the reduction of inorganic compounds, such as sulfate. Other potential sources of odor causing substances, such as industrial processes, will not occur as part of the Project. Therefore, taste and odor-producing substances are not pollutants of concern for the Project.

5.1.2.4 *Mineral Quality: TDS, Sulfate, Chloride, and Boron*

Mineral quality in groundwater is largely influenced by the mineral assemblage of soils and rocks that it comes into contact with. Elevated mineral concentrations could impact beneficial uses; however, the minerals listed in the Basin Plan are not believed to be pollutants of concern due to the anticipated runoff concentrations and the typical mineral concentrations in irrigation water (CLWA), which are below the Basin Plan objectives (Table 5-2). Therefore, these constituents are not considered pollutants of concern for the Project.

Table 5-2 Comparison of Basin Plan Mineral Groundwater Objectives with Measured Runoff Values in Los Angeles County and Delivered Water Quality

Mineral	Los Angeles Basin Plan Groundwater Quality Objective[1] (mg□L)	Range of Mean Concentrations in Urban Runoff[2] (mg□L)	Typical Concentration in CLWA Water[3] (mg□L)
Total Dissolved Solids	700	53□237	275
Sulfate	250	7□35	41
Chloride	100	4□50	76

Notes:
[1] Santa Clara-Bouquet and San Francisquito Canyons Subbasin
[2] Source: Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report. Includes all monitored land uses.
[3] Source: The Santa Clarita Valley Water Quality Report (CLWA 2014b)

[25] The Basin Plan includes water quality objectives for various constituents. The Santa Clara River watershed has basin objectives established by the Regional Water Quality Control Board Los Angeles Region (Region 4). Water quality objectives were established to protect the various beneficial uses for that particular water body or reach. Table 4-6 in the 2010 UWMP shows all the water quality objectives for the Santa Clara River watershed (CLWA 2011a).

Mineral	Los Angeles Basin Plan Groundwater Quality Objective[1] (mg/L)	Range of Mean Concentrations in Urban Runoff[2] (mg/L)	Typical Concentration in CLWA Water[3] (mg/L)
Total Dissolved Solids	700	53–237	245
Sulfate	250	7–35	42
Chloride	100	4–50	56

Notes:
[1] Santa Clara-Bouquet and San Francisquito Canyons Subbasin
[2] Source: Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report. Includes all monitored land uses.
[3] Source: The Santa Clarita Valley Water Quality Report (CLWA 2013)

5.1.2.5 *Methyl Tertiary-Butyl Ether (MTBE)*

MTBE has been a concern for the past several years, and on May 17, 2000, DPH adopted a primary MCL for MTBE of 0.013 mg/L. CLWA and the local retail purveyors have been testing for MTBE since 1997 and, to date, have not detected it in any of the production wells.

5.1.2.6 *Total Trihalomethanes (TTHMs)*

In 2002, the U.S. EPA implemented the new Disinfectants and Disinfection Byproducts Rule. In part, this rule establishes a new MCL of 80 ug/L (based on an annual running average) for TTHM. TTHMs are byproducts created when chlorine is used as a means for disinfection. In 2005, CLWA and the local retail purveyors implemented an alternative method of disinfection, chloramination, to maintain compliance with the new rule and future regulations relating to disinfection byproducts.[26] TTHM concentrations have remained significantly below the MCL since implementation of the alternative disinfection method.

5.1.2.7 *Arsenic*

The U.S. EPA revised the federal MCL for arsenic from 50 µg/L to 10 µg/L. Naturally occurring arsenic has historically only been detected at concentrations of less that 5 µg/L in local groundwater supplies and at concentrations of less than 3 µg/L in SWP water supplies. While maximum limits occasionally exceed the detection limit of 2 µg/L, typical analytical results for arsenic for most groundwater wells in the Valley have been non-detect (CLWA 2014b).

5.1.2.8 *Hardness*

Hard water is the primary complaint from VWC customers, and it is estimated that more than 50 percent have installed individual water softening units at their homes. Many of these units have high operating costs and are designed to discharge a salt solution to the sanitary sewer system that is eventually discharged to the Santa Clara River, or becomes part of the recycled water supply. The environmental impact of these discharges was the subject of a chloride Total Maximum Daily Load (TMDL) investigation (CLWA 2011). The SCVSD has officially adopted an EIR dealing with compliance with the chloride TMDL (For more detailed information on the status of chloride see Section 5.2 and 5.3.1 below.)

To address the hard water complaints of customers, VWC began a demonstration project in 2008, delivering presoftened groundwater from one of its wells to approximately 420 residents located in the Copperhill Community of Valencia (CLWA 2011). VWC's project is aimed at improving the quality of water for its customers to eliminate the need for home softening devices. While the program was not designed to address TMDL compliance, it does complement the efforts of the SCVSD in removing self-regenerating softeners by providing customers with another alternative for softer water (pers. comm., Abercrombie 2013).

[26] See U.S. EPA site: http://www.epa.gov/ogwdw/mdbp/qrg_st1.pdf

VWC's demonstration project uses a softening technology that removes calcium and produces small calcium carbonate pellets which can be reused in a variety of industries. The demonstration project provides VWC with customer feedback and technical/financial information to assess potential future expansion of treatment to other well sites. For much of 2011 and 2012, the project was offline while upgrades and modifications to equipment were conducted. The project resumed operation in December 2012 and was operated periodically in 2013 with additional upgrades to various components. The plant is expected to resume normal operations during 2014 (LSCE 2014). The program has been operated off and on for the past year, with VWC working through operational issues. It is yet to be decided whether this program will be implemented on a larger scale (pers. comm., Abercrombie 2013).

5.2 Imported Water Quality

CLWA provides SWP and other sources of imported water to the Valley. The source of SWP water is rain and snow of the Sierra Nevada, Cascade, and Coastal mountain ranges that travels to the Delta through a series of rivers and SWP structures. From the Delta it is pumped into a series of canals and reservoirs which provide water to urban and agricultural users throughout northern, central, and southern California. The most southern reservoir on the West Branch of the SWP California Aqueduct is Castaic Lake, where CLWA receives water and distributes it to the purveyors following treatment.

CLWA operates two surface water treatment plants, the Earl Schmidt Filtration Plant located near Castaic Lake and the Rio Vista Water Treatment Plant located in Saugus. CLWA produces water that meets drinking water standards set by the U.S. EPA and DPH. SWP water has different aesthetic characteristics than groundwater with lower dissolved mineral concentrations (total dissolved solids) of approximately 250 to 360 mg/L, and lower hardness (as calcium carbonate) of about 105 to 135 mg/L. Historically, the chloride content of SWP water has varied widely from over 100 mg/L to below 40 mg/L, depending on Delta conditions (CLWA 2011).

Historically, the SWP delivered only surface water from the Delta. However, in anticipation of drought, CLWA and other SWP users began water banking programs where SWP water could be stored or exchanged during wet years and withdrawn in dry years. During the statewide drought from 2008 through 2010, a greater portion of water in the SWP has been this "pumped-in" water. As a result, water has been withdrawn from the banking programs. This withdrawn water can be delivered by exchange with SWP supplies allocated to others, or by pumping it into the SWP system. The pumped-in water has met all water quality standards established by DWR under its anti-degradation policy for the SWP. The pumped-in water serves to reduce the chloride concentration in SWP water (CLWA 2011).

Chloride concentrations at Castaic Lake resulting from SWP operational changes were analyzed in a technical report prepared for CLWA, entitled *State Water Project Chloride Modelling Analysis* (Kennedy/Jenks Consultants 2012). The purpose of the study was to predict future chloride levels in SWP water imported to Santa Clarita Valley to assist in complying with the chloride TMDL. The modeling analysis was based on the *2009 SWP Delivery Reliability Report*, which was the latest published report at the time and included the operational constraints of the 2008 and 2009 Biological Opinions for delta smelt, salmon, and steelhead. The modeling analysis included creating the Historic Model and applying it to forecast future chloride levels in SWP water imported to the Santa Clarita Valley. The Historical Model, which was developed to match measured chloride concentrations at various locations along the California Aqueduct, including Castaic Lake, was used to develop a Simulated Case that forecasted chloride concentration and water fluxes under low SWP allocations during a future 6-year drought representative of the historical 1987 to 1992 dry period. This case simulates conditions under dry and critical dry years, and inflows and outflows were based on the CalSim II model outputs used in the *2009 SWP Delivery Reliability Report*. Groundwater pump-in water, which is anticipated to occur along the California Aqueduct under low allocation years, was also taken into account by this model. The Simulated Case forcasted chloride concentrations in Castaic Lake with an average range from 60 to 70 mg/L, and a high

of 80 mg/L. These predicted chloride concentrations were overall lower than the historical range of 100 to 130 mg/L.

Based on the projected SWP operations and assuming the 2007 and 2008 chloride concentrations used in the model, these results suggest that the peak chloride levels recorded during the 1987 to 1992 drought are not likely to occur again. 2007 and 2008 were dry and critical years with low SWP allocations; the study determined those years to be reflective of conditions under low SWP allocations. This is generally because high chloride concentrations in SWP deliveries occurred when Delta inflows were low, resulting in a relatively high salt water component to the water exported through the SWP. However, as a result of Delta water export limitations imposed by the 2008 and 2009 Biological Opinions and the State Water Board's D-1641, diversions when Delta inflows are low are substantially reduced (or eliminated); therefore, future projected SWP deliveries with high chloride levels are not likely to reoccur.

The SWP water chemistry may fluctuate over time and is influenced by its passage through the Delta, where large amounts of organic material are present and salt water from San Francisco Bay contributes bromide and chlorides. Chloride levels from the Delta elevate chloride locally, which is concerning for farmers that grow chloride sensitive crops, including strawberries and avocados. Additionally, bromide and total organic carbon may react with disinfectants such as ozone and chlorine, creating disinfection by-products. All constituents in SWP water meet the federal and state MCL levels as reported in the Santa Clarita Valley Water Quality Report but remain a management concern in the watershed (CLWA 2011). (See Section 5.3 below for details on the SCVSD's adopted EIR alternative for chloride compliance.)

5.3 Water Quality Constituents of Interest

The following are constituents discussed in the 2010 UWMP that may impact water quality in the Santa Clarita Valley. (Perchlorate contamination and hardness are discussed in detail above and are therefore not included here.)

5.3.1 Metals and Salts

Metals and salts are tested in wells at least every 3 years and in Castaic Lake water every month. Small quantities of naturally occurring arsenic are found in Castaic Lake and in a few wells. Inorganic compounds such as salts and metals can be naturally occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming. Arsenic levels in the Santa Clarita Valley are below the MCL (CLWA 2014b).

Nitrates are tested at least annually and the drinking water meets federal and state MCL standards (CLWA 2014b). Principal sources of nitrogen to a watershed typically include discharges from WRPs and runoff from agricultural activities. Elevated nitrogen concentrations (ammonia, nitrate, and nitrite) can cause impairments in warm water fish and wildlife habitat, along with contributing to eutrophic effects such as algae growth and low dissolved oxygen.

Sources of chloride include water softeners, SWP and other imported water, and wastewater effluent. In 1998, a chloride TMDL was established in response to areas within the Upper Santa Clara River being included on the 303(d) list[27]. A chloride TMDL in the Upper Santa Clara River (Reaches 5 and 6) was adopted by the Los Angeles Regional Water Quality Control Board and became effective on May 5, 2005. The Basin Plan Amendment for the chloride TMDL in the Upper Santa Clara River was unanimously adopted by the Los Angeles Regional Water Quality Control Board on December 11, 2008. The TMDL

[27] The term "303(d) list" is short for a list of impaired and threatened waters that the CWA requires all states to submit for U.S. EPA approval every 2 years on even-numbered years. The states identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards, and establish priorities for development of TMDLs based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors (40 C.F.R. Section 130.7(b)(4)). States then provide a long-term plan for completing TMDLs (http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/overview.cfm, accessed April 9, 2014).

established waste load allocations of 100 mg/L for the Saugus and Valencia WRPs. The TMDL implementation schedule allows for several special studies to determine whether existing Water Quality Objectives and waste-load allocations for chloride can be revised, and provides for an 11-year schedule to attain compliance with the final water quality objectives and waste-load allocations for chloride (CLWA 2011). On October 28, 2013, the SCVSD adopted a certified EIR (*Santa Clarita Valley Sanitation District Chloride Compliance Facilities Plan and EIR, SCH No. 2012011010*) that complies with the state-mandated chloride limit for recycled water produced by wastewater treatment plants. Alternative 2 was approved by the SCVSD Board of Directors, which will meet the state chloride TMDL of 100 mg/L by adding new treatment facilities consisting of reverse osmosis, microfiltration, ultraviolet disinfection, and brine disposal via deep well injection. Under this alternative, a pipeline will be constructed to convey water from the Valencia WRP to the Saugus WRP, in order to meet discharge compliance at the Saugus WRP (SCVSD 2013).

5.3.2 Disinfection By-Products

CLWA uses ozone and chloramines to disinfect its water. Disinfection by-products, which include trihalomethanes (THMs) and haloacetic acids (HAA5), are generated by the interaction between naturally occurring organic matter and disinfectants such as chlorine and ozone. THMs and HAA5 are measured at several points in each system, averaged once per quarter, and reported as a running annual average. Ozone is a very powerful disinfectant that not only kills organisms that no other disinfectant can, but also destroys organic chemicals that causes unpleasant tastes and odors. Ozone can also interact with bromide, a naturally occurring salt, to produce bromate. As a result, CLWA is required to analyze the water leaving its two treatment plants for bromate once a month under federal regulations and the state's adopted Disinfectants and Disinfection Byproducts Rule (CLWA 2011). CLWA adjusts its operations as needed to ensure that no standards are exceeded, and to date the bromate MCL has never been violated (pers. comm., Folsom 2013).

5.3.3 Microbiological

Microbial contaminants, such as viruses and bacteria, can be naturally occurring or result from urban storm water runoff, sewage treatment plants, septic systems, agricultural livestock operations and wildlife. Water is tested throughout the systems weekly for total coliform bacteria and testing for *Escherichia coli* (*E. coli*) occurs when coliform testing is positive. No *E. coli* was detected in any drinking waters in 2010. The MCL for total coliforms is 5 percent of all monthly tests showing positives for larger systems. Bacteriological tests met federal and state requirements. Additional microbiological tests for the water-borne parasites *Cryptosporidium parvum* and *Giardia lamblia* were performed on Castaic Lake water, and none were detected (CLWA 2011).

5.3.4 Radiological Tests

Radioactive compounds can be found in both ground and surface waters, and can be naturally occurring or be the result of oil and gas production and mining activities. Testing is conducted for two types of radioactivity; alpha and beta. If none is detected at concentrations above five picocuries per liter no further testing is required. If it is detected, the water must be checked for uranium and radium. Although naturally occurring radioactivity can be detected, the CLWA levels meet the federal and state MCL standards (CLWA 2011).

5.3.5 Organic Compounds

Organic chemical contaminants, including synthetic and volatile organic chemicals, are byproducts of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff and septic systems. Organic compounds also include pesticides and herbicides, which may come from a variety of sources such as agriculture, urban storm water runoff and residential uses. Water is tested for two types of organic compounds, volatile organic compounds (VOCs) and non-volatile synthetic organic compounds (SOCs). These organic compounds are synthetic chemicals produced from industrial

and agricultural uses. Castaic Lake water is checked annually for VOCs and SOCs. Tetrachloroethylene was found in trace levels below the MCL in groundwater in the Valley. Local wells are tested at least annually for VOCs and periodically for SOCs and levels comply with standards (CLWA 2011).

6 Project Demand/Supply

6.1 Project Demand

VWC was consulted concerning the Project's infrastructure requirements and its water demand. VWC reported that it retained the services of GSI Water Solutions, Inc. (a consulting firm with expertise in groundwater and other water resources). GSI provided water demand projections for the Project to support VWC's water system planning activities. GSI also completed a technical memorandum updating the water demand projections for the Project (GSI 2013).

Water demand projections for the Project were estimated using a water demand projection methodology developed by the Irvine Ranch Water District. This water demand projection tool categorizes a community's water demands as indoor (potable) demands, outdoor potable demands, and outdoor demands that can be met with nonpotable water. The tool also compares nonpotable water demands with the available recycled water supply, and identifies how this supply can be used. During the lowest-demand months, the tool specifies the amount of recycled water that must be discharged to the Santa Clara River or is available as recycled water; and specifies the amount of nonpotable demand that must be met by other water supplies (GSI 2013).

GSI calculated the Project water demand projections based on the current land use plan, the residential use of potable water, nonresidential use of potable water, and nonpotable water use.

6.1.1 Residential Use of Potable Water

For indoor residential areas, the projection tool uses a per capita potable water use rate of 75 gallons per capita per day (gpcpd) for attached residences and highest-density single-family residences, a 70 gpcpd for mixed-use residences, and 80 to 100 gpcpd for lower-density single-family residences. For outdoor residential use, the projection tool uses potable water use rates of 42 to 45 gpcpd for high- and medium-density residential areas, and 50 to 60 gpcpd for low-density single family housing.

6.1.2 Nonresidential Use of Potable Water

For nonresidential indoor use, the potable use rates range from 0.01 to 0.20 gallon per day per square foot for facilities with high occupancy during part of the day (retail commercial facilities, business parks, hotels). For hospitals and senior assisted housing the potable water use rates are 500 and 100 gallons per day per bed, respectively, and for schools the rate assigned is 260 gallons per acre per day. The outdoor potable water use rate is specified as 305 gallons per acre per day for industrial facilities, fire stations, hotels, and visitor-serving facilities (club houses at golf courses).

6.1.3 Nonpotable Water Use

Nonpotable water will be used for irrigation of common-area landscaping. Conservative (high) water use projections were provided using the following rates of nonpotable water use:

- 6.7 afy for attached residential development, assuming 15 percent of the area containing these develpoments will be irrigated.
- 1.34 to 1.40 afy for nonresidential development, assuming 25 percent of the area will be irrigated.
- 4.59 afy for golf courses and water features.
- 3.43 afy for other recreational facilities and parks.
- 3.47 afy for landscaping located on irrigated slopes along arterial highways and easements (GSI 2013).

6.1.4 Total Project Demand

Total water demand for the Project is estimated to be approximately 1,143 afy, which includes a potable water demand of 703 afy and a non-potable water demand of 440 afy (GSI 2013). Table 6-1 below provides the breakdown of Project demand. The total demand for residential areas is projected to be 659 afy, consisting of 607 afy of potable water (379 afy for indoor use and 228 afy for outdoor use) and 52 afy of nonpotable water.

The Project is designed to include a water reuse system that will recycle (after treatment) virtually all the wastewater generated by the community. The amount of wastewater generated by the Project is predicted to be approximately 475 afy, which is 67 percent of the total potable water demand and 100 percent of the indoor use of potable water. Of this 475 afy of generated wastewater, 80 percent (379 afy) is from residences, with the remaining 20 percent (96 afy) generated by nonresidential development. The annual wastewater volume of 475 afy is equal to 0.424 million gallons per day. Of this 475 afy of wastewater that flows to WRPs, 80 percent (378 afy) is recycled for irrigation use within the Project, and the remaining 20 percent (97 afy) is discharged to the Santa Clara River during winter (primarily from December through March) or available as recycled water supply for other areas (GSI 2013).

Table 6-1 Project Demand Breakdown

Potable Demand						Nonpotable Demand		
Residential		Nonresidential		Other[1]		Residential	Employment	Other[1]
Interior	Exterior	Interior	Exterior	Interior	Exterior			
379	228	94	0	2	0	52	76	312

Notes:
[1]Recreation, Arterials, Open Space Space
Source: GSI 2013

6.2 Project Supply

Water supply to meet Project demand (and other existing and projected demands) includes all water sources available to CLWA and the four retail purveyors in the Santa Clarita Valley service area (see Table 4-13). Collectively, CLWA and the four retail purveyors have existing water supplies that include wholesale (imported) supplies, local groundwater, recycled water, and water from existing groundwater banking programs. Planned supplies include new groundwater production and additional banking programs.

Diversity of supply allows CLWA and the retail purveyors the option of drawing on multiple sources of supply in response to changing positions, such as varying weather patterns (average/normal years, single-dry years, multiple-dry years), fluctuations in delivery amounts of SWP water, natural disasters, perchlorate-impacted wells, and other factors.

The 2010 UWMP includes planning from 2010 through 2050. Taking into account both current and planned supplies and banking programs, CLWA and the purveyors project to have 152,617 af of available supply in 2015 and 184,537 af of available supply in 2050.

6.3 Water Supply Conclusions

After assessing existing and planned CLWA/purveyor water supply and subtracting existing and projected demand, including the Entrada South development, there is sufficient supply for the Project. Tables 4-15, 4-16, and 4-17 show CLWA's available supply and projected demands based on the year type through 2050. These projected demands include those of the Entrada South Project (pers. comm., Abercrombie 2014a and Marks 2014a), and they do not exceed available supply within the CLWA service area — which includes the service areas of the four retail purveyors. CLWA and the purveyors have adequate supply for average/normal, single-dry, and multiple-dry years.

6.3.1 Average Normal Year

Table 4-15 shows the projected demand and supply for an average/normal year. The total existing and planned supplies for 2050 is 134,907 af. CLWA projects total demand to be 121, 877 af, which includes the demand generated by the Entrada South Project (pers. comm., Abercrombie 2014a and Marks 2014a); thus, the demand is lower than the total supplies under these conditions.

6.3.2 Single-Dry Year

Table 4-16 shows the projected demand and supply for a single-dry year. The total existing and planned supplies for 2050 is 155,137 af. CLWA projects total demand to be 135,773 af, which includes the demand generated by the Entrada South Project (pers. comm., Abercrombie 2014a and Marks 2014a); thus, the demand is lower than the total supplies under these conditions.

6.3.3 Multiple-Dry Year

Table 4-17 shows the projected demand and supply for a multiple-dry year. The total existing and planned supplies for 2050 is 163,002 af. CLWA projects total demand to be 135,773 af, which includes the demand generated by the Entrada South Project (pers. comm., Abercrombie 2014a and Marks 2014a); thus, the demand is lower than the total supplies under these conditions.

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Appendix 5.21D

Notice of Water Availability (Will Serve Letter)

Valencia Water Company

March 6, 2014

Valencia Water Company

24631 Avenue Rockefeller • Valencia, CA 91355-3907 Telephone (661) 294-0828 • Fax (661) 294-3806 www.valenciawater.com

March 6, 2014

Ms. Imelda Ng
County of Los Angeles, Department of Public Works
900 S. Fremont Ave.
Alhambra, CA 91803

Notice of Water Availability
Tract No: 53295
Developer: The Newhall Land and Farming Company

Dear Ms. Ng:

The Valencia Water Company ("Valencia") has determined that water (potable and recycled) is available to serve the above-referenced project. Valencia agrees to operate the water system and provide service in accordance with the company's Schedules and Rules. The determination of water availability shall remain valid for two years from the date of this letter. Unless construction of the project has commenced within this two year time frame, Valencia is under no obligation to serve the project unless the developer receives an updated letter from Valencia confirming water availability.

Valencia has determined that the existing facilities (potable and recycled) and the additional facilities (potable and recycled) to be installed by Valencia through developer funding of this project will be adequate to serve this project and each of the individual parcels under normal operating conditions. These facilities will provide a fire flow of 5,000 gallons per minute at 20-psi residual pressure for 5 hours as required by the Fire Department.

Valencia requires that the project comply with the Company's Best Management Practices regarding water conservation. This program identifies water saving techniques, methods, landscape designs and internal water use practices that will achieve the Company's long term conservation goals described in its most current Santa Clarita Valley Urban Water Management Plan. Unless the project is constructed to Valencia's conservation standards, Valencia is under no obligation to serve the project.

If you have any questions regarding the above, please call me at (661) 295-6504.

Sincerely,

Keith Abercrombie
General Manager

cc: Cris Pérez, Operations Manager, Valencia Water Company

Appendix 5.21E

2010 Urban Water Management Plan

Kennedy/Jenks Consultants, Nancy Clemm, P.E.,
Luhdorff & Scalmaninin Consulting Engineers, and
Stacy Miller Public Affairs

June 2011

2010 Urban Water Management Plan

Final

Prepared for:

Castaic Lake Water Agency (CLWA)
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company
(Los Angeles County Waterworks District No. 36/Cooperating Agency)

Prepared by:
Kennedy/Jenks Consultants
Nancy Clemm , P.E.
Luhdorff & Scalmanini Consulting Engineers
Stacy Miller Public Affairs

June 2011

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List of Abbreviations and Acronyms

The following abbreviations and acronyms are used in this report.

AB	Assembly Bill
ACOE	U.S. Army Corps of Engineers
Act	California Urban Water Management Planning Act
AF	acre-feet
AFY	acre-feet per year
Agency	Castaic Lake Water Agency
APA	Administrative Procedure Act
AWRM	Alternative Water Resources Management Program
AWWARF	American Water Works Association Research Foundation
Basin	Santa Clara River Valley Groundwater Basin, East Subbasin
BDCP	Bay Delta Conservation Plan
BMPs	Best Management Practices
BO	Biological Opinion
BVWSD	Buena Vista Water Storage District
CCF	One Hundred Cubic Feet

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CCR	Consumer Confidence Report
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CESA	California Endangered Species Act
CLWA	Castaic Lake Water Agency
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
DBP	Disinfection by-products
D/DBP	Disinfectants and Disinfectant By-Products
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DHS	California Department of Health Services
District	Los Angeles County Waterworks District No. 36
DMM	Demand Management Measure
DOF	Department of Finance
DPH	Department of Public Health
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
EC	Electrical conductivity
Edison	Southern California Edison
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ETo	evapotranspiration
FWS	United States Fish and Wildlife Service
GPCD	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
GSWI	groundwater and surface water interaction model
GWMP	Groundwater Management Plan
HAA5	Haloacetic Acids
KCWA	Kern County Water Agency
LACDRP	Los Angeles County Department of Regional Planning
LACSD	Sanitation Districts of Los Angeles County
LACWWD 36	Los Angeles County Waterworks District No. 36

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M&I	Municipal and Industrial
MCL	Maximum contaminant level
Metropolitan	Metropolitan Water District of Southern California
MAF	million acre-feet
mgd	million gallons per day
mg/L	milligrams per liter
MOU	Memorandum of Understanding Regarding Water Conservation in California
MWD	Metropolitan Water District of Southern California
NCWD	Newhall County Water District
NEPA	National Environmental Protection Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
OVOV	One Valley One Vision
Plan	Urban Water Management Plan 2010
PPHH	persons-per-household
PUC	California Public Utilities Commission
Purveyor	Supplier of drinking water at the retail level (also retailer and retail purveyor)
RAP	Remedial Action Plan
RO	Reverse Osmosis
RRB	Rosedale-Rio Bravo
RRBWSD	Rosedale-Rio Bravo Water Storage District
RPA	Reasonable and Prudent Alternative
RTP	Regional Transportation Plan
RWQCB	Regional Water Quality Control Board
SCAG	Southern California Association of Governments
SCLLC	Santa Clarita LLC
SCOPE	Santa Clarita Organization for Planning the Environment
SCVSD	Santa Clarita Valley Sanitation District
SCWD	Santa Clarita Water Division
SRWS	self-regenerating water-softeners
Semitropic	Semitropic Water Storage District
SSO	site specific objective
SOC	Synthetic organic compounds
SWP	State Water Project
Suppliers	CLWA and purveyors collectively

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SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
THM	Trihomethanes
TTHM	Total Trihalomethanes
TOC	Total Organic Carbon
umhos/cm	Micromhos per centimeter
USCR	Upper Santa Clara River
UWMP	Urban Water Management Plan
Valley	Santa Clarita Valley
VOC	Volatile organic compounds
VWC	Valencia Water Company
WTP	Wastewater Treatment Plant
WRP	Water Reclamation Plant
WQOs	Water Quality Objectives

RESOLUTION NO. 2809

RESOLUTION OF THE CASTAIC LAKE WATER AGENCY BOARD OF DIRECTORS ADOPTING THE 2010 URBAN WATER MANAGEMENT PLAN

WHEREAS, the California Urban Water Management Planning Act, Water Code Section 10610, et seq. (the Act) mandates that every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre feet of water annually, prepare and adopt an updated urban water management plan (UWMP) at least once every five years on or before December 31, in years ending five and zero; and

WHEREAS, the Castaic Lake Water Agency (CLWA), which includes the CLWA Santa Clarita Water Division (SCWD), is an urban water supplier for purposes of the Act, and in 2005 approved and adopted its most recent UWMP and submitted its 2005 UWMP to the California Department of Water Resources (DWR); and

WHEREAS, the Water Conservation Act of 2009, Water Code Section 10608 et seq. (SBX7-7), extended the time by which urban retail water suppliers must adopt 2010 UWMPs to July 1, 2011 to permit coordination between urban wholesale water suppliers and urban retail water suppliers and, among other things, established requirements for urban retail water suppliers to prepare urban water use targets in accordance with the goals of SBX7-7 to reduce statewide daily per capita water use by 15 percent by the year 2015 and 20 percent by the year 2020; and

WHEREAS, the SCWD is an "urban retail water supplier" for purposes of SBX7-7 because it directly provides potable municipal water to more than 3,000 end users; and

WHEREAS, Section 10620(d)(1) of the Act encourages urban water suppliers to satisfy the requirements of the Act by participation in area wide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use; and

WHEREAS, CLWA, in cooperation with SCWD, Newhall County Water District (NCWD) and the Valencia Water Company (VWC), prepared a document labeled "Public Review Draft 2010 Urban Water Management Plan" for the CLWA service area (Draft 2010 UWMP), upon which Los Angeles County Waterworks District No. 36 (LACWWD #36) participated as a cooperating agency; and

WHEREAS, in accordance with applicable law, including the requirements of the Act and of SBX7-7, CLWA has prepared the Draft 2010 UWMP and has undertaken certain agency coordination, public notice, public involvement and outreach, public comment, and other procedures in relation to the Draft 2010 UWMP; and

WHEREAS, as authorized by Section 10620(e) of the Act, CLWA has prepared its Draft 2010 UWMP with its own staff, with the assistance of consulting professionals and in cooperation with other governmental agencies, and has utilized and relied upon industry standards and the expertise of industry professionals in preparing its Draft 2010 UWMP, and has, in part, utilized and relied upon the DWR Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan (March 2011) and the DWR Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Act of 2009) (February 2011) in preparing its Draft 2010 UWMP; and

WHEREAS, CLWA began its public outreach and community involvement in the preparation of the Draft 2010 UWMP in May 2010, with its first scheduled community workshop, followed by five more community workshops and three public hearings; and

WHEREAS, pursuant to Section 10621(b) of the Act, on March 3, 2011, CLWA notified the City of Santa Clarita and the Counties of Ventura and Los Angeles that it would be preparing its 2010 UWMP, and that it would be releasing the Draft 2010 UWMP in April 2011, and subsequently met with, consulted with and obtained comments from the City of Santa Clarita, the United Water Conservation District and the County of Los Angeles; and

WHEREAS, in accordance with applicable law, including Water Code Sections 10608.26 and 10642, and Government Code Section 6066, CLWA made its Draft 2010 UWMP available for public inspection, and provided notice of the time and place of each joint public hearing on the Draft UWMP; and

WHEREAS, on March 23, 2011, CLWA and NCWD held a joint public hearing, properly noticed pursuant to Section 10642 of the Act and Government Code Section 6066, at which time CLWA's Board of Directors reviewed draft sections and tables for inclusion in the Draft 2010 UWMP, and, as part of that review, considered a presentation regarding the Draft 2010 UWMP by its staff and consultants, and oral and written public comments; and

WHEREAS, on May 18, 2011, CLWA and NCWD held a second joint public hearing, properly noticed pursuant to Section 10642 of the Act and Government Code Section 6066, at which time CLWA's Board of Directors considered further oral and written public comments, and responses to those comments by its staff and consultants, which included a presentation of the changes that had been made in the Public Review Draft 2010 UWMP; and

WHEREAS, on June 15, 2011, CLWA circulated to each of the members of its Board of Directors a Final Draft 2010 UWMP; and

WHEREAS, on June 22, 2011, CLWA and NCWD held a properly noticed joint public meeting and public hearing to consider adoption of the Final Draft 2010 UWMP, at which time CLWA's Board of Directors considered further oral and written public comments, and responses to those comments by its staff and consultants, which included a presentation of the changes that had been made in the Final Draft 2010 UWMP, and reviewed and considered adoption of the Final Draft 2010 UWMP; and

WHEREAS, pursuant to Water Code Section 10620(d)(2), CLWA coordinated the preparation of its Draft 2010 UWMP and Final Draft 2010 UWMP with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies and relevant public agencies, to the extent practicable; and

WHEREAS, pursuant to Water Code Section 10620(f), CLWA describes in the Draft 2010 UWMP and in the Draft Final 2010 UWMP water management tools and options used by CLWA that will maximize resources and minimize the need to import water from other regions; and

WHEREAS, pursuant to Water Code Section 10641, CLWA consulted with and obtained comments from those public agencies or persons with special expertise with respect to demand management methods and techniques; and

WHEREAS, CLWA has encouraged the active involvement of diverse social, cultural and economic elements of the population within the Agency's service area with regard to the preparation of the Draft UWMP and Final Draft UWMP, allowed input by members of the public and any other interested party regarding all aspects of the Draft 2010 UWMP and Final Draft 2010 UWMP, allowed community input regarding SCWD's implementation plan for complying with SBX7-7, considered the economic impacts of the SCWD's implementation plan for complying with SBX7-7 and adopted Method 1 under Water Code Section 10608.20(b) for determining its urban water use targets; and

WHEREAS, to assure public participation in the process, CLWA has exceeded the requirements of the Act, by holding more than one public hearing; and

WHEREAS, the CLWA Board of Directors has considered the public and Board comments made at the three public hearings, as well as all written public comments on the Draft 2010 UWMP and the Final Draft 2010 UWMP distributed to the Board of Directors; and

WHEREAS, the CLWA Board of Directors has carefully reviewed the Final Draft 2010 UWMP, any errata, revisions and modifications made at the hearing; and

WHEREAS, the CLWA Board of Directors has carefully reviewed and considered the purposes and requirements of the Act and SBX7-7, the contents of the Final Draft 2010 UWMP, any errata, revisions and modifications made at the hearing, the documentation contained in the administrative record in support of the Final Draft 2010 UWMP, and all public and agency input received with regard to the Final Draft 2010 UWMP, and has determined that the factual analyses and conclusions set forth in the 2010 UWMP are supported by substantial evidence.

NOW THEREFORE, BE IT RESOLVED that this Board of Directors of Castaic Lake Water Agency does hereby adopt Method 1 under Water Code Section 10608.20(b) for determining its urban water use targets, and the Final Draft 2010 UWMP attached hereto as Exhibit "A" and incorporated herein by this reference, including any errata, revisions and modifications made at the hearing, is hereby approved and adopted as CLWA's 2010 Urban Water Management Plan, and filed with the Secretary of the Board; and

RESOLVED FURTHER that the General Manager of the Agency is hereby authorized and directed to include a copy of this Resolution in the Agency's 2010 Urban Water Management Plan and, in accordance with Water Code Section 10644(a), to file the 2010 Urban Water Management Plan with the California Department of Water Resources, the California State Library, and any city or county within which the Agency provides water supplies within thirty (30) days of this adoption date; and

RESOLVED FURTHER that in accordance with Water Code Section 10645, the General Manager is hereby authorized and directed to make the 2010 Urban Water Management Plan available for public review during normal business hours at CLWA's administrative offices at 27234 Bouquet Canyon Road, Santa Clarita, CA, not later than thirty (30) days after filing a copy thereof with the California Department of Water Resources; and

RESOLVED FURTHER that in accordance with Water Code Section 10635(b), the General Manager is hereby authorized and directed to provide that portion of the 2010 Urban Water Management Plan prepared pursuant to Water Code Section 10635(a) to any city or county within which the Agency provides water supplies not later than sixty (60) days after filing a copy thereof with the California Department of Water Resources; and

RESOLVED FURTHER in accordance with the Urban Water Management Planning Act and SBX7-7, including, but not limited to, the Agency's Water Conservation Programs and its Water Shortage Contingency Plan, the General Manager is hereby authorized and directed to implement the components of the 2010 Urban Water Management Plan; and

RESOLVED FURTHER that the General Manager is authorized and directed to recommend to the Board of Directors additional steps necessary or appropriate to effectively carry out the implementation of the 2010 Urban Water Management Plan, the Urban Water Management Planning Act and SBX7-7.

William L. Cooper
Vice President

I, the undersigned, hereby certify I am the duly appointed and acting Secretary of the Castaic Lake Water Agency and at a regular meeting of the Board of Directors of said Agency held on Wednesday, June 22, 2011, the foregoing Resolution No. 2809 was duly and regularly adopted by said Board, and that said resolution has not been rescinded or amended since the date of its adoption, and it is now in full force and effect.

DATED: June 22, 2011

April Jacobs, Secretary

EXHIBIT "A"

FINAL DRAFT 2010 UWMP
(Attached hereto)

RESOLUTION NO. 2011-10

RESOLUTION OF THE BOARD OF DIRECTORS OF NEWHALL COUNTY WATER DISTRICT ADOPTING ITS 2010 URBAN WATER MANAGEMENT PLAN

WHEREAS, the California Urban Water Management Planning Act, Water Code Section 10610, et seq. (the Act) mandates that every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre feet of water annually, prepare and adopt an updated urban water management plan (UWMP) at least once every five years on or before December 31, in years ending five and zero; and

WHEREAS, the Newhall County Water District (NCWD) is an urban water supplier for purposes of the Act, and in 2005 approved and adopted its most recent UWMP and submitted its 2005 UWMP to the California Department of Water Resources (DWR); and

WHEREAS, the Water Conservation Act of 2009, Water Code section 10608 et seq. (SBX7-7), extended the time by which urban retail water suppliers must adopt 2010 UWMPs to July 1, 2011 and, among other things, established requirements for urban retail water suppliers to prepare urban water use targets in accordance with the goals of SBX7-7 to reduce statewide daily per capita water use by 15 percent by the year 2015 and 20 percent by the year 2020; and

WHEREAS, SBX7-7 was amended in 2010, extending the time by which urban water wholesale suppliers must adopt 2010 UWMPs to July 1, 2011, to permit coordination between urban wholesale water suppliers and urban retail water suppliers; and

WHEREAS, section 10620(d)(1) of the Act encourages urban water suppliers to satisfy the requirements of the Act by participation in area wide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use; and

WHEREAS, NCWD, Castaic Lake Water Agency (CLWA), Santa Clarita Water Division (SCWD) and the Valencia Water Company (VWC) collectively referred to as the Water Suppliers, prepared a document labeled "Public Review Draft 2010 Urban Water Management Plan" (Draft 2010 UWMP), upon which Los Angeles County Waterworks District No. 36 (LACWWD #36) participated as a cooperating agency; and

WHEREAS, in accordance with applicable law, including the requirements of the Act and of SBX7-7, the Water Suppliers have prepared the Draft 2010 UWMP and have undertaken certain agency coordination, public notice, public involvement and outreach, public comment, and other procedures in relation to the Draft 2010 UWMP; and

WHEREAS, as authorized by Section 10620(e) of the Act, the Water Suppliers have prepared the Draft 2010 UWMP with their own staff, with the assistance of consulting professionals and in cooperation with other governmental agencies, and have utilized and relied upon industry standards and the expertise of industry professionals in preparing the Draft 2010 UWMP, and have, in part, utilized and relied upon the DWR Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan (March 2011) and the DWR Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the

Consistent Implementation of the Water Conservation Act of 2009) (February 2011) in preparing the Draft 2010 UWMP; and

WHEREAS, the Water Suppliers began public outreach and community involvement in the preparation of the Draft 2010 UWMP in May 2010, with the first scheduled community workshop, followed by five more community workshops and three public hearings; and

WHEREAS, pursuant to Section 10621(b) of the Act, on March 3, 2011, the Water Suppliers notified the City of Santa Clarita and the Counties of Ventura and Los Angeles that they would be preparing the 2010 UWMP, and that they would be releasing the Draft 2010 UWMP in April 2011; and, in addition the Water Suppliers subsequently met with, consulted with and obtained comments on the 2010 UWMP from the City of Santa Clarita, the United Water Conservation District and the County of Los Angeles; and

WHEREAS, in accordance with applicable law, including Water Code sections 10608.26 and 10642, and Government Code section 6066, the Water Suppliers made the Draft 2010 UWMP available for public inspection, and published notice of the time and place of each joint public hearing on the Draft UWMP; and

WHEREAS, on March 23, 2011, NCWD and CLWA held a joint public hearing, properly noticed pursuant to Section 10642 of the Act and Government Code section 6066, at which time NCWD's Board of Directors reviewed draft sections and tables for inclusion in the Draft 2010 UWMP, and, as part of that review, considered a presentation regarding the Draft 2010 UWMP by staff and consultants, and oral and written public comments; and

WHEREAS, on May 18, 2011, NCWD and CLWA held a second joint public hearing, properly noticed pursuant to Section 10642 of the Act and Government Code section 6066, at which time NCWD's Board considered further oral and written public comments, and responses to those comments by staff and consultants, which included a presentation of the changes that had been made in the Public Review Draft 2010 UWMP; and

WHEREAS, on June 15, 2011, NCWD circulated to each of the members of its Board of Directors a Final Draft 2010 UWMP; and

WHEREAS, on June 22, 2011, CLWA and NCWD held a properly noticed joint public meeting and public hearing to consider adoption of the Final Draft 2010 UWMP, at which time NCWD's Board of Directors considered further oral and written public comments, and responses to those comments by staff and consultants, which included a presentation of the changes that had been made in the Final Draft 2010 UWMP and reviewed and considered adoption of the Final Draft 2010 UWMP; and

WHEREAS, pursuant to Water Code Section 10620(d)(2), the Water Suppliers coordinated the preparation of the Draft 2010 UWMP and Final Draft 2010 UWMP with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies and relevant public agencies, to the extent practicable; and

WHEREAS, pursuant to Water Code Section 10620(f), the Water Suppliers describe in the Draft 2010 UWMP and in the Draft Final 2010 UWMP water management tools and options used by the Water Suppliers which will maximize resources and minimize the need to import water from other regions; and

WHEREAS, pursuant to Water Code Section 10641, the Water Suppliers consulted with and obtained comments from those public agencies or persons with special expertise with respect to demand management methods and techniques; and

WHEREAS, the Water Suppliers have encouraged the active involvement of diverse social, cultural and economic elements of the population within NCWD's service areas and surrounding communities, with regard to the preparation of the Draft UWMP and Final Draft UWMP, allowed input by members of the public and any other interested party regarding all aspects of the Draft 2010 UWMP and Final Draft 2010 UWMP, allowed community input regarding NCWD's implementation plan for complying with SBX7-7, considered the economic impacts of NCWD's implementation plan for complying with SBX7-7 and adopted Method 1 under Water Code section 10608.20(b) for determining its urban water use targets; and

WHEREAS, to assure public participation in the process, the Water Suppliers have exceeded the requirements of the Act, by holding more than one public hearing; and

WHEREAS, the NCWD Board of Directors has considered the public and Board comments made at the three public hearings, as well as all written public comments on the Draft 2010 UWMP and the Final Draft 2010 UWMP distributed to the Board of Directors; and

WHEREAS, the NCWD Board of Directors has carefully reviewed and considered the purposes and requirements of the Act and SBX7-7, the contents of the Final Draft 2010 UWMP, any errata, revisions and modifications made at the hearing, the documentation contained in the administrative record in support of the Final Draft 2010 UWMP, and all public and agency input received with regard to the Final Draft 2010 UWMP, and has determined that the factual analyses and conclusions set forth in the 2010 UWMP are supported by substantial evidence.

NOW THEREFORE, BE IT RESOLVED that the Board of Directors of Newhall County Water District do hereby adopt Method 1 under Water Code section 10608.20(b) for determining its urban water use targets, and the Final Draft 2010 UWMP attached hereto as Exhibit "A" and incorporated herein by this reference, including any errata, revisions and modifications made at the hearing, is hereby approved and adopted as NCWD's 2010 Urban Water Management Plan, and ordered filed with the Secretary of the Board; and

RESOLVED FURTHER that the General Manager of the District is hereby authorized and directed to include a copy of this Resolution in the District's 2010 Urban Water Management Plan and, in accordance with Water Code section 10644(a), to file the 2010 Urban Water Management Plan with the California Department of Water Resources, the California State Library, and any city or county within which the District provides water supplies, within thirty (30) days of this adoption date; and

RESOLVED FURTHER that in accordance with Water Code section 10645, the General Manager is hereby authorized and directed to make the 2010 Urban Water Management Plan available for public review during normal business hours at NCWD's administrative offices at 23780 North Pine Street, Santa Clarita, CA, not later than thirty (30) days after filing a copy thereof with the California Department of Water Resources; and

RESOLVED FURTHER that in accordance with Water Code section 10635(b), the General Manager is hereby authorized and directed to provide that portion of the 2010 Urban Water Management Plan prepared pursuant to Water Code section 10635(a) to any city or county

within which the District provides water supplies not later than sixty (60) days after filing a copy thereof with the California Department of Water Resources; and

RESOLVED FURTHER in accordance with the Urban Water Management Planning Act and SBX7-7, including, but not limited to, the District's Water Conservation Programs and its Water Shortage Contingency Plan, the General Manager is hereby authorized and directed to implement the components of the 2010 Urban Water Management Plan; and

RESOLVED FURTHER that the General Manager is authorized and directed to recommend to the Board of Directors additional steps necessary or appropriate to effectively carry out the implementation of the 2010 Urban Water Management Plan, the Urban Water Management Planning Act and SBX7-7.

RESOLVED FURTHER that the General Manager and District staff are hereby authorized and directed to take such other and further actions as may be necessary or appropriate to carry out the purposes of this resolution, the Act and SBX7-7.

PASSED, APPROVED AND ADOPTED at a Special Meeting of the Board of Directors of Newhall County Water District held on June 22, 2011. Resolution No. 2011-10 was adopted by the following vote:

AYES:	**Directors**	ATKINS, COLLEY, GUTZEIT, MORTENSEN, PLAMBECK
NOES:	**Directors**	NONE
ABSTAIN:	**Directors**	NONE

Dan Mortensen, President,
Board of Directors of the
Newhall County Water District

ATTEST:

Karin J. Russell
Secretary of the Board of Directors

EXHIBIT "A"

2010 UWMP
(Attached hereto)

STATE OF CALIFORNIA)
) ss.
COUNTY OF LOS ANGELES)

I, Karin J. Russell, Secretary of the Newhall County Water District, DO HEREBY CERTIFY that the foregoing is full, true and correct copy of Resolution No. 2011-10 of the Board of Directors of Newhall County Water District adopted at a Special Meeting held on June 22, 2011, and that the same has not been amended or repealed.

Karin J. Russell
Secretary of the Board of Directors

DATED: 6-22-2011 (SEAL)

VALENCIA WATER COMPANY
BOARD OF DIRECTORS MEETING (JUNE 27, 2011)
RESOLUTION ADOPTING
THE 2010 URBAN WATER MANAGEMENT PLAN

WHEREAS, the California Urban Water Management Planning Act, Water Code Section 10610, et seq. (the Act) mandates that every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre feet of water annually, prepare and adopt an updated urban water management plan (UWMP) at least once every five years on or before December 31, in years ending five and zero; and

WHEREAS, the Valencia Water Company (VWC) is an urban water supplier for purposes of the Act, and in 2005 approved and adopted its most recent UWMP and submitted its 2005 UWMP to the California Department of Water Resources (DWR); and

WHEREAS, the Water Conservation Act of 2009, Water Code Section 10608 et seq. (SBX7-7), extended the time by which urban retail water suppliers must adopt 2010 UWMPs to July 1, 2011 to permit coordination between urban wholesale water suppliers and urban retail water suppliers and, among other things, established requirements for urban retail water suppliers to prepare urban water use targets in accordance with the goals of SBX7-7 to reduce statewide daily per capita water use by 15 percent by the year 2015 and 20 percent by the year 2020; and

WHEREAS, the VWC is an "urban retail water supplier" for purposes of SBX7-7 because it directly provides potable municipal water to more than 3,000 end users; and

WHEREAS, Section 10620(d)(1) of the Act encourages urban water suppliers to satisfy the requirements of the Act by participation in area wide urban water management planning where those plans will reduce preparation costs and contribute to the achievement of conservation and efficient water use; and

WHEREAS, Valencia Water Company, in cooperation with Castaic Lake Water Agency (CLWA), the CLWA Santa Clarita Water Division (SCWD), and Newhall County Water District (NCWD), prepared a document labeled "Public Review Draft 2010 Urban Water Management Plan" for the CLWA service area (Draft 2010 UWMP), upon which Los Angeles County Waterworks District No. 36 (LACWWD #36) participated as a cooperating agency; and

WHEREAS, in accordance with applicable law, including the requirements of the Act and of SBX7-7, CLWA has prepared the Draft 2010 UWMP and has undertaken certain agency coordination, public notice, public involvement and outreach, public comment, and other procedures in relation to the Draft 2010 UWMP; and

WHEREAS, as authorized by Section 10620(e) of the Act, CLWA and the retail purveyors have prepared the Draft 2010 UWMP with their own staff, with the assistance of consulting professionals and in cooperation with other governmental agencies, and has utilized and relied upon industry standards and the expertise of industry professionals in preparing its Draft 2010 UWMP, and have, in part, utilized and relied upon the DWR Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan (March 2011) and the DWR Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Act of 2009) (February 2011) in preparing the Draft 2010 UWMP; and

WHEREAS, CLWA and the retail purveyors began the public outreach and community involvement in the preparation of the Draft 2010 UWMP in May 2010, with the first scheduled community

workshop, followed by five more community workshops and three public hearings; and

WHEREAS, pursuant to Section 10621(b) of the Act, on March 3, 2011, CLWA notified the City of Santa Clarita and the Counties of Ventura and Los Angeles that it would be preparing the 2010 UWMP, and that the Draft 2010 UWMP would be released in April 2011, and subsequently met with, consulted with and obtained comments from the City of Santa Clarita, the United Water Conservation District and the County of Los Angeles; and

WHEREAS, in accordance with applicable law, including Water Code Sections 10608.26 and 10642, and Government Code Section 6066, the Draft 2010 UWMP was made available for public inspection, and notice was provided of the time and place of each joint public hearing on the Draft UWMP; and

WHEREAS, on March 23, 2011, CLWA and NCWD held a joint public hearing, properly noticed pursuant to Section 10642 of the Act and Government Code Section 6066, at which time CLWA's Board of Directors reviewed draft sections and tables for inclusion in the Draft 2010 UWMP, and, as part of that review, considered a presentation regarding the Draft 2010 UWMP by its staff and consultants, and oral and written public comments; and

WHEREAS, on May 18, 2011, CLWA and NCWD held a second joint public hearing, properly noticed pursuant to Section 10642 of the Act and Government Code Section 6066, at which time CLWA's Board of Directors considered further oral and written public comments, and responses to those comments by its staff and consultants, which included a presentation of the changes that had been made in the Public Review Draft 2010 UWMP; and

WHEREAS, on June 3, 2011, the VWC Board Secretary sent each Board of Director the Draft 2010 UWMP, Public Review Draft, dated April 2011, along with six public workshop presentations, two public hearing presentations and transcripts and eight letters/emails received to date from the public commenting on the Plan. At the time, the Secretary informed the Board that a secondary transmittal of information would be forthcoming on June 24, 2011;

WHEREAS, on June 15, 2011, CLWA circulated to each of the members of its Board of Directors a Final Draft 2010 UWMP; and

WHEREAS, on June 22, 2011, CLWA and NCWD held a properly noticed joint public meeting and public hearing to consider adoption of the Final Draft 2010 UWMP, at which time CLWA's Board of Directors considered further oral and written public comments, and responses to those comments by its staff and consultants, which included a presentation of the changes that had been made in the Final Draft 2010 UWMP, and reviewed and considered adoption of the Final Draft 2010 UWMP; and

WHEREAS, on June 24, 2010, the VWC Board received and reviewed a second transmittal, dated June 24, 2011, with additional information about the 2010 UWMP process, further 2010 UWMP documents, and the 2010 UWMP timeline;

WHEREAS, pursuant to Water Code Section 10620(d)(2), VWC coordinated the preparation of the Draft 2010 UWMP and Final Draft 2010 UWMP with CLWA and other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies and relevant public agencies, to the extent practicable; and

WHEREAS, pursuant to Water Code Section 10620(f), the Draft 2010 UWMP and in the Draft Final 2010 UWMP describe the water management tools and options used by CLWA and the retail purveyors that will maximize resources and minimize the need to import water from other regions; and

WHEREAS, pursuant to Water Code Section 10641, CLWA and the retail purveyors consulted with and obtained comments from those public agencies or persons with special expertise with respect to demand management methods and techniques; and

WHEREAS, CLWA and the retail purveyors have encouraged the active involvement of diverse social, cultural and economic elements of the population within the CLWA service area with regard to the preparation of the Draft UWMP and Final Draft UWMP, allowed input by members of the public and any other interested party regarding all aspects of the Draft 2010 UWMP and Final Draft 2010 UWMP, allowed community input regarding the implementation plan for complying with SBX7-7, considered the economic impacts of the implementation plan for complying with SBX7-7 and adopted Method 1 under Water Code Section 10608.20(b) for determining its urban water use targets; and

WHEREAS, to assure public participation in the process, CLWA and the retail purveyors have exceeded the requirements of the Act, by holding more than one public hearing; and

WHEREAS, the VWC Board of Directors has considered the public and Board comments made at the three public hearings, as well as all written public comments on the Draft 2010 UWMP and the Final Draft 2010 UWMP distributed to the Board of Directors; and

WHEREAS, the VWC Board of Directors has carefully reviewed the Final Draft 2010 UWMP, any errata, revisions and modifications made at the final public hearing; and

WHEREAS, the VWC Board of Directors has carefully reviewed and considered the purposes and requirements of the Act and SBX7-7, the contents of the Final Draft 2010 UWMP, any errata, revisions and modifications made at the final public hearing, the documentation contained in the administrative record in support of the Final Draft 2010 UWMP, and all public and agency input received with regard to the Final Draft 2010 UWMP, and has determined that the factual analyses and conclusions set forth in the 2010 UWMP are supported by substantial evidence.

NOW THEREFORE, BE IT RESOLVED that the VWC Board of Directors does hereby adopt Method 1 under Water Code Section 10608.20(b) for determining urban water use targets, and the Final Draft 2010 UWMP, incorporated herein by this reference, including any errata, revisions and modifications made at the final public hearing, is hereby approved and adopted as the 2010 Urban Water Management Plan, and filed with the Secretary of the Board; and

RESOLVED FURTHER that the General Manager is hereby authorized and directed to include a copy of this Resolution in the 2010 Urban Water Management Plan and, in accordance with Water Code Section 10644(a), to file the 2010 Urban Water Management Plan with the California Department of Water Resources, the California State Library, and any city or county within which the Valencia Water Company provides water supplies within thirty (30) days of this adoption date; and

RESOLVED FURTHER that in accordance with Water Code Section 10645, the General Manager is hereby authorized and directed to make the 2010 Urban Water Management Plan available for public review during normal business hours at VWC's offices not later than thirty (30) days after filing a copy thereof with the California Department of Water Resources; and

RESOLVED FURTHER that in accordance with Water Code Section 10635(b), the General Manager is hereby authorized and directed to provide that portion of the 2010 Urban Water Management Plan prepared pursuant to Water Code Section 10635(a) to any city or county within which the Valencia Water Company provides water supplies not later than sixty (60) days after filing a copy thereof with the California Department of Water Resources; and

RESOLVED FURTHER in accordance with the Act and SBX7-7, including, but not limited to, the Water Conservation Programs and the Water Shortage Contingency Plan, the General Manager is hereby authorized and directed to implement the components of the 2010 Urban Water Management Plan; and

RESOLVED FURTHER that the General Manager is authorized and directed to recommend to the Board of Directors additional steps necessary or appropriate to effectively carry out the implementation of the 2010 Urban Water Management Plan, the Act, and SBX7-7.

I, the undersigned, hereby certify that I am the duly appointed Secretary of the Valencia Water Company, and that at a regular meeting of the Board of Directors of said Company held on Monday, June 27, 2011, the foregoing Resolution was duly and regularly adopted by said Board, and that said resolution has not been rescinded or amended since the date of its adoption, and that it is in full force and effect.

July 8, 2011

Greg Milleman

Greg Milleman, Secretary

Section 1: Introduction

1.1 Overview

This volume presents the Urban Water Management Plan 2010 (Plan) for the Castaic Lake Water Agency (Agency, CLWA) service area, which includes four retail water purveyors. These retail water purveyors are the Santa Clarita Water Division of CLWA, Newhall County Water District, Valencia Water Company and Los Angeles County Waterworks District 36. Together CLWA and the purveyors are the Santa Clarita Valley's 'water suppliers'. This chapter describes the general purpose of the Plan, discusses Plan implementation and provides general information about CLWA, the retail purveyors and service area characteristics.

1.2 Purpose

An Urban Water Management Plan (UWMP) is a planning tool that generally guides the actions of urban water suppliers. It provides managers and the public with a broad perspective on a number of water supply issues. It is not a substitute for project-specific planning documents, nor was it intended to be when mandated by the State Legislature. For example, the Legislature mandated that a plan include a section which "…describes the opportunities for exchanges or water transfers on a short-term or long-term basis." (Wat. Code, § 10631, subd. (d)). The identification of such opportunities and the inclusion of those opportunities in a plan's general water service reliability analysis neither commits an urban water supplier to pursue a particular water exchange/transfer opportunity, nor precludes it from exploring exchange/transfer opportunities never identified in its plan. Before an urban water supplier is able to implement any potential future sources of water supply identified in a plan, detailed project plans are prepared and approved, financial and operational plans are developed and all required environmental analysis is completed.

"A plan is intended to function as a planning tool to guide broad-perspective decision making by the management of water suppliers." (*Sonoma County Water Coalition v. Sonoma County Water Agency* (2010) 189 Cal. App. 4th 33, 39.) It should not be viewed as an exact blueprint for supply and demand management. Water management in California is not a matter of certainty and planning projections may change in response to a number of factors. "[L]ong-term water planning involves expectations and not certainties. Our Supreme Court has recognized the uncertainties inherent in long-term land use and water planning and observed that the generalized information required . . . in the early stages of the planning process are replaced by firm assurances of water supplies at later stages." (*Id.*, at 41.) From this perspective, it is appropriate to look at the UWMP as a general planning framework, not a specific action plan. It is an effort to generally answer a series of planning questions including:

- What are the potential sources of supply and what is the reasonable probable yield from them?
- What is the probable demand, given a reasonable set of assumptions about growth and implementation of good water management practices?
- How well do supply and demand figures match up, assuming that the various probable supplies will be pursued by the implementing agency?

Using these "framework" questions and resulting answers, the implementing agency will pursue feasible and cost-effective options and opportunities to meet demands.

The water suppliers will explore enhancing basic supplies from traditional sources such as the State Water Project (SWP) as well as other options. These include groundwater extraction, water exchanges and transfers, water conservation, recycling, brackish water desalination and water banking/conjunctive use. Specific planning efforts will be undertaken in regard to each option, involving detailed evaluations of how each option would fit into the overall supply/demand framework, how each option would impact the environment and how each option would affect customers. The objective of these more detailed evaluations would be to find the optimum mix of conservation and supply programs that ensure that the needs of the customers are met.

The California Urban Water Management Planning Act (Act) requires preparation of a plan that:

- Accomplishes water supply planning over a 20-year period in five year increments. (CLWA and the purveyors are going beyond the requirements of the Act by developing a plan which spans forty years.)
- Identifies and quantifies adequate water supplies, including recycled water, for existing and future demands, in normal, single-dry and multiple-dry years.
- Implements conservation and efficient use of urban water supplies.

Additionally, newly passed State legislation, Senate Bill 7 of Special Extended Session 7 (SBX7-7), was signed into law in November 2009, which calls for progress towards a 20 percent reduction in per capita water use statewide by 2020. As a result, the legislation now mandates each urban retail supplier to develop and report a water use target in the retailer's 2010 UWMP. The legislation further requires that retailers report an interim 2015 water use target, their baseline daily per capita use and 2020 compliance daily per capita use, along with the basis for determining those estimates.

SBX7-7 provides four possible methods for an urban retail water supplier to use to calculate its water use target. The California Department of Water Resources (DWR) has also developed methodologies for calculating base daily per capita water use; baseline commercial, industrial and institutional water use; compliance daily per capita water use; gross water use; service area population; indoor residential water use and landscape area water use.

Also of importance is Assembly Bill (AB) 1420. AB 1420, passed in 2007 and in effect as of January 2009, changes the funding eligibility requirements of Section 10631.5 of the Water Code. For any urban water supplier to be eligible for grant or loan funding administered by DWR, the State Water Resources Control Board (SWRCB) or the Bay-Delta Authority (such as those funding programs Propositions 50 and 84), the supplier must show implementation of water use efficiency demand management measures/best management practices (DMMs/BMPs) listed and described in the Act and the California Urban Water Conservation Council (CUWCC) Memorandum of Understanding Regarding Urban Water Conservation in California (MOU), or show the schedules and budgets by which the supplier will begin implementing the DMMs/BMPs. Any supplier not implementing the measures based on cost-effectiveness must submit proof showing why the measures are not cost-effective. Tables ensuring compliance with AB 1420 are provided in Appendix E.

A checklist to ensure compliance of this Plan with the Act requirements is provided in Appendix A.

It is the stated goal of CLWA and the retail water purveyors to deliver a reliable and high quality water supply to their customers, even during dry periods. Based on conservative water supply and demand assumptions over the next forty years in combination with conservation of non-essential demand during normal water years, the UWMP successfully achieves this goal.

1.3 Implementation of the Plan

CLWA has a contract with the State of California, through DWR, to acquire and distribute SWP water to its four local retail water purveyors in the Santa Clarita Valley: CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), Valencia Water Company (VWC) and Los Angeles County Waterworks District No. 36 (LACWWD 36). This Plan is required for CLWA and three of the purveyors, SCWD, NCWD and VWC. The fourth purveyor, LACWWD 36, is not required to prepare an UWMP because the District does not provide water to more than 3,000 customers or supply more than 3,000 acre-feet (AF) of water annually; however, LACWWD 36 participated in the development of the Plan on an "ad-hoc" basis. This subsection provides the cooperative framework within which the Plan will be implemented including agency coordination, public outreach and resources maximization.

1.3.1 Joint Preparation of the Plan

Water suppliers are permitted by the State to work together to develop a cooperative regional plan for the CLWA service area. This approach has been adopted by the water suppliers in the Santa Clarita Valley (Valley), which are jointly sponsoring the current Plan. Water resource specialists with expertise in water resource management were retained to assist the local water suppliers in preparing the details of the Plan. Agency coordination for this Plan is summarized in Table 1-1.

TABLE 1-1
AGENCY COORDINATION SUMMARY

	Participated in UWMP Development	Received Copy of Draft	Commented on Draft	Attended Public Meetings	Contacted for Assistance	Sent Notice of Intent to Adopt	Invited/Not Involved
Aquilar Landscape				X			
Atkins Environmental Help				X			
Assembly Member Audra Strickland (representatives)							X
Assembly Member Cameron Smyth (representatives)				X			
Assembly Member Jeff Gorell (representatives)				X			
Associated Builders and Contractors of CA				X			
Building Industry Association – Los Angeles/Ventura Chapter				X			
Burbank Water and Power				X			
California Department of Water Resources (SoCal; Glendale; retired)				X	X		
Castaic Lake Water Agency	X			X			
Castaic Area Town Council				X			
City of Los Angeles				X			
City of Santa Clarita Department of Planning and Building Services		X		X		X	
City of Santa Clarita Intergovernmental Relations				X		X	
CLWA Santa Clarita Water Division	X			X			
College of the Canyons				X			
Congressman Howard McKeon (representatives)				X			
Friends of the Santa Clara River			X				X
Grass Is Greener Landscape Design				X			
Impact Sciences				X	X		
Integrated Property Services Group, Inc.				X			
Los Angeles County Flood Control Department				X			
Los Angeles County Department of Public Works				X			
Los Angeles County Department of Regional Planning		X		X	X	X	
Los Angeles County LAFCO		X		X			
Los Angeles County Supervisor Mike Antonovich (representatives)				X		X	

	Participated in UWMP Development	Received Copy of Draft	Commented on Draft	Attended Public Meetings	Contacted for Assistance	Sent Notice of Intent to Adopt	Invited/Not Involved
Los Angeles County Waterworks District 36	X			X			
Metropolitan Water District of Southern California					X		
Newhall County Water District	X			X			
Santa Clarita Organization for Planning the Environment – SCOPE			X	X			
Santa Clarita Valley Chamber of Commerce				X			
Santa Clarita Valley Fair Elections Committee			X	X			
Santa Clarita Valley Residents Mr. and Mrs. Dunn			X	X			
Santa Clarita Valley Resident Mr. Naoum			X				
Santa Clarita Valley Resident Ms. Nolltemeyer			X	X			
Santa Clarita Valley Sanitation District				X	X		
Santa Clarita Valley Well Owners Association							X
Sierra Club Angeles Chapter			X				
Southern California Association of Governments							X
State Senator George Runner (representatives)				X			
State Senator Sharon Runner (representatives)				X			
State Senator Tony Strickland							X
Sutters Home Owners Association				X			
United Water Conservation District		X			X		
Valley Industrial Association of Santa Clarita							X
Valencia Water Company	X			X			
Ventura County LAFCO		X					
Ventura County Resource Management Agency		X				X	X
Vista Ridge Homeowners Association				X			
Waterwise				X			
West Ranch Town Council				X			
Whittaker Bermite Citizens Advisory Group			X	X			

1.3.2 Plan Adoption

CLWA and the retail purveyors began preparation of this Plan for the CLWA service area in November 2009. The final draft of the Plan was adopted by the Agency Board on June 22, 2011 and submitted to DWR within thirty days of Board approval. NWCD's Board adopted the final draft of the Plan on June 22, 2011. VWC's Board adopted the final draft of the Plan on June 27, 2011. This plan includes all information necessary to meet the requirements of Water Conservation Act of 2009 (Wat. Code, §§ 10608.12-10608.64) and the Urban Water Management Planning Act (Wat. Code, §§ 10610-10656).

1.3.3 Public Outreach

The water suppliers have encouraged community participation in water planning. For the current Plan, five public workshop sessions were held to solicit input on the Draft Plan before its adoption. Interested groups were informed about the development of the Plan along with the schedule of public activities. Notices of public meetings were published in the local press and at the water supplier websites. Copies of the Draft Plan were made available at the water suppliers' offices and websites, local public libraries and sent to the City of Santa Clarita, the County of Los Angeles and the County of Ventura, as well as to interested parties as identified in Table 1-1. The water suppliers also convened meetings with various interests to gather data concerning planned development and the probable implementation of approved development. Such informed data gathering on important issues is a means of checking the short-term "reality" of official projections and understanding the concerns of various groups.

CLWA contracted with a local public relations firm to coordinate preparation of the Plan with the local community and stakeholders. CLWA notified the cities and counties within its service area of the opportunity to provide input regarding the Plan. Table 1-2 presents a timeline for public participation during the development of the Plan. A copy of the public outreach materials, including paid advertisements, newsletter covers, website postings and invitation letters are attached in Appendix B.

TABLE 1-2
PUBLIC PARTICIPATION TIMELINE

Public Workshops and Hearings	Date	Public Participation Task
1st Public Workshop	May 25, 2010	Presented UWMP requirements and Plan outline
2nd Public Workshop	July 27, 2010	Progress update on UWMP requirements and process, discuss supplies
Presentation to the Upper Santa Clara River IRWMP Stakeholder Group	November 9, 2010	UWMP requirements, process, preliminary SBX7-7 calculations
3rd Public Workshop	November 16, 2010	Discussed Santa Clarita Valley supplies and demands, reliability analysis and SBX7-7 calculations
4th Public Workshop	January 25, 2011	Discussed supply and demand analysis and SBX7-7 calculations
5th Public Workshop	March 8, 2011	Discussed supply and demand analysis
1st Public Hearing	March 23, 2011	Presented overview of Draft 2010 UWMP
2nd Public Hearing	May 18, 2011	Discussed comments on Public Draft 2010 UWMP
3rd Public Hearing	June 22, 2011	Discussed comments on Public Draft 2010 UWMP
Plan Adoption	June 22, 2011	Adoption Hearing for CLWA and NCWD for Final Draft 2010 UWMP
Plan Adoption	June 27, 2011	Adoption of Final Draft 2010 UWMP by VWC's Board of Directors
Plan Submittal	July 21, 2011	File 2010 UWMP with DWR within thirty days of adoption

The components of public participation include:

Local Media

- Paid advertisements in local newspapers
- Meeting(s) with local editorial boards (*The Signal*)

Community-Based Outreach

- Building Industry Association
- Castaic Town Council
- Santa Clarita Valley Chamber of Commerce
- Friends of the Santa Clara River
- Santa Clarita Valley Well Owners Association
- Santa Clarita Organization for Planning the Environment
- Sierra Club
- Valley Industrial Association of Santa Clarita Valley
- West Ranch Town Council

Water Suppliers Public Participation

- Presentations to NCWD Board
- Presentations to CLWA Board

City/County Outreach

- Meeting with City of Santa Clarita Planning Division
- Meeting with Los Angeles County Department of Regional Planning
- Meeting with Supervisor Antonovich representatives Rosalind Wayman and Edel Vizcarra

Public Availability of Documents

- Water suppliers' offices and websites
- City Hall
- Local libraries

1.3.4 Resources Maximization

Several documents were developed to enable the water suppliers to maximize the use of available resources and minimize use of imported water, including the 2005 CLWA UWMP, CLWA's 2009 Water Supply Reliability Plan Update, the 2008 Integrated Regional Water Management Plan for the Upper Santa Clara River, the 2009 Santa Clarita Valley Water Report, DWR's 2009 State Water Project Delivery Reliability Report, the 2002 Draft Recycled Water Master Plan, the 2009 Basin Yield Analysis by Luhdorff and Scalmanini Consulting Engineers and GSI Water Solutions, Inc., the 2010 Data Document[1] and the 2003 Groundwater Management Plan (GWMP). Chapter 3 of this Plan describes in detail the water resources available to CLWA and the retail purveyors for the forty-year period covered by the Plan. A complete reference list is provided in Section 9 of this Plan.

1.4 Water Suppliers of the Santa Clarita Valley

1.4.1 Castaic Lake Water Agency

CLWA was formed in 1962 for the purpose of contracting with DWR to acquire and distribute imported SWP water to the water purveyors in the Valley. CLWA serves an area of 195 square miles in Los Angeles and Ventura Counties.

Adequate planning for, and the procurement of, a reliable water supply is a fundamental function of CLWA. CLWA obtains its water supply for wholesale purposes principally from the

[1] CLWA regularly updates its Data Document as the basis for establishing its facility capacity fees. Several significant developments since the last Data Document update in 2008 were incorporated into the 2010 Update: water conservation legislation that could significantly affect water demand projections and the cost of water conservation programs; the need to coordinate water supply and demand projections with the preparation of the 2010 Urban Water Management Plan; establishment of Total Maximum Daily Load allocations for the Santa Clara River that could affect recycled water availability; judicial and regulatory determinations for the Delta that affect SWP reliability; engineering studies completed since the 2008 Data Document, particularly those related to emergency and operating storage, recycled water, and transmission system improvements; and updated cost allocation issues from the 2008 Document.

SWP and currently has a Water Supply Contract with DWR for 95,200 acre-feet per year (AFY) of SWP Table A Amount[2]. The maximum annual Table A Amount in CLWA's SWP Water Supply Contract with DWR was originally 23,000 AF, but was amended to 41,500 AF in 1966. In 1991 CLWA purchased 12,700 AF of annual Table A Amount from a Kern County water district and in 1999 CLWA purchased 41,000 AF of annual Table A Amount from another Kern County water district, for the current total of 95,200 AFY. CLWA also imports water from two other water districts in Kern County. Under the 2007 Water Acquisition Agreement with the Buena Vista Water Storage District (Buena Vista, BVWSD) and the Rosedale-Rio Bravo Water Storage District (Rosedale-Rio Bravo, RRBWSD), Buena Vista's high flow Kern River entitlements (and other acquired waters that may become available) are captured and recharged within the Rosedale-Rio Bravo's service area on an ongoing basis. CLWA receives 11,000 AF of these supplies annually through either exchange of Buena Vista's and Rosedale-Rio Bravo's SWP supplies or through direct delivery of water to the California Aqueduct via the Cross Valley Canal. All imported water is delivered to Castaic Lake through SWP facilities. From Castaic Lake, which serves as the terminal reservoir of the SWP's West Branch, the water is treated at either CLWA's Earl Schmidt Filtration Plant or Rio Vista Water Treatment Plant and delivered to the retail water purveyors through transmission lines owned and operated by CLWA.

CLWA is able to meet approximately half of the Valley's urban demand with imported water. However, the availability of SWP supply is variable. It fluctuates from year to year depending on precipitation, regulatory restrictions, legislative restrictions and operational conditions and is subject to severe curtailment during dry years. Of particular concern is the recent (2007) U.S. District Court ruling whereby the SWP was held in violation of the federal Endangered Species Act due to potential pumping impacts on populations of the Delta smelt, a fish species living in the Sacramento-San Joaquin Delta, resulting in the order to curb water imports from the Delta by up to 35 percent from the SWP and the Central Valley Project. A similar court decision was rendered in 2009 involving endangered salmon. The results of these impacts on environmental resources in the Delta, when combined with recent socioeconomic conditions and hydrology changes, have already reduced the utilization of SWP and other imported supplies in the Region from a high in 2004 of about 47,500 AF to approximately 38,700 AF in 2009. Recently (December 14, 2010), the court overturned these rulings and has required new analysis of Delta pumping requirements. While the results are unknown at this time, it is expected that some level of SWP pumping restrictions will continue into the future. Further, in June 2008, Governor Arnold Schwarzenegger declared California to be in a statewide drought condition, and called for a reduction in statewide water uses by 20 percent by the year 2020, which resulted in the passage of SBX7-7 in late 2009.

CLWA and the retail purveyors mainly meet the balance of their demands with local groundwater and a small amount of recycled water. CLWA has evaluated the long-term water needs (water demand) within its service area based on applicable county and city land use plans and has compared these needs against existing and potential water supplies. Results indicate that as CLWA's water requirements utilize increased proportions of its SWP Table A Amount, conjunctive use, water conservation, water transfers, recycled water and water banking are becoming increasingly more important water management elements for CLWA's long-term water supply strategy.

[2] Table A is a schedule of annual water amounts as set forth in long-term SWP delivery contracts. Table A defines the annual volume of water that could be delivered to a SWP contractor in a given year under regular contract provisions without consideration of surplus SWP water deliveries or other supplies available to a SWP contractor.

Since the preparation of the 2005 Plan, DWR has prepared updates to the SWP Reliability Report in 2007 and 2009. Also, the water demand projections within CLWA's service area have been updated based on detailed information provided by CLWA's retail purveyors. In addition, based on DWR estimates of SWP supply reliability, CLWA has developed additional water supplies as well as capacity in groundwater banks. Together with its SWP Table A supply and the flexible storage allowed under the Monterey Amendments to the SWP Water Supply Contracts, these additional water management strategy elements have created a series of water management options that are addressed in this UWMP Update.

1.4.2 Retail Water Purveyors

Four retail purveyors provide water service to most residents of the Valley.

1. LACWWD 36's service area includes the Hasley Canyon area in the unincorporated community of Val Verde. During most years, the District obtains its water supply from CLWA.

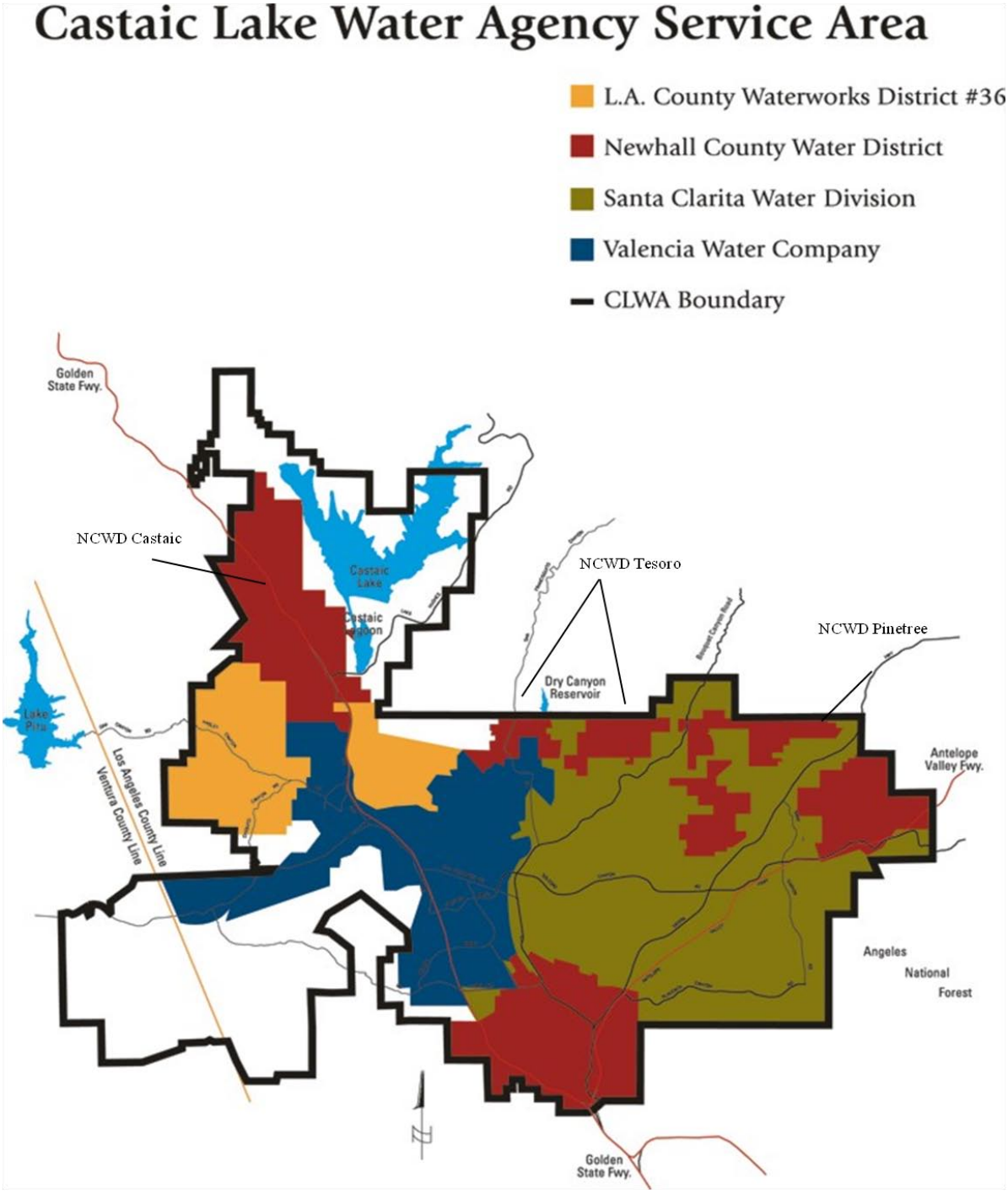
2. NCWD's service area includes portions of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Castaic, Newhall, Valencia and Canyon Country. The District supplies water from local groundwater and CLWA imported water.

3. SCWD's service area includes portions of the city of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Canyon Country, Newhall and Saugus. SCWD supplies water from local groundwater and CLWA imported water.

4. VWC's service area includes a portion of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Valencia, Stevenson Ranch and portions of Castaic, Saugus and Newhall. VWC supplies water from local groundwater, CLWA imported water and recycled water.

The service area for CLWA and the retail water purveyors is shown on Figure 1-1.

FIGURE 1-1


Castaic Lake Water Agency Service Area
L.A. County Waterworks District #36
Newhall County Water District
Santa Clarita Water Division
Valencia Water Company
CLWA Boundary
Golden State Fwy.
NCWD Castaic
Castaic Lake
Castaic Lagoon
NCWD Tesoro
Dry Canyon Reservoir
NCWD Pinetree
Lake Piru
Los Angeles County Line
Ventura County Line
Antelope Valley Fwy.
Angeles National Forest
Golden State Fwy.

The four retail purveyors – (1) SCWD, (2) NCWD, (3) VWC and (4) LACWWD 36 – deliver these waters to primarily municipal and industrial (M&I) users within the Valley. Together, as shown below in Table 1-3, the purveyors provide water to nearly 70,000 service connections (2009 Santa Clarita Valley Water Report, May 2010).

TABLE 1-3
RETAIL WATER SERVICE CONNECTIONS

Retail Water Purveyor	Connections
LACWWD 36	1,400
NCWD	9,600
SCWD	28,700
VWC	30,000
Total Connections	**69,700**

Source: 2009 Santa Clarita Valley Water Report (May 2010)

1.5 Climate

The climate in CLWA's service area is generally semi-arid and warm. Summers are dry with temperatures as high as 110°F. Winters are somewhat cool with temperatures as low as 20°F. Average rainfall since 1980 is about 17.3 inches per year in the flat areas and about 25 to 30 inches in the mountains. The region is subject to wide variations in annual precipitation and also experiences periodic wildfires. The region's average climate conditions are presented in Tables 1-4 and 1-5.

TABLE 1-4
CLIMATE DATA FOR THE SANTA CLARITA VALLEY

Month	Standard Monthly Avg. ETo (in.)	Avg. Max. Temperature (Fahrenheit)
Jan	3.43	65.4
Feb	3.08	67.7
Mar	5.6	74.6
Apr	6.5	79.4
May	7.94	85.5
Jun	8.36	90.3
Jul	9.15	95.8
Aug	8.76	95.5
Sep	6.75	88.7
Oct	5.24	79.5
Nov	4.03	73.9
Dec	2.58	64.3
Annual	**71.42**	**80.0**

Source: California Irrigation Management System (CIMIS) data provided from Santa Clarita Station No. 204, Los Angeles region, January 2007 to December 2010 http://wwwcimis.water.ca.gov/cimis/welcome.jsp.
ETo = evapotranspiration

TABLE 1-5
ANNUAL RAINFALL RECORD FOR THE SANTA CLARITA VALLEY

Year	Annual Rainfall (in.)	Year	Annual Rainfall (in.)
1980	24.3	1995	29.2
1981	13.4	1996	15.8
1982	20.2	1997	7.1
1983	39.1	1998	28.2
1984	12.9	1999	9.0
1985	8.4	2000	13.6
1986	18.0	2001	18.8
1987	14.5	2002	7.8
1988	16.9	2003	15.6
1989	7.6	2004	22.8
1990	7.0	2005	37.2
1991	17.2	2006	13.9
1992	32.0	2007	5.8
1993	22.1	2008	18.2
1994	10.3	2009	11.6
		Average	**17.3**

Source: Data provided from rain gage Newhall-Soledad 32c, January 1980 to January 2009

1.6 Potential Effects of Climate Change

A topic of growing concern for water planners and managers is climate change and the potential impacts it could have on California's future water supplies. Climate change models have predicted that potential effects from climatic changes will result in increased temperature, reduction in Sierra Nevada snowpack depth, early snow melt and a rise in sea level.

In June 2005, Governor Arnold Schwarzenegger issued Executive Order S-3-05, which requires biennial reports on climate change impacts in several areas, including water resources. The Climate Action Team (CAT) was formed in response to Executive Order S-3-05. To help unify analysis across topic areas, the CAT worked with scientists from the California Applications Program's California Climate Change Center to select a set of future climate projections to be used for analysis. In the assessment *"Using Future Climate Projections to Support Water Resources Decision Making in California,"* the CAT selected six different global climate change models to evaluate climate change impacts, assuming two different greenhouse gas emission levels (a high end and a low end), for a total of 12 scenarios. The results of the study indicated that climate change has already been observed, in that in the last 100 years air temperatures have risen about one degree Fahrenheit and there has been a documented greater variance in precipitation, with greater extremes in both heavy flooding and severe droughts.

In July 2006, DWR issued "*Progress on Incorporating Climate Change into Management of California's Water Resources*," as required by Executive Order S-3-05. That report demonstrated how various analytical tools could be used to address issues related to climate change. The report presents analysis results showing potential impacts on SWP operations, including reservoir inflows, delivery reliability, and average annual carryover storage, as well as many other operational parameters. Some of the main impacts include changes to south-of-Delta SWP deliveries (from an increase of about one percent in a wetter climate change scenario to about a ten percent reduction for a drier scenario), increased winter runoff and lower

SWP allocations in the three driest scenarios, lower carryover storage in drier scenarios and higher carryover storage in the wetter scenario.

In the 2009 update of the DWR *California Water Plan*, multiple scenarios of future climate conditions are evaluated. These changing hydrological conditions could affect future planning efforts, which are typically based on historic conditions. The *California Water Plan* identifies the following probable impacts due to changes in temperature and precipitation:

- Decrease in snowpack, which is a major part of annual water storage, due to increasing winter temperatures.
- More winter runoff and less spring/summer runoff due to warmer temperatures.
- Greater extremes in flooding and droughts.
- Greater water demand for irrigation and landscape water due to increased temperatures and their impacts on plant water needs.
- Increased sea level rise, further endangering the functions of the SWP, which can depend on movement of water through the low-lying channels of the low-lying Sacramento-San Joaquin Delta. Sea level rise could also require the SWP to release additional storage water to avoid sea water intrusion into the Delta.

In its *State Water Project Delivery Reliability Report (Reliability Report)* (2009), DWR included the potential effects of climate change in its analysis of SWP delivery reliability under future conditions. For that report, DWR used a single climate change scenario, selecting a scenario with median effects out of a number of climate change scenarios it analyzed in 2009.

Even without population changes, water demand could increase. Precipitation and temperature influence water demand for outdoor landscaping and irrigated agriculture. Outdoor water use is a large component of Santa Clarita Valley water demands. Lower spring rainfall increases the need to apply irrigation water. Further, warmer temperatures increase crop evapotranspiration, which increases water demand.

These effects and their potential to impact the supplies available to the Santa Clarita Valley have been evaluated indirectly in DWR's *Reliability Report*, and their potential to impact demand is considered in CLWA's assessment of demands in Chapter 2 of this UWMP.

Section 2: Water Use

2.1 Overview

This chapter describes historic and current water usage and the methodology used to project future demands within CLWA's service area. Water usage is divided into sectors such as residential, industrial, commercial, landscape, agricultural, and other purposes. To undertake this evaluation, existing land use data and new housing construction information were compiled from each of the retail water purveyors and projections evaluated from each retailer's master planning documents. This information was then compared to historical trends for new water service connections and customer water usage information. In addition, weather and water conservation effects on historical water usage were considered in the evaluation.

Several factors can affect demand projections, including:

- Land use revisions
- New regulations
- Consumer choice
- Economic conditions
- Transportation needs
- Highway construction
- Environmental factors
- Conservation programs
- Building and plumbing codes

The foregoing factors affect the amount of water needed, as well as the timing of when it is needed. During an economic recession, there is a major downturn in development and a subsequent slowing of the projected demand for water. The projections in this Plan do not attempt to forecast recessions or droughts. Likewise, no speculation is made about future building and plumbing codes or other regulatory changes. However, the projections do include water conservation consistent with new legislative requirements calling for a 20 percent reduction in per capita demand by 2020 (SBX7-7).

An analysis was performed that combined growth projections with water use data to forecast total water demand in future years. Water uses were broken out into specific categories and assumptions made about each to more accurately project future use. Three separate data sets were collected and included in the model: historical water use by land use type, current population and projected population.

2.2 Demographics

Water service is provided to residential, commercial, industrial, institutional, recreational, and agricultural customers and for environmental and other uses, such as fire protection and landscaping.

The total demand trend on water supplies is expected to continue to rise within the Valley area (along with most of California) because of population, economic activity, environmental and water quality needs and regulatory requirements.

2.3 Historical Water Use

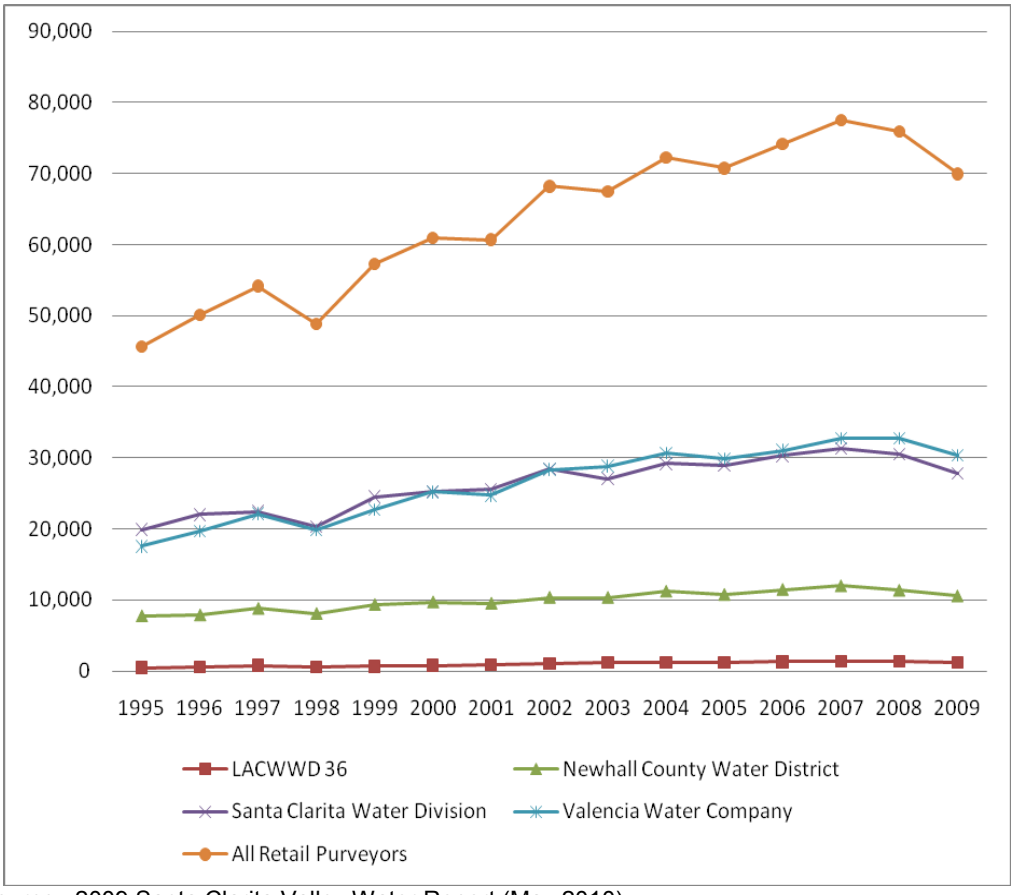
Predicting future water supply requires accurate historic water use patterns and water usage records. The historical use of all water supplies used to meet municipal water requirements, including the use of local groundwater, imported water supplies and recycled water, are summarized in Table 2-1. Figure 2-1 illustrates this use, which shows an increasing trend in Valley water demand since 1995 with a downturn in recent years likely due to weather conditions, response by customers to dry-year conservation efforts and economic conditions.

TABLE 2-1
HISTORICAL WATER USE BY RETAIL WATER PURVEYORS

Year	LACWWD 36	Newhall County Water District	Santa Clarita Water Division	Valencia Water Company	All Retail Purveyors
1995	477	7,755	19,898	17,543	45,673
1996	533	7,887	22,006	19,721	50,147
1997	785	8,801	22,456	22,131	54,173
1998	578	8,087	20,319	19,874	48,858
1999	654	9,348	24,513	22,735	57,250
2000	800	9,718	25,280	25,190	60,988
2001	907	9,525	25,544	24,715	60,691
2002	1,069	10,362	28,434	28,360	68,225
2003	1,175	10,351	27,092	28,829	67,447
2004	1,234	11,217	29,191	30,654	72,296
2005	1,200	10,756	28,921	29,891	70,768
2006	1,289	11,470	30,302	31,065	74,126
2007	1,406	11,975	31,355	32,756	77,492
2008	1,354	11,340	30,476	32,730	75,900
2009	1,243	10,560	27,816	30,355	69,974

Source: 2009 Santa Clarita Valley Water Report (May 2010)

FIGURE 2-1
HISTORICAL WATER USE



Source: 2009 Santa Clarita Valley Water Report (May 2010)

2.4 Projected Water Use

2.4.1 Purveyor Projections

Each of the four retail water purveyors provided projected water demands based on development projects that are under evaluation, in the planning process or the result of its own water planning efforts for its service area. The purveyors maintain historical data, as well as work closely with property owners and developers in their service areas, to ensure they have an adequate water supply and the necessary infrastructure to provide water service.

Since there are only four purveyors in the service area, there is close coordination and exchange of data. SCWD's engineering department continually updates expected demands and infrastructure needs. NCWD's master plans provide the basis for projected demands. VWC is an investor-owned utility regulated by the California Public Utilities Commission (PUC) and is required to regularly provide its service plan for rate increases and service area changes.

The projected water demands provided by the four purveyors are shown in Tables 2-3 through 2-6, for LACWWD 36, NCWD, SCWD and VWC, respectively. These tables show current and projected water demand, by customer type and in total, through 2050. Table 2-2 provides a summary from these tables of each purveyor's projected total water demands through 2050.

TABLE 2-2
SUMMARY OF PROJECTED WATER DEMANDS[(a)(b)(c)]

	2010	2015	2020	2025	2030	2035	2040	2045	2050	Annual Increase
Water Demands										
LACWWD 36[(d)]	1,243	1,759	2,189	2,619	3,048	3,478	3,908	4,338	4,768	3.5%
NCWD	10,560	12,571	14,246	15,922	17,598	19,273	20,949	22,624	24,300	2.2%
SCWD	27,816	31,633	34,814	37,995	41,176	44,357	47,538	50,719	53,900	1.7%
VWC	30,354	34,107	37,235	40,362	43,490	46,617	49,745	52,872	56,000	1.6%
Total Demand	69,973	80,070	88,484	96,898	105,313	113,725	122,141	130,553	138,968	1.8%

Notes:
(a) Summary of demands from Tables 2-3 to 2-6.
(b) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies.
(c) Demands exclude non-purveyor demands. Similarly, supplies evaluated in this UWMP exclude non-purveyor supplies.
(d) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

TABLE 2-3
LOS ANGELES COUNTY WATERWORKS DISTRICT 36
CURRENT AND PROJECTED WATER DELIVERIES BY CUSTOMER TYPE

Year	Water Use Sectors	Single Family Residential[a]	Multi Family Residential[a]	Commercial	Construction/ Industrial	Institutional/ Government	Landscape	Total[b]
2010	No. of Accounts	1,527	6	5	6	6	6	1,555
	Deliveries (AF)	1,168	35	1	4	24	13	1,243
2015	No. of Accounts	2,155	8	5	8	8	8	2,194
	Deliveries (AF)	1,649	49	1	5	33	23	1,759
2020	No. of Accounts	2,682	10	5	10	10	10	2,729
	Deliveries (AF)	2,052	61	1	6	42	28	2,189
2025	No. of Accounts	3,209	12	5	12	12	12	3,264
	Deliveries (AF)	2,455	73	1	7	50	34	2,619
2030	No. of Accounts	3,735	14	5	14	14	14	3,797
	Deliveries (AF)	2,857	85	1	9	58	39	3,048
2035	No. of Accounts	4,262	17	6	17	17	17	4,333
	Deliveries (AF)	3,260	97	1	10	66	45	3,478
2040	No. of Accounts	4,788	19	6	19	19	19	4,863
	Deliveries (AF)	3,663	109	1	11	74	50	3,908
2045	No. of Accounts	5,315	21	7	21	21	21	5,405
	Deliveries (AF)	4,066	121	1	12	82	56	4,338
2050	No. of Accounts	5,842	23	8	23	23	23	5,940
	Deliveries (AF)	4,469	133	1	14	91	61	4,768

Notes:
(a) Projected Single Family and Multi-Family residential accounts have been adjusted to reflect dwelling units.
(b) Totals do not include fire services.

TABLE 2-4
NEWHALL COUNTY WATER DISTRICT
CURRENT AND PROJECTED WATER DELIVERIES BY CUSTOMER TYPE

Year	Water Use Sectors	Single Family Residential[a]	Multi Family Residential[a]	Commercial	Construction/ Industrial	Institutional/ Government	Landscape	Total[b]
2010 [c]	No. of Accounts	8,500	4,893	400	80	70	250	14,193
	Deliveries (AF)	6,400	1,500	560	100	400	1,600	10,560
2015	No. of Accounts	10,135	4,955	476	95	83	298	16,042
	Deliveries (AF)	7,631	1,785	655	119	476	1,906	12,571
2020	No. of Accounts	11,485	5,003	540	108	94	337	17,568
	Deliveries (AF)	8,647	2,023	742	135	540	2,159	14,246
2025	No. of Accounts	12,620	5,093	600	135	120	375	18,493
	Deliveries (AF)	9,665	2,261	831	151	603	2,412	15,922
2030	No. of Accounts	14,188	5,100	667	133	117	417	20,621
	Deliveries (AF)	10,682	2,499	917	168	667	2,666	17,598
2035	No. of Accounts	15,538	5,148	730	146	128	456	22,146
	Deliveries (AF)	11,699	2,737	1,005	182	730	2,920	19,273
2040	No. of Accounts	16,889	5,196	794	159	139	496	23,673
	Deliveries (AF)	12,716	2,975	1,091	198	793	3,175	20,949
2045	No. of Accounts	18,241	5,245	857	171	150	536	25,200
	Deliveries (AF)	13,733	3,213	1,179	214	857	3,428	22,624
2050	No. of Accounts	19,591	5,293	921	184	161	575	26,725
	Deliveries (AF)	14,750	3,452	1,266	230	920	3,681	24,300

Notes:

(a) Projected Single Family and Multi-Family residential accounts have been adjusted from the 2005 UWMP to reflect dwelling units.

(b) Totals do not include fire services.

(c) Year 2010 projection based on 2009 actual data. Growth to 2015 reflects six years of data.

TABLE 2-5
SANTA CLARITA WATER DIVISION
CURRENT AND PROJECTED WATER DELIVERIES BY CUSTOMER TYPE

Year	Water Use Sectors	Single Family Residential[a]	Multi Family Residential[a]	Commercial	Construction/ Industrial	Institutional/ Government	Landscape	Total[b]
2010[c]	No. of Accounts	24,382	13,151	726	71	107	890	39,327
	Deliveries (AF)	16,189	4,200	1,029	445	862	5,090	27,816
2015	No. of Accounts	26,368	14,311	781	135	117	990	42,702
	Deliveries (AF)	18,410	4,776	1,170	506	982	5,789	31,633
2020	No. of Accounts	29,019	15,750	859	148	129	1,089	46,994
	Deliveries (AF)	20,261	5,257	1,288	558	1,079	6,371	34,814
2025	No. of Accounts	31,670	17,188	938	162	141	1,189	51,288
	Deliveries (AF)	22,111	5,737	1,406	608	1,178	6,955	37,995
2030	No. of Accounts	34,320	18,627	1,016	175	152	1,288	55,578
	Deliveries (AF)	23,962	6,217	1,523	659	1,276	7,539	41,176
2035	No. of Accounts	36,971	20,066	1,095	189	164	1,388	59,873
	Deliveries (AF)	25,813	6,697	1,641	715	1,375	8,116	44,357
2040	No. of Accounts	39,622	21,504	1,174	203	176	1,487	64,166
	Deliveries (AF)	27,664	7,177	1,759	761	1,479	8,698	47,538
2045	No. of Accounts	42,273	22,943	1,252	216	188	1,587	68,459
	Deliveries (AF)	29,514	7,658	1,876	812	1,579	9,280	50,719
2050	No. of Accounts	44,930	24,385	1,331	230	200	1,687	72,763
	Deliveries (AF)	31,370	8,139	1,994	862	1,671	9,864	53,900

Notes:
(a) Projected Single Family and Multi-Family residential accounts have been adjusted from the 2005 UWMP to reflect dwelling units.
(b) Totals do not include fire services.
(c) Year 2010 projection based on 2009 actual data. Growth to 2015 reflects six years of data.

TABLE 2-6
VALENCIA WATER COMPANY
CURRENT AND PROJECTED WATER DELIVERIES BY CUSTOMER TYPE

Year	Water Use Sectors	Single Family Residential[a]	Multi Family Residential[a]	Commercial	Industrial	Institutional/ Government	Landscape[b]	Total[c]
	No. of Accounts	25,386	8,854	1,546	451	646	13	36,896
2010[d]	Deliveries (AF)	14,384	1,845	6,981	1,856	4,586	702	30,354
	No. of Accounts	26,497	11,956	1,598	485	647	362	41,545
2015	Deliveries (AF)	14,883	2,993	7,203	1,990	4,595	2,442	34,107
	No. of Accounts	27,423	14,542	1,641	514	648	652	45,419
2020	Deliveries (AF)	15,299	3,949	7,389	2,101	4,603	3,894	37,235
	No. of Accounts	28,348	17,127	1,684	542	650	943	49,294
2025	Deliveries (AF)	15,715	4,906	7,575	2,213	4,611	5,343	40,362
	No. of Accounts	29,274	19,713	1,727	570	651	1,233	53,168
2030	Deliveries (AF)	16,130	5,862	7,760	2,324	4,619	6,794	43,490
	No. of Accounts	30,200	22,298	1,770	599	652	1,524	57,042
2035	Deliveries (AF)	16,546	6,818	7,946	2,436	4,627	8,244	46,617
	No. of Accounts	31,125	24,883	1,813	627	653	1,814	60,917
2040	Deliveries (AF)	16,962	7,775	8,131	2,548	4,635	9,696	49,745
	No. of Accounts	32,051	27,469	1,856	656	654	2,105	64,791
2045	Deliveries (AF)	17,378	8,731	8,317	2,659	4,643	11,144	52,872
	No. of Accounts	32,977	30,054	1,900	684	655	2,395	68,665
2050	Deliveries (AF)	17,793	9,687	8,503	2,771	4,650	12,596	56,000

Notes:
(a) Projected Single Family and Multi-Family residential accounts have been adjusted from the 2005 UWMP to reflect dwelling units.
(b) Landscape customers consist of potable and recycled water users for outdoor irrigation.
(c) Totals do not include fire services.
(d) Year 2010 projection based on 2009 actual data. Growth to 2015 reflects six years of data.

2.5 Population

2.5.1 Historical Population

The methodology for estimating the historical populations of areas served by the water purveyors is prescribed by DWR[3]. The method enables those suppliers whose service areas are not fully contained in existing city boundaries to obtain service area population from a data source such as a regional planning agency or an association of governments (such as Southern California Association of Governments, SCAG), assuming that their estimates use the State Department of Finance (DOF) or U.S. Census Bureau data as a basis. In such situations water suppliers must use DOF, Census or SCAG data to a define persons per Single Family (SF) and Multi-Family (MF) residential connection factor, and then calculate yearly populations based on the number of SF and MF connections each year. This calculation of historical population must cover each year of the period 1995 to 2010.

Accordingly, each purveyor provided an accounting of its historical SF residential and MF residential dwelling units for the years 1995 to 2009 (LACWWD 36 provided 2000-2009 data). Planning assumptions utilized the 2000 U.S. Census, SCAG's 2012 Regional Transportation Plan (RTP) growth forecast (baseline 2008) and the DOF 2000 and 2010 datasets to capture both City of Santa Clarita and the northern portion of unincorporated Los Angeles County within the CLWA service area. Actual data for 2010 SF and MF dwelling units were provided by the purveyors.

The population for each purveyor was estimated by taking the number of accounts for SF and MF in a given year and multiplying by a persons-per-household (PPHH) factor for the number of people living at each type of account, and then summing the result. Using a PPHH factor of 3.11[4] and a growth rate of 0.53 percent, annual historical populations were calculated for each purveyor from 1995, as shown in Table 2-7. The total of these estimates, as summarized in Table 2-8, reflect the total population within the CLWA service area.

[3] See Appendix A in "*Methodologies for Calculating Baseline and Compliance per Capita Urban Water Use"* (DWR 2010).
[4] The PPHH of 3.11 was anchored to the purveyors' year 2000 residential connections and then projected backward to 1995 and forward to 2010 using the calculated growth rate.

TABLE 2-7
HISTORICAL POPULATION BY RETAIL PURVEYOR SERVICE AREA

	NCWD			SCWD		
Year	SF Residential Units[(a)]	MF Residential Units[(a)]	Population[(b)(c)]	SF Residential Units[(a)]	MF Residential Units[(a)]	Population[(b)(c)(d)]
1995	5,680	4,552	30,898	17,632	10,062	83,628
1996	5,723	4,589	31,323	17,812	10,100	84,784
1997	6,035	4,612	32,533	17,856	9,842	84,634
1998	6,037	4,622	32,764	18,222	9,884	86,394
1999	6,202	4,651	33,561	18,671	9,994	88,642
2000	6,255	4,713	34,121	19,408	10,527	93,128
2001	6,428	4,768	35,041	20,145	10,985	97,430
2002	6,777	4,823	36,526	20,691	11,458	101,230
2003	7,199	4,852	38,178	21,278	11,685	104,427
2004	7,873	4,870	40,618	22,152	12,104	109,189
2005	8,163	4,875	41,814	23,035	12,479	113,897
2006	8,292	4,875	42,490	23,620	13,066	118,385
2007	8,431	4,875	43,206	24,347	13,195	121,903
2008	8,450	4,875	43,539	24,398	13,133	122,631
2009	8,492	4,875	43,951	24,374	13,126	123,302
2010	8,500	4,893	44,316	24,382	13,151	124,192

Notes:
(a) Single Family (SF) and Multi-Family (MF) residential units provided by each retail purveyor.
(b) Population estimated for non-census years assuming consistent exponential growth 1990-2000 and 2000-2010.
(c) Population derived from DOF population data for City of Santa Clarita. Table 1 Total Population 2000 and 2010 Incorporated Cities by County in California and Table 1 Population Change 1990-2000 Incorporated Cities by County, and City of Santa Clarita, 2000-2010 U.S. Census Bureau, 2000 Summary File 1 (SF1) 100 Percent Data, City of Santa Clarita, 2000, SCAG, Adopted 2008 RTP.
(d) SCWD data for 2010 population based on 2009 population and SCWD Water Master Plan (2008).
(e) LACWWD 36, rather than calculating population based on dwelling units, provided its historical population for 2000-2010.

TABLE 2-7 CON'T
HISTORICAL POPULATION BY RETAIL PURVEYOR SERVICE AREA

	VWC			LACWWD 36		
Year	SF Residential Units[a]	MF Residential Units[a]	Population[b][c]	SF Residential Units[a]	MF Residential Units[a]	Population[e]
1995	14,696	4,184	57,012	-	-	-
1996	15,433	4,285	59,895	-	-	-
1997	16,276	4,285	62,826	-	-	-
1998	17,311	5,191	69,168	-	-	-
1999	18,264	5,457	73,353	-	-	-
2000	19,179	5,725	77,476	948	5	2,965
2001	20,631	6,342	84,420	1,093	5	3,393
2002	21,818	6,941	90,556	1,177	5	4,232
2003	22,822	7,676	96,618	1,251	5	4,508
2004	24,193	7,949	102,451	1,278	5	4,600
2005	24,953	8,405	106,983	1,289	5	4,624
2006	25,044	8,437	108,043	1,300	5	4,660
2007	25,131	8,537	109,324	1,303	5	4,681
2008	25,211	8,590	110,443	1,310	5	4,688
2009	25,171	8,854	111,876	1,310	5	4,684
2010	25,386	8,854	113,296	1,527	6	4,947

Notes:

(a) Single Family (SF) and Multi-Family (MF) residential units provided by each retail purveyor.

(b) Population estimated for non-census years assuming consistent exponential growth 1990-2000 and 2000-2010.

(c) Population derived from DOF population data for City of Santa Clarita. Table 1 Total Population 2000 and 2010 Incorporated Cities by County in California and Table 1 Population Change 1990-2000 Incorporated Cities by County, and City of Santa Clarita, 2000-2010 U.S. Census Bureau, 2000 Summary File 1 (SF1) 100 Percent Data, City of Santa Clarita, 2000, SCAG, Adopted 2008 RTP.

(d) SCWD data for 2010 population based on 2009 population and SCWD Water Master Plan (2008).

(e) LACWWD 36, rather than calculating population based on dwelling units, provided its historical population for 2000-2010.

TABLE 2-8
SUMMARY OF HISTORICAL POPULATION BY RETAIL PURVEYOR SERVICE AREA[(a)]

Year	NCWD	SCWD	VWC	LACWWD 36[(b)]	Total CLWA Service Area
1995	30,898	83,628	57,012	-	**171,537**
1996	31,323	84,784	59,895	-	**176,002**
1997	32,533	84,634	62,826	-	**179,994**
1998	32,764	86,394	69,168	-	**188,326**
1999	33,561	88,642	73,353	-	**195,556**
2000	34,121	93,128	77,476	2,965	**207,690**
2001	35,041	97,430	84,420	3,393	**220,284**
2002	36,526	101,230	90,556	4,232	**232,544**
2003	38,178	104,427	96,618	4,508	**243,730**
2004	40,618	109,189	102,451	4,600	**256,857**
2005	41,814	113,897	106,983	4,624	**267,318**
2006	42,490	118,385	108,043	4,660	**273,578**
2007	43,206	121,903	109,324	4,681	**279,114**
2008	43,539	122,631	110,443	4,688	**281,301**
2009	43,951	123,302	111,876	4,684	**283,813**
2010	44,316	124,192	113,296	4,947	**286,750**

Notes:
(a) Summary of population from Table 2-7.
(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

2.5.2 Population Projections

The population for the CLWA service area was projected for the years 2010 to 2050 using the connection-PPHH method described in Section 2.5.1. The purveyors provided their projections of SF and MF residential dwelling units within their service areas for the years 2010 to 2050, as estimated in their master planning documents. SCWD, rather than providing dwelling units, provided its projections of population at build-out of its service area in 2050.

Using a PPHH factor of 3.31[5] (increased by the growth rate from 3.11 PPHH in year 2000), assumed constant over the projection period, projections of population for years out to 2050 were calculated. The results of these calculations are shown in Table 2-9.

Based on these results, population in the CLWA service area is projected to grow at an average annual rate of approximately 1.5 percent per year over the 40-year planning period to 2050.

[5] The PPHH of 3.31 was projected forward from the year 2000 PPHH of 3.11, using the calculated growth rate.

TABLE 2-9
PROJECTED POPULATION

Year	NCWD[(a)]	SCWD[(b)]	VWC[(a)]	LACWWD 36[(a)]	Total CLWA Service Area
2010	44,316	124,192	113,296	4,947	**286,750**
2015	49,933	133,868	127,241	7,157	**318,199**
2020	54,559	143,544	138,862	8,908	**345,873**
2025	58,612	153,220	150,477	10,658	**372,967**
2030	63,824	162,896	162,098	12,405	**401,223**
2035	68,450	172,572	173,716	14,159	**428,897**
2040	73,079	182,248	185,330	15,906	**456,564**
2045	77,715	191,924	196,952	17,657	**484,248**
2050	82,341	201,600	208,570	19,407	**511,918**

Notes:
(a) Based on average household size calculated over the census decade to 3.31 persons per household, and remaining fixed through 2050.
(b) SCWD data based on SCWD Water Master Plan (2008).

2.5.3 Comparison to City and County Planning

One Valley, One Vision (OVOV) is a joint planning effort by the City of Santa Clarita and Los Angeles County representing the build-out of the entire Santa Clarita Valley, including Canyon Country, Newhall, Saugus and Valencia and the County communities of Stevenson Ranch, Castaic, Val Verde, Agua Dulce and the future Newhall Ranch. The OVOV includes both City and County jurisdictions in its planning effort which are the development of a General Plan and associated EIR. Both the OVOV area and the Santa Clarita Valley planning area (defined by SCAG) are slightly larger than the CLWA service area and factors into the modest differences in population projections. As the overwhelming majority of the OVOV population is located in the CLWA service area, it is appropriate to compare the CLWA service area population projections to the OVOV projections, as shown in Table 2-10.

TABLE 2-10
POPULATION COMPARISON

Year	Total CLWA Service Area[(a)]	OVOV[(b)]	Santa Clarita Valley Planning Area
2010	286,750	252,000[(c)]	267,299[(d)]
2015	318,199	278,000 - 280,750	319,715[(d)]
2020	345,873	304,000 - 309,500	352,336[(d)]
2025	372,967	330,000 - 338,250	384,217[(d)]
2030	401,223	356,000 - 367,000	397,112[(d)(e)]
2035	428,897	382,000 - 395,750	410,008[(d)]
2040	456,564	408,000 - 424,500	448,228[(f)]
2045	484,248	434,000 - 453,250	490,011[(f)]
2050	511,918	460,000 - 482,000	535,689[(f)]

Notes:
(a) See Table 2-9.
(b) OVOV General Plan EIR.
(c) The OVOV estimated population in 2008 was 252,000 which, for this analysis, was assumed to occur in 2010.
(d) 2010 and 2035 Projection for Santa Clarita Valley Planning Area are the sums of the City of Santa Clarita and unincorporated Los Angeles area. The unincorporated area provided by the County of Los Angeles Department of Planning from adjusted GIS data from U.S. Census Bureau & SCAG data provided by email communication, April 5, 2011.
(e) Year 2030 value adjusted. Actual GIS data had 2030 value of 414,612 which was higher than 2035 value. Used growth rate assumptions to correct.
(f) Years 2040-2050 assumed 2010-2035 growth rates.

In Table 2-10, the OVOV projections and SCAG projections indicate a 1.6 to 1.8 percent annual growth rate of population for the Santa Clarita Valley. The purveyor projections of population growth are just slightly below that with a 1.5 percent annual growth rate. These population growth rates align with the annual rate of increase in the purveyors' projected water demands of 1.8 percent, as shown in Table 2-2.

Based on a detailed analysis of the OVOV Planning Area conducted by traffic analysis zones, County and City staff have determined that population of the Santa Clarita Valley at full build-out of the uses shown on the land use map of the Area Plan will be approximately 460,000 to 482,000 residents.

County staff has also provided updated and adjusted 2010 and 2035 population projections using SCAG data for the unincorporated areas of CLWA's service area (using year 2000 Census base data). Based on these projections for the unincorporated area and SCAG's projections for the City, projections for the Santa Clarita Valley at full build-out are about 535,700 persons.

The total population projected in this UWMP for the CLWA service area in 2050 is approximately 512,000 residents. The difference between this and OVOV projections may be due to some purveyors' master planning efforts taking a more conservative approach to ensure an adequate supply of water for all future uses.

2.6 Existing and Targeted Per Capita Water Use

2.6.1 Base Daily Per Capita Water Use for SBX7-7 Reduction

As described in Senate Bill 7 of Special Extended Session 7 (SBX7-7), it is the intent of the California legislature to increase water use efficiency and the legislature has set a goal of a twenty percent per capita reduction in urban water use statewide by 2020. As SBX7-7 applies to retail water suppliers, NCWD, SCWD and VWC must comport with its requirements. Consistent with SBX7-7, the 2010 UWMP must provide an estimate of Base Daily Per Capita Water Use. This estimate utilizes information on population as well as base gross water use. For the purposes of this UWMP, population was estimated as described in the previous section. Base gross water use is defined as the total volume of water, treated or untreated, entering the distribution systems of the retail purveyors, excluding (1) recycled water, (2) net volume of water placed into long-term storage and (3) water conveyed to another urban water supplier. This calculation of base daily per capita water use is limited to the NCWD, SCWD and VWC retail service areas.

The UWMP Act allows urban water retailers to evaluate their base daily per capita water use using two base periods, a 10 or 15-year continuous period is used to calculate baseline per capita water use. A 5-year base period is used to determine whether the 2020 per capita water use target meets the legislation's minimum water use reduction requirements of at least a 5 percent reduction per capita water use for those suppliers with baseline water use above 100 GPCD. The legislation provided some flexibility in what actual periods of time are used to establish these baselines, to account for short-term water demand variations resulting from weather influences, as well as acknowledging the advances of water suppliers that have already begun using recycled water to reduce potable demands. The 15-year base period within the range January 1, 1990 to December 31, 2010 is allowed if recycled water made up ten percent or more of 2008 retail water deliveries. If recycled water did not make up ten percent or more of the 2008 retail water deliveries, then a retailer must use a 10-year base period within the range January 1, 1995 to December 31, 2010. Recycled water did not make up ten percent of 2008 deliveries by NCWD, SCWD or VWC, and for this reason base daily per capita water use has been based on a 10-year period. The 5-year period required by SBX7-7 must be within the range January 1, 2003 to December 31, 2010.

Tables 2-11 to 2-13 provide the data used to calculate the base daily per capita water use in GPCD, and the 10-year and 5-year base periods for each purveyor. Tables 2-15, 2-17 and 2-19 provide the data used to determine whether the purveyor's 2015 and 2020 per capita water use targets meet the legislation's minimum water use reduction requirement of five percent. If the 2020 target is greater than the 5-year value, the target is reduced to this value. These tables show that the 2020 targets do not exceed these minimum values. Per SBX7-7 requirements, the 2015 interim targets were therefore set to the mid-point between the 10-year baseline per capita water use and the 2020 target.

TABLE 2-11
NEWHALL COUNTY WATER DISTRICT - BASE DAILY PER CAPITA WATER USE

Base Period Year		Distribution System Population	Annual System Gross Water Use (AFY)	Annual Daily Per Capita Water Use (GPCD)	10-Year Average (GPCD)	5-Year Average (GPCD)
Sequence Year	*Calendar Year*					
1	1995	30,898	7,755	224		
2	1996	31,323	7,887	225		
3	1997	32,533	8,801	242		
4	1998	32,764	8,087	220		
5	1999	33,561	9,348	249		
6	2000	34,121	9,718	254		
7	2001	35,041	9,525	243		
8	2002	36,526	10,362	253		
9	2003	38,178	10,351	242		
10	2004	40,618	11,217	247	240	
11	2005	41,814	10,756	230	240	
12	2006	42,490	11,470	241	242	
13	2007	43,206	11,975	247	243	241
14	2008	43,539	11,340	233	244	239
15	2009	43,951	10,560	214	240	233
				Period Selected	**244**	**241**

Note: Shaded cells show calendar years used in selected 5-year average.

TABLE 2-12
SANTA CLARITA WATER DIVISION - BASE DAILY PER CAPITA WATER USE

Base Period Year		Distribution System Population	Annual System Gross Water Use (AFY)	Annual Daily Per Capita Water Use (GPCD)	10-Year Average (GPCD)	5-Year Average (GPCD)
Sequence Year	*Calendar Year*					
1	1995	83,628	19,898	212		
2	1996	84,784	22,006	232		
3	1997	84,634	22,456	237		
4	1998	86,394	20,319	210		
5	1999	88,642	24,513	247		
6	2000	93,128	25,280	242		
7	2001	97,430	25,544	234		
8	2002	101,230	28,434	251		
9	2003	104,427	27,092	232		
10	2004	109,189	29,191	239	234	
11	2005	113,897	28,921	227	235	
12	2006	118,385	30,302	229	235	
13	2007	121,903	31,355	230	234	231
14	2008	122,631	30,476	222	235	229
15	2009	123,302	27,816	201	231	222
				Period Selected	**235**	**231**

Note: Shaded cells show calendar years used in selected 5-year average.

TABLE 2-13
VALENCIA WATER COMPANY - BASE DAILY PER CAPITA WATER USE

Base Period Year		Distribution System Population	Annual System Gross Water Use (AFY)[(a)]	Annual Daily Per Capita Water Use (GPCD)	10-Year Average (GPCD)	5-Year Average (GPCD)
Sequence Year	*Calendar Year*					
1	1995	57,012	17,543	275		
2	1996	59,895	19,721	294		
3	1997	62,826	22,131	314		
4	1998	69,168	19,874	257		
5	1999	73,353	22,735	277		
6	2000	77,476	25,190	290		
7	2001	84,420	24,715	261		
8	2002	90,556	28,360	280		
9	2003	96,618	28,779	266		
10	2004	102,451	30,234	263	278	
11	2005	106,983	29,473	246	275	
12	2006	108,043	30,646	253	271	
13	2007	109,324	32,286	264	266	258
14	2008	110,443	32,419	262	266	258
15	2009	111,876	30,027	240	263	253
				Period Selected	**278**	**258**

Notes: Shaded cells show calendar years used in selected 5-year average.

(a) Excludes recycled water use in years 2003-2009.

2.6.2 Urban Water Use Targets for SBX7-7 Reduction

In addition to calculating base gross water use, SBX7-7 requires that NCWC, SCWD and VWC, as retail purveyors, identify their demand reduction targets for year 2015 and 2020 by utilizing one of four options:

- Option 1. 80 percent of baseline GPCD water use (i.e., a 20 percent reduction).
- Option 2. The sum of the following performance standards: indoor residential use (provisional standard set at 55 GPCD); plus landscape use, including dedicated and residential meters or connections equivalent to the State Model Landscape Ordinance (80 percent ETo existing landscapes, 70 percent of ETo for future landscapes); plus 10 percent reduction in baseline commercial, industrial institutional use by 2020.
- Option 3. 95 percent of the applicable state hydrologic region target as set in the DWR "20x2020 Water Conservation Plan" (February, 2010) (20x2020 Plan).
- Option 4. Savings by Water Sector: this provisional method developed by DWR, identifies water savings obtained through identified practices and subtracts them from the base daily per capita water use value identified for the water supplier.

Option 2 and Option 4 were considered and not selected because they required data not currently being collected within the purveyors service areas.

The CLWA service area is within the South Coast Hydrologic Region (#4) as defined by DWR and this hydrologic region has been assigned a 2020 water use target of 149 GPCD per the DWR 20x2020 Plan. Therefore, in order to use Option 3, each purveyor's daily per capita water use for the 5-year base period would have to be close to 95 percent of the 149 GPCD target, or 142 GPCD. Since none of the purveyors 5-year base period is within this limit, as shown in Table 2-14, none of the purveyors chose this option as the target method.

TABLE 2-14
OPTION 3 – 95 PERCENT OF STATE HYDROLOGIC REGION TARGET

Purveyor	5-Year Base Period	95% of 5-Year Base Period (149 GPCD)
NCWD	241	229 > 149
SCWD	231	219 > 149
VWC	258	245 > 149

Option 1 is the simplest of the options provided and requires reduction to 80 percent of baseline per capita water use. Option 1 is also the most conservative of the four Options provided. Each of the purveyors selected Option 1 to calculate its SBX7-7 target.

This results in the 2020 GPCD targets for the purveyors as shown in Tables 2-15, 2-17, and 2-19. Each purveyor plans to meet the proposed 20X2020 water use targets implementing conservation methods that are discussed in Chapter 7 Demand Management Measures, as well as with recycled water as described in Chapter 4, Recycled Water. Tables 2-16, 2-18, and 2-20, show the calculation of reduction in demand required by each purveyor. SBX7-7 allows for both conservation and recycled water supply to assist in meeting these SBX7-7 conservation requirements.

The 2015 and 2020 projected consumption without additional reduction shown in Tables 2-16, 2-18, to 2-20 are calculated in accordance with SBX7-7 and, therefore, do not match the projected deliveries in Tables 2-4, 2-5 and 2-6 which are based on purveyors' master planning documents.

TABLE 2-15
NCWD - COMPONENTS OF TARGET DAILY PER CAPITA WATER USE

Period	Value		Unit	
10-year period selected for baseline GPCD	First Year	1999	Last Year	2008
5-year period selected for maximum allowable GPCD	First Year	2003	Last Year	2007
Highest 10-year Average	244		GPCD	
Highest 5-year Average	241		GPCD	
Compliance Water Use Target (20% Reduction on 10yr)	195		GPCD	
Minimum Water Use Reduction Requirement (5% Reduction 5yr)	229		GPCD	
2020 Target	**195**		GPCD	
2015 Interim Target	**219**		GPCD	
Methodology Used	**Option #1**			

TABLE 2-16
NCWD - SBX7-7 CONSERVATION SAVINGS SUMMARY

Description	Units	2015 Interim Target	2020 Compliance Target
Base Daily Water Use	GPCD	244	244
Population	GPCD	49,933	54,559
Method 1 Compliance Target	GPCD	219	195
GPCD Reduction		24	49
% Reduction		10%	20%
Projected Consumption w/out additional Reduction	AFY	13,647	14,912
Projected Consumption at Goal	AFY	12,283	11,929
Reduction to Meet Target	AFY	1,365	2,982

TABLE 2-17
SCWD - COMPONENTS OF TARGET DAILY PER CAPITA WATER USE

Period	Value		Unit	
10-year period selected for baseline GPCD	First Year	1997	Last Year	2006
5-year period selected for maximum allowable GPCD	First Year	2003	Last Year	2007
Highest 10-year Average	235		GPCD	
Highest 5-year Average	231		GPCD	
Compliance Water Use Target (20% Reduction on 10yr)	188		GPCD	
Minimum Water Use Reduction Requirement (5% Requirement 5yr)	219		GPCD	
2020 Target	**188**		GPCD	
2015 Interim Target	**212**		GPCD	
Methodology Used	**Option #1**			

TABLE 2-18
SCWD - SBX7-7 CONSERVATION SAVINGS SUMMARY

Description	Units	2015 Interim Target	2020 Compliance Target
Base Daily Water Use	GPCD	235	235
Population	GPCD	133,868	143,544
Method 1 Compliance Target	GPCD	212	188
GPCD Reduction		24	47
% Reduction		10%	20%
Projected Consumption w/out additional Reduction	AFY	35,239	37,786
Projected Consumption at Goal	AFY	31,715	30,229
Reduction to Meet Target	AFY	3,524	7,557

TABLE 2-19
VWC - COMPONENTS OF TARGET DAILY PER CAPITA WATER USE

Period	Value		Unit	
10-year period selected for baseline GPCD	First Year	1995	Last Year	2004
5-year period selected for maximum allowable GPCD	First Year	2003	Last Year	2007
Highest 10-year Average	278		GPCD	
Highest 5-year Average	258		GPCD	
Compliance Water Use Target (20% Reduction on 10yr)	222		GPCD	
Minimum Water Use Reduction Requirement (5% Reduction 5yr)	245		GPCD	
2020 Target	**222**		GPCD	
2015 Interim Target	**250**		GPCD	
Methodology Used	**Option #1**			

TABLE 2-20
VWC – SBX7-7 CONSERVATION SAVINGS SUMMARY

Description	Units	2015 Interim Target	2020 Compliance Target
Base Daily Water Use	GPCD	278	278
Population	GPCD	127,241	138,862
Method 1 Compliance Target	GPCD	250	222
GPCD Reduction		28	56
% Reduction		10%	20%
Projected Consumption w/out additional Reduction	AFY	39,623	43,242
Projected Consumption at Goal	AFY	35,661	34,593
Reduction to Meet Target	AFY	3,962	8,648

LACWWD 36 is not required to comport with the requirements of SBX7-7. However the District does implement conservation measures and will contribute to the conservation savings as indicated in Table 2-21.

TABLE 2-21
LACWWD 36 – CONSERVATION SAVINGS

Description	Units	2015	2020
Projected Consumption w/out additional Reduction	AFY	1,759	2,189
Projected Consumption at Goal	AFY	1,583	1,751
Reduction to Meet Target	AFY	176	438

2.6.3 Purveyor Projections and SBX7-7 Objectives

Table 2-22 summarizes the retail purveyors' projected water demands through 2050. This summary includes demands without conservation, based on the purveyors' projected water demands shown in Table 2-2, and with conservation, using the SBX7-7 requirements discussed previously in Section 2.6.2. Appendix C includes demand projections for a single-dry water year and a multiple-dry year period, assuming a ten percent increase in demand without conservation in dry years. It should be noted that the SBX7-7 conservation requirements do not change for different year types, so those requirements in the dry years shown in Appendix C are the same as SBX7-7 requirements shown in Table 2-22.

The demand reductions required to comply with SBX7-7 may be achieved through a combination of water conservation measures and the use of recycled water. The anticipated increase in recycled water use after 2020 could potentially reduce the quantity of water conservation needed to achieve the SBX7-7 goals. However, the water conservation amounts achieved by 2020 are assumed in this Plan to be maintained through 2050. These amounts plus planned recycled water use will exceed the SBX7-7 water reduction requirements for the period 2020-2050. Thus potable water reductions shown in Table 2-22 exceed the requirements of SBX7-7.

TABLE 2-22
NORMAL YEAR SBX7-7 DEMAND CALCULATIONS (AF)

	2015	2020	2025	2030	2035	2040	2045	2050
Water Demands w/ and w/o Conservation[a]								
LACWWD 36[b]								
Demand w/o Conservation[c]	1,759	2,189	2,619	3,048	3,478	3,908	4,338	4,768
Anticipated Conservation Objective[d]	176	438	524	610	696	782	868	954
Reduction from Recycled Water[e]	0	50	50	50	50	50	50	50
Net Anticipated Water Conservation[f]	176	388	474	560	646	732	818	904
Demand w/ Conservation[g]	1,583	1,801	2,145	2,489	2,833	3,177	3,520	3,864
SBX7-7 Compliance Calculations								
NCWD								
Demand w/o Conservation[c]	12,571	14,246	15,922	17,598	19,273	20,949	22,624	24,300
20x2020 Reduction[h]	1,365	2,982	3,204	3,489	3,742	3,995	4,248	4,501
Reduction from Recycled Water[e]	200	500	1,000	1,275	1,775	2,275	2,775	3,275
Reduction from Water Conservation[i]	1,165	2,482	2,482	2,482	2,482	2,482	2,482	2,482
Demand w/ Conservation[j]	11,406	11,764	13,440	15,115	16,791	18,466	20,142	21,818
SCWD								
Demand w/o Conservation[c]	31,633	34,814	37,995	41,176	44,357	47,538	50,719	53,900
20x2020 Reduction[k]	3,524	7,557	8,067	8,576	9,085	9,595	10,104	10,614
Reduction from Recycled Water[e]	100	500	1,500	2,275	2,775	3,775	4,775	5,775
Reduction from Water Conservation[i]	3,424	7,057	7,057	7,057	7,057	7,057	7,057	7,057
Demand w/ Conservation[j]	28,209	27,757	30,938	34,119	37,300	40,481	43,662	46,843
VWC								
Demand w/o Conservation[c]	34,107	37,235	40,362	43,490	46,617	49,745	52,872	56,000
20x2020 Reduction[l]	3,962	8,648	9,372	10,095	10,819	11,542	12,266	12,990
Reduction from Recycled Water[e]	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Reduction from Water Conservation[i]	2,962	6,648	6,648	6,648	6,648	6,648	6,648	6,648
Demand w/ Conservation[j]	31,145	30,586	33,714	36,841	39,969	43,097	46,224	49,352
Regional Summary								
Demand w/o Conservation[c]	80,070	88,484	96,898	105,312	113,726	122,140	130,554	138,968
20x2020 Reduction	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[m]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation	72,343	71,908	80,236	88,564	96,892	105,220	113,549	121,877

Notes:

(a) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies. Known parties potentially seeking annexation include Legacy/Stevenson Ranch Phase 5, Tapia Canyon and Tesoro Del Valle.

(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(c) Demand w/o Conservation from Table 2-2.

(d) LACWWD 36 conservation objective estimated at 20% of projected demand commencing 2020; see Table 2-21.

(e) Recycled water projections from Table 4-3.

(f) Net Anticipated Conservation for LACWWD 36 is Anticipated Conservation Objective minus Reduction from Recycled Water.

(g) Demand w/ Conservation for LACWWD 36 is Demand w/o Conservation minus Net Anticipated Conservation.

(h) NCWD 20x2020 Reduction from Table 2-16. The 20 percent conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(i) Reduction from Water Conservation is 20x2020 Reduction minus Reduction from Recycled Water for 2015 and 2020; the quantity of water conservation remains at least at 2020 amounts through 2050.

(j) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

(k) SCWD 20x2020 Reduction from Table 2-18. The 20 percent conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(l) VWC 20x2020 Reduction from Table 2-20. The 20 percent conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.

(m) Recycled water reductions do not include demands from Honor Rancho.

2.6.3.1 Low Income Projected Water Demands

Senate Bill 1087 requires that water use projections of a UWMP include the projected water use for single-family and multi-family residential housing for lower income households as identified in the housing element of any city, county, or city and county general plan in the service area of the supplier.

Housing elements rely on the Regional Housing Needs Allocation (RHNA) generated by the State Department of Housing and Community Development (HCD) to allocate the regional need for housing to the regional Council of Governments (COG) (or a HCD for cities and counties not covered by a COG) for incorporation into housing element updates. Before the housing element is due, the HCD determines the total regional housing need for the next planning period for each region in the state and allocates that need. The COGs then allocate to each local jurisdiction its "fair share" of the RHNA, broken down by income categories – very low, low, moderate and above moderate – over the housing element's planning period.

Jurisdictions located within the region covered by the Southern California Association of Governments (SCAG), including the County of Los Angeles, were required to submit their adopted Housing Elements to the State Department of Housing and Community Development by July 1, 2008.

The City of Santa Clarita and the County last updated their housing elements in 2008, and it covers the planning period 2008-2014. These elements incorporate the formally transmitted Los Angeles County housing allocation that was incorporated into the Final RHNA approved by the SCAG Regional Council on July 12, 2007[6]. The allocation for very low and low income classes as defined by the California Health and Safety Code were the following for the City of Santa Clarita:

- Very Low – 26.0%
- Low – 16.2%

Neither the SCAG RHNA nor the City of Santa Clarita and County housing elements further classify the allocation of low income households into single-family and multi-family residential housing units. For this reason, it is not possible to project water use for lower income households by this specific land use category. However, to remain consistent with the intent of the SB 1087 legislation and also to comply with the UWMP Planning Act, the water use projections for very low and low residential income households based on the income category were identified and their classification percentage was applied to the purveyor's calculated demand projections as shown in Table 2-23 on the following page.

Note that the current planning period for the RHNA is January 1, 2006 to June 30, 2014. The next RHNA planning cycle will cover January 1, 2011 to September 30, 2021. Thus, the 2015 UWMP update will need to be updated with the next RHNA planning cycle and classification percentages.

[6] Final Regional Housing Need Allocation Plan - Planning Period (January 1, 2006 - June 30, 2014) for Jurisdictions within the Six-County SCAG Region (approved by the SCAG Regional Council on July 12, 2007); http://www.scag.ca.gov/housing/pdfs/rhna/RHNA_FinalAllocationPlan071207.pdf

The City of Santa Clarita and/or County will not deny or condition approval of water services, or reduce the amount of services applied for by any proposed development unless one of the following occurs:

- City of Santa Clarita and the County specifically finds that it does not have sufficient water supply.
- City of Santa Clarita and the County is subject to a compliance order issued by the State Department of Public Health (DPH) that prohibits new water connections.
- The applicant has failed to agree to reasonable terms and conditions relating to the provision of services.

TABLE 2-23
LOW INCOME DEMANDS[(a)(b)]

	2015	2020	2025	2030	2035	2040	2045	2050
LACWWD 36								
Demand w/ Conservation[(c)]	1,583	1,801	2,145	2,489	2,833	3,177	3,520	3,864
Very Low[(d)]	412	468	558	647	737	826	915	1,005
Low[(e)]	256	292	347	403	459	515	570	626
Subtotal	*668*	*760*	*905*	*1,050*	*1,195*	*1,341*	*1,486*	*1,631*
NWCD								
Demand w/ Conservation[(c)]	11,406	11,764	13,440	15,115	16,791	18,466	20,142	21,818
Very Low[(d)]	2,966	3,059	3,494	3,930	4,366	4,801	5,237	5,673
Low[(e)]	1,848	1,906	2,177	2,449	2,720	2,992	3,263	3,534
Subtotal	*4,813*	*4,964*	*5,672*	*6,379*	*7,086*	*7,793*	*8,500*	*9,207*
SCWD								
Demand w/ Conservation[(c)]	28,209	27,757	30,938	34,119	37,300	40,481	43,662	46,843
Very Low[(d)]	7,334	7,217	8,044	8,871	9,698	10,525	11,352	12,179
Low[(e)]	4,570	4,497	5,012	5,527	6,043	6,558	7,073	7,589
Subtotal	*11,904*	*11,713*	*13,056*	*14,398*	*15,741*	*17,083*	*18,425*	*19,768*
VWC								
Demand w/ Conservation[(c)]	31,145	30,586	33,714	36,841	39,969	43,097	46,224	49,352
Very Low[(d)]	8,098	7,952	8,766	9,579	10,392	11,205	12,018	12,831
Low[(e)]	5,045	4,955	5,462	5,968	6,475	6,982	7,488	7,995
Subtotal	*13,143*	*12,907*	*14,227*	*15,547*	*16,867*	*18,187*	*19,507*	*20,826*
Total	**30,529**	**30,345**	**33,860**	**37,374**	**40,889**	**44,403**	**47,917**	**51,432**

Notes:
(a) Demands already included within purveyor projections.
(b) 2007 Adopted SCAG RHNA; allocation for very low income (26.0%) and low income (16.2%).
(c) From Table 2-22.
(d) 26.0% of total purveyor Demand w/ Conservation.
(e) 16.2% of total purveyor Demand w/ Conservation.

2.7 Other Factors Affecting Water Usage

A major factor that affects water usage is weather. Historically, when the weather is hot and dry, water usage increases. The amount of increase varies according to the number of consecutive years of hot, dry weather and the conservation activities imposed. During cool, wet years, historical water usage has decreased, reflecting less water usage for exterior landscaping. This factor is discussed below in detail.

2.7.1 Weather Effects on Water Usage

California faces the prospect of significant water management challenges due to a variety of issues including population growth, regulatory restrictions and climate change. Climate change is of special concern because of the range of possibilities and their potential impacts on essential operations, particularly operations of the SWP. The most likely scenarios involve increased temperatures, which will reduce the Sierra Nevada snowpack and shift more runoff to winter months, and accelerated sea level rise. These changes can cause major problems for the maintenance of the present water export system since water supplies are conveyed through the fragile levee system of the Sacramento-San Joaquin Delta. The other much-discussed climate scenario or impact is an increase in precipitation variability, with more extreme drought and flood events posing additional challenges to water managers[7].

Figure 2-2 shows the purveyors overall water use since 2000 as well as total precipitation occurring over the same time period. Past studies have indicated that during dry years within the Santa Clarita Valley, demands can increase from between five to ten percent. This analysis assumes a conservative ten percent increase in per capita demands during dry periods.

Figure 2-3 shows the purveyors average annual monthly water use since 2002. In the Santa Clarita Valley, the largest amount of water use occurs during the end of summer and in the beginning of fall months (July, August and September). Water is used least in the cooler months leading into spring (February, March). This variation gives some indication about how weather affects water demands in the CLWA service area.

2.7.2 Conservation Effects on Water Usage

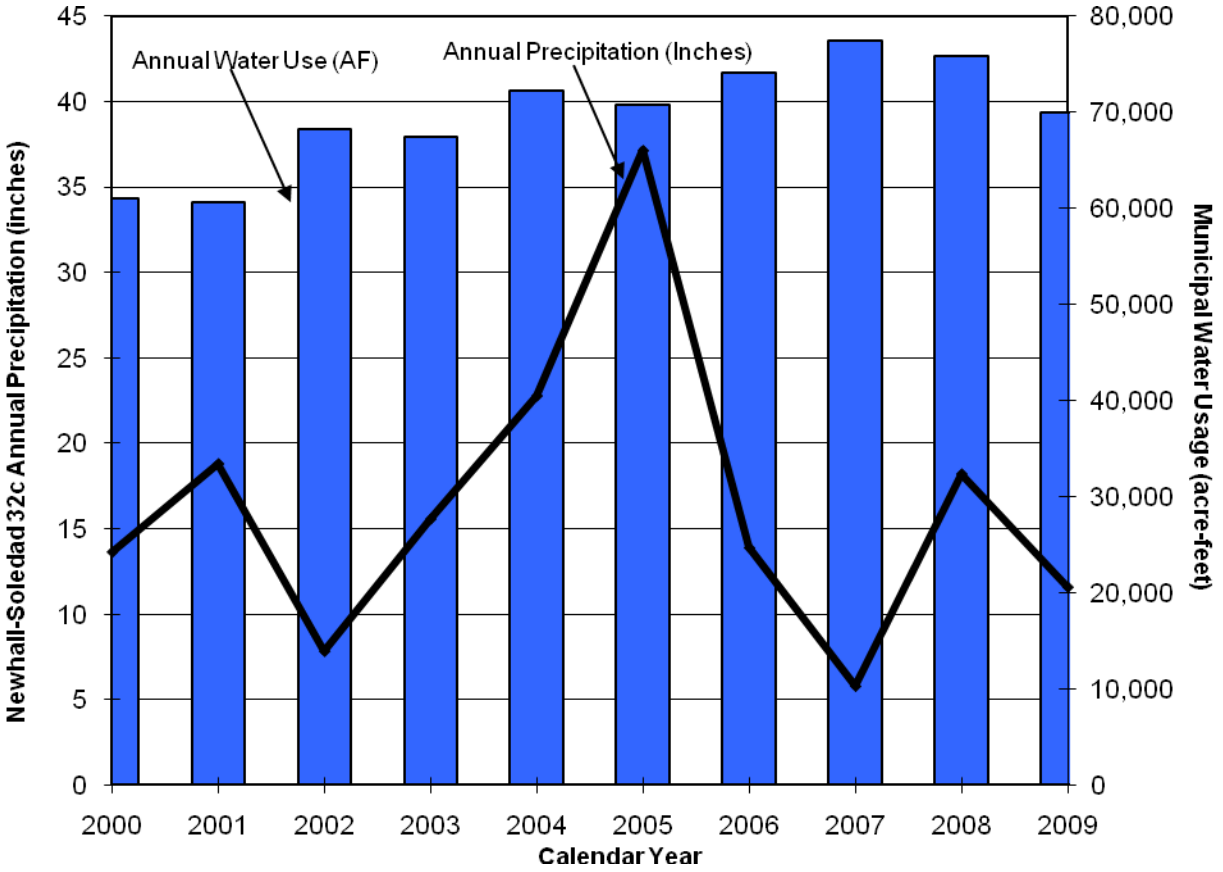
In recent years, water conservation has become an increasingly important factor in water supply planning in California. Since the 2005 UWMP there have been a number of regulatory changes related to conservation including new standards for plumbing fixtures, a new landscape ordinance, a state universal retrofit ordinance, new Green Building standards, demand reduction goals and more. The California plumbing code has also instituted requirements for new construction that mandate the installation of ultra low-flow toilets and low-flow showerheads.

During the 1987 to 1992 drought period, overall water requirements due to the effects of hot, dry weather were projected to increase by approximately ten percent. As a result of extraordinary conservation measures enacted during the period, the overall water requirements actually decreased by more than ten percent.

[7] Final California Water Plan Update 2009 Integrated Water Management: Bulletin 160.

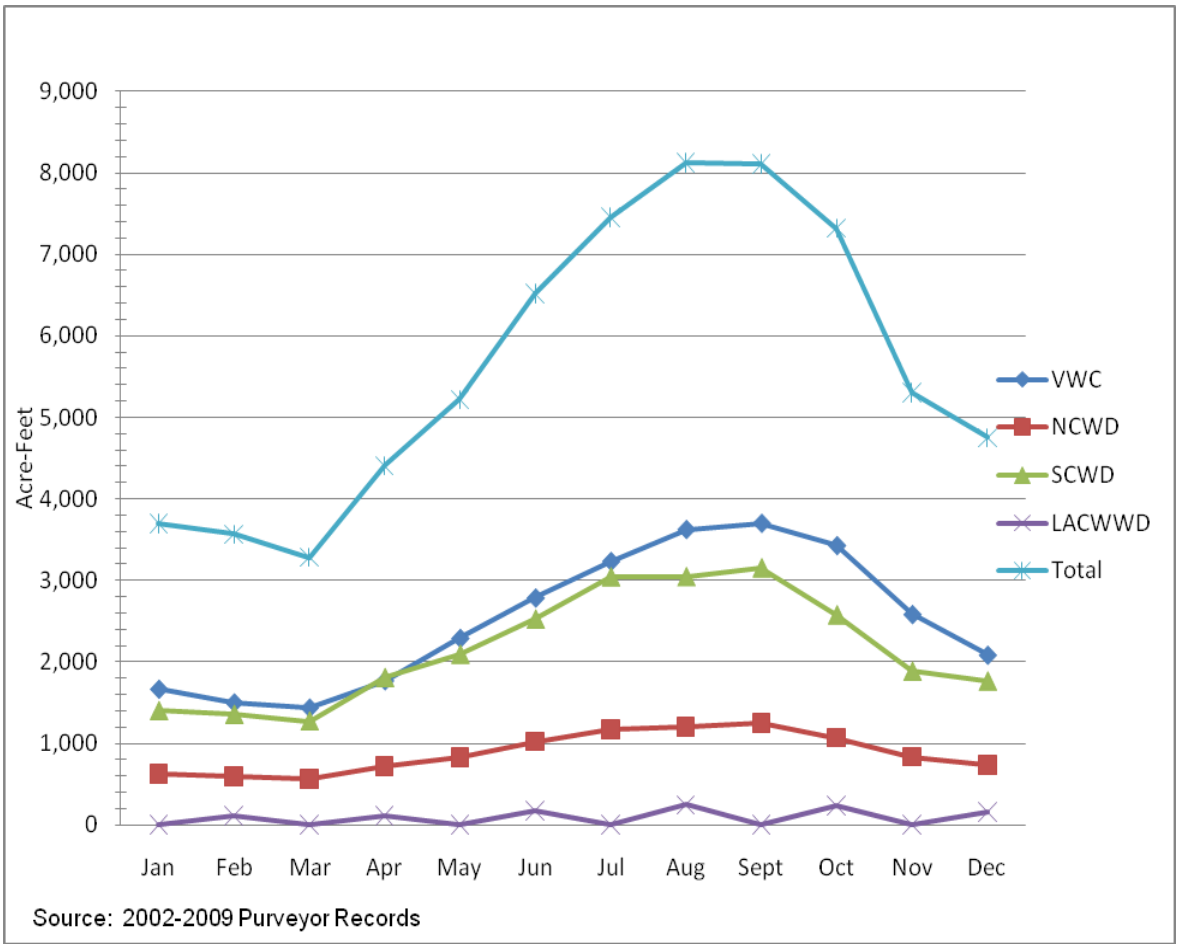
Residential, commercial, and industrial usage can be expected to decrease as a result of the implementation of more aggressive water conservation practices. In southern California, the greatest opportunity for conservation is in developing greater efficiency and reduction in landscape irrigation. The irrigation demand can typically represent as much as seventy percent of the water demand for residential customers depending on lot size and amount of irrigated turf and plants. Conservation efforts will increasingly target this component of water demand.

FIGURE 2-2
HISTORICAL WATER USE AND PRECIPITATION



Sources: Precipitation data provided from rain gage Newhall-Soledad 32c. Total water use from Table 2-1.

FIGURE 2-3
AVERAGE MONTHLY RETAIL CONSUMPTION



Section 3: Water Resources

3.1 Overview

This section describes the water resources available to CLWA and the purveyors for the next forty years. The suppliers' existing water resources include wholesale (imported) supplies, local groundwater, recycled water and water from existing groundwater banking programs. Planned supplies include new groundwater production as well as additional banking programs. These existing and planned supplies are summarized in Table 3-1 and discussed in more detail in this section.

The distribution of water supplies presented in this UWMP does not represent an allocation of water rights among the retail water purveyors. Local and imported water resources in the Santa Clarita Valley are managed cooperatively between CLWA and the purveyors. Just as the demands on the sources of supply were identified on an individual purveyor basis in Section 2, the existing and planned sources of supply have also been broken down by source on an individual purveyor basis. These tables have been included in Appendix C.

TABLE 3-1
SUMMARY OF CURRENT AND PLANNED WATER SUPPLIES AND BANKING PROGRAMS[a]

		2010	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies										
Existing Groundwater[b]										
Alluvial Aquifer		24,385	24,000	24,000	24,000	25,000	25,000	25,000	25,000	25,000
Saugus Formation[c]		6,725	9,225	10,225	10,225	10,225	10,225	10,225	10,225	10,225
	Total Groundwater	**31,110**	**33,225**	**34,225**	**34,225**	**35,225**	**35,225**	**35,225**	**35,225**	**35,225**
Recycled Water[d]	**Total Recycled**	**325**	**325**	**325**	**325**	**325**	**325**	**325**	**325**	**325**
Imported Water										
State Water Project[e]		58,300	58,100	57,900	57,600	57,400	57,400	57,400	57,400	57,400
Flexible Storage Accounts[f]		6,060	6,060	4,680	4,680	4,680	4,680	4,680	4,680	4,680
Buena Vista-Rosedale		11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land		1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
	Total Imported	**76,967**	**76,767**	**75,187**	**74,887**	**74,687**	**74,687**	**74,687**	**74,687**	**74,687**
Existing Banking Programs[g]										
Rosedale Rio-Bravo		20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Semitropic		15,000	15,000	15,000	-	-	-	-	-	-
Semitropic - Newhall Land		4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
	Total Banking	**39,950**	**39,950**	**39,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**
Planned Supplies										
Future Groundwater[h]										
Alluvial Aquifer		-	-	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation		-	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
	Total Groundwater	**-**	**1,375**	**2,375**	**3,375**	**4,375**	**5,375**	**6,375**	**7,375**	**8,375**
Recycled Water[i]	**Total Recycled**	**-**	**975**	**2,725**	**5,225**	**7,775**	**10,275**	**13,775**	**17,275**	**20,975**
Banking Programs	**Total Banking Programs**	**-**	**-**	**-**	**10,000**	**10,000**	**20,000**	**20,000**	**20,000**	**20,000**

Notes:

(a) The values shown under "Existing Supplies" and "Planned Supplies" are projected to be available in average/normal years. The values shown under "Existing Banking Programs" and "Planned Banking Programs" are the maximum capacity of program withdrawals.

(b) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(c) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(d) Represents recycled water being delivered in 2010 with existing facilities. CLWA currently has 1,700 AFY under contract.

(e) SWP supplies are based on the Department of Water Resources "*2009 State Water Project Delivery Reliability Report*."

(f) Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with Ventura County entities expires after 2015.

(g) Supplies shown are annual amounts that can be withdrawn and would typically be used only during dry years.

(h) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production remains within the sustainable ranges identified in Table 3-8 of 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-10, existing and planned groundwater pumping remain within the basin operating plan shown on Table 3- 5.

(i) See Table 4-3. Total Purveyor Recycled Water less Existing Recycled Supply.

The term "dry" is used throughout this chapter and in subsequent chapters concerning water resources and reliability as a measure of supply availability. As used in this Plan, dry years are those years when supplies are the lowest, which occurs primarily when precipitation is lower than the long-term average precipitation. The impact of low precipitation in a given year on a particular source of supply may differ based on how low the precipitation is, or whether the year follows a high-precipitation year or another low-precipitation year. For the SWP, a low-precipitation year may or may not affect supplies, depending on how much water is in SWP storage at the beginning of the year. Also, dry conditions can differ geographically. For example, a dry year can be local to the Valley area (thereby affecting local groundwater replenishment and production), local to northern California (thereby affecting SWP water deliveries), or statewide (thereby affecting both local groundwater and the SWP). When the term "dry" is used in this Plan, statewide drought conditions are assumed, affecting both local groundwater and SWP supplies at the same time.

3.2 Wholesale (Imported) Water Supplies

CLWA's imported water supplies consist primarily of SWP supplies, which were first delivered to CLWA in 1980. From the SWP, CLWA also has access to water from Flexible Storage Accounts in Castaic Lake, which are planned for dry-year use, but are not strictly limited as such. More detail on SWP supplies is provided in Section 3.2.1. In addition to its SWP supplies, CLWA has an imported surface supply from the Buena Vista Water Storage District (BVWSD) and Rosedale Rio-Bravo Water Storage District (RRBWSD) in Kern County, which was first delivered to CLWA in 2007. More information on this supply is provided in Section 3.2.2. CLWA wholesales both these imported supplies to each of the local retail water purveyors. Additionally, Newhall Land has acquired a water transfer supply from a source in Kern County. This supply, referred to as Nickel water, would be made available to VWC through CLWA.

3.2.1 State Water Project Supplies

3.2.1.1 Background

3.2.1.1.1 SWP Facilities

The SWP is the largest state-built, multi-purpose water project in the country. It was authorized by the California State Legislature in 1959, with the construction of most initial facilities completed by 1973. Today, the SWP includes 28 dams and reservoirs, 26 pumping and generating plants and approximately 660 miles of aqueducts. The primary water source for the SWP is the Feather River, a tributary of the Sacramento River. Storage released from Oroville Dam on the Feather River flows down natural river channels to the Sacramento-San Joaquin River Delta (Delta). While some SWP supplies are pumped from the northern Delta into the North Bay Aqueduct, the vast majority of SWP supplies are pumped from the southern Delta into the 444-mile-long California Aqueduct. The California Aqueduct conveys water along the west side of the San Joaquin Valley to Edmonston Pumping Plant, where water is pumped over the Tehachapi Mountains and the aqueduct then divides into the East and West Branches. CLWA takes delivery of its SWP water at Castaic Lake, a terminal reservoir of the West Branch. From Castaic Lake, CLWA delivers its SWP supplies to the local retail water purveyors through an extensive transmission pipeline system.

3.2.1.1.2 SWP Water Supply Contracts

SWP Water Supplies

In the early 1960s, DWR entered into individual SWP Water Supply Contracts with urban and agricultural public water supply agencies located throughout northern, central and southern California for SWP water supplies. CLWA is one of 29 water agencies (commonly referred to as "contractors") that have an SWP Water Supply Contract with DWR. Each SWP contractor's SWP Water Supply Contract contains a "Table A," which lists the maximum amount of contract water supply, or "Table A water," an agency may request each year throughout the life of the contract. The Table A Amounts in each contractor's SWP Water Supply Contract ramped up over time, based on projections at the time the contracts were signed of future increases in population and water demand, until they reached a maximum Table A Amount. Most contractor's Table A Amounts reached their maximum levels in the early to mid 1990s. Table A Amounts are used in determining each contractor's proportionate share, or "allocation," of the total SWP water supply DWR determines to be available each year.

The total planned annual delivery capability of the SWP and the sum of all contractors' maximum Table A amounts was originally 4.23 MAF. The initial SWP storage facilities were designed to meet contractors' water demands in the early years of the SWP, with the construction of additional storage facilities planned as demands increased. However, essentially no additional SWP storage facilities have been constructed since the early 1970s. SWP conveyance facilities were generally designed and have been constructed to deliver maximum Table A amounts to all contractors. After the permanent retirement of some Table A amount by two agricultural contractors in 1996, the maximum Table A amounts of all SWP contractors now totals about 4.17 MAF. Currently, CLWA's annual Table A Amount is 95,200 AF[8].

The primary supply of SWP water made available under the SWP Water Supply Contracts is allocated Table A supply. An estimation of Table A supply availability is provided in Section 3.2.1.2. Each contractor has some flexibility in managing the Table A supply allocated to it in a given year. A contractor may take delivery of that supply for direct use or storage within its service area, store that water outside its service area for later withdrawal and use within its service area, or carry over a portion of that supply for storage on an as-available-basis in SWP reservoirs, for delivery the following year.

[8] CLWA's original SWP Water Supply Contract with DWR was amended in 1966 for a maximum annual Table A Amount of 41,500 AF. In 1991, CLWA purchased 12,700 AF of annual Table A Amount from a Kern County water district, and in 1999 purchased an additional 41,000 AF of annual Table A Amount ("41K transfer") from another Kern County water district, for a current total annual Table A Amount of 95,200 AF. Later in 1999 legal action was filed challenging the sufficiency of the Environmental Impact Report ("EIR") prepared in connection with the 41K transfer. (*Friends of the Santa Clara River v. Castaic Lake Water Agency*, LASC Case No. BS 056954.) In late 2004, CLWA approved a revised EIR for the 41K transfer ("2004 EIR"). In 2005, new legal actions were filed (and subsequently consolidated) in the Los Angeles County Superior Court (LASC) challenging the sufficiency of the 2004 EIR. (*Planning & Conservation League v. Castaic Lake Water Agency*, LASC Consolidated Case No. BS 098724.) On December 17, 2009, the Court of Appeal, Second District, issued a published decision upholding the sufficiency of the 2004 EIR under the California Environmental Quality Act ("CEQA"). (*Planning & Conservation League v. Castaic Lake Water Agency* (2009) 180 Cal.App.4th 210) Remittitur was issued on March 19, 2010, and final Judgment was entered on July 12, 2010. The entry of final Judgment by the LASC concluded eleven years of legal challenges concerning the sufficiency of the 41K transfer EIRs prepared by CLWA, and it resolved all issues that may have remained concerning the adequacy of the 2004 EIR and the finality of the 41K transfer.

In addition to Table A supplies, the SWP Water Supply Contracts provide for additional types of water that may periodically be available, including "Article 21" water and Turnback Pool water. Article 21 water (which refers to the SWP contract provision defining this supply) is water that may be made available by DWR when excess flows are available in the Delta (i.e., when Delta outflow requirements have been met, SWP storage south of the Delta is full and conveyance capacity is available beyond that being used for SWP operations and delivery of allocated and scheduled Table A supplies). Article 21 water is made available on an unscheduled and interruptible basis and is typically available only in average to wet years, generally only for a limited time in the late winter. The Turnback Pool is a program through which contractors with allocated Table A supplies in excess of their needs in a given year may "turn back" that excess supply for purchase by other contractors who need additional supplies that year. The Turnback Pool can make water available in all types of hydrologic years, although generally less excess water is turned back in dry years. As urban contractor demands have increased, the amount of water turned back and available for purchase has diminished.

The availability of Article 21 water and Turnback Pool water is uncertain. When available, these supplies provide additional water that CLWA may be able to use, either directly to meet demands or for later use after storage in its groundwater banking programs. Due to the uncertainty in availability of Article 21 water and Turnback Pool water, supplies of these types of SWP water are not included in this report. However, to the extent CLWA is able to make use of these supplies when available, CLWA may be able to improve the reliability of its SWP supplies beyond the values used throughout this Plan.

While not specifically provided for in the SWP Water Supply Contracts, DWR has in critically dry years created Dry Year Water Purchase Programs for contractors needing additional supplies. Through these programs, water is purchased by DWR from willing sellers in areas that have available supplies and is then sold by DWR to contractors willing to purchase those supplies. The availability of these supplies is uncertain, and are therefore not included in this report. However, CLWA's access to these supplies when they are available would enable it to improve the reliability of its dry-year supplies beyond the values used throughout this report.

Flexible Storage Account

As part of its water supply contract with DWR, CLWA has access to a portion of the storage capacity of Castaic Lake. This Flexible Storage Account allows CLWA to utilize up to 4,684 AF of the storage in Castaic Lake. Any of this amount that CLWA borrows must be replaced by CLWA within five years of its withdrawal. CLWA manages this storage by keeping the account full in normal and wet years and then delivering that stored amount (or a portion of it) during dry periods. The account is refilled during the next year that adequate SWP supplies are available to CLWA to do so. In 2005, CLWA negotiated with Ventura County SWP contractor agencies to obtain the use of their Flexible Storage Account. This allows CLWA access to another 1,376 AF of storage in Castaic Lake. CLWA access to this additional storage is available on a year-to-year basis through 2015. While it is expected that CLWA and Ventura County will extend the existing flexible storage agreement beyond the 2015 term, it is not assumed to be available beyond 2015 in this Plan.

3.2.1.1.3 Factors Affecting SWP Table A Supplies

While Table A identifies the maximum annual amount of Table A water a SWP contractor may request, the amount of SWP water actually available and allocated to SWP contractors each

year is dependent on a number of factors and can vary significantly from year to year. The primary factors affecting SWP supply availability include: the availability of water at the source of supply in northern California, the ability to transport that water from the source to the primary SWP diversion point in the southern Delta and the magnitude of total contractor demand for that water.

Availability of SWP Source Water

SWP supplies originate in northern California, primarily from the Feather River watershed. The availability of these supplies is dependent on the amount of precipitation in the watershed, the amount of that precipitation that runs off into the Feather River, water use by others in the watershed and the amount of water in storage in the SWP's Lake Oroville at the beginning of the year. Variability in the location, timing, amount and form (rain or snow) of precipitation, as well as how wet or dry the previous year was, produces variability from year to year in the amount of water that flows into Lake Oroville. However, Lake Oroville acts to regulate some of that variability, storing high inflows in wetter years that can be used to supplement supplies in dry years with lower inflows.

As discussed in Section 1.6 and in DWR's *2009 Reliability Report*, climate change adds another layer of uncertainty in estimating the future availability of SWP source water. Current literature suggests that global warming may change precipitation patterns in California from the patterns that occurred historically. While different climate change models show differing effects, potential changes could include more precipitation falling in the form of rain rather than snow and earlier snowmelt, which would result in more runoff occurring in the winter rather than spread out over the winter and spring.

Ability to Convey SWP Source Water

As discussed previously, water released from Lake Oroville flows down natural river channels into the Delta. The Delta is a network of channels and reclaimed islands at the confluence of the Sacramento and San Joaquin rivers. The SWP and the federal Central Valley Project (CVP) use Delta channels to convey water to the southern Delta for diversion, making the Delta a focal point for water distribution throughout the state.

A number of issues affecting the Delta can impact the ability to divert water supplies from the Delta, including water quality, fishery protection and levee system integrity. Water quality in the Delta can be adversely affected by both SWP and CVP diversions, which primarily affect salinity, as well as by urban discharge and agricultural runoff that flows into the Delta, which can increase concentrations of constituents such as mercury, organic carbon, selenium, pesticides, toxic pollutants and reduce dissolved oxygen. The Delta also provides a unique estuarine habitat for many resident and migratory fish species, some of which are listed as threatened or endangered. The decline in some fish populations is likely the result of a number of factors, including water diversions, habitat destruction, degraded water quality and the introduction of non-native species. Delta islands are protected from flooding by an extensive levee system. Levee failure and subsequent island flooding can lead to increased salinity requiring the temporary shut down of SWP pumps.

In order to address some of these issues, SWP and CVP operations in the Delta are limited by a number of regulatory and operational constraints. These constraints are primarily incorporated

into the State Water Resources Control Board's (SWRCB) Water Rights Decision 1641 (D-1641), which establishes Delta water quality standards and outflow requirements that the SWP and CVP must comply with. In addition, SWP and CVP operations are further constrained by requirements included in Biological Opinions (BOs) for the protection of threatened and endangered fish species in the Delta, issued by the United States Fish and Wildlife Service (FWS) in December 2008 and the National Marine Fishery Service (NMFS) in June 2009. The requirements in the BOs are based on real-time physical and biological phenomena (such as turbidity, water temperature and location of fish), which results in uncertainty in estimating potential impacts on supply of the additional constraints imposed by the BOs.

Demand for SWP Water

The reliability of SWP supplies is affected by the total amount of water requested and used by SWP contractors, since an increase in total requests increases the competition for limited SWP supplies. As previously mentioned, contractor Table A Amounts in the SWP Water Supply Contracts ramped up over time, based on projected increases in population and water demand at the time the contracts were signed. Urban SWP contractors' requests for SWP water were low in the early years of the SWP, but have increased steadily over time, although more slowly than the ramp-up in their Table A Amounts, which reached a maximum for most contractors in the early to mid 1990s. Since that time, urban contractors' requests for SWP water have continued to increase until recent years when nearly all SWP contractors are requesting their maximum Table A Amounts.

Consistent with other urban SWP contractors, SWP deliveries to CLWA have increased as its requests for SWP water have increased. Historical total SWP deliveries to CLWA are shown at the end of this Section 3.2 in Table 3-3. The table shows deliveries to the service area for supply to the purveyors, as well as delivery to storage programs outside the service area. A breakdown of Table 3-3 showing how much imported supply was delivered to each purveyor is provided in Appendix H. SWP demand projections provided by CLWA to DWR are shown at the end of this Section 3.2 in Table 3-4. CLWA demand projections provided to DWR are typically conservative in order to maximize water deliveries available to CLWA in any given year for both deliveries to purveyors and current and future storage programs.

3.2.1.2 SWP Table A Supply Assessment

The "*State Water Project Delivery Reliability Report"* (*Reliability Report*), prepared biennially by DWR, assists SWP contractors and local planners in assessing the reliability of the SWP component of their overall supplies. In its 2009 update of the *Reliability Report*, DWR provides SWP supply estimates for SWP contractors to use in their planning efforts, including for preparing their 2010 Urban Water Management Plans. The 2009 *Reliability Report* includes DWR's estimates of SWP water delivery reliability under both current (2009) and future (2029) conditions.

3.2.1.2.1 Analysis Assumptions

DWR's estimates of SWP deliveries are based on a computer model that simulates monthly operations of the SWP and CVP systems. Key inputs to the model include the facilities included in the system, hydrologic inflows to the system, regulatory and operational constraints on system operations and contractor demands for SWP water. In conducting its model studies, DWR must make assumptions regarding each of these key inputs.

In the model studies for the 2009 *Reliability Report*, DWR assumed existing facilities for the analyses of both current and future conditions, with no additional storage or significant improvements to convey water through or past the Delta. Hydrologic inflows to the model are based on 82 years of historical inflows (1922 through 2003), adjusted to reflect current and future levels of development in the source areas. Hydrologic inflows for the future conditions analysis were further adjusted to reflect potential impacts due to climate change and accompanying sea level rise. The 2009 *Reliability Report* model studies include current regulatory and operational constraints in the analyses of both current and future conditions, including D-1641, the 2008 FWS BO and the 2009 NMFS BO. Contractor demands for SWP water used in the analysis of current conditions are derived from recent historical data and information from the contractors. Contractor demands for the future conditions analysis are assumed at maximum Table A Amounts in all 82 years of the simulation.

3.2.1.2.2 Analysis Results

DWR's 2009 *Reliability Report* estimates that for all contractors combined, the SWP can deliver a total Table A supply of 60 percent of total maximum Table A Amounts on a long-term average basis, under both current and future conditions. In the worst-case single critically dry year, DWR estimates the SWP can deliver a total Table A supply of seven percent of total maximum Table A Amounts under current conditions and eleven percent under future conditions. During multiple-year dry periods, DWR estimates the SWP can deliver a total Table A supply averaging 34 to 36 percent of total maximum Table A Amounts under current conditions and 28 to 32 percent under future conditions.

The results DWR presents in its 2009 *Reliability Report* are of total SWP Table A deliveries, which it also expresses as a percentage of total maximum Table A Amounts. However, these percentages are SWP-wide averages and do not reflect the differences among contractors in assumed SWP requests and use, and the differing allocations to individual contractors that result. For this reason, DWR also made available on its website more detailed results from the same model studies presented in the 2009 *Reliability Report*, showing SWP deliveries to each contractor (http://baydeltaoffice.water.ca.gov/swpreliability/index.cfm).

For this Plan, SWP Table A supplies to CLWA were taken from DWR's more detailed, contractor-specific delivery data from its analyses for the 2009 *Reliability Report*. DWR's analysis of current (2009) conditions is used in this Plan to estimate 2010 SWP supplies and its analysis of future (2029) conditions is used to estimate 2030-2050 SWP supplies. As suggested by DWR, SWP supplies for the five-year increments between 2010 and 2030 are interpolated between these values. Since SWP demands cannot increase beyond the maximum demands assumed in the future conditions analysis, SWP supplies for years beyond 2030 are assumed to be the same as for 2030.

Table 3-2 shows CLWA's contractor-specific SWP supplies projected to be available in average/normal years (based on the average delivery over the study's historic hydrologic period from 1922 through 2003). Table 3-2 also summarizes estimated SWP supply availability in a single dry year (based on a repeat of the worst-case historic hydrologic conditions of 1977) and over a multiple dry year period (based on a repeat of the historic four-year drought of 1931 through 1934).

TABLE 3-2
SWP TABLE A SUPPLY RELIABILITY (AF)[(a)(b)]

Wholesaler (Supply Source)	2010	2015	2020	2025	2030-2050
Average Water Year[(c)]					
DWR (SWP)					
Table A Supply	58,300	58,100	57,900	57,600	57,400
% of Table A Amount[(d)]	61%	61%	61%	61%	60%
Single Dry Year[(e)]					
DWR (SWP)					
Table A Supply	12,800	11,900	11,000	10,000	9,100
% of Table A Amount	13%	12%	12%	11%	10%
Multi-Dry Year[(f)]					
DWR (SWP)					
Table A Supply	32,800	32,900	32,900	33,000	33,000
% of Table A Amount	34%	35%	35%	35%	35%

Notes:
(a) Supplies to CLWA provided by DWR from detailed delivery results from the analyses presented in DWR's "*2009 SWP Delivery Reliability Report*." As indicated in the 2009 *Reliability Report*, the supplies are based on existing SWP facilities and current regulatory and operational constraints.
(b) Table A supplies include supplies allocated in one year that are carried over for delivery the following year.
(c) Based on average deliveries over the study's historic hydrologic period of 1922 through 2003.
(d) Supply as a percentage of CLWA's Table A Amount of 95,200 AF.
(e) Based on the worst case historic single dry year of 1977.
(f) Supplies shown are annual averages over four consecutive dry years, based on the historic four-year dry period of 1931-1934.

3.2.1.2.3 Potential Future SWP Supplies

An ongoing planning effort to increase long-term supply reliability for both the SWP and CVP is taking place through the Bay Delta Conservation Plan (BDCP) process. The co-equal goals of the BDCP are to improve water supply and restore habitat in the Delta. The BDCP is being prepared through a collaboration of state, federal and local water agencies, state and federal fish agencies environmental organizations and other interested parties. Several "isolated conveyance system" alternatives are being considered in the plan that would divert water from the north Delta to the south Delta where water is pumped into the south-of-Delta stretches of the SWP and CVP. The new conveyance facilities would allow for greater flexibility in balancing the needs of the estuary with reliable water supplies.

In December 2010, DWR released a "Highlights of the BDCP" document that summarizes the activities and expected outcomes of the BDCP. The results of preliminary analysis included in the document indicate the proposed conveyance facilities may increase the combined average long-term water supply to the SWP and CVP from 4.7 MAF per year to 5.9 MAF/year. This would represent an increase in SWP supply reliability from 60 to 75 percent. Planned completion of the BDCP and corresponding environmental analysis documents is early 2013.

DWR estimates of SWP supply reliability in its 2009 *Reliability Report* are based on existing facilities, and so do not include the proposed conveyance facilities that are part of the BDCP. Since this Plan uses DWR's 2009 *Reliability Report* to estimate SWP supplies to CLWA, the improvements in SWP supply reliability that would result from the proposed facilities are not included in this Plan. Any of the proposed facilities that are completed would increase SWP reliability beyond the values used throughout this Plan.

3.2.1.3 Recent Changes to Factors Affecting SWP Supplies

Since the last round of UWMPs were prepared in 2005, DWR has twice updated its *Reliability Report*. In each of its updates, DWR has projected further reductions in average SWP water deliveries than were projected in 2005. The 2009 *Reliability Report* is the most recent update, and identifies several emerging factors that have the potential to affect the availability and reliability of SWP supplies. Although the 2009 *Reliability Report* presents a conservative projection of SWP delivery reliability, particularly in light of events occurring since its release, it remains the best available information concerning the SWP. Following is information and a brief summary of several factors identified in the 2009 *Reliability Report* having the potential to affect the availability and reliability of SWP supplies. A more detailed discussion of the factors discussed below is attached as Appendix D.

A. FWS and NMFS Biological Opinions

As discussed previously in Subsection 3.2.1.1.3, in December 2008 and June 2009, respectively, the FWS and NMFS issued BOs, with each agency concluding that the operation of the SWP and CVP as proposed by DWR and the Bureau of Reclamation would jeopardize the continued existence of protected species.[9] As required by the Endangered Species Act (ESA), FWS and NMFS each developed a Reasonable and Prudent Alternative (RPA) to the proposed SWP and CVP operations, and included that RPA in its respective BO. If the RPA terms are fully implemented, the resulting SWP and CVP operations are deemed to be in compliance with the ESA.

The RPAs developed and adopted by FWS and NMFS impose many new restrictions and requirements on SWP and CVP operations which can result in substantially reduced water exports from the Delta. Preliminary estimates prepared by DWR indicate that implementation of the RPAs in both BOs could reduce SWP deliveries by 28 to 39 percent during average and dry conditions, respectively. Supply impacts resulting from the BO RPAs can vary from year to year, since the operating restrictions in them are dependent upon highly variable factors such as hydrologic and flow conditions in the Delta, migratory and reproductive patterns of the protected species and numerous other non-SWP and non-CVP factors that impact the abundance of the species. Moreover and as further discussed below, legal challenges have been filed against the FWS and NMFS BOs and, should a court conclude the RPA restrictions are invalid, SWP exports could return to higher levels.

1. FWS BO Litigation

In early 2009, the State Water Contractors, the San Luis Delta-Mendota Water Authority and several individual State and Federal contractor water agencies filed legal challenges against the FWS Delta smelt BO (*The Consolidated Delta Smelt Cases*, E.D. Cal. 1:09-CV-00407-OWW-GSA). Plaintiffs claim that the federal defendants violated the National Environmental Policy Act (NEPA) by failing to perform NEPA analysis prior to provisionally adopting and implementing the FWS BO and RPA and that FWS violated the ESA and the Administrative Procedure Act (APA) in adopting the BO's RPA. In December 2010, the court issued a memorandum decision that invalidated the BO and RPA in several respects and remanded the matter to FWS. Further proceedings are expected to address interim operations of the SWP and CVP while the BO and RPA are revised by FWS.

[9] The December 15, 2008 FWS B.O. evaluated impacts to the Delta smelt. The June 4, 2009 NMFS B.O. evaluated impacts to winter-run and spring-run Chinook salmon, steelhead, green sturgeon and resident killer whales.

2. NMFS BO Litigation

After issuance of the NMFS BO in June 2009, the State Water Contractors and other water agencies filed legal challenges against the NMFS salmonid BO (*The Consolidated Salmon Cases*, E.D. Cal. 1:09-CV-1053-OWW-DLB). In May 2010, the court ruled that the federal defendants violated NEPA by failing to analyze the impact of the BO and RPA on humans and the human environment and authorized the SWP and CVP to operate in accordance with D-1641 until the end of June 2010, unless there was a showing of jeopardy to the species or adverse modification of its critical habitat. Motions for summary judgment to obtain a final ruling in the cases were heard in mid-December 2010 and a decision is expected in 2011.

B. Consistency Determination Litigation

Because the Delta smelt and salmon species are also protected under California's ESA (CESA), the SWP and CVP are required to obtain take authorization for SWP and CVP operations from the California Department of Fish and Game (DFG). In July 2009 and September 2009, respectively, DFG issued "consistency determinations" pursuant to CESA and determined that SWP and CVP operations do not violate that statute to the extent the operations are in compliance with the RPAs set forth in the FWS and NMFS BOs. Because the consistency determinations pose a risk that the SWP could remain bound to the terms of the RPAs even if the BOs are overturned by a federal court, DFG's decisions were challenged in state court by the State Water Contractors and Kern County Water Agency. The cases are currently stayed pending the outcome of *The Consolidated Delta Smelt Cases* and *The Consolidated Salmon Cases* (above).[10]

C. Longfin Smelt Protections

Regulatory actions related to longfin smelt also have the potential to affect the availability and reliability of SWP supplies. In February 2008, longfin smelt were listed as a "candidate" species under CESA and DFG imposed certain interim restrictions on the SWP for protection of the longfin smelt and its critical habitat. In February 2009, shortly before longfin smelt were officially listed as a "threatened" species under CESA, DFG issued Incidental Take Permit No. 2081-2009-001-03 (the Permit) to DWR, which imposes terms and conditions on the ongoing and long-term operations of SWP facilities in the Delta. The operating restrictions under the Permit are based in large part on the restrictions imposed on the SWP by the new FWS BO for Delta smelt (see above). The resulting water supply reductions under the Permit depend on several variable factors, such as Delta hydrology, migratory and reproductive patterns of longfin smelt and other factors affecting species abundance in the Delta. Notably, DWR has not indicated whether any particular reductions in SWP exports are likely to result from the Permit. In March 2009, a legal challenge was filed against the Permit.[11] Although that litigation is currently stayed pursuant to a stipulation of the parties, the challenge puts DFG's ability to enforce the Permit into question.

[10] See, e.g., State Water Contractors v. Cal. Dept. of Fish and Game, Sac. Sup. Ct. Case No. 34-2010-80000552; State Water Contractors v. Cal. Dept. of Fish and Game, Sac. Sup. Ct. Case No. 34-2010-80000560.

[11] See State Water Contractors v. California Dept. of Fish and Game, et al., Sac. Sup. Ct. Case No. 34-2009-80000203.

D. Development of Delta Plan and Delta Flow Criteria Pursuant to New State Laws

In November 2009, the California Legislature enacted SBX7-1 as part of a multi-pronged water package related to water supply reliability, ecosystem health and the Delta.[12] Among other things, SBX7-1 creates the Delta Stewardship Council (Council) and directs the Council to develop a comprehensive management plan for the Delta by January 1, 2012 (the Delta Plan). In addition, the State Water Resources Control Board (SWRCB) was directed to develop flow criteria for the Delta to protect public trust resources, including fish, wildlife, recreation and scenic enjoyment and DFG was required to identify quantifiable biological objectives and flow criteria for species of concern in the Delta.

In August 2010, the SWRCB adopted Resolution No. 2010-0039 approving its report entitled "Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem" (Flow Criteria). The SWRCB report concludes that substantially higher flows are needed through the Delta than in have occurred in previous decades in order to benefit zooplankton and various fish species.[13] Separately, in September 2010, DFG issued a draft report entitled "Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of Concern Dependent on the Delta" (DFG Report). The DFG Report is based on similar biological objectives and recommends Delta flows similar to those set forth in the SWRCB's Flow Criteria.[14] Notably, both the SWRCB and DFG recognize that their recommended flow criteria for the Delta do *not* balance the public interest or the need to provide an adequate and reliable water supply.[15] Also of importance, both the SWRCB and DFG acknowledge that their recommended flow criteria do not have any regulatory or adjudicatory effect; however, they may be used to inform the Council as it prepares the Delta Plan and may be considered as the BDCP process moves forward.[16]

E. Resulting Effect on SWP Supplies

DWR's latest published report on SWP supply reliability, the 2009 *Reliability Report*, includes assumptions to account for the institutional, environmental, regulatory and legal factors affecting SWP supplies, including but not limited to water quality constraints, fishery protections, other D-1641 requirements and the operational limitations imposed by the FWS and NMFS BOs. The *Reliability Report* assumes that all of these restrictions and limitations will remain in place over the next twenty-year period and that no actions to improve the Delta will occur, even though numerous legal challenges, various Delta restoration processes and new legal requirements for Delta improvements are currently underway (i.e., BDCP, Delta Vision, Delta Plan, etc.). Further, DWR's future conditions analysis incorporates assumptions to account for potential supply impacts related to global climate change.[17] These and other factors result in DWR presenting a conservative projection of SWP delivery reliability in its 2009 *Reliability Report*.

[12] SBX7-1 became effective February 3, 2010 and adds Division 35 to the California Water Code (commencing with Section 85300). Division 35 is referred to as the Sacramento-San Joaquin Delta Reform Act of 2009.
[13] (Flow Criteria at 5-8.)
[14] (DFG Report at 13.)
[15] (Flow Criteria at 4; DFG Report at 16.)
[16] (Flow Criteria at 3, 10; DFG Report at ES-4.)
[17] (*See*, *e.g.*, DWR Report at 19, 29-30, Appendices A-B.)

Conservative projections are useful from a long-range urban water supply planning perspective.[18] But it is noted that recent rulings in various legal actions and other factors described above, among others, support higher estimates of average annual SWP deliveries than projected in DWR's 2009 *Reliability Report*. While this may lead DWR to increase its projections in its next update of the *Reliability Report*, the 2009 *Reliability Report* remains the best available information concerning the long-term delivery reliability of SWP supplies. Therefore, the conservative estimates from the 2009 *Reliability Report* are used in this Plan.

3.2.2 Other Imported Supplies

The following supplies are now available to CLWA and the purveyors through transfers that have been executed since 2005. These supplies are now part of the imported supplies available to the service area.

3.2.2.1 Buena Vista-Rosedale

CLWA has executed a long-term transfer agreement for 11,000 AFY with BVWSD and RRBWSD. These two districts, both located in Kern County, joined together to develop a program that provides both a firm water supply and a water banking component. Both districts are member agencies of the Kern County Water Agency (KCWA), a SWP contractor and both districts have contracts with KCWA for SWP Table A Amounts. The supply is based on existing long-standing Kern River water rights held by BVWSD, and is delivered by exchange of the two districts' SWP Table A supplies. This water supply is firm; that is, the total amount of 11,000 AFY is available in all water year types based on the Kern River water right. CLWA began taking delivery of this supply in 2007 as shown in Table 3-3.

3.2.2.2 Nickel Water - Newhall Land

Newhall Land has acquired a water transfer from Kern County sources known as the Nickel water. This source of supply totals 1,607 AFY. The Nickel water comes from a firm source of supply. This source of supply was acquired in anticipation of the Newhall Ranch Specific Plan development. In this UWMP it is anticipated that the water supply will be available to the VWC.

[18] *See*, *e.g.*, *Sonoma County Water Coalition v. Sonoma County Water Agency* (2010) 189 Cal.App.4th 33; *Watsonville Pilots Association v. City of Watsonville* (2010) 183 Cal.App.4th 1059; *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal.4th 412.

TABLE 3-3
HISTORICAL IMPORTED SUPPLY DELIVERIES (AF)

Year	SWP Deliveries to CLWA Service Area[a]	SWP Deliveries to Out-of-Service Area Storage[b]	Withdrawals from Out-of-Service Area Storage[b]	Other Imported Deliveries to CLWA Service Area[c]	Total Imported Supplies to CLWA Service Area
1980	1,210	-	-	-	1,210
1981	5,761	-	-	-	5,761
1982	9,516	-	-	-	9,516
1983	9,476	-	-	-	9,476
1984	11,477	-	-	-	11,477
1985	12,401	-	-	-	12,401
1986	13,928	-	-	-	13,928
1987	16,167	-	-	-	16,167
1988	18,904	-	-	-	18,904
1989	21,719	-	-	-	21,719
1990	22,139	-	-	-	22,139
1991	7,357	-	-	-	7,357
1992	14,812	-	-	-	14,812
1993	13,787	-	-	-	13,787
1994	14,919	-	-	-	14,919
1995	17,747	-	-	-	17,747
1996	18,448	-	1,256	-	19,704
1997	21,586	1,256	-	-	21,586
1998	19,782	-	-	-	19,782
1999	28,813	-	-	-	28,813
2000	31,085	-	2,589	-	33,674
2001	35,632	2,589	-	-	35,632
2002	42,080	24,000	395	-	42,475
2003	44,967	-	-	-	44,967
2004	47,463	32,522	-	-	47,463
2005	36,747	20,000	-	-	36,747
2006	39,622	20,395	-	-	39,622
2007	34,919	8,200	-	11,000	45,919
2008	31,878	-	-	11,000	42,878
2009	26,096	-	1,650	11,000	38,746

Sources: DWR Bulletin 132, Management of the California State Water Project; and DWR delivery files.
Notes:
(a) Includes deliveries of Table A supplies, carryover water, Article 21 water, Turnback Pool water, local supply (from West Branch reservoirs) and water purchased through DWR.
(b) Out-of-service area storage includes flexible storage in Castaic Lake, the Semitropic Banking Program and the Rosedale-Rio Bravo Banking Program.
(c) Deliveries from Buena Vista-Rosedale.

TABLE 3-4
CLWA DEMAND PROJECTIONS PROVIDED TO WHOLESALE SUPPLIERS[a] (AF)

Wholesaler (Supply Source)	2015	2020	2025	2030	2035	2040	2045	2050
DWR (SWP)[b]	95,200	95,200	95,200	95,200	95,200	95,200	95,200	95,200
BVWSD/RRBWSD (Kern River)[c]	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000

Notes:
(a) Nickel Water is excluded from this table because it is not contractually a CLWA supply. It is a Newhall Land supply that would be conveyed by CLWA and made available to VWC. Under Newhall Land's agreement for this fixed water supply, the provider is required to provide the amount contracted for every year.
(b) CLWA has provided demand projections to DWR through 2035 based on its maximum Table A Amount and anticipates that its demands beyond 2035 will also be at maximum Table A Amounts.
(c) Under the agreement for this fixed water supply, the wholesale provider is required to provide the amount contracted for every year. Therefore, no demand projections are actually provided to BVWSD and RRBWSD.

3.3 Groundwater

This section presents information about the purveyors groundwater supplies, including a summary of the adopted groundwater management plan (GWMP).

3.3.1 Santa Clara River Groundwater Basin – East Subbasin

The sole source of local groundwater for urban water supply in the Valley is the groundwater Basin identified in the DWR Bulletin 118, 2003 Update as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin) (Basin No. 4-4.07). The Basin is comprised of two aquifer systems, the Alluvium and the Saugus Formation. The Alluvium generally underlies the Santa Clara River and its several tributaries, to maximum depths of about 200 feet; and the Saugus Formation underlies practically the entire Upper Santa Clara River area, to depths of at least 2,000 feet. There are also some scattered outcrops of Terrace deposits in the Basin that likely contain limited amounts of groundwater. However, since these deposits are located in limited areas situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers for municipal water supply; consequently they have not been developed for any significant water supply in the Basin and are not included as part of the existing or planned groundwater supplies described in this UWMP. Figure 3-1 illustrates the mapped extent of the Santa Clara River Valley East Subbasin in DWR Bulletin 118 (2003), which approximately coincides with the outer extent of the Alluvium and Saugus Formation. The CLWA service area is also shown on Figure 3-1.

3.3.2 Adopted Groundwater Management Plan

As part of legislation authorizing CLWA to provide retail water service to individual municipal customers, Assembly Bill (AB) 134 (2001) included a requirement that CLWA prepare a GWMP in accordance with the provisions of Water Code Section 10753, which was originally enacted by AB 3030. The general contents of CLWA's GWMP were outlined in 2002, and a detailed plan was adopted in 2003 to satisfy the requirements of AB 134. The plan both complements and formalizes a number of existing water supply and water resource planning and management activities in CLWA's service area, which effectively encompasses the East Subbasin of the Santa Clara River Valley Groundwater Basin. Notably, CLWA's GWMP (provided on CD as Appendix G) also includes a basin-wide monitoring program, the results of which provide input to annual reporting on water supplies and water resources in the Basin, as well as input to assessment of Basin yield for water supply as described herein. The existing

groundwater monitoring program will be reflected in the upcoming groundwater reporting to DWR as part of SBX7-6 implementation.

The GWMP contains four management objectives, or goals, for the Basin including (1) development of an integrated surface water, groundwater and recycled water supply to meet existing and projected demands for municipal, agricultural and other water uses; (2) assessment of groundwater basin conditions to determine a range of operational yield values that use local groundwater conjunctively with supplemental SWP supplies and recycled water to avoid groundwater overdraft; (3) preservation of groundwater quality, including active characterization and resolution of any groundwater contamination problems and (4) preservation of interrelated surface water resources, which includes managing groundwater to not adversely impact surface and groundwater discharges or quality to downstream basin(s).

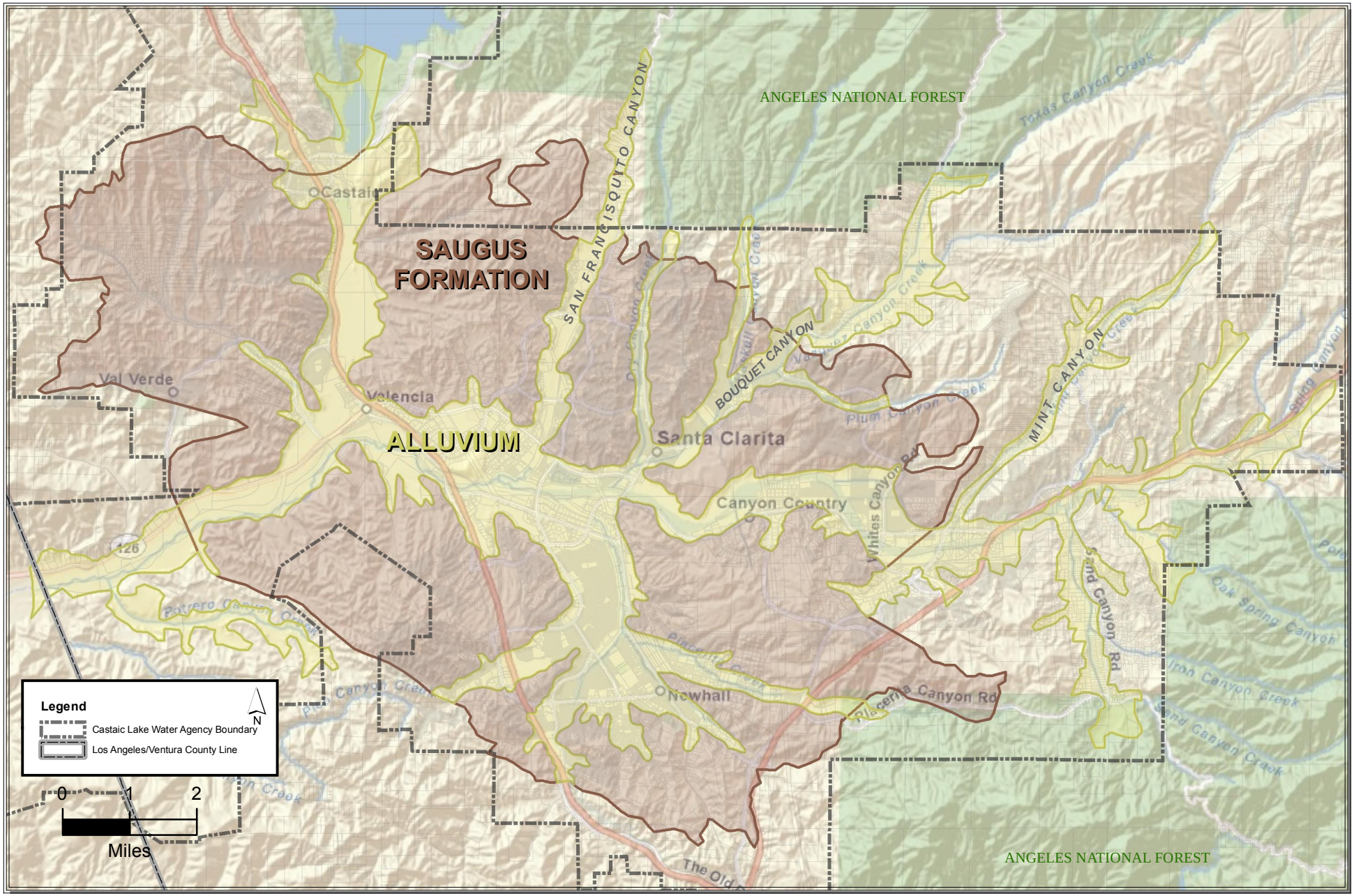


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Figure 3-1
Santa Clara River Valley, East Groundwater Subbasin

Prior to preparation and adoption of the GWMP, a local Memorandum of Understanding (MOU) process among CLWA, the retail water purveyors and United Water Conservation District (UWCD) in neighboring Ventura County, downstream of the East Subbasin of the Santa Clara River Valley, had produced the beginning of local groundwater management, now embodied in the GWMP. Prepared and implemented in 2001, the MOU was a collaborative and integrated approach to several of the aspects of water resource management included in the GWMP. As a result of the MOU, the cooperating agencies integrated their respective database management efforts and continued to monitor and report on the status of Basin conditions, as well as on geologic and hydrologic aspects of their respective parts of the overall stream-aquifer system. Following adoption of the GWMP, the water suppliers developed and utilized a numerical groundwater flow model for analysis of groundwater basin yield and for analysis of extraction and containment of groundwater contamination. The results of those basin yield and contamination analyses, most recently updated in 2009 (Basin Yield Analysis, 2009), are bases for the amounts and allocations of groundwater supplies in this UWMP.

The adopted GWMP includes 14 elements intended to accomplish the Basin management objectives listed above. In summary, the plan elements include:

- Monitoring of groundwater levels, quality, production and subsidence
- Monitoring and management of surface water flows and quality
- Determination of Basin yield and avoidance of overdraft
- Development of regular and dry-year emergency water supply
- Continuation of conjunctive use operations
- Long-term salinity management
- Integration of recycled water
- Identification and mitigation of soil and groundwater contamination, including involvement with other local agencies in investigation, cleanup and closure
- Development and continuation of local, state and federal agency relationships
- Groundwater management reports
- Continuation of public education and water conservation programs
- Identification and management of recharge areas and wellhead protection areas
- Identification of well construction, abandonment and destruction policies
- Provisions to update the groundwater management plan

Work on a number of the GWMP elements had been ongoing for some time prior to the formal adoption of the GWMP, and expanded work on implementation of the GWMP continues on an ongoing basis. The results of some of that work were incorporated in the last UWMP, and subsequent analyses of the groundwater basin are reflected in this current UWMP. Notable in the implementation of the GWMP has been the annual preparation of a Santa Clarita Valley Water Report that summarizes (1) water requirements, (2) all three sources of water supply (groundwater, imported surface water and recycled water, all as part of the GWMP's overall management objectives) and (3) projected water supply availability to meet the following year's projected water requirements.

3.3.2.1 Available Groundwater Supplies

The groundwater component of overall water supply in the Valley derives from a groundwater operating plan developed and analyzed over the last 25 years to meet water requirements (municipal, agricultural, small domestic) while maintaining the Basin in a sustainable condition, specifically no long-term depletion of groundwater or interrelated surface water. The operating plan also addresses groundwater contamination issues in the Basin, all consistent with the GWMP described above. The groundwater operating plan is based on the concept that pumping can vary from year to year to allow increased groundwater use in dry periods and increased recharge during wet periods to collectively assure that the groundwater Basin is adequately replenished through various wet/dry cycles. As ultimately formalized in the GWMP, the operating yield concept has been quantified as ranges of annual pumping volumes to capture year-to-year pumping fluctuations in response to both hydrologic conditions and customer demand.

Ongoing work through implementation of the GWMP has produced three detailed technical reports in addition to the annual Water Reports (the most recent of which, for 2009, was the twelfth annual report). The first report (CH2M Hill, April 2004) documents the construction and calibration of the groundwater flow model for the Valley. The second report (CH2M Hill and LSCE, August 2005) presents the initial modeling analysis of the purveyors' original groundwater operating plan. The most recent report, an updated analysis of the basin (LSCE and GSI, August, 2009) presents the modeling analysis of the current groundwater operating plan, including restoration of contaminated wells for municipal supply after treatment and also presents a range of potential impacts deriving from climate change considerations. All those results are reflected in this UWMP. The primary conclusion of the modeling analysis is that the groundwater operating plan will not cause detrimental short or long term effects to the groundwater and surface water resources in the Valley and is therefore sustainable. The analysis of sustainability for groundwater and interrelated surface water is described in detail in "Analysis of Groundwater Supplies and Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin," prepared by Luhdorff and Scalmanini, Consulting Engineers and GSI Water Solutions, Inc. August 2009 (Basin Yield Analysis, 2009).

The updated groundwater operating plan, summarized in Table 3-5, is as follows:

- **Alluvium:** Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern Santa Clara River watershed. Pumping ranges between 30,000 and 40,000 AFY during normal and above-normal rainfall years. However, due to hydrogeologic constraints in the eastern part of the Basin, pumping is reduced to between 30,000 and 35,000 AFY during locally dry years.

- **Saugus Formation:** Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly from the SWP. During average-year conditions within the SWP system, Saugus pumping ranges between 7,500 and 15,000 AFY. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 AFY during a drought year and can increase to between 21,000 and 25,000 AFY if SWP deliveries are reduced for two consecutive years and between 21,000 and 35,000 AFY if SWP deliveries are reduced for three consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 AFY, to further enhance the effectiveness of natural recharge processes that would recover water levels and groundwater storage volumes after the higher pumping during dry years.

TABLE 3-5
GROUNDWATER OPERATING PLAN FOR THE SANTA CLARITA VALLEY

	Groundwater Production (AF)			
Aquifer	**Normal Years**	**Dry Year 1**	**Dry Year 2**	**Dry Year 3**
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus Formation	7,500 to 15,000	15,500 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

Within the groundwater operating plan, three factors affect the availability of groundwater supplies: sufficient source capacity (wells and pumps), sustainability of the groundwater resource to meet pumping demand on a renewable basis and protection of groundwater sources (wells) from known contamination, or provisions for treatment in the event of contamination. The first two factors are briefly discussed below, and more completely addressed in the 2009 Annual Water Report and the aforenoted Basin Yield Analysis (2009).

Protection of groundwater sources and provisions for treatment in the event of contamination are discussed further in Chapter 5.

Recent historical groundwater pumping by the retail water purveyors and other groundwater users is summarized in Table 3-6. Planned future groundwater pumping in normal years, by the retail water purveyors as well as by other groundwater users, is summarized in Table 3-7. Existing and planned groundwater pumping by the retail water purveyors as well as by other groundwater users, for normal, single-dry and multiple-dry years, are summarized in Section 3.3.3.4 and in Tables 3-10 through 3-12 below.

TABLE 3-6
RECENT HISTORICAL GROUNDWATER PRODUCTION[a]

Basin Name	Groundwater Pumped (AF)				
	2005	2006	2007	2008	2009
Santa Clara River Valley East Subbasin					
SCWD	12,408	13,156	10,686	11,878	10,077
Alluvium	12,408	13,156	10,686	11,878	10,077
Saugus Formation	0	0	0	0	0
LACWWD 36	343	0	0	0	0
Alluvium	343	0	0	0	0
Saugus Formation	0	0	0	0	0
NCWD	4,824	5,572	5,497	5,912	5,728
Alluvium	1,389	2,149	1,806	1,717	1,860
Saugus Formation	3,435	3,423	3,691	4,195	3,868
VWC	14,741	14,333	15,570	16,094	15,295
Alluvium	12,228	11,884	13,140	14,324	12,459
Saugus Formation	2,513	2,449	2,367	1,770	2,836
Total Purveyor	**32,316**	**33,061**	**31,690**	**33,884**	**31,100**
Alluvium	**26,368**	**27,189**	**25,632**	**27,919**	**24,396**
Saugus Formation	**5,948**	**5,872**	**6,058**	**5,965**	**6,704**
Agricultural and Other[b]	12,785	17,312	14,768	14,750	16,564
Alluvium	12,280	15,872	13,141	13,797	15,590
Saugus Formation	505	1,440	1,627	953	974
Total Basin	**45,101**	**50,373**	**46,458**	**48,634**	**47,664**
Alluvium	**38,648**	**43,061**	**38,773**	**41,716**	**39,986**
Saugus Formation	**6,453**	**7,312**	**7,685**	**6,918**	**7,678**
Groundwater Fraction of Total Municipal Water Supply	**46%**	**45%**	**41%**	**45%**	**44%**

Notes:
(a) From 2009 Santa Clarita Valley Water Report (May 2010).
(b) Includes agricultural and other small private well pumping.

TABLE 3-7
PROJECTED GROUNDWATER PRODUCTION (NORMAL YEAR)[a]

	Groundwater Pumping (AF)							
Basin Name	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Santa Clara River Valley								
East Subbasin								
LACWWD 36								
Alluvium	0	0	0	0	0	0	0	0
Saugus Formation	500	500	500	500	500	500	500	500
NCWD								
Alluvium	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
Saugus Formation	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400
SCWD								
Alluvium	10,500	10,500	10,500	11,500	11,500	11,500	11,500	11,500
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
VWC								
Alluvium	11,675	12,675	13,675	14,675	15,675	16,675	17,675	18,675
Saugus Formation	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
Total Purveyor								
Alluvium	**24,000**	**25,000**	**26,000**	**28,000**	**29,000**	**30,000**	**31,000**	**32,000**
Saugus Formation	**10,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**	**11,600**
Agricultural and Other[b]								
Alluvium	14,500	13,500	12,500	10,100	9,100	8,100	7,100	6,600
Saugus Formation	900	900	900	900	900	900	900	900
Total Basin								
Alluvium	**38,500**	**38,500**	**38,500**	**38,100**	**38,100**	**38,100**	**38,100**	**38,600**
Saugus Formation	**11,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**

Notes:
(a) Existing and planned pumping by individual purveyors is shown in Appendix C. The distribution of pumping does not represent a formal allocation of water resources among the retail purveyors.
(b) Agricultural and other small private well pumping, including Newhall Land, Robinson Ranch Golf Course, Wayside Honor Rancho, Valencia Golf Course and proposed Palmer Golf Course.

As reflected in Table 3-7, the groundwater operating plan recognizes ongoing pumping for the two major uses of groundwater in the Basin, municipal and agricultural water supply. Consistent with the groundwater operating plan, projected groundwater pumping includes an ongoing conversion of pumping, coincident with planned land-use changes, from agricultural to municipal water supply. This is shown in Table 3-7, with projected pumping by agricultural and other users decreasing as purveyor pumping increases by a similar amount, resulting in total pumping remaining essentially constant through 2050. The groundwater operating plan and projected pumping also includes other small private domestic and related pumping (discussed further below). As shown in Table 3-7, total projected groundwater pumping by all users within each aquifer is within the ranges for normal year pumping identified in the groundwater operating plan (Table 3-5).

During preparation of the 2005 Plan, the Santa Clarita Valley Well Owners' Association submitted some limited information about the nature and magnitude of private well pumping. This included a detailed estimate of private well pumping in the San Francisquito Canyon portion of the Basin – a total of 85 AFY by 73 individual private pumpers, or nearly 1.2 AFY per private well pumper. As a result of that input, it continues to be recognized that total private pumping is likely well within the 500 AFY estimates of small private well pumping in recent annual Water Reports, or about 1 percent of typical Alluvial Aquifer pumping by the purveyors

and other known private well owners, e.g. agricultural pumpers, combined. Thus, while the small private wells are not explicitly modeled in the Basin yield analysis described herein because their locations and operations are not known, their operation creates a pumping stress that is essentially negligible at the scale of the regional model. Ultimately, implementation of the GWMP to maintain overall pumping within the operating plan, including private pumping, will result in sustainable groundwater conditions to support the combination of municipal (purveyor), agricultural and small private groundwater use on an ongoing basis.

Another change that has affected the UWMP is the requirement by DWR pursuant to the UWMP Act to provide estimates of the projected groundwater use of each of the purveyors. For the purposes of this report and compliance with the UWMP Act, the retail water purveyors have each set forth their estimates of projected groundwater use. The Agency and the retail water purveyors recognize that these estimates of projected groundwater use are subject to adjustment based on various factors and conditions occurring from time to time. These estimates are provided for the planning purposes of this report and the UWMP, and do not constitute an allocation of groundwater from the local groundwater basins.

3.3.2.2 Alluvium

Based on a combination of historical operating experience and recent (2005 and 2009) groundwater modeling analyses, the Alluvial Aquifer can supply groundwater on a long-term sustainable basis in the overall range of 30,000 to 40,000 AFY, with a probable reduction in dry years to a range of 30,000 to 35,000 AFY. Both of those ranges include about 15,000 AFY of Alluvial pumping for current agricultural and other non-municipal water uses. The dry year reduction is a result of practical constraints in the eastern part of the Basin, where lowered groundwater levels in dry periods have the effect of reducing pumping capacities in that shallower portion of the aquifer. Over time, directly related to the rate of suburban development and corresponding decrease in agricultural land use the amount of Alluvial pumping for agricultural water supply is expected to decrease, with an equivalent increase in the amount of Alluvial pumping for municipal water supply. On an overall basis, Alluvial pumping is intended to remain within the sustainable ranges in the groundwater operating plan.

Adequacy of Supply

For municipal water supply, with existing wells and pumps, the three retail water purveyors with Alluvial wells (NCWD, SCWD and VWC) have a combined pumping capacity from active wells of nearly 42,000 gallons per minute (gpm), which translates into a current full-time Alluvial source capacity of approximately 67,000 AFY. Alluvial pumping capacity from all the active municipal supply wells is summarized in Table 3-8. The locations of the various municipal Alluvial wells throughout the Basin are illustrated on Figure 3-2.

In terms of adequacy and availability, the combined active Alluvial groundwater source capacity of municipal wells, approximately 67,000 AFY, is more than sufficient to meet the current and potential future municipal, or urban, component of groundwater supply from the Alluvium, which in the near term is about 24,000 to 26,000 AFY of the total planned Alluvial pumping of 30,000 to 40,000 AFY. The higher individual and cumulative pumping capacities are, of course, primarily for operational reasons (i.e., to meet daily and other fluctuations from average day to maximum day and peak hour system demands). As noted above, the balance of Alluvial pumping in the operating plan is for agricultural and other non-municipal, including small private, pumping.

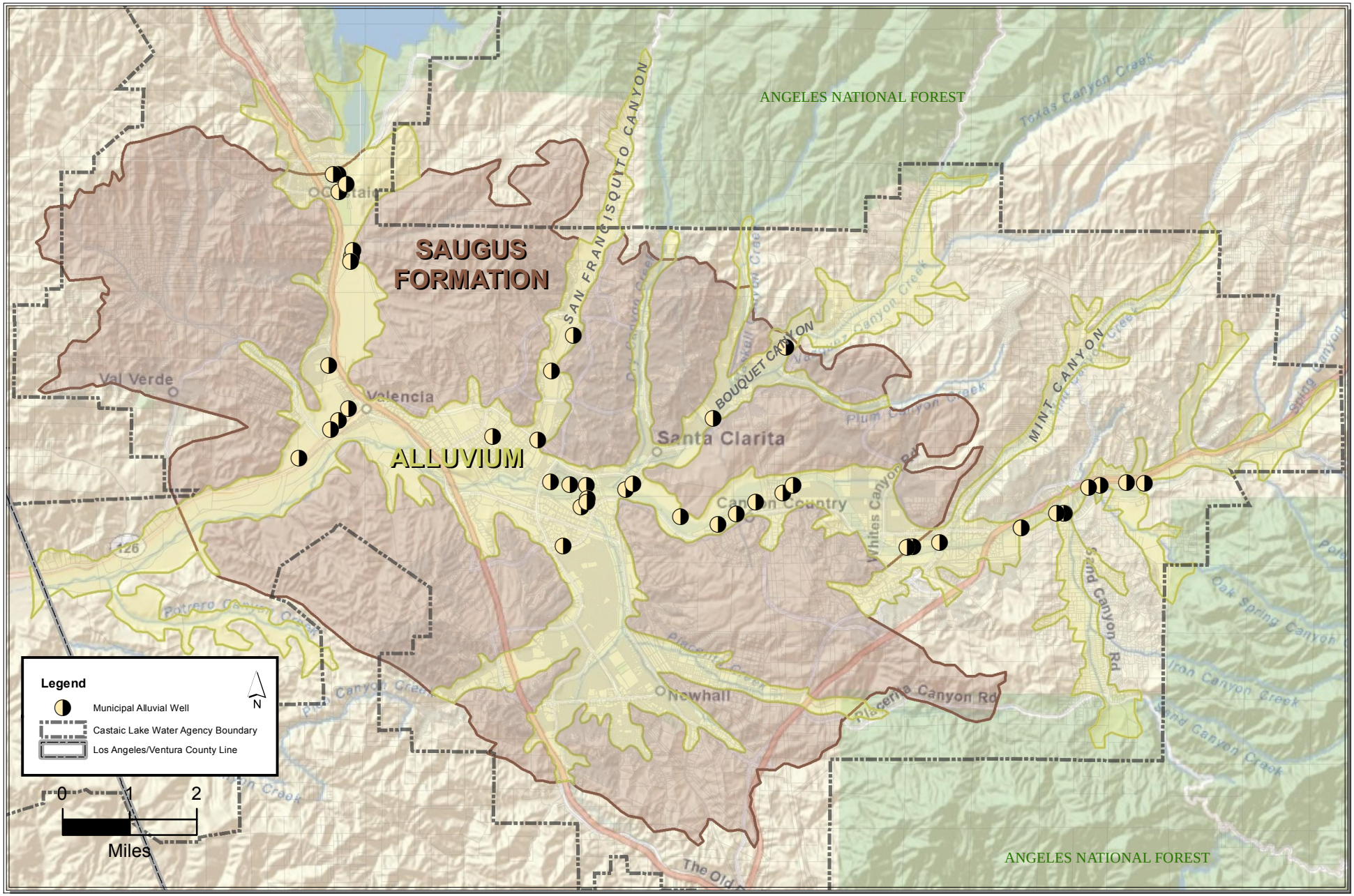

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Figure 3-2
Municipal Alluvial Well Locations
Santa Clara River Valley, East Groundwater Subbasin

TABLE 3-8
ACTIVE MUNICIPAL GROUNDWATER SOURCE CAPACITY — ALLUVIAL AQUIFER WELLS

	Well	Pump Capacity (gpm)	Max. Annual Capacity (AF)	Normal Year Production[(a)] (AF)	Dry-Year Production[(a)] (AF)
NCWD					
	Castaic 1	650	1,040	350	250
	Castaic 2	450	720	100	100
	Castaic 4	270	430	100	0
	Castaic 7	1,450	2,330	300	200
	Pinetree 1	300	480	150	0
	Pinetree 3	550	880	350	300
	Pinetree 4	400	640	300	200
	Pinetree 5	550	880	300	200
	NCWD Subtotal	*4,620*	*7,400*	*1,950*	*1,250*
SCWD					
	Clark	600	960	700	700
	Guida	1,000	1,610	1,300	1,200
	Honby	950	1,530	1,000	700
	Lost Canyon 2	850	1,370	300	0
	Lost Canyon 2A	825	1,330	300	0
	Mitchell 5A	950	1,530	500	200
	Mitchell 5B	700	1,120	800	300
	N. Oaks Central	1,275	2,050	850	700
	N. Oaks East	950	1,530	800	700
	N. Oaks West	1,300	2,290	800	700
	Sand Canyon	1,050	1,690	200	0
	Santa Clara	1,500	2,420	1,200	1,200
	Sierra	1,500	2,420	1,100	700
	Valley Center	1,200	1,930	1,200	1,200
	SCWD Subtotal	*14,650*	*23,580*	*11,050*	*8,300*
VWC					
	Well D	1,050	1,690	880	880
	Well E-15	1,400	2,250	800	800
	Well N	1,250	2,010	650	650
	Well N7	2,500	4,030	1,160	1,160
	Well N8	2,500	4,030	1,160	1,160
	Well Q2	1,200	1,930	1,100	1,100
	Well S6	2,000	3,220	1,000	1,000
	Well S7	2,000	3,220	500	500
	Well S8	2,000	3,220	500	500
	Well T7	1,200	1,930	750	750
	Well U4	1,000	1,610	800	800
	Well U6	1,250	2,010	800	800
	Well W9	800	1,290	1,000	1,000
	Well W10	1,500	2,420	800	800
	Well W11	1,000	1,610	950	950
	VWC Subtotal	*22,650*	*36,470*	*12,850*	*12,850*
Total Purveyors		**41,920**	**67,450**	**25,850**	**22,400**

Note:
(a) Production amounts simulated in the updated Basin Yield analysis (LSCE & GSI, 2009).

Sustainability

Until 2003, the long-term renewability of Alluvial groundwater was empirically determined from approximately 60 years of pumping and groundwater level records. Generally, those long-term observations included stability in groundwater levels and storage, with some dry-period fluctuations in the eastern part of the Basin, over a historical range of total Alluvial pumpage from as low as about 20,000 AFY to as high as about 43,000 AFY. Those empirical observations have since been complemented by the development and application of a numerical groundwater flow model, which has been used to simulate aquifer response to the planned operating ranges of pumping. The numerical groundwater flow model has also been used to analyze the control of perchlorate contaminant migration under selected pumping conditions that have now been implemented to restore, with treatment, pumping capacity that was formerly inactivated due to perchlorate contamination detected in some wells in the Basin. To examine the yield of the Alluvium, or the sustainability of the Alluvium on a renewable basis, the original groundwater flow model was used to examine the long-term projected response of the aquifer to pumping for municipal and agricultural uses in the 30,000 to 40,000 AFY range under average/normal and wet conditions and in the 30,000 to 35,000 AFY range under locally dry conditions, documented in the "Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California, prepared for the Upper Basin Water Purveyors" (2005 Basin Yield Analysis), prepared by CH2M Hill & LSCE, 2005). To examine the response of the entire aquifer system, the original model also incorporated pumping from the Saugus Formation in accordance with the normal (7,500 to 15,000 AFY) and dry year (15,000 to 35,000 AFY) operating plan for that aquifer. The model was run over a synthetic 78-year hydrologic period, which was selected from actual historical precipitation to examine a number of hydrologic conditions expected to affect both groundwater pumping and groundwater recharge.

Simulated Alluvial Aquifer response to the range of hydrologic conditions and pumping stresses was essentially a long-term repeat of the historical conditions that have resulted from similar pumping over the last several decades. The resultant response included (1) generally constant groundwater levels in the middle to western portion of the Alluvium, and fluctuating groundwater levels in the eastern portion as a function of wet and dry hydrologic conditions, (2) variations in recharge that directly correlate with wet and dry hydrologic conditions and (3) no long-term decline in groundwater levels or storage. Consequently, the Alluvial Aquifer was considered in the 2005 UWMP to be a sustainable water supply source to meet the Alluvial portion of the operating plan for the groundwater Basin.

In 2008, partly in preparation for this 2010 UWMP, and partly in response to concerns about events expected to impact the future reliability of supplemental water supply from the SWP, an updated analysis was undertaken to assess groundwater development potential and possible augmentation of the groundwater operating plan. In addition to extending the model's calibration, the updated analysis simulated the historical record of climate and incorporated SWP deliveries for those climatic conditions for an 86-year period from 1922 through 2007, in place of the original model's synthetic 78-year hydrologic period that had been developed prior to the availability of combined climate and SWP deliveries since 1922. While the overall operating plan ranges in the updated basin yield analysis did not change from the original operating plan, prevailing land-use conditions and the specific distributions of pumping reflected in Tables 3-8 and 3-9 were found to produce the same kinds of resultant Alluvial groundwater conditions as concluded to be sustainable in 2005 – (1) no long-term declines in Alluvial groundwater levels and storage; (2) multi-year periods of locally declining, or locally increasing, groundwater levels in response to cycles of below-normal and above-normal precipitation and

(3) short-term impacts on pumping capacities in eastern parts of the basin due to declining groundwater levels during dry periods, mitigable by some redistribution of pumping (reflected in pumping volumes included in this UWMP) and by conformance with the dry-period reduction in Alluvial pumping in the operating plan (Table 3-5). Based on the results of the updated basin yield analysis (LSCE & GSI, 2009), the operating plan is considered to reflect ongoing sustainable groundwater supply rates. In the Alluvium, sustainability was found via explicit simulation of pumping in wet/normal years near the upper end of the operating plan range. In dry years, sustainability was found via explicit simulation of pumping throughout the dry-year operating plan range, with the additional consideration that some pumping redistribution (reflected in this UWMP) be implemented to achieve pumping rates near the upper end of the dry-period range.

3.3.2.3 Saugus Formation

Based on historical operating experience and recent (2005 and 2009) groundwater modeling analysis, the Saugus Formation can supply water on a long-term sustainable basis in a normal range of 7,500 to 15,000 AFY, with intermittent increases to 25,000 to 35,000 AF in dry years. The dry-year increases, based on limited historical observation and modeled projections, demonstrate that a small amount of the large groundwater storage in the Saugus Formation can be pumped over a relatively short (dry) period. This would be followed by recharge (replenishment) of that storage during a subsequent normal-to-wet period when pumping would be reduced.

Adequacy of Supply

For municipal water supply with existing wells, the three retail water purveyors with Saugus wells (NCWD, SCWD and VWC) have a combined pumping capacity from active wells of nearly 17,000 gpm, which translates into a full-time Saugus source capacity of about 27,000 AFY. Saugus pumping capacity from all the active municipal supply wells is summarized in Table 3-9; the locations of the various active municipal Saugus wells are illustrated on Figure 3-3. These capacities include two Saugus wells contaminated by perchlorate (Saugus 1 and 2), which have now been returned to service with treatment facilities for use of the treated water for municipal supply under permit from the State Department of Public Health. They also reflect the most recent replacement well, VWC's Well 207, in a non-impacted part of the basin. Excluded from these capacities is VWC Well 201 that was recently impacted by the detection of perchlorate. The well represents a total of 2,400 gpm of pumping capacity (for a dry-year production capacity of 3,777 AFY). VWC has removed Well 201 from service.

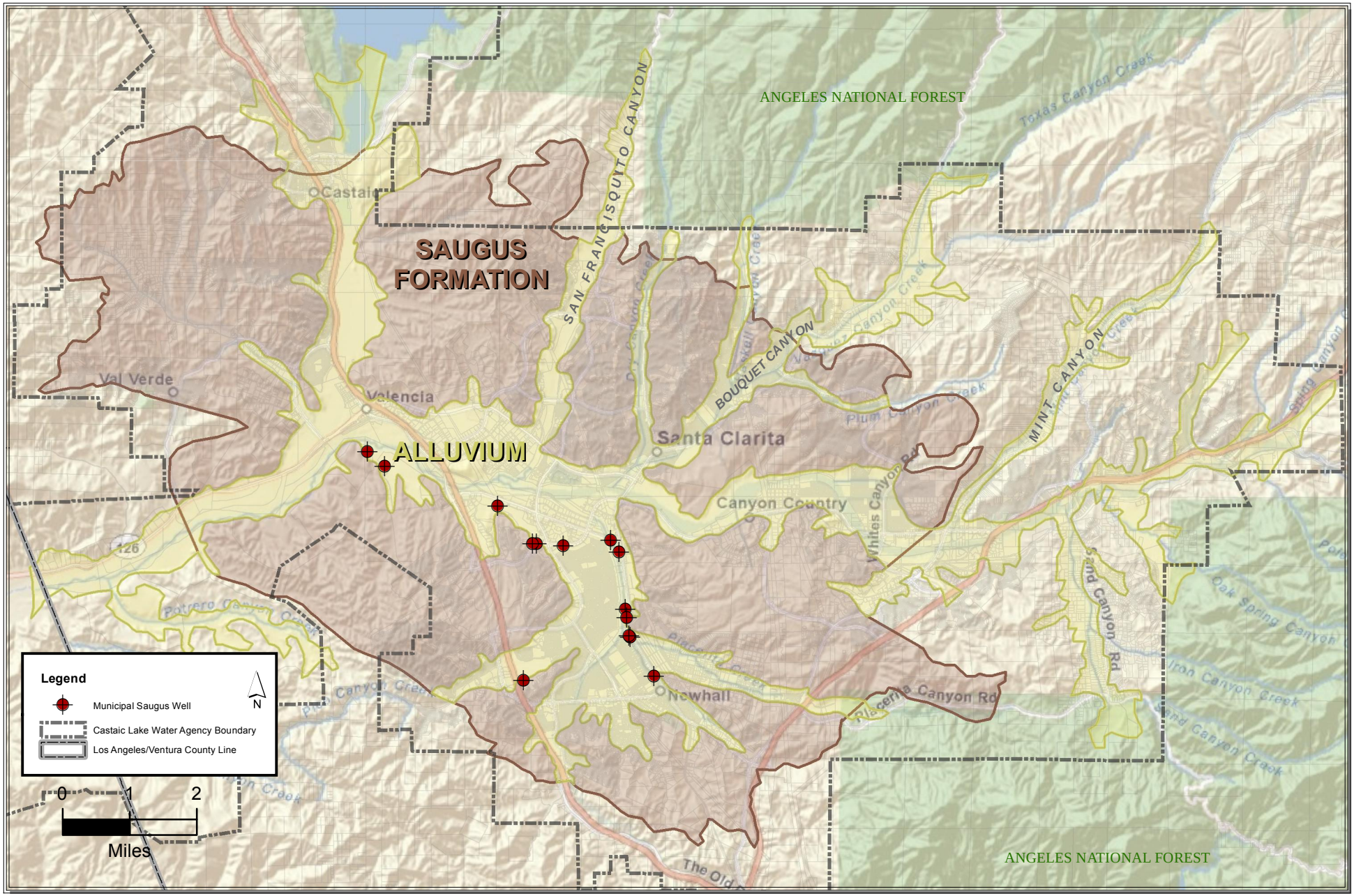
TABLE 3-9
MUNICIPAL GROUNDWATER SOURCE CAPACITY—SAUGUS FORMATION WELLS

Well	Pump Capacity (gpm)	Max. Annual Capacity (AF)	Normal Year Production[(a)] (AF)	Dry-Year Production[(a)] (AF)
NCWD				
12	2,400	3,870	1,765	2,494
13	2,250	3,630	1,765	2,494
NCWD Subtotal	*4,650*	*7,500*	*3,530*	*4,988*
VWC				
159	500	800	50	50
160	2,000	3,220	500	830
205	2,700	4,350	1,211	4,038
206	2,500	4,030	1,175	3,500
207	2,500	4,030	1,175	3,500
VWC Subtotal	*10,200*	*16,430*	*4,111*	*11,918*
SCWD				
Saugus 1	1,100	1,770	1,772	1,772
Saugus 2	1,100	1,770	1,772	1,772
SCWD Subtotal	*2,200*	*3,540*	*3,544*	*3,544*
Total Purveyors	**17,050**	**27,470**	**11,185**	**20,450**

Note:
(a) Production amounts simulated in the updated Basin Yield analysis (LSCE & GSI, 2009).

In terms of adequacy and availability, the combined active Saugus groundwater source capacity of municipal wells of 27,000 AFY is more than sufficient to meet the planned use of Saugus groundwater in normal years of 7,500 to 15,000 AFY. This currently active capacity is more than sufficient to meet water demands, in combination with other sources. In order to supplement near term dry-year supplies, VWC Well 201 could be brought back into service within two years utilizing treatment technologies currently being used in the Santa Clarita Valley (See Section 5). This estimate is conservative because, in 2005, VWC Well Q2 was restored to service in October 2005, six months after perchlorate was detected in the well in April 2005. In addition, in 2005 there was no third-party funding initially available to pay for the cost of putting the well back into service; VWC negotiated a separate agreement with the Whittaker-Bermite property owners to pay for the cost. Also in May 2007, the perchlorate litigation settlement agreement was executed, which established a "Rapid Response Fund" to immediately treat any additional wells that could be become impacted by perchlorate.

With the restored capacity of the VWC Well 201, the Saugus Formation groundwater source capacity of municipal wells would be increased to 31,000 AFY. In order to accommodate longer-term dry-year needs, additional Saugus wells are planned by 2020 and expected to have a combined capacity of 10,000 AFY.



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LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure 3-3
Saugus Well Locations
Santa Clara River Valley, East Groundwater Subbasin

Sustainability

Until 2003, the long-term sustainability of Saugus groundwater was empirically estimated from limited historical experience. Historically (and continuing to the present), pumping from the Saugus has been fairly low in most years, with one four-year period of increased pumping up to about 15,000 AFY that had short-term water level impacts but produced no long-term depletion of the substantial groundwater storage in the Saugus. Those empirical observations have now been complemented by the development and application of the numerical groundwater flow model, which has been used to examine aquifer response to the operating plan for pumping from both the Alluvium and the Saugus and also to examine the effectiveness of pumping for both contaminant extraction and control of contaminant migration within the Saugus Formation. The latter aspects of Saugus pumping were being studied at the time of the 2005 UWMP, and were thus reflected at that time as groundwater extraction capacity to be restored. As discussed in Section 3.3.3 those restoration efforts have been undertaken and that pumping is thus reflected in this UWMP as part of the Saugus operating plan (Table 3-5) and pumping distribution (Table 3-9).

To examine the yield of the Saugus Formation, or its sustainability on a renewable basis, the original groundwater flow model was used to examine long-term projected response to pumping from both the Alluvium and the Saugus over the synthetic 78-year period of hydrologic conditions that incorporated alternating wet and dry periods as have historically occurred (CH2M Hill and LSCE, 2005). The pumping simulated in the model was in accordance with the then-current operating plan for the Basin. For the Saugus, simulated pumping included the then-planned restoration of historic pumping from the perchlorate-impacted wells.

The originally simulated Saugus Formation response to the ranges of operating plan pumping under assumed recurrent historical hydrologic conditions was consistent with actual experience under smaller pumping rates: (1) short-term declines in groundwater levels and storage near pumped wells during dry-period pumping, (2) recovery of groundwater levels and storage after cessation of dry-period pumping and (3) no long-term decreases or depletion of groundwater levels or storage. The combination of actual experience with Saugus recharge and pumping up to about 15,000 AFY, complemented by modeled projections of aquifer response that showed long-term utility of the Saugus at 7,500 to 15,000 AFY in normal years and rapid recovery from higher pumping rates during intermittent dry periods, was the basis for concluding that the Saugus Formation could be considered a sustainable water supply source to meet the Saugus portion of the operating plan for the groundwater Basin.

As discussed under Sustainability of the Alluvium above, an updated basin yield analysis was undertaken in 2008 to assess groundwater development potential and possible augmentation of the groundwater operating plan. After extended and updated model calibration and incorporation of extended historical records, the overall operating plan (Table 3-5) and specific distribution of Saugus pumping (Table 3-9) were found to produce the same kinds of resultant Saugus groundwater conditions as concluded to be sustainable in 2005 – (1) long-term stability of groundwater levels, with no sustained declines; (2) groundwater levels slightly below historic Saugus levels, in response to greater long-term utilization of the Saugus and (3) maintenance of sufficiently high Saugus groundwater levels to ensure achievement of planned individual pumping capacities (Table 3-9). Thus, the operating plan for the Saugus, with fairly low pumping in wet/normal years and increased pumping through dry periods, is concluded to reflect sustainable groundwater supply rates.

3.3.3 Existing and Planned Groundwater Pumping

3.3.3.1 Impacted Well Capacity

As discussed in the 2000 UWMP Perchlorate Contamination Amendment, and again in the 2005 UWMP, certain wells in the Basin were impacted by perchlorate contamination and thus represented a temporary loss of well capacity within CLWA's service area. Six wells were ultimately taken out of service upon the detection of perchlorate including four Saugus wells and two Alluvial wells. All have either been (1) abandoned and replaced, (2) returned to service with the addition of treatment facilities that allow the wells to be used for municipal water supply as part of the overall water supply systems permitted by the State Department of Public Health (DPH) or (3) will be replaced under an existing perchlorate litigation settlement agreement (See Section 5). The restored wells (two Saugus wells and one Alluvial well) and the replacement wells (one Saugus and one Alluvial well), which collectively restore much of the temporarily lost well capacity, are now included as parts of the active municipal groundwater source capacities delineated in Tables 3-8 and 3-9. An additional two wells will be drilled to fully restore 4,200 gpm (6,776 AFY) of the impacted well capacity, thus restoring the operational flexibility that existed prior to the perchlorate being discovered. The cost of drilling the remaining two wells will be fully reimbursed under the terms of the perchlorate litigation settlement agreement. Additional information concerning water quality issues and maintenance of pumping capacity is provided in Section 5.

Most recently, in August 2010, VWC's Well 201, located downgradient from the Whittaker-Bermite site and downgradient from the initially impacted Saugus 1, Saugus 2 and V157 wells, had detectable concentrations of perchlorate and the well was taken out of service. Water sampling tests from August 2010 through April 2011 also confirmed the presence of perchlorate over the adopted regulatory standard. This well was immediately taken out of service in August 2010 and its capacity is not included in active groundwater sources delineated in Table 3-9. VWC plans to actively seek remediation under the settlement agreement and restore the impacted well capacity in the near term.

3.3.3.2 Alluvium

In terms of adequacy and availability, the combined active Alluvial Aquifer groundwater sources of municipal wells, approximately 67,000 AFY, are more than sufficient to meet the current and potential future urban component of the groundwater supply from the Alluvium. The potential future urban component of groundwater from the Alluvium in the near-term is about 24,000 to 26,000 AFY of the total planned Alluvial pumping of 30,000 to 40,000 AFY. The higher individual and cumulative pumping capacities of the purveyors are for operational reasons (i.e., to meet daily and other fluctuations from average day to maximum day and peak hour system demands).

Tables 6-2, 6-3 and 6-4 as well as Tables C-2, C-5 and C-8 include planned Alluvial Aquifer supplies. These planned supplies do not increase the quantity of water being withdrawn from Alluvial Aquifer, but represent anticipated or potential shifts in pumping involving different or new wells.

For example, VWC's planned Alluvial Aquifer supplies represent a shifting of pumping from Newhall Land agricultural uses to VWC for the anticipated Newhall Ranch project. While new or improved wells would be required, no net change in Alluvial Production would be anticipated. There is also a potential that SCWD may require additional well capacity to meet the total

anticipated pumping for a single dry year as described in Tables C-4 and C-5. Overall purveyor and non-purveyor supplies remain consistent with the operating plan shown on Table 3-5.

3.3.3.3 Saugus Formation

In terms of adequacy and availability, the combined active Saugus groundwater source municipal well capacity of 27,000 AFY is more than sufficient to meet the planned use of Saugus groundwater in normal years of 7,500 to 15,000 AFY. This current active capacity is also more than sufficient to meet water demands, in combination with other sources. In order to supplement near term dry-year supplies, VWC Well 201 could conservatively be brought back into service within two years utilizing treatment technologies currently being used in the Santa Clarita Valley (see Section 5). In order to accommodate the longer-term demands, additional Saugus wells would be required to meet the planned use of 35,000 AFY of Saugus groundwater during a multiple-dry year period.

Tables 6-2, 6-3 and 6-4 as well as Tables C-2, C-5 and C-8 include planned Saugus Formation supplies. Planned Saugus Formation pumping would only increase the quantity of water being withdrawn from Saugus Formation to levels consistent with the operating plan shown on Table 3-5. To obtain full Saugus Formation supplies of 35,000 AFY in certain dry years, restoration of the perchlorate impacted well (VWC Well 201) along with additional wells with a collective combined total production of approximately 14,000 AFY would be required.

LACWWD 36 anticipates planned Saugus Formation supplies of 500 AFY to be available beginning in 2011. This planned supply included in Tables C-2, C-5 and C-8 is incorporated into Tables 6-2, 6-3 and 6-4; however, the total purveyor and non-purveyor Saugus Formation supplies remain consistent with the operating plan shown on Table 3-5.

There is also a potential that NCWD may require additional well capacity to meet anticipated pumping levels included in Tables C-2, C-5 and C-8 and incorporated into Tables 6-2, 6-3 and 6-4. Overall NCWD existing and planned Saugus Formation supplies, along with the supplies of the other purveyors and non-purveyors, are consistent with the operating plan shown on Table 3-5.

As previously discussed in this section, VWC expects to remediate the capacity from its recently impacted Well 201 in the near term under conservative projections (i.e., within two years utilizing replacement well construction and/or treatment technologies currently being used in the Santa Clarita Valley; see Section 5).

The need for additional new Saugus Formation wells to achieve full dry-year pumping has been planned for some time. Most notably, as part of the 2009 Updated Basin Yield Analysis, three new Saugus wells were simulated in the western part of the basin, remote from the Whittaker-Bermite site and perchlorate-impacted Saugus wells. The conclusion of the analysis that Saugus pumping is sustainable included multiple dry-year pumping at a combined capacity for the three wells of 9,750 AFY.

3.3.3.4 Summary

Overall, the total municipal supply in this Plan includes a groundwater component that is, in turn, part of the overall groundwater supply of the Valley. As such, the municipal groundwater supply, distributed among the retail purveyors, recognizes the existing and projected future uses of groundwater by overlying interests in the Valley such that the combination of municipal and

all other groundwater pumping remains within the groundwater operating plan (Table 3-5) that has been analyzed for sustainability. The distribution of groundwater among the purveyors are detailed in Appendix C and aggregated for all the purveyors in Chapter 6 for normal years, single dry years and multiple dry years. Relative to the 2009 Groundwater Basin Yield Analysis, total groundwater pumping, by all other pumpers as well as by the purveyors from their existing and planned wells, is summarized in Tables 3-10 through 3-12 for normal, single-dry and multiple-dry years.

TABLE 3-10
AVERAGE/NORMAL YEAR EXISTING AND PLANNED GROUNDWATER USAGE IN UPPER SANTA CLARA RIVER BASIN (AF)

Alluvium Supplies	2015	2020	2025	2030	2035	2040	2045	2050
Purveyors Existing	24,000	24,000	24,000	25,000	25,000	25,000	25,000	25,000
Purveyors Planned	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Purveyors Existing and Planned	24,000	25,000	26,000	28,000	29,000	30,000	31,000	32,000
Non purveyors	14,500	13,500	12,500	10,100	9,100	8,100	7,100	6,600
Total Alluvium Production	**38,500**	**38,500**	**38,500**	**38,100**	**38,100**	**38,100**	**38,100**	**38,600**
Alluvium Yield	*38,600*	*38,600*	*38,600*	*38,600*	*38,600*	*38,600*	*38,600*	*38,600*

Saugus Formation Supplies	2015	2020	2025	2030	2035	2040	2045	2050
Purveyors Existing	9,225	10,225	10,225	10,225	10,225	10,225	10,225	10,225
Purveyors Planned	1375	1375	1375	1375	1375	1375	1375	1375
Purveyors Existing and Planned	10,600	11,600	11,600	11,600	11,600	11,600	11,600	11,600
Non Purveyors	900	900	900	900	900	900	900	900
Total Saugus	**11,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**	**12,500**
Saugus Yield	*12,500*	*12,500*	*12,500*	*12,500*	*12,500*	*12,500*	*12,500*	*12,500*

TABLE 3-11
SINGLE-DRY YEAR EXISTING AND PLANNED GROUNDWATER USAGE IN UPPER SANTA CLARA RIVER BASIN (AF)

Alluvium Supplies	2015	2020	2025	2030	2035	2040	2045	2050
Purveyors Existing	20,300	20,250	20,200	21,050	21,050	21,025	21,000	20,650
Purveyors Planned	200	1,250	2,300	3,850	4,850	5,875	6,900	7,750
Purveyors Existing and Planned	20,500	21,500	22,500	24,900	25,900	26,900	27,900	28,400
Non purveyors	14,350	13,350	12,350	9,950	8,950	7,950	6,950	6,450
Total Alluvium Production	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**
Alluvium Yield	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*

Saugus Formation Supplies	2015	2020	2025	2030	2035	2040	2045	2050
Purveyors Existing	20,400	20,400	20,400	20,400	20,400	20,400	20,400	20,400
Purveyors Planned (Restored Well)	825	3,777	3,777	3,777	3,777	3,777	3,777	3,750
Purveyors Planned (New Wells)	2,875	9,923	9,923	9,923	9,923	9,923	9,923	9,950
Purveyors Existing and Planned	24,100	34,100	34,100	34,100	34,100	34,100	34,100	34,100
Non purveyors	900	900	900	900	900	900	900	900
Total Saugus	**25,000**	**35,000**	**35,000**	**35,000**	**35,000**	**35,000**	**35,000**	**35,000**
Saugus Yield	*25,000*	*35,000*	*35,000*	*35,000*	*35,000*	*35,000*	*35,000*	*35,000*

TABLE 3-12
MULTIPLE-DRY YEAR EXISTING AND PLANNED GROUNDWATER USAGE IN UPPER SANTA CLARA RIVER BASIN (AF)

Alluvium Supplies	2015	2020	2025	2030	2035	2040	2045	2050
Purveyors Existing	20,425	20,425	20,425	21,825	21,825	21,825	21,825	21,325
Purveyors Planned	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Purveyors Existing and Planned	20,425	21,425	22,425	24,825	25,825	26,825	27,825	28,325
Non purveyors	14,425	13,425	12,425	10,025	9,025	8,025	7,025	6,525
Total Alluvium Production	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**	**34,850**
Alluvium Yield	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*	*34,850*

Saugus Formation Supplies	2015	2020	2025	2030	2035	2040	2045	2050
Purveyors Existing	19,700	19,700	19,700	19,700	19,700	19,700	19,700	19,700
Purveyors Planned (Restored Well)	2,375	1,625	1,500	1,400	1,275	1,125	1,000	875
Purveyors Planned (New Wells)	2,250	10,325	10,450	10,550	10,675	10,825	10,950	11,075
Purveyors Existing and Planned	24,325	31,650	31,650	31,650	31,650	31,650	31,650	31,650
Non purveyors	900	900	900	900	900	900	900	900
Total Saugus	**25,225**	**32,550**	**32,550**	**32,550**	**32,550**	**32,550**	**32,550**	**32,550**
Saugus Yield	*25,225*	*32,550*	*32,550*	*32,550*	*32,550*	*32,550*	*32,550*	*32,550*

3.4 Transfers and Exchanges

An opportunity available to CLWA to increase water supplies is to participate in voluntary water transfer programs. Since the drought of 1987-1992, the concept of water transfer has evolved into a viable supplemental source to improve supply reliability. The initial concept for water transfers was codified into law in 1986 when the California Legislature adopted the "Katz" Law (California Water Code, Sections 1810-1814) and the Costa-Isenberg Water Transfer Law of 1986 (California Water Code, Sections 470, 475, 480-483). These laws help define parameters for water transfers and set up a variety of approaches through which water or water rights can be transferred among individuals or agencies.

Up to 27 MAF of water are delivered for agricultural use every year. Over half of this water use is in the Central Valley, and much of it is delivered by, or adjacent to, SWP and CVP conveyance facilities. This proximity to existing water conveyance facilities could allow for the voluntary transfer of water to many urban areas, including CLWA, via the SWP. Such water transfers can involve water sales, conjunctive use and groundwater substitution and water sharing. They usually occur as a form of spot, option or core transfers agreements. The costs of a water transfer would vary depending on the type, term and location of the transfer. The most likely voluntary water transfer programs would probably involve the Sacramento or southern San Joaquin Valley areas.

One of the most important aspects of any resource planning process is flexibility. A flexible strategy minimizes unnecessary or redundant investments (or stranded costs). The voluntary transfer of water between willing sellers and buyers can be an effective means of achieving flexibility. However, not all water transfers have the same effectiveness in meeting resource

needs. Through the resource planning process and ultimate implementation, several different types of water transfers could be undertaken.

3.4.1 Core Transfers

Core transfers are agreements to purchase a defined quantity of water every year. These transfers have the benefit of more certainty in costs and supply, but in some years can be surplus to imported water (available in most years) that is already paid for.

3.4.2 Spot Market Transfers

Spot market transfers involve water purchased only during the time of need (usually a drought). Payments for these transfers occur only when water is actually requested and delivered, but there is usually greater uncertainty in terms of costs and availability of supply. Examples of such transfers were the Drought Water Banks of 1991, 1992 and 1994 and DWR Dry Year Water Purchase Programs in 2001 through 2004 and 2008. An additional risk of spot market transfers is that the purchases may be subject to institutional limits or restricted access (e.g., requiring the purchasing agency to institute rationing before it is eligible to participate in the program).

3.4.3 Option Contracts

Option contracts are agreements that specify the amount of water needed and the frequency or probability that the supply will be called upon (an option). Typically, a relatively low up-front option payment is required and, if the option is actually called upon, a subsequent payment would be made for the amount called. These transfers have the best characteristics of both core and spot transfers. With option contracts, the potential for redundant supply is minimized, as are the risks associated with cost and supply availability.

3.4.4 Future Market Transfers

The most viable types of water transfers are core and option transfers and, as such, represent CLWA's long-term strategy. The most recent costs for this type of transfer is estimated to be about $300 per AFY (equivalent to $5,500 per AF for Table A Amount) for core transfers.

3.5 Groundwater Banking Programs

With recent developments in conjunctive use and groundwater banking, significant opportunities exist to improve water supply reliability for CLWA. Conjunctive use is the coordinated operation of multiple water supplies to achieve improved supply reliability. Most conjunctive use concepts are based on storing surface supplies in groundwater basins in times of surplus for withdrawal and use during dry periods and drought when surface water supplies would likely be reduced.

Groundwater banking programs involve storing available SWP surface water supplies during wet years in groundwater basins in, for example, the San Joaquin Valley. Water would be stored either directly by surface spreading or injection, or indirectly by supplying surface water to farmers for their use in lieu of their intended groundwater pumping. During water shortages, the stored water could be pumped out and conveyed through the California Aqueduct to CLWA

as the banking partner, or used by the farmers in exchange for their surface water allocations, which would be delivered to CLWA as the banking partner through the California Aqueduct.

CLWA is a partner in two existing groundwater banking programs, the Semitropic Banking Program and RRBWSD Banking Program, discussed below in Sections 3.5.1 and 3.5.2, respectively. Newhall Land is also a partner in the Semitropic Banking Program, as discussed in Section 3.5.3, with its supplies assumed to be available to VWC. In addition, CLWA has updated its plan to enhance its overall supply reliability, including the need for additional banking programs, as discussed in Section 3.5.4.

3.5.1 Semitropic Banking Program

Semitropic Water Storage District (Semitropic) provides SWP water to farmers for irrigation. Semitropic is located in the San Joaquin Valley in the northern part of Kern County immediately east of the California Aqueduct. Using its available groundwater storage capacity (approximately one MAF), Semitropic has developed a groundwater banking program, that takes available SWP supplies in wet years and returns the water in dry years. As part of this dry-year return, Semitropic can leave its SWP water in the Aqueduct for delivery to a banking partner and increase its groundwater production for its farmers. Semitropic constructed facilities so that groundwater can be pumped into a Semitropic canal and, through reverse pumping plants, be delivered to the California Aqueduct. Semitropic currently has six long-term first priority banking partners: the Metropolitan Water District of Southern California (Metropolitan), Santa Clara Valley Water District, Alameda County Water District, Alameda County Flood Control and Water Conservation District Zone 7, Vidler Water Company and Newhall Land and Farming. The total amount of storage under contract is approximately one MAF.

In 2002, CLWA entered into a temporary storage agreement with Semitropic, and stored an available portion of its Table A supply (24,000 AF) in an account in Semitropic's program. In 2004, 32,522 AF of available 2003 Table A supply was stored in a second temporary Semitropic account. In accordance with the terms of CLWA's storage agreements with Semitropic, 90 percent of the banked amount, or a total of 50,870 AF, was recoverable through 2013 to meet CLWA water demands when needed. Each account had a term of ten years for the water to be withdrawn and delivered to CLWA.[19] Of this recoverable storage, 4,950 AF has been withdrawn, with 1,650 AF delivered in 2009 and 3,300 AF delivered in 2010, leaving a balance of 45,920 AF in storage available to meet future CLWA needs. CLWA executed an amendment for a ten-year extension of each banking agreement with Semitropic in April 2010. A negative declaration for the program extension was approved by CLWA's Board of Directors on January 19, 2011 and by the Semitropic Board of Directors on April 6, 2011.

Current operational planning includes use of the water stored in Semitropic for dry-year supply. Accordingly, it is reflected in the available supplies delineated in this section, and it is also reflected as contributing only to dry-year supply reliability in Chapter 6, through 2023.

3.5.2 Rosedale-Rio Bravo Banking Program

Also located in Kern County, immediately adjacent to the Kern Water Bank, RRBWSD has developed a Water Banking and Exchange Program. CLWA has entered into a long-term agreement with RRBWSD that provides it with storage and pumpback capacity of 20,000 AFY,

[19] Thereafter, the remaining amount of project water would be forfeited from the account.

with up to 100,000 AF of storage capacity. CLWA began storing water in this program in 2005 and has since reached the program's maximum storage capacity, with 100,000 AF currently available for withdrawal.

This project is a water management program to improve the reliability of CLWA's existing dry-year supplies; it is not an annual supply that could support growth. Accordingly, it is reflected in the available supplies delineated in this section and it is also reflected as contributing only to dry-year supply reliability in Chapter 6.

3.5.3 Semitropic Banking Program – Newhall Land

As mentioned above, one of Semtropic's long-term groundwater banking partners is Newhall Land. In its agreement with Semitropic, Newhall Land has available to it a pumpback capacity of 4,950 AFY and a storage capacity of 55,000 AF. Newhall Land has a current storage balance of 18,828 AF. This supply is assumed to be available to VWC and is planned to be used only in dry years. Accordingly, it is reflected in the available supplies delineated in this section, and it is also reflected as contributing only to dry-year supply reliability in Chapter 6.

3.5.4 Other Opportunities

In 2003, CLWA produced a Water Supply Reliability Plan (Reliability Plan), and updated it in 2009. The Reliability Plan outlines primary elements that CLWA should include in its water supply mix to obtain maximum overall supply reliability enhancement. These elements include both conjunctive use and groundwater banking programs, which enhance the reliability of both the existing and future supplies, as well as water acquisitions. The Reliability Plan recommends water banking storage and pumpback capacity north and south of Tehachapi Mountains, the latter of which would provide an emergency supply in case of catastrophic outage along the California Aqueduct. The Reliability Plan also contains a recommended implementation plan and schedule. CLWA has made significant progress on its water supply reliability program, obtaining storage capacity in two banking programs north of the Tehachapi Mountains, with approximately 146,000 AF of water currently banked in those programs and available for withdrawal. Negotiations with one program south of the Tehachapis were initiated, but identification of a program for emergency outage storage remains ongoing.

The 2009 update of the Reliability Plan presents the implementation schedule recommended for both storage and pumpback capacity beginning in 2010 and incrementally increasing through 2050. CLWA's plans call for development of additional groundwater banking programs, with pumpback capacity of at least an additional 10,000 AF by 2025, and a second additional 10,000 AF by 2035. Table 3-13 summarizes CLWA's future reliability enhancement programs.

TABLE 3-13
FUTURE RELIABILITY ENHANCEMENT PROGRAMS

Project Name	Year Available	Proposed Quantities (AF) Average/ Normal Year	Single Dry Year[(a)]	Multiple Dry Years[(b)]
Additional Planned	2025	0	10,000	7,500
Banking Programs	2035	0	20,000	15,000

Notes:
(a) Supplies shown are maximum annual withdrawal capacity.
(b) Supplies shown are average withdrawals during four consecutive dry years.

3.6 Planned Water Supply Projects and Programs

The Reliability Plan also discusses the potential for acquiring additional water supplies to meet future demands (the plan refers to these as "water transfer opportunities"). CLWA has been participating in the initial planning stages of the Garden Bar Water and Power Supply Project. This north-of-Delta water supply project is sponsored by the South Sutter Water District (SSWD). The project consists of a new dam and associated hydroelectric facilities. SSWD is investigating a reservoir with a storage capacity of between 245,000 and 350,000 AF. Table 3-14 summarizes CLWA's transfer and exchange opportunities.

TABLE 3-14
TRANSFER AND EXCHANGE OPPORTUNITIES

Source Transfer Agency	Transfer/ Exchange	Year Available	Short/Long Term	Proposed Quantity (AFY)
South Sutter Water District	Transfer	2020-2025	Long Term	TBD

3.7 Development of Desalination

The California UWMP Act requires a discussion of potential opportunities for use of desalinated water (Water Code Section 10631[i]). CLWA has explored such opportunities, and they are described in the following section, including opportunities for desalination of brackish water, groundwater and seawater. However, at this time, none of these opportunities are practical or economically feasible for CLWA and CLWA has no current plans to pursue them. Therefore, desalinated supplies are not included in the supply summaries in this Plan (e.g., Tables 3-1, 6-2, 6-3 and 6-4).

3.7.1 Opportunities for Brackish Water and/or Groundwater Desalination

As discussed in Chapter 3, the two sources of groundwater in the Santa Clarita Valley are drawn from the Alluvial Aquifer and from the Saugus Formation. Neither of these supplies can be considered brackish in nature, and desalination is not required.

However, CLWA and the retail water purveyors could team with other SWP contractors and provide financial assistance in construction of other regional groundwater desalination facilities in exchange for SWP supplies. The desalinated water would be supplied to users in communities near the desalination plant, and a similar amount of SWP supplies would be exchanged and allocated to CLWA from the SWP contractor. A list summarizing the groundwater desalination plans of other SWP contractors is not available; however, CLWA would begin this planning effort should the need arise.

In addition, should an opportunity emerge with a local agency other than a SWP contractor, an exchange of SWP deliveries would most likely involve a third party, such as Metropolitan. Most local groundwater desalination facilities would be projects implemented by retailers of SWP contractors and, if an exchange program was implemented, would involve coordination and wheeling of water through the contractor's facilities to CLWA.

3.7.2 Opportunities for Seawater Desalination

Because the Santa Clarita Valley is not in a coastal area, it is neither practical nor economically feasible for CLWA and its purveyors to implement a seawater desalination program. However, similar to the brackish water and groundwater desalination opportunities described above, CLWA and the purveyors could provide financial assistance to other SWP contractors in the construction of their seawater desalination facilities in exchange for SWP supplies.

CLWA and the purveyors have been following the existing and proposed seawater desalination projects along California's coast. Table 3-15 provides a summary of the status of several of California's municipal/domestic seawater desalination facilities.

As shown Table 3-15, most of the existing and proposed seawater desalination facilities are/would be operated by agencies that are not SWP contractors. However, in these cases as described above, an exchange for SWP deliveries would most likely involve a third party (SWP contractor), the local water agency and CLWA.

TABLE 3-15
EXISTING AND PROPOSED SEAWATER DESALINATION FACILITIES ALONG THE CALIFORNIA COAST

Project	Member Agency Service Area	AF per Year	Status
Long Beach Seawater Desalination Project	Long Beach Water Department	10,000	Pilot study
South Orange Coastal Ocean Desalination Project	Municipal Water District of Orange County	16,000-28,000	Pilot study
Carlsbad Seawater Desalination Project	San Diego County Water Authority	56,000	Permitting
West Basin Seawater Desalination Project	West Basin Municipal Water District	20,000	Pilot study
Huntington Beach Seawater Desalination Project	Municipal Water District of Orange County	56,000	Permitting
Camp Pendleton Seawater Desalination Project	San Diego County Water Authority	56,000 to 168,000	Planning
Rosarito Beach Seawater Desalination Feasibility Study	San Diego County Water Authority	28,000 to 56,000	Feasibility study
	Total AFY	**102,000-280,000**	

Source: MWD 2010 UWMP

Although not listed in Table 3-15, the Bay Area Regional Desalination Partnership, comprised of five agencies collaborating on a Regional Desalination Project in the San Francisco Bay area, is working to develop desalination as a water supply for the region. The agencies are the San Francisco Public Utilities Commission, Santa Clara Valley Water District, East Bay Municipal Utilities District, Contra Costa Water District and Alameda County Flood Control and Water Conservation District Zone 7. This regional desalination project is an example of the type of project that CLWA could participate in on an exchange basis.

To date the Partnership has completed a feasibility study to refine the institutional, technical, environmental and scientific merits of developing a regional facility and are planning to build and test a pilot plant in Contra Costa County. Construction is planned for 2012.

Section 4: Recycled Water

This section of the Plan describes the existing and future recycled water opportunities available to the CLWA service area. The description includes estimates of potential recycled water supply and demand for 2010 to 2050 in five year increments, as well as CLWA's proposed incentives and implementation plan for recycled water.

4.1 Recycled Water Master Plan

In normal years, approximately 55 percent of the demands within CLWA's service area is met with imported water. However, the reliability of the imported SWP supply is variable (due in part to its dependence on current year hydrology in northern California and prior year storage in SWP reservoirs). When sufficient imported water is not available, the balance is met with local groundwater provided by the purveyors and from water banking programs.

It is anticipated that water demands will continue to increase. Accordingly, additional reliable sources of water are necessary to meet projected water demands. CLWA recognizes that recycled water is an important and reliable source of additional water. Recycled water enhances reliability in that it provides an additional source of supply and allows for more efficient utilization of CLWA's groundwater and imported water supplies. Draft Recycled Water System Master Plans for the CLWA service area were completed in 1993 and 2002. These master plans considered significant developments affecting recycled water sources, supplies, users and demands so that CLWA could develop a cost-effective recycled water system within its service area. In 2007, CLWA completed California Environmental Quality Act (CEQA) analysis of the 2002 Recycled Water Master Plan (Recycled Plan). This analysis consisted of a Program Environmental Impact Report (EIR) covering the various phases for a recycled water system as outlined in the Recycled Plan. The Program EIR was certified by the CLWA Board in March 2007.

Table 4-1 provides a list of the agencies that participate in the implementation of the Recycled Plan.

CLWA has constructed Phase I of the Recycled Plan, which can deliver 1,700 AFY of water to the VWC service area. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips. In 2009, recycled water deliveries were 328 AF.

TABLE 4-1
PARTICIPATING AGENCIES

Participating Agencies	Role in Plan Development
Castaic Lake Water Agency	Wholesale water provider
Newhall County Water District	Retail water purveyor
Santa Clarita Water Division	Retail water purveyor
Valencia Water Company	Retail water purveyor
Los Angeles County Waterworks District No. 36	Retail water purveyor
Los Angeles County Sanitation District No. 26[20]	Recycled water supplier
Los Angeles County Sanitation District No. 32[21]	Recycled water supplier
Berry Petroleum	Potential recycled water supplier

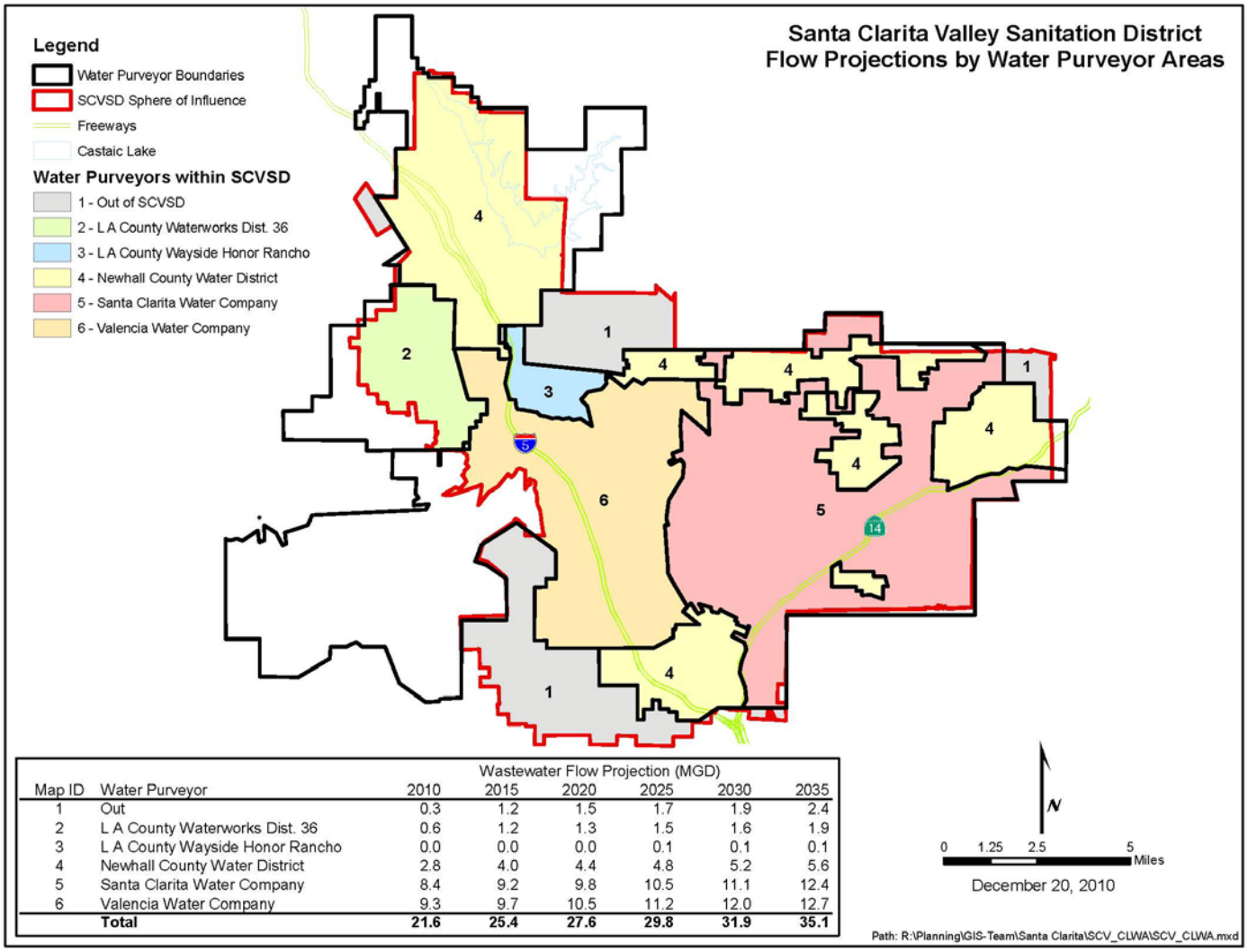
Overall, the Recycled Plan along with the Newhall Ranch development is expected to ultimately recycle up to 22,800 AF of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping and other non-potable uses.

CLWA completed a preliminary design report in 2009 on the second phase of the Recycled Plan (Phase 2A) that will take water from the Saugus Water Reclamation Plant (WRP) and distribute it to identified users to the north, across the Santa Clara River and then to the west and east. Customers included in the Phase 2A expansion will be Santa Clarita Central Park and the Bridgeport and River Village developments. Large irrigation customers will be served with this expansion with a collective design that will increase recycled water deliveries by 500 AFY.

Recycled water will be further expanded with the South End Recycled Water project (Phase 2C). VWC has initiated project design expanding the existing recycled water transmission and distribution system southerly to supply recycled water to additional customers as well as to potentially supply a source of recycled water to customers of adjacent water agencies. Phase 2C of the Recycled Plan will result in the use of 910 AFY of recycled water.

[20] Los Angeles County Sanitation District No. 26 and No. 32, the majority of which serve the City of Santa Clarita, have been consolidated into the Santa Clarita Valley Sanitation District.
[21] Ibid.

FIGURE 4-1
SANTA CLARITA VALLEY SANITATION DISTRICT FLOW PROJECTIONS BY WATER PURVEYOR SERVICE AREA



		Wastewater Flow Projection (MGD)					
Map ID	Water Purveyor	2010	2015	2020	2025	2030	2035
1	Out	0.3	1.2	1.5	1.7	1.9	2.4
2	L A County Waterworks Dist. 36	0.6	1.2	1.3	1.5	1.6	1.9
3	L A County Wayside Honor Rancho	0.0	0.0	0.0	0.1	0.1	0.1
4	Newhall County Water District	2.8	4.0	4.4	4.8	5.2	5.6
5	Santa Clarita Water Company	8.4	9.2	9.8	10.5	11.1	12.4
6	Valencia Water Company	9.3	9.7	10.5	11.2	12.0	12.7
	Total	**21.6**	**25.4**	**27.6**	**29.8**	**31.9**	**35.1**

4.2 Existing Wastewater Treatment Facilities

The Santa Clarita Valley Sanitation District (SCVSD) of Los Angeles County owns and operates two Water Reclamation Plants (WRPs), the Saugus WRP and the Valencia WRP, within the CLWA service area. The water is treated to tertiary levels and, with the exception of water used in Phase I of the Recycled Plan, is discharged to the Santa Clara River. The Newhall Ranch development is also planning to construct a WRP, and non-potable recycled water from this source may be incorporated into CLWA's recycled water system.

The Valencia WRP, completed in 1967, is located on The Old Road near Magic Mountain Amusement Park. The Valencia WRP has a current treatment capacity of 21.6 million gallons per day (MGD), equivalent to 24,192 AFY, developed over time in stages. In 2010, the Valencia WRP produced an average of 15.17 MGD (16,993 AFY) of tertiary recycled water. Use of recycled water from the Valencia WRP is permitted under Los Angeles Regional Water Quality Control Board (RWQCB) Order Nos. 87-48 and 97-072.

The Saugus WRP, completed in 1962, is located southeast of the intersection of Bouquet Canyon Road and Soledad Canyon Road. The Saugus WRP has a current treatment capacity of 6.5 MGD (7,280 AFY). No future expansions are possible at the plant due to space limitations at the site. In 2010, the Saugus WRP produced an average of 5.02 MGD (5,623 AFY) of tertiary recycled water. Use of recycled water from this facility is permitted under Los Angeles RWQCB Order Nos. 87-49 and 97-072.

The Saugus and Valencia WRPs operated independently until 1980, at which time the two plants were linked by a bypass interceptor. The interceptor was installed to transfer a portion of flows received at the Saugus WRP to the Valencia WRP. Together, the Valencia and Saugus WRPs have a design capacity of 28.1 MGD (31,472 AFY). In 2008 they produced an average of 20.9 MGD (23,422 AFY). The primary sources of wastewater to the Saugus and Valencia WRPs are domestic. Both plants are tertiary treatment facilities and produce high quality effluent. Historically, the effluent from the two WRPs has been discharged to the Santa Clara River. The Saugus WRP effluent outfall is located approximately 400 feet downstream (west) of Bouquet Canyon Road. Effluent from the Valencia WRP is discharged to the Santa Clara River at a point approximately 2,000 feet downstream (west) of The Old Road Bridge.

Phase 1 of the Recycled Plan has been constructed and begins with a 4,000 gpm pump station at the Valencia Water Reclamation Plant that connects to a 1.5 mg reservoir in the Westridge area with 15,600 linear feet of 24- and 20-inch pipeline. It serves landscape customers along The Old Road and the Tournament Players Club golf course, all of which are VWC customers. Phase 2C of the Recycled Plan (the South End project) would use this existing system and connect at The Old Road and Valencia Boulevard. From there it would cross the freeway and run south in Rockwell Canyon Road, ultimately reaching the intersection of Orchard Village Road and Lyons Avenue. The proposed Recycled Plan Phase 2A project would start at the Saugus WRP and cross the Santa Clara River through an existing pipeline. It would then serve customers on the north side of the river, generally along Newhall Ranch Road both west and east of Bouquet Canyon Road (Figure 4-2).

FIGURE 4-2
RECYCLED WATER MASTER PLAN PHASES 2A, 2B, 2C

4.3 Wastewater Treatment Facility Improvements and Expansions

To accommodate anticipated growth in the Santa Clarita Valley, a 6 MGD expansion of the Valencia WRP is planned as indicated in the 2015 Joint Sewerage System Facilities Plan and EIR (Los Angeles County Sanitation District [LACSD] 1998). With this expansion, the capacity of the Valencia WRP would be 27.6 MGD (30,912 AFY), a need the SCVSD projects by 2035. No expansion is planned at the Saugus WRP. The total current planned capacity for both WRPs is 34.1 MGD (38,197 AFY). Based on the Recycled Plan, reuse of the tertiary treated water from these two plants is anticipated at 15.5 MGD (17,400 AFY) by year 2030. As this UWMP plans to 2050, supplies in the Recycled Plan projected to be available by year 2030 have similarly been assumed to be available through 2050 and beyond.

A third Valley reclamation plant, the Newhall Ranch WRP, is proposed as part of the Newhall Ranch project. This proposed facility would be located near the western edge of the development project along the south side of State Route 126. The plant would be constructed in stages, with an ultimate capacity of 6.8 MGD (7,616 AFY) as stated in the RWQCB's Order R4-2007-0046. According to the Draft Newhall Ranch Resource Management and Development Plan/Spineflower Conservation Plan EIS/EIR, April 2009, approximately 5,400 AFY of the tertiary treated water from this plant is projected to be used by the Newhall Ranch Project. The WRP will serve the Newhall Ranch Specific Plan and a new County Sanitation District has been created to operate and maintain the Newhall Ranch WRP.

Table 4-2 provides the projected wastewater flows in each purveyor's service area from the combined Valencia and Saugus WRP planning area and from the proposed Newhall Ranch WRP. Projected wastewater flow for the Valencia and Saugus WRPs was determined using projected populations from Table 2-9 and the wastewater generation factor SCVSD uses for planning of 86 GPCD, and for the Newhall Ranch WRP based on its projections of production capacity.

Table 4-2 does not reflect Newhall Ranch WRP production capacity from 2010 through 2024. During this interim period, Newhall Ranch-generated wastewater would be temporarily treated at the Valencia WRP based on the need to build-up an adequate, steady flow of wastewater until construction of the Newhall Ranch WRP. The Valencia WRP has sufficient capacity to tertiary-treat wastewater from Newhall Ranch during this interim period, consistent with the Interconnection Agreement approved by SCVSD in 2002.

TABLE 4-2
PROJECTED WASTEWATER FLOWS

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Projected Populations									
LACWWD 36	4,947	7,157	8,908	10,658	12,405	14,159	15,906	17,657	19,407
NCWD	44,316	49,933	54,559	58,612	63,824	68,450	73,079	77,715	82,341
SCWD	124,192	133,868	143,544	153,220	162,896	172,572	182,248	191,924	201,600
VWC	113,296	127,241	138,862	150,477	162,098	173,716	185,330	196,952	208,570
Total Projected Populations[(a)]	**286,751**	**318,199**	**345,873**	**372,967**	**401,223**	**428,897**	**456,563**	**484,248**	**511,918**
Wastewater Generation									
LACWWD 36	476	689	858	1,027	1,195	1,364	1,532	1,701	1,869
NCWD	4,269	4,810	5,255	5,646	6,148	6,593	7,039	7,486	7,931
SCWD	11,962	12,894	13,826	14,758	15,690	16,622	17,554	18,486	19,418
VWC	10,913	12,256	13,375	14,494	15,613	16,732	17,851	18,970	20,089
Total Wastewater Generated (AF)[(b)]	**27,620**	**30,649**	**33,314**	**35,924**	**38,646**	**41,311**	**43,976**	**46,643**	**49,308**
WRP Production Capacity									
Saugus and Valencia WRPs									
Treatment Capacity (MGD)[(c)]	28.1	28.1	28.1	28.1	28.1	34.1	34.1	34.1	34.1
Treatment Capacity (AF)	31,472	31,472	31,472	31,472	31,472	38,192	38,192	38,192	38,192
Newhall Ranch WRP (MGD)[(d)]	-	-	-	2.0	2.0	4.0	4.0	6.8	6.8
Newhall Ranch WRP (AF)	-	-	-	2,240	2.240	4,480	4,480	7,616	7,616
Total WRP Production Capacity (AF)	**31,472**	**31,472**	**31,472**	**33,712**	**33,712**	**42,672**	**42,672**	**45,808**	**45,808**
Wastewater Treated (AF)[(e)]	**27,620**	**30,649**	**31,472**	**33,712**	**33,712**	**41,311**	**42,672**	**45,808**	**45,808**

Notes:

(a) From Table 2-9.

(b) Based on projected populations and SCVSD's wastewater generation planning factor of 86 GPCD.

(c) Existing WRP capacity of 28.1 MGD, plus planned Valencia WRP expansion assumed on line by 2035, for total planned capacity of 34.1 MGD. Timing for increase in WRP treatment capacity is based on SCVSD's population projections, which are lower than those presented in this table. SCVSD will continue to monitor sewer flows and expand Valencia WRP when available capacity becomes limited.

(d) Per RWQCB Order No. R4-2007-0046, the Newhall Ranch WRP will incrementally increase its design capacity to accommodate the development project as completed (2.0 MGD in Phase I, 4.0 MGD in Phase II and 6.8 MGD in Phase III). For the purposes of this analysis, Phase I begins in 2025 commensurate with increased planned recycled water demand.

(e) Lesser of Wastewater Generated and Total WRP Production Capacity.

4.4 Recycled Water Supply

The use of wastewater effluent is limited by various state water laws, codes and court decisions. These regulatory limitations are described in greater detail in the Recycled Plan.

CLWA is currently approved to use 1,700 AFY. Any additional ultimate use of existing wastewater for recycled water use is governed by, among other things, the availability of native versus foreign water as shown in Table 4-3 and the impacts to legal users of water. Native water is water that under natural conditions would contribute to a given stream or other body of water (i.e., surface water or upwelling groundwater). "Foreign" water is water that is not natural to a watercourse and occurs in the watercourse through human efforts. Foreign water can be removed from a watercourse without infringing on the water rights of downstream water users. Use may also be restricted to protect biological resources in the river. The Santa Clarita Valley Sanitation District will need to assess the issues of water rights and protection of biological resources relative to Sections 1210 and 1211 of the Water Code as CLWA's recycled water program expands.

In 2010, the Valley's potable water supply was approximately less than one percent recycled water, 44 percent groundwater (native water) and 55 percent imported water (foreign water)[22]. Projected potable water demand less recycled water for 2050 is 99,077 with conservation, 56 percent derived from foreign water and 44 percent derived from native sources, in a normal year. Accordingly, the potential recycled water component would consist of approximately 56 percent (55,477 AF foreign/99,077 AF total) of projected wastewater generation. This volume is determined by multiplying the percentage of foreign water by the wastewater flow. The future foreign water portion of wastewater is 27,609 AFY (56 percent times 49,308 AFY). It is important to note that these percentages are of potable water demand only (i.e., they do not include the use of recycled water in the calculation) and as such are not percentages of total water demand. The demand numbers used for the calculation reflect the implementation of SBX7-7, which requires retailers to reduce demand by 20 percent by 2020. Although the foreign water percentage of potable water demand only increases by one percent from 2010 to 2050, actual use of foreign water increases by nearly 50 percent.

Assuming the capacities and recycled water demand (as discussed in Section 4.3), the existing and projected wastewater flows and potential recycled water use are as summarized in Table 4-3. These numbers differ slightly from those presented in the Recycled Plan and are more conservative in terms of wastewater flows. Table 4-3 also shows the associated wastewater generation through 2050.

[22] Demand for foreign water is calculated as demand with conservation, less recycled water use, less local groundwater pumping.

TABLE 4-3
PROJECTED WASTEWATER GENERATION AVAILABLE FOR RECYCLED WATER USE (AF)

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Projected Wastewater Generation[a]	**27,620**	**30,649**	**33,314**	**35,924**	**38,646**	**41,311**	**43,976**	**46,643**	**49,308**
Demand w/ Conservation[b]	69,673	72,343	71,908	80,236	88,564	96,892	105,220	113,549	121,877
Recycled Water									
LACWWD 36	0	0	50	50	50	50	50	50	50
NCWD	0	200	500	1,000	1,275	1,775	2,275	2,775	3,275
SCWD	0	100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC	325	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Total Purveyor	325	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Non-Purveyor (Honor Rancho)	0	0	0	0	1,500	1,500	1,500	1,500	1,500
Total Purveyor and Non-Purveyor Recycled Water[c]	**325**	**1,300**	**3,050**	**5,550**	**9,600**	**12,100**	**15,600**	**19,100**	**22,800**
Potable Demand[d]	69,348	71,043	68,858	74,686	78,964	84,792	89,620	94,449	99,077
Supplies to Meet Potable Demand									
Groundwater[e]	31,100	34,600	36,600	37,600	39,600	40,600	41,600	42,600	43,600
Imported (foreign) water[f]	38,248	36,443	32,258	37,086	39,364	44,192	48,020	51,849	55,477
Foreign % of Potable Demand	55%	51%	47%	50%	50%	52%	54%	55%	56%
Potentially Available for Recycled Water Use[g]	**15,233**	**15,722**	**15,607**	**17,838**	**19,265**	**21,531**	**23,563**	**25,605**	**27,609**

Notes:
(a) From Table 4-2.
(b) From Table 2-22.
(c) Projected recycled water demand based on implementation of complete build-out of Recycled Water Master Plan.
(d) Demand w/ Conservation minus Recycled Water.
(e) From Table 3-7.
(f) Potable Demand minus Groundwater.
(g) Projected Wastewater Generation multiplied by Foreign Percent of Potable Demand.

4.4.1 Alternative Water Resources Management Program

Salinity and nutrient management concerns in the Upper Santa Clara River Watershed are primarily driven by salt sensitive crops located downstream. High chloride levels are of particular concern since high value, chloride sensitive crops like strawberries and avocados grown in the lower watershed utilize surface waters or ground water influenced by surface water for irrigation. Findings from previous reports cite the sources of chloride as source waters and residential self-regenerating water-softeners (SRWS). In 2003, SCVSD passed an ordinance banning the installation of all new SRWSs, and by passage of Senate Bill 475, the District has authority to remove all SRWSs remaining in the Santa Clarita Valley that were installed prior to 2003.

A Total Maximum Daily Load (TMDL) for chloride in the Upper Santa Clara River (Reaches 5 and 6) was adopted by the Los Angeles RWQCB and became effective on May 5, 2005. The Basin Plan Amendment for the chloride TMDL in the Upper Santa Clara River was unanimously adopted by the RWQCB on December 11, 2008. The TMDL established waste load allocations of 100 mg/L for the Saugus and Valencia WRPs. The TMDL implementation schedule allows for several special studies to determine whether existing Water Quality Objectives (WQOs) and waste-load allocations for chloride can be revised, and provides for an 11-year schedule to attain compliance with the final water quality objectives and waste-load allocations for chloride.

In 2008, the SCVSD evaluated the Alternative Water Resources Management (AWRM) Program. This program was developed jointly between Upper Basin Water Purveyors, Ventura County agricultural and water interests and the SCVSD to comply with the chloride WQOs established by the TMDL. Stakeholders along the Los Angeles County and Ventura County stretches of the Santa Clara River collaboratively developed an alternative approach to water resources management that will achieve TMDL compliance. The AWRM uses a basin water supply management approach to achieve the final water quality objectives and waste-load allocation for chloride determined through the TMDL collaborative process. AWRM permits a TMDL for the Santa Clara River that diverges from the Basin Plan, but protects beneficial uses while establishing feasible site specific objectives (SSOs). The program requires studies that showed the alternative WQO was protective of threatened and endangered species, sensitive agriculture and groundwater under the influence of surface water. AWRM, in comparison with the conventional approach, would have a number of benefits in terms of economics, public acceptance, feasibility and environmental quality.

A groundwater and surface water interaction model (GSWI) was developed (March 2008) to evaluate the impact of WRP effluent discharges to the Santa Clara River on downstream surface water and groundwater in the Los Angeles and Ventura County portion of the watershed. The same model is now being used by the AWRM Program to study the link between imported water quality, chloride and total dissolved solids (TDS) in the Upper Santa Clara River. In the model, historical water levels, flows, concentrations and movements within the time period of 1975 through 2005 were simulated and then calibrated to assess the assimilative capacity of surface water in Reaches 4 through 6 and the underlying groundwater basins in these areas. Additional assessments were made regarding (1) the gradient of chloride concentrations from the Saugus and Valencia WRP outfalls to receiving water stations located downstream, (2) the impacts of the WRP effluent in the USCR's groundwater and (3) simulations of potential chloride impacts projected for 2007 through 2030. These findings[23]

[23] The results of the initial GSWI Study are presented in a report entitled “Task 2B-1 Numerical Model Development and Scenario Results” (CH2M Hill, 2008; Geomatrix, 2008a).

resulted in the development of the AWRM Program where chloride WQOs would be increased in select groundwater basins and reaches of the USCR watershed while being decreased in the eastern Piru Basin where the ultimate objective would be an overall reduction in chloride loading and benefits to the water supply.

Given the benefits of chloride reduction and in the context of achieving a salt balance for the watershed, RWQCB staff proposed conditional SSOs that support the AWRM, while still being protective of beneficial uses. When implemented with the AWRM Program, the conditional SSOs of 117 mg/L during normal conditions and 130 mg/L during drought conditions in Reach 4B and the underlying groundwater will protect agricultural uses in the area (USCR Chloride TMDL Conditional SSOs Staff Report, Los Angeles RWQCB 2008). These conditional SSOs apply and supersede the existing regional water quality objectives of 100 mg/L only when chloride load reductions and/or chloride export projects are in operation by the SCVSD according to the implementation provisions provided in the RWQCB's Staff Report (RWQCB 2008).

Special studies were required for the implementation of AWRM and to evaluate whether the SSOs were protective of beneficial uses. The GSWI model was used to evaluate the effectiveness of the AWRM after the program was implemented. A study using the model showed that the AWRM WQOs could meet SSOs for chloride under drought and non-drought conditions. Based on the Final Staff Report from the Los Angeles RWQCB, the additional studies showed the chloride level protective of the most chloride-sensitive organisms for which data are available and is below the U.S. Environmental Protection Agency aquatic life chloride criteria. The conditional SSOs are not expected to harm in-stream or riparian species or habitat.

Due to ratepayer concerns regarding the perceived high cost of the AWRM Program, the recommended wastewater rate increases to implement AWRM were not approved by the SCVSD Board. In response, SCVSD and the water suppliers have been exploring alternative approaches that could result in revisions to the TMDL. These evaluations are ongoing.

4.5 Other Potential Sources of Recycled Water

Oilfield produced water is a by-product of oil production generated when oil is extracted from the oil reservoir. It is generally of poor quality and unsuitable for potable, industrial or irrigation use without treatment. Because of the poor water quality, reinjection has often been the most cost-effective disposal option. Treatment processes can produce potable quality water; yet, because of the poor initial water quality and the organic constituents, it is often more appropriate for treated oilfield produced water to be used for irrigation or industrial purposes to offset potable water demand. The economics of oil production are market-driven and are different from those of drinking water supplies. As oil prices rise or drop, oilfield production is increased or decreased as dictated by economics. Also, oilfields are eventually depleted of supply and abandoned. Therefore, while oilfield produced water should be considered as long-term, it is not a completely firm supply and is not permanent.

Berry Petroleum has expressed interest in treating oilfield produced water from the Placerita Oilfield for sale to CLWA for non-potable uses. Studies of the potential reuse of treated oilfield produced water from the Placerita Oilfield have indicated that approximately 44,000 barrels per day (1.8 MGD or 2,016 AFY) of treated oilfield produced water may be available. Pilot studies performed at the Placerita Oilfield have indicated that, even with reverse osmosis (RO) treatment, some organic compounds such as naphthalene, 2-butanone and ethylbenzene can

be detected in the RO effluent. For irrigation reuse, the produced water would need to be cooled and treated to remove hardness, silica, total dissolved solids (TDS), boron, ammonia and total organic carbon (TOC).

4.6 Recycled Water Demand

Currently, recycled water is served to landscape irrigation customers, including the TPC Golf Course. Potential recycled water users have been identified through a number of sources including:

- 1993 Recycled Water Master Plan
- Water consumption records for LACWWD 36, NCWD, SCWD and VWC
- Land use maps
- General Plans and Specific Plans for the City of Santa Clarita and County of Los Angeles
- Discussions with City, County, water purveyor and land developer staff
- On-site surveys of the CLWA service area
- 2002 Recycled Water Master Plan

In order to be considered as a potential recycled water user, the user has to be located within CLWA's service area and have a potential non-potable water demand of at least 4 AFY. A total potential demand for existing and future recycled water users is 34,500 AFY for 2015 as identified in the Recycled Plan. As this volume is already greater than the anticipated source of recycled water supply, additional future recycled users were not identified at this time. However, CLWA reevaluates the list of recycled users as conditions change or during the designing of projects under the Recycled Plan including users not identified in 2002. For example, the Los Angeles County Sheriff's Honor Rancho has undertaken sod farming operations. CLWA has therefore identified it as a potential future customer for 1,500 AFY of recycled water.

The initial list of potential recycled water users was reduced by evaluating the potential users that would be most expensive to serve until potential users totaled approximately 17,400 AF. The unit cost to serve each user was calculated using the capital costs for pipelines, reservoirs and pump stations as well as operational costs for pumping. The areas retained for recycled water service have costs ranging from $120 to $5,000 per AFY. Areas eliminated from service had costs as high as $13,000 per AFY. However, only two of the proposed phases in the Recycled Plan had costs above $1,000 per AFY. In addition, the Newhall Ranch project will require about 5,400 AFY. The resulting proposed recycled water service area encompasses a large portion of CLWA's western service area.

The total potential annual recycled water demand identified in the Recycled Plan and for the Newhall Ranch project that is cost effective to serve is approximately 22,800 AFY. Of this total 21,300 AFY is projected use by purveyor customers. Implementation of the recycled water system is expected to occur over the next 40 years.

4.7 Recycled Water Comparison

The 2005 Santa Clarita Valley UWMP projected a total recycled water demand of 1,600 AFY by the year 2010. Although it did not specifically state a projected 2005 demand, CLWA had approval for 1,700 AFY of recycled water use and was in the process of constructing the necessary facilities to deliver this amount at the time the 2005 UWMP was written. Approximately 325 AFY was served in 2010 to landscape irrigation customers, including the TPC Golf Course. Current demand is lower than originally predicted due to lack of funding available to expand the recycled water distribution system. Table 4-4 provides a comparison of the 2005 projected demand versus the actual 2010 demand.

TABLE 4-4
RECYCLED WATER USES - 2005 PROJECTION COMPARED WITH 2010 USE

User Type	2005 Projection for 2010 (AF)	2010 Use (AF)
Landscape	1,600	325
Total	**1,600**	**325**

Table 4-5 provides the comparison of anticipated demands and supplies. As shown in the table, potential demand for recycled water is equal to supplies.

TABLE 4-5
POTENTIAL RECYCLED WATER SUPPLIES AND DEMANDS

Demand	Supply (AF)	Adjusted Demands (AF)
Recycled Plan	17,400	
Newhall Ranch Project	5,400	
Total	**22,800**	**22,800**

4.8 Methods to Encourage Recycled Water Use

In order to provide an incentive to recycled water users, it was recommended in the Recycled Plan that CLWA issue a monthly rebate directly to each recycled water user. CLWA plans on making recycled water available at a reduced rate relative to the cost of potable water. CLWA may consider providing financial assistance to retail water providers to offset the costs of extending the recycled water conveyance system or to existing customers to cover all or a portion of the costs to convert their potable water systems to receive recycled water.

4.9 Implementation Plan for the Recycled Water Plan

Production from the WRPs is not anticipated to be adequate to meet the total demands of the existing system. However, as potable water demands increase and, consequently, recycled water production increases, the water available to meet system demands would also increase. Therefore, it is recommended that construction of the recycled water system be phased to utilize the increases in plant production.

Oilfield produced water would also not be available immediately, nor would it be available as a permanent source of supply. Instead, this alternative water source could be used as an interim long-term supply when the field is in operation and inadequate recycled water is available from

the Valencia and Saugus WRPs. Oilfield produced water is anticipated to be available for approximately the next twenty years. Implementation phasing considers when this water source would be available. A detailed discussion of the recommended phasing plan is provided in the Recycled Plan.

Phasing implementation of the recycled water system is recommended for the following reasons:

- A number of the potential recycled water users are future users that do not yet need recycled water.
- The current flow of the Valencia WRP is not adequate to meet the total demands of the recycled water users.
- Capital funding requirements would be spread over CLWA's current planning period through 2050.
- Oilfield produced water is not immediately (nor permanently) available.
- Demand is increasing due to development of Newhall Ranch.

The recycled water system is divided into implementation phases based primarily on service zone boundaries.

In general, the following factors were considered in developing a phasing plan:

- Ease or willingness of customers to connect to recycled water
- Retrofit costs
- Regulatory requirements
- Community impacts and development requirements
- Water utility involvement/cooperation
- Funding availability
- Reliability and operational costs considerations
- System flexibility

The implementation phases are prioritized based on the status of the users (existing or future), the anticipated construction schedule of future users and the proximity of the users to the non-potable water source (e.g., Valencia WRP, Saugus WRP or Placerita Oilfield).

4.10 Additional Considerations Relating to the Use of Recycled Water

4.10.1 Salt and Nutrient Management Plan

The SWRCB adopted a statewide Recycled Water Policy (Policy) on February 3, 2009 to establish uniform requirements for the use of recycled water. The purpose of this Policy is to increase the use of recycled water from municipal wastewater sources that meet the definition in Water Code Section 13050, subdivision (n), in a manner that implements state and federal

water quality laws. As part of this Policy, the preparation of a salt and nutrient management plan for each basin/subbasin in California, including compliance with CEQA and participation by Los Angeles RWQCB staff, is required by 2014. The Policy states that salts and nutrients from all sources should be managed on a basin wide or watershed wide basis in a manner that ensures attainment of water quality objectives and protection of beneficial uses.

The SWRCB finds that the appropriate way to address salt and nutrient issues is through the development of regional or sub-regional salt and nutrient management plans rather than through imposing requirements solely on individual recycled water projects. These plans shall be consistent with the DWR Bulletin 160 as appropriate and shall be locally developed. The salt and nutrient plan should include a basin/sub basin wide monitoring plan that specifies an appropriate network of monitoring locations. The monitoring plan should be site specific and must be adequate to provide a reasonable, cost-effective means of determining whether the concentrations of salt, nutrients and other constituents of concern as identified in the salt and nutrient plans are consistent with applicable water quality objectives.

CLWA, along with other Upper Santa Clara River Integrated Regional Water Management Plan participants, applied for a Proposition 84 Planning Grant that would update the IRWMP including preparation of a salt and nutrient management plan. In January 2011 CLWA was notified that its proposal was placed on the list of proposals recommended for funding. CLWA anticipates completing the study in 2012 at which time its impacts on the proposed recycled water supply and costs would be assessed.

4.10.2 Basin Plan

The Santa Clara River watershed has basin objectives established by the Regional Water Quality Control Board Los Angeles Region (Region 4). Water quality objectives were established to protect the various beneficial uses for that particular water body or reach. Table 4-6 shows the water quality objectives for salt and nutrients for the Santa Clara River watershed.

TABLE 4-6
WATER QUALITY OBJECTIVES FOR WATERS IN THE SANTA CLARA RIVER WATERSHED

	TDS (mg/L)	Chloride (mg/L)[a]	Sulfate (mg/L)	Nitrogen (mg/L)	SAR (mg/L)[b]	Boron (mg/L)
Inland Surface Waters						
Above Lang gaging station	500	50	100	5	5	0.5
Between Lang gaging station and Bouquest Canyon Road Bridge	800	100	150	5	5	1.0
Between Bouquet Canyon Road Bridge and West Pier Highway 99	1000	100	300	10	5	1.5
Between West Pier Highway 99 and Blue Cut gaging station	1000	100	400	5	10	1.5
Between Piru Creek and A Street, Fillmore[c]	1300	100	600	5	5	1.5
Between Blue Cut gaging station and Piru Creek, Fillmore[c]	1300	100	600	5	5	1.5
Between A Street, Fillmore and Freeman Diversion "Dam" near Saticoy[d]	1300	100	650	5	5	1.5
Between Freeman Diversion "Dam" near Saticoy and Highway 101 Bridge	1200	150	600	-	-	1.5
Between Highway 101 Bridge and Santa Clara River Estuary[e]			See basin plan			
Santa Paula Creek above Santa Paula Water Works diversion Dam	600	45	250	5	5	1.0
Sespe Creek above gaging station 500' downstream from Little Sespe Creek	800	60	320	5	5	1.5
Piru Creek above gaging station below Santa Felicia Dam	800	60	400	5	5	1.0
Groundwater Basins						
Acton Valley	550	100	150	10;45;10;1[f]	NA	1.0
Sierra Pelona Valley (Agua Dulce)	600	100	100	10;45;10;1[f]	NA	0.5
Upper Mint Canyon	700	100	150	10;45;10;1[f]	NA	0.5
Upper Bouquet Canyon	400	30	50	10;45;10;1[f]	NA	0.5
Green Valley	400	25	50	10;45;10;1[f]	NA	-
Lake Elizabeth-Lake Hughes area	500	50	100	10;45;10;1[f]	NA	0.5
Santa Clara-Mint Canyon	800	150	150	10;45;10;1[f]	NA	1.0
South Fork	700	100	200	10;45;10;1[f]	NA	0.5
Placerita Canyon	700	100	150	10;45;10;1[f]	NA	0.5
Santa Clara-Bouquet and San Francisquito Canyons	700	100	250	10;45;10;1[f]	NA	1.0
Castaic Valley	1000	150	350	10;45;10;1[f]	NA	1.0
Saugus Formation	-	-	-		NA	-

Notes:
(a) The RWQCB has adopted revised SSOs for chloride. See Section 4.4.1 and RWQCB Order No. R4-2008-012,
(b) SAR = Sodium adsorption ratio.
(c) The reach of the Santa Clara River between Blue Cut gaging station and A Street, Fillmore has been split into two reaches, between the confluence of Piru Creek and A Street, Fillmore and between the Blue Cut gaging station and the confluence of Piru Creek under RWQCB Resolution No. R4-2007-018.
(d) The chloride objective for this reach has been revised from 80 mg/L to 100 mg/L under RWQCB Resolution No. 2003-015.
(e) The reach between Highway 101 bridge and the Santa Clara River Estuary have not be designated with specific water quality objectives. In this case general objectives to protect specific beneficial uses are assigned in the basin plan.
(f) 10 mg/L nitrogen (as nitrate + nitrite); 45 mg/L nitrate (as NO_3); 10 mg/L nitrate-nitrogen; 1 mg/L nitrite-nitrogen

4.10.3 Nutrients

The LARWQCB found that the Santa Clara River was being impacted by ammonia and nitrate plus nitrite (nitrogen compounds) with the primary source being wastewater discharge into the river. Nitrogen compounds can cause or contribute to eutrophic effects such as low dissolved oxygen, algae blooms and reduced benthic macro invertebrates. Three reaches in the Santa Clara River have been identified as impaired due to ammonia (Reaches 3, 7 and 8), two of which exceed Basin Plan water quality objectives. These findings lead to a Basin Plan Amendment for a nitrogen compounds TMDL for the Santa Clara River that was adopted on March 23, 2004. The TMDL includes numeric targets for ammonia as listed in Table 4-7, and also for nitrate plus nitrite as shown in Table 4-8.

In 2005 the SCVSD upgraded the treatment processes at the Valencia and Saugus WRPs to include nitrification/denitrification to address nutrients. The 2010 average ammonia levels in the Valencia and Saugus WRP recycled water were 1.05 and 1.16 mg/L, respectively (SCVSD Industrial Waste Pretreatment Program, 2011). The 2010 average nitrate plus nitrite levels in Valencia and Saugus WRP recycled water were 2.41 and 4.08 mg/L, respectively (SCVSD Industrial Waste Pretreatment Program, 2011).

TABLE 4-7
TMDL FOR AMMONIA ON THE SANTA CLARA RIVER

Reach	One-hour NT (mg-N/L)	Thirty-day NT (mg-N/L)
Reach 8	14.8	3.2
Reach 7 above Valencia	4.8	2.0
Reach 7 below Valencia	5.5	2.0
Reach 7 at County Line	3.4	1.2
Reach 3 above Santa Paula	2.4	1.9
Reach 3 at Santa Paula	2.4	1.9
Reach 3 below Santa Paula	2.2	1.7

Source: LARWQCB Santa Clara River TMDL for Nitrogen Compounds Staff Report, June 2003

TABLE 4-8
TMDL FOR NITRATE PLUS NITRITE ON THE SANTA CLARA RIVER

Reach	Thirty-day Average (mg-N/L)
Reach 8	9.0
Reaches 3 and 7 above Valencia	4.5

Source: LARWQCB Santa Clara River TMDL for Nitrogen Compounds Staff Report, June 2003

4.10.4 Projected Salt Levels from Recycled Water

Salt balances depend on the amount imported and the amount exported. The total salt and nutrient loads in waste water discharges primarily depend on the levels in source waters and the type of treatment process that the water agency employs. Recycled water does not import additional salt into the watershed; instead the salt is transferred and cycled within the watershed. Recycled water generally contains salt levels 150 to 400 mg/L above potable water levels and 15 to 50 mg/L of ammonia.

Within California, agricultural irrigation is the largest consumer of recycled water followed by landscape irrigation, which are also typical uses in the Santa Clara River watershed. However, in the Los Angeles region, which is governed by RWQCB Region 4, groundwater recharge is the largest use of recycled water.

Table 4-9 represents the amount of salt above baseline levels that will need management. These levels are projected and may vary due to regulatory changes or changes in the source waters. The amounts do not represent the total loading but represent salt that will not be exported from the watershed through discharge into surface waters Management of salts and nutrients within the watershed is anticipated to be addressed through development of Salt and Nutrient Management Plans discussed in Section 4.10.1.

TABLE 4-9
ESTIMATED SALT ABOVE POTABLE LEVELS BY RECYCLED WATER USERS

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Projected recycled water use (AF)[(a)]	325	1,300	3,050	5,550	9,600	12,100	15,600	19,100	22,800
Non-exported salt levels (tons/yr)[(b)(c)(d)]	121	486	1,140	2,075	3,589	4,524	5,833	7,142	8,525

Notes:
(a) From Table 4-3.
(b) Amounts are in addition to baseline levels.
(c) Assumes average salt in recycled water is 275 mg/L based on Salt Management Guide for Landscape Irrigation with Recycled Water in Coastal Southern California, A Comprehensive Literature Review. The range cited for most recycled water is 150-400 mg/L.
(d) Based on the following conversions: 456,592 mg/lb; 0.0006063 lb/L; 1,233,481 L/AF; 747.82 lb/AF; 2,000 lb/ton.

Section 5: Water Quality

5.1 Overview

The quality of any natural water is dynamic in nature. This is true for the SWP and the local groundwater of the Basin. During periods of intense rainfall or snowmelt, routes of surface water movement are changed and new constituents are mobilized and enter the water while other constituents are diluted or eliminated. The quality of water changes over the course of a year. These same basic principles apply to groundwater. Depending on water depth, groundwater will pass through different layers of rock and sediment and leach different materials from those strata. Water depth is a function of local rainfall and snowmelt. During periods of drought, the mineral content of groundwater increases. Water quality is not a static feature of water, and these dynamic variables must be recognized.

Water quality regulations also change. This is the result of the discovery of new contaminants, changing understanding of the health effects of previously known as well as new contaminants, development of new analytical technology and the introduction of new treatment technology. All water suppliers are subject to drinking water standards set by the United States Environmental Protection Agency (EPA) and DPH. Additionally, investor-owned water utilities, such as VWC, are subject to water quality regulation by the PUC. CLWA provides imported water from the SWP and other sources, while local retail water purveyors combine local groundwater with treated imported water from CLWA for delivery to their customers. (While LACWWD 36 currently exclusively takes imported water from CLWA, it anticipates bringing a groundwater well into production soon). An annual Consumer Confidence Report (CCR) or Water Quality Report is provided to all Valley residents who receive water from CLWA and one of the four retail water purveyors. That report includes detailed information about the results of quality testing of the water supplied during the preceding year (Water Quality Report 2010). Water quality is also addressed in the annual Santa Clarita Valley Water Report (CLWA et. al., 2009), which describes the current water supply conditions in the Valley and provides information about the water requirements and water supplies of the Santa Clarita Valley.

The quality of water received by individual customers will vary depending on whether they receive imported water, groundwater or a blend. Some will receive only imported water at all times, while others will receive only groundwater. Others may receive water from one well at one time, water from another well at a different time, different blends of well and imported water at other times, and only imported water at yet other times. These times may vary over the course of a day, a week, or a year.

This section provides a general description of the water quality of the supplies within the Valley, aquifer protection and a discussion of potential water quality impacts on the reliability of these supplies.

5.2 Water Quality Constituents of Interest

The Santa Clarita Valley's water suppliers (Section 1.4) are committed to providing their customers with high quality water that meets all federal and state primary drinking water standards. Some contaminants are naturally-occurring minerals and radioactive material. In some cases the presence of animals or human activity can contribute to the constituents in the

source waters. The following sections address constituents reported in the 2010 CCR that may impact water quality.

5.2.1 Perchlorate

Perchlorate, a chemical used in making rocket and ammunitions propellants, has been a water quality concern in the Santa Clarita Valley since 1997 when it was originally detected in four wells operated by the purveyors in the eastern part of the Saugus Formation, near the former Whittaker-Bermite facility. In late 2002, the contaminant was detected in a fifth well, an Alluvial well (SCWD's Stadium Well) also located near the former Whittaker-Bermite site, which was immediately taken out of service. Perchlorate was detected again in early 2005 in a second Alluvial well (VWC's Well Q2) near the former Whittaker-Bermite site, and in 2006 in very low concentrations (below the detection limit for reporting) in a Saugus well (NCWD's NC-13) near one of the originally impacted wells. The maximum contaminant level (MCL) of 6 µg/L was adopted by DPH in 2007.

In August 2010, perchlorate was detected VWC's Saugus Well 201. Confirmation sampling in the months that followed confirmed the detection of perchlorate at concentrations that ranged from 5.7 to 12 micrograms per liter (µg/L). VWC removed Well 201 from service when perchlorate was first detected and is currently evaluating remediation alternatives including wellhead treatment in order to return the well to service and restore impacted well capacity. To date, perchlorate has been detected in a total of 8 wells, in both the Saugus Formation and the Alluvium. Table 5-1 summarizes the current remediation status of all wells where perchlorate has been detected.

The following is a summary of the status of perchlorate remediation and restoration of perchlorate-impacted groundwater supply. A more detailed discussion of pertinent events related to perchlorate contamination, containment, remediation and water supply restoration is included in Appendix I. As part of the evaluation of the containment system's effectiveness, the groundwater model is being updated and recalibrated using actual pumping data. These discussions are provided to illustrate that work toward the reactivation of impacted groundwater supply wells has progressed on several integrated fronts over the last ten years and is being expanded to include VWC Well 201. With the updated model VWC will be evaluating response actions to the contamination in Well 201.

TABLE 5-1
STATUS OF IMPACTED WELLS

Year Perchlorate Detected	Purveyor Well	Groundwater Aquifer	Status
1997	SCWD Saugus 1	Saugus	DPH approved well return to service in January 2011; well in active service utilizing approved perchlorate treatment.
1997	SCWD Saugus 2	Saugus	DPH approved wells return to service in January 2011; well in active service utilizing approved perchlorate treatment.
1997	VWC Well 157	Saugus	Sealed and capacity replaced by new well.
1997	NCWD Well 11	Saugus	Out of service.
2002	SCWD Stadium Well	Alluvium	Sealed and capacity replaced by new well.
2005	VWC Well Q2	Alluvium	DPH approved perchlorate treatment removal in 2007; treatment was installed in 2005 and relocated for potential future use; well remains in service.
2006	NCWD Well NC-13	Saugus	DPH approved annual monitoring, results have always been below the detection limit for reporting; well remains in service.
2010	VWC Well 201	Saugus	Out of service pending additional monitoring and evaluation of remediation alternatives.

In 2002 CLWA and the U.S. Army Corps of Engineers (ACOE) signed a cost-sharing agreement for a feasibility study of the area. Under federal and state law, the owners of the Whittaker-Bermite property have the responsibility for the groundwater cleanup. CLWA, the purveyors, and the Department of Toxic Substances Control (DTSC) signed an oversight agreement in 2003 regarding studies of treatment technologies for removing perchlorate from water supplies, and have also been working with DPH to obtain the necessary permits for these treatment processes. Treatment method pilot studies were conducted during 2003, and in 2004 CLWA and the purveyors selected ion exchange as the preferred treatment method for removing perchlorate.

Although that agreement expired in January 2005 the parties, under DTSC oversight, jointly developed a plan to “pump and treat” contaminated water from two of the purveyors’ impacted wells to stop migration of the contaminant plume and to partially restore the municipal well capacity that has been impacted by perchlorate. The containment plan specifies that wells Saugus 1 and Saugus 2 operate at a continuous pumping rate of 1,100 gpm at each well, for a combined total of 2,200 gpm from the two wells. The annual pumping volume of 1,772 AFY per well assumes that pumping will occur continuously, except for occasional maintenance purposes.

A final settlement to fund, remediate and treat the contaminated water was completed and executed by the parties in April 2007. Design of the CLWA treatment facilities and related pipelines was completed in 2007. Construction of the treatment facility and pipelines began in

November 2007 and treatment of the water began in 2010. Since January 2011 when DPH issued a permit for CLWA to serve this water, CLWA has included this water as part of its supply and has been delivering this water to purveyors. This water is shown as part of the regional supply in Section 3, and as part of NCWD's and SCWD's supply in the detailed supply tables by purveyor in Appendix C.

VWC and CLWA are pursuing the funding for evaluating remediation alternatives, including wellhead treatment of contaminated water from VWC Well 201 through the final settlement agreement. The schedule for restoring service to Well 201 is in development but is projected to be less than two years. During that time, however, the removal from service of Well 201 will not limit the ability to meet dry year target production levels from the Saugus Formation since there is sufficient capacity in the remaining, non-impacted Saugus production facilities to make up for the temporary loss of capacity from VWC Well 201 through the first two years of a multiple dry-year period. Restoration of VWC Well 201 and new Saugus well construction are planned to achieve full Saugus Formation capacity through a third year or longer dry period as discussed in Section 3.

Returning the impacted Saugus well (VWC Well 201) to municipal water supply service by installing treatment requires DPH approval before the water can be considered potable and safe for delivery to customers. The permit requirements are contained in DPH Policy Memo 97-005 for direct domestic use of impaired water sources.

Before issuing a permit to a water utility for use of an impaired source as part of the utility's overall water supply permit, DPH requires that studies and engineering work be performed to demonstrate that pumping the well and treating the water will be protective of public health for users of the water. The Policy Memo 97-005 requires that DPH review the local retail water purveyor's plan, establish appropriate permit conditions for the wells and treatment system, and provide overall approval of returning the impacted wells to service for potable use. Ultimately, VWC's plan and the DPH requirements are intended to ensure that the water introduced to the potable water distribution system has no detectable concentration of perchlorate.

The DPH Policy Memo 97-005 requires, among other things, the completion of a source water assessment for the impacted well intended to be returned to service. The purpose of the assessment is to determine the extent to which the aquifer is vulnerable to continued migration of perchlorate and other contaminants of interest from the Whittaker-Bermite site. The assessment includes the following:

- Delineation of the groundwater capture zone caused by operating the impacted wells.
- Identification of contaminants found in the groundwater at or near the impacted wells.
- Identification of chemicals or contaminants used or generated at the Whittaker-Bermite facility.
- Determination of the vulnerability of pumping the impacted wells to these contaminant sources.

The groundwater model that was developed for use in analyzing the operating yield and sustainability of groundwater in the Basin was also used for simulating the capture and control of perchlorate contamination in the originally impacted Saugus wells. The results of that work are summarized in "Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California" (CH2M Hill, December 2004). The recent detection

of perchlorate in VWC Well 201 was not totally unexpected in light of the previously identified gradient for groundwater flow (westerly) from the source location and previously impacted wells. That gradient is now being controlled by the containment and extraction program that is in operation for the originally impacted wells, as discussed in this section and in Appendix I. The analysis is expected to be used in the development of the source water assessment of VWC Well 201.

All proceedings and data are available to the public through a DTSC information repository as well as public meetings.

5.2.2 Metals and Salts

Metals and salts are tested in wells at least every three years and in Castaic Lake water every month. Small quantities of naturally occurring arsenic are found in Castaic Lake and in a few wells. Inorganic compounds such as salts and metals can be naturally occurring or result from urban storm water runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming. Arsenic levels in the Santa Clarita Valley are below the MCL (Luhdorff & Scalmanini, 2010).

Nitrate in drinking water at levels above 45 mg/L is a health risk for infants less than six months of age due to the possibility of methemoglobinemia. Nitrate levels may rise quickly for short periods of time because of rainfall or agricultural activity. Principal sources of nitrogen to a watershed typically include discharges from water reclamation plants and runoff from agricultural activities. Elevated nitrogen concentrations (ammonia, nitrate and nitrite) can cause impairments in warm water fish and wildlife habitat, along with contributing to eutrophic effects such as algae growth and low dissolved oxygen. Nitrates are tested at least annually and the drinking water meets federal and state MCL standards (CCR, 2010).

A chloride TMDL was established in 1998 due to the listing of Reaches 5 and 6 of the Upper Santa Clara River for chloride on the 303(d) list. Sources of chloride include water softeners, SWP and other imported water and wastewater effluent. The chloride TMDL includes a number of special studies to provide scientific certainty over the appropriate waste load allocations and objectives for chloride that are necessary to support various beneficial uses, including salt-sensitive agriculture, groundwater and endangered species. The special studies performed for the TMDL found that the WQO of 100 mg/L could not be achieved as adopted in 2005. As a result, conditional site specific objectives were adopted in 2008 as described by the Los Angeles RWQCB Staff Report on the Upper Santa Clara River Chloride TMDL Reconsideration and Conditional Site-Specific Objectives. To comply with the chloride TMDL, a stakeholder-driven group developed the Alternative Water Resources Management (AWRM) Plan that provides multiple benefits for stakeholders in Los Angeles and Ventura Counties. These benefits include the revision of water quality objectives that will support water recycling and thereby increase water supplies in the CLWA service area. In addition, the AWRM will implement water supply facilities in Ventura County that will allow for the conjunctive use of groundwater and surface water resources to increase water supplies and improve water quality in groundwater and surface waters of the Santa Clara River watershed. As part of the agreement, the SCVSD and CLWA plan to amend the existing recycled water agreement to expand the quantity of recycled water that can be purchased by the water suppliers from the SVCSD. The AWRM also calls for accelerated expansion of CLWA's Recycled Plan, which would reduce chloride mass loading in the Santa Clara River, particularly during dry seasons, additional information provided in Chapter 4.

SCVSD, CLWA and the retail water purveyors have been exploring alternative approaches towards developing an adaptive management strategy that could reduce the cost of implementing the AWRM.

5.2.3 Disinfection By-Products

CLWA uses ozone and chloramines to disinfect its water. Disinfection By-Products (DBPs), which include Trihalomethanes (THMs) and Haloacetic Acids (HAA5), are generated by the interaction between naturally occurring organic matter and disinfectants such as chlorine and ozone. THMs and HAA5 are measured at several points in each system and averaged once per quarter and reported as a running annual average.

Ozone is a very powerful disinfectant that not only kills organisms that no other disinfectant can, but also destroys organic chemicals that causes unpleasant tastes and odors. However, ozone can also interact with bromide, a naturally occurring salt, to produce bromate. As a result, CLWA is required to analyze the water leaving its two treatment plants for bromate once a month under federal regulations and the State's adopted Disinfectants and Disinfection Byproducts Rule (D/DBP Rule).

5.2.4 Hardness

In 2008, the VWC began a demonstration project delivering pre-softened groundwater from one of its wells to approximately 420 residents located in the Copperhill Community of Valencia. Hard water is the primary complaint from Valley customers and it is estimated that more than 50 percent have installed individual water softening units in their homes. In addition to having high operating costs, many of these units are designed to discharge a brine (salt) solution to the sanitary sewer system that is eventually discharged to the Santa Clara River. The environmental impact of such discharges was the subject of the chloride TMDL investigation which concluded with a commitment by the purveyors to achieve surface water quality goals for instream discharge from the basin. VWC's project is aimed at improving the quality of water for its customers to eliminate the need for home softening devices and to achieve the environmental benefits of reduced chloride discharge to the river.

The demonstration project utilizes softening technology that removes calcium and produces small calcium carbonate pellets that can be reused in a variety of industries. The demonstration project has now been operated for over two years and provides VWC with customer feedback and technical/financial information to assess potential future expansion of treatment to other well sites.

5.2.5 Microbiological

Microbial contaminants, such as viruses and bacteria, can be naturally occurring or result from urban storm water runoff, sewage treatment plants, septic systems, agricultural livestock operations and wildlife. Water is tested throughout the systems weekly for Total Coliform bacteria and testing for *Escherichia coli* (*E. coli*) occurs when coliform testing is positive. No *E. coli* was detected in any drinking waters in 2010. The MCL for total coliforms is 5 percent of all monthly tests showing positives for larger systems. Bacteriological tests met federal and state requirements. Additional microbiological tests for the water-borne parasites *Cryptosporidium parvum* and *Giardia lamblia* were performed on Castaic Lake water, and none were detected.

5.2.6 Radiological Tests

Radioactive compounds can be found in both ground and surface waters, and can be naturally occurring or be the result of oil and gas production and mining activities. Testing is conducted for two types of radioactivity; alpha and beta. If none is detected at concentrations above five picoCuries per liter no further testing is required. If it is detected, the water must be checked for uranium and radium. Although naturally occurring radioactivity can be detected, the levels meet the federal and state MCL standards.

5.2.7 Organic Compounds

Organic chemical contaminants, including synthetic and volatile organic chemicals, are by-products of industrial processes and petroleum production, and can also come from gas stations, urban storm water runoff and septic systems. Organic compounds also include pesticides and herbicides, which may come from a variety of sources such as agriculture, urban storm water runoff and residential uses. Water is tested for two types of organic compounds, volatile organic compounds (VOCs) and non-volatile synthetic organic compounds (SOCs). These organic compounds are synthetic chemicals produced from industrial and agricultural uses. Castaic Lake water is checked annually for VOCs and SOCs. Tetrachloroethylene (TCE) was found in trace levels below the MCL in groundwater in the Valley. Local wells are tested at least annually for VOCs and periodically for SOCs.

5.3 Imported Water Quality

CLWA provides SWP and other imported water to the Valley. The source of SWP water is rain and snow of the Sierra Nevada, Cascade and Coastal mountain ranges. This water travels to the Delta through a series of rivers and various SWP structures. From there it is pumped into a series of canals and reservoirs, which provide water to urban and agricultural users throughout the San Francisco Bay Area and central and southern California. The most southern reservoir on the West Branch of the SWP California Aqueduct is Castaic Lake. CLWA receives water from Castaic Lake and distributes it to the purveyors following treatment.

CLWA operates two water treatment plants, the Earl Schmidt Filtration Plant located near Castaic Lake and the Rio Vista Water Treatment Plant located in Saugus. CLWA produces water that meets drinking water standards set by the U.S. EPA and DPH. SWP water has different aesthetic characteristics than groundwater, with lower dissolved mineral concentrations (total dissolved solids) of approximately 250 to 360 mg/L, and lower hardness (as calcium carbonate) of about 105 to 135 mg/L. Historically, the chloride content of SWP water varies widely from over 100 milligrams per liter (mg/L) to below 40 mg/L, depending on Delta conditions; however as discussed below, SWP operations have changed significantly since historic levels of chloride were experienced.

Historically, the SWP delivered only surface water from the Sacramento-San Joaquin River Delta. However, CLWA and other SWP users, in anticipation of increased demand and dry periods, began “water banking” programs where SWP water could be stored or exchanged during wet years and withdrawn in dry years. The last three years have seen severe statewide drought. As a result, water has been withdrawn from the banking programs. This withdrawn water can either be delivered by exchange with SWP supplies allocated to others, or by pumping it into the SWP system. During the period of 2008 through 2010, a greater portion of water in the SWP has been this “pumped-in” water. The “pumped-in” water has met all water

quality standards established by DWR under its anti-degradation policy for the SWP. In particular, the pumped-in water serves to reduce the chloride concentration in SWP water. CLWA, on behalf of the SCVSD, is currently developing a SWP water quality model to quantify potential chloride reductions in SWP water due to "pumped-in" water. The results of this modeling will inform potential modifications to the AWRM Plan.

The SWP water chemistry may fluctuate and is influenced by its passage through the Delta in which large amounts of organic material are present and salt water from San Francisco Bay that contributes bromide and chlorides. Chloride levels from the Delta elevate chloride locally resulting in concern for local agriculture that grows chloride sensitive crops. Additionally, bromide and total organic carbon (TOC) may react with disinfectants such as ozone, chlorine, or DBPs. All constituents meet the federal and state MCL levels as reported in the CCR but remain a management concern in the watershed.

5.4 Surface Water Quality

CLWA does not deliver and treat water from the Santa Clara River as a source of supply; however, this source is a continual source of recharge to the underlying groundwater basin.

Surface water quality data for the Upper Santa Clara River in the County is based on the DWR investigation of water quality and beneficial uses conducted for the Upper Santa Clara River Hydrologic Area (DWR 1993). The investigation found that Castaic Lake and Castaic Lagoon water are influenced by thermal stratification and biochemical processes. Castaic Lake contains a high level of sodium chloride from SWP deliveries to the system; while sodium-calcium bicarbonate to sodium bicarbonate dominates Bouquet Canyon due to water deliveries from the Los Angeles Aqueduct (Mono-Owens water) that is stored in Bouquet Reservoir.

The surface water quality data in the Upper Santa Clara River are obtained from continuous sampling records at two gaging stations at the Old Highway Bridge and at the Los Angeles - Ventura County Line and historical records at two stations near Ravenna and Lang. The period of water quality records for these stations is from 1951 to 1990 (UWCD and CLWA 1996). These data have shown increasing concentrations of TDS and sulfate downstream and an overall general decrease, respectively, over the studied time period.

Nitrate ranged from 9 to 35 milligrams per liter (mg/L) nitrate at the Blue Cut gaging station near the County line but it generally occurs in very low concentrations in the undeveloped drainages north of the Santa Clara River. Chloride concentrations tend to also be relatively low in undeveloped portions of the watershed and higher in developed areas. Sources of chloride include water softeners, SWP water and wastewater effluent. Salt loading during 2001-2007 from the Saugus and Valencia WRP ranged from 23,500 pounds per day (ppd) to 28,500 ppd. SWP chloride contributions measured between 28 mg/L to 128 mg/L based on records from the past thirty years (Los Angeles RWQCB 2008) and have averaged just over 70 mg/L for the past few years.

5.5 Groundwater Quality

The groundwater basin has two sources of groundwater, the Alluvial Aquifer whose quality is primarily influenced by rainfall and stream flow, and the Saugus Formation which is a much deeper aquifer and recharged primarily by a combination of rainfall and deep percolation from the partially overlying Alluvium. A larger part of the Valley's groundwater supply is from the

Alluvial Aquifer, between 30,000 to 40,000 AFY; and a smaller portion of the Valley's water supply is drawn from the Saugus Formation, between 7,500 and 15,000 AFY in normal water years.

Local groundwater does not have microbial water quality problems. Parasites, bacteria and viruses are filtered out as the water percolates through the soil, sand and rock on its way to the aquifer. Even so, disinfectants are added to local groundwater when it is pumped by wells to protect public health. Local groundwater has very little TOC and generally has very low concentrations of bromide, minimizing potential for DPB formation. Taste and odor problems from algae are not an issue with groundwater.

The mineral content of local groundwater is very different from SWP water. The groundwater is very "hard," and it has high concentrations of calcium and magnesium (approximately 250 to 600 mg/L total hardness as $CaCO_3$). Groundwater may also contain higher concentrations of nitrates and chlorides when compared to SWP water. However, all groundwater meets drinking water standards.

5.5.1 Water Quality - Alluvium

Groundwater quality is a key factor in assessing the Alluvial Aquifer as a municipal and agricultural water supply. Groundwater quality details and long-term conditions, examined by integration of individual records from several wells completed in the same aquifer materials and in close proximity to each other, have been discussed in the annual Water Reports and in the 2005 UWMP. There were some changes in groundwater quality in 2009 that reflect fluctuations, trends or other groundwater quality conditions. Most of the trends show a significant lowering of the specific conductance values by half following the wet years of 2004-2005. Since then, those trends have returned to 2004 levels but do not exceed historical levels. In summary, those conditions include no long-term overall trend and, most notably, no long-term decline in Alluvial groundwater quality; a general groundwater quality "gradient" from east to west, with lowest dissolved mineral content to the east, increasing in a westerly direction; and periodic fluctuations in some parts of the basin, where groundwater quality has inversely varied with precipitation and stream flow. Those variations are typically characterized by increased mineral concentrations through dry periods of lower stream flow and lower groundwater recharge, followed by lower mineral concentrations through wetter periods of higher stream flow and higher groundwater recharge.

Specific conductance throughout the Alluvium is currently below the Secondary (aesthetic) MCL of 1,600 micromhos per centimeter (µmhos/cm). The presence of long-term consistent water quality patterns, although intermittently affected by wet and dry cycles, supports the conclusion that the Alluvial aquifer is a viable ongoing water supply source in terms of groundwater quality.

The most notable groundwater quality issue in the Alluvium is perchlorate contamination. Section 5.2.1 describes this issue in detail.

5.5.2 Water Quality - Saugus Formation

Water quality in the Saugus Formation has not historically exhibited the precipitation-related fluctuations seen in the Alluvium. As discussed above for the Alluvium, groundwater quality is a key factor in also assessing the Saugus Formation as a municipal and agricultural water supply. Long-term Saugus groundwater quality data are not sufficiently extensive to permit any sort of

basin-wide analysis or assessment of pumping-related impacts on quality. However, integration of individual records from several wells has been used to examine general water quality trends. Based on those records, water quality in the Saugus Formation had not historically exhibited the precipitation-related fluctuations seen in the Alluvium. Based on available data over the last fifty years, groundwater quality in the Saugus had exhibited a slight overall increase in dissolved mineral content. More recently, several wells within the Saugus Formation exhibited an additional increase in dissolved mineral content, similar to short term changes in the Alluvium, possibly as a result of recharge to the Saugus Formation from the Alluvium. Since 2005, however, these levels have been steadily dropping or remaining constant.

Dissolved mineral concentrations in the Saugus Formation remain below the Secondary (aesthetic) MCL. Groundwater quality within the Saugus will continue to be monitored to ensure that degradation that presents concern relative to the long-term viability of the Saugus as an agricultural or municipal water supply does not occur.

As with the Alluvium, the most notable groundwater quality issue in the Saugus Formation is perchlorate contamination. Perchlorate was originally detected in four Saugus wells operated by the retail water purveyors in the eastern part of the Saugus Formation in 1997, near the former Whittaker-Bermite facility. Two of those impacted wells have now been "restored" and returned to municipal water supply service as described in Section 5.2.1. A third impacted well has been abandoned and replaced by a new well, distant from the perchlorate-impacted part of the Saugus Formation. The fourth impacted well remains out of service, with its capacity made up from the restored and other non-impacted Saugus wells. The inactivation of that well does not limit the ability of the purveyors to meet water requirements. The local retail water purveyors continue to test for perchlorate in active water supply wells near the Whittaker-Bermite site. While perchlorate was detected in a fifth Saugus well nearby, the concentration was very low and below the detection limit for reporting. The sixth Saugus well with recently detected perchlorate concentrations that exceed the maximum contaminant levels for drinking water has been taken out of service pending evaluation of remediation alternatives including wellhead treatment and reactivation. There has been no additional detection of perchlorate above the detection limit for reporting in any other municipal Saugus well.

5.6 Aquifer Protection

There has been extensive investigation of the extent of perchlorate contamination which, in combination with the groundwater modeling previously described in Section 3.3.2.1, has led to the now-implemented plan for integrated control of contamination migration and restoration of impacted pumping (well) capacity. While most of the perchlorate contamination control and restoration plan is focused on the Saugus Formation, part of that plan includes potential capture of contaminated groundwater in the Alluvium by pumping of selected Saugus wells. Specific long-term resolution of perchlorate contamination in the Alluvium, which impacted two water supply wells, had focused on a combination of temporary wellhead treatment at one well, VWC's Well Q2, replacement of the second impacted well, SCWD's Stadium well, and several source control methods such as on-site pumping and treatment in the northern Alluvium (at the northerly portion of the former Whittaker-Bermite site). An ongoing challenge is protection of active Alluvial wells that could be impacted, including what effect that might have on adequacy of Alluvial groundwater pumping capacity and what response will be taken.

In April 2005, perchlorate was detected in VWC's Well Q2. VWC's response was to remove the well from active water supply service and to rapidly seek approval for installation of wellhead

treatment and return of the well to service. As part of outlining its plan for treatment and return of the well to service, VWC analyzed the impact of the temporary inactivation of the well on its water supply capability; the analysis determined that VWC's other sources are sufficient to meet demand and that the inactivation of Well Q2 had no impact on VWC's water supply capability (LSCE, 2005). VWC proceeded through mid-2005 to gain approval for installation of wellhead treatment (ion-exchange as described below), including environmental review and completed the installation of the wellhead treatment facilities in September 2005. Well Q2 was returned to active water supply service in October 2005.

After nearly two years of operation with wellhead treatment, including regular monitoring specified by DPH, all of which resulted in no detection of perchlorate in Well Q2, Valencia requested that DPH allow treatment to be discontinued. DPH approved that request in August 2007, and treatment was subsequently discontinued. DPH-specified monitoring for perchlorate continues at Well Q2, which remains in service; there has been no detection of perchlorate since discontinuation of wellhead treatment.

Ongoing monitoring of all active municipal wells near the Whittaker-Bermite site has shown no detections of perchlorate in any active Alluvial wells. However, based on a combination of proximity to the Whittaker-Bermite site and prevailing groundwater flow directions, complemented by findings in the ongoing on-site and off-site investigations by Whittaker-Bermite and the ACOE, there is logical concern that perchlorate could impact nearby, downgradient Alluvial wells. As a result, provisions are in place to respond to perchlorate contamination if it should occur. The groundwater model was used to examine capture zones around Alluvial wells under planned operating conditions (pumping capacities and volumes) (Technical Memorandum "*Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property (Santa Clarita, California)*", CH2M Hill, December 2004). The capture zone analysis of Alluvial wells generally near the Whittaker-Bermite site suggests that inflow to those wells will either be upgradient of the contamination site, or will be from the Alluvium beyond where perchlorate is most likely to be transported, with the possible exception of the VWC's Pardee wellfield (which includes Wells N, N7 and N8). Although the capture zone analysis does not show the Pardee wells to be impacted, they are considered to be at some potential risk due to the proximity of their capture zone to the Whittaker-Bermite site.

The combined pumping capacity of VWC's Pardee wells is 6,200 gpm, which equates to about 10,000 AF of maximum annual capacity. However, in the operating plan for both normal and dry-year Alluvial pumping, the planned use of those wells represents 2,940 AFY of the total 30,000 to 40,000 AFY Alluvial groundwater supply. Thus, if the wells were to become contaminated with perchlorate, they would represent an amount of the total Alluvial supply that could be readily replaced on a short-term interim basis by utilizing an equivalent amount of imported water from CLWA or by utilizing existing capacity from other Alluvial wells. However, if the Pardee wells were to become contaminated by perchlorate contamination, VWC has made site provisions at its Pardee wellfield for installation of wellhead treatment. Such treatment would be the same methodology as installed at its Well Q2.

On the Whittaker-Bermite site, soil remediation activities in operating unit subareas started in 2005. Groundwater "pump and treat" operations in the Northern Alluvium also started in 2005 and is ongoing. Expanded pumping, intended to effect perchlorate containment as well as to treat 'hot spots' in the Northern Alluvium, became operational in October 2007.

In addition, on-site remediation, a Work Plan for a Pilot Remediation Pumping Program in the Northern Alluvium and certain on-site sub-areas east/southeast, or generally upgradient of the impacted Stadium Well, was completed in June 2005. The pilot program began sustained operation in October 2007. That program involves the establishment of containment, generally along the northern boundary of the Whittaker-Bermite site, upgradient of the Stadium Well, by continuous pumping of a former Whittaker-Bermite facility well, complemented by pumping at several groundwater "hot spots" also generally upgradient of the Stadium Well. Due to the low conductivity of the aquifer materials at the various "hot spots," pumping for containment at those locations would be from several wells at low pumping capacities. Extracted water would be treated at Whittaker-Bermite's existing on-site treatment system. Generally consistent with the Saugus restoration concept, the Northern Alluvium pumping program would have the concurrent objectives of preventing site-related contaminants from leaving the site and removing some contamination from groundwater such that it can be removed in the on-site treatment process prior to discharge of the water back to the groundwater Basin.

In February 2003, DTSC and the impacted purveyors entered into a voluntary cleanup agreement entitled *Environmental Oversight Agreement*. Under the Agreement, DTSC is providing review and oversight of the response activities being undertaken by CLWA and the purveyors related to the detection of perchlorate in the impacted wells. Under the Agreement's Scope of Work, CLWA and impacted purveyors prepared a Work Plan for sampling the production wells, a report on the results and findings of the production well sampling, a draft Human Health Risk Assessment, a draft Remedial Action Work Plan, an evaluation of treatment technologies and an analysis showing the integrated effectiveness of a project to restore impacted pumping capacity, extract perchlorate-impacted groundwater from two Saugus wells for treatment, and control the migration of perchlorate in the Saugus Formation. Environmental review of that project was completed in 2005 with adoption of a mitigated Negative Declaration. The Final Interim Remedial Action Plan for containment and extraction of perchlorate was completed and approved by DTSC in January 2006. Design and construction of the treatment facilities and related pipelines to implement the pump and treat program and to also restore inactivated municipal well capacity has been completed and the restored wells are now returned to service as part of the operational Saugus groundwater supply (see Section 3.3).

A Rapid Response Fund has also been established under the terms of the CLWA Litigation Settlement Agreement. The fund will be used if the remedy to contain perchlorate contamination in the Alluvial Aquifer and portions of the Saugus Formation does not prevent migration of the perchlorate plume towards downgradient threatened wells (VWC Wells N, N-7, N-8, S6, S7, S8, 201 and 205 and NCWD Wells NC-10, NC-12 and NC-13). The Rapid Response Fund provides up to $10 million for any additional costs of providing replacement water, associated operations and maintenance costs of treatment equipment and resin under the terms of the Agreement. As noted, VWC Well 201 was a downgradient threatened well, so it is anticipated that the fund will be used for evaluating remediation alternatives, including wellhead treatment, of perchlorate recently detected in Well 201.

5.7 Water Quality Impacts on Reliability

Three factors affecting the availability of groundwater are sufficient source capacity (wells and pumps),sustainability of the groundwater resource to meet pumping demand on a renewable basis and protection of groundwater sources (wells) from known contamination, or provisions for treatment in the event of contamination. The first two of those factors are addressed in Section 3. The resolution of contamination for aquifer protection is addressed below.

Perchlorate has been a water quality concern in the Valley since 1997 when it was originally detected in four wells operated by the purveyors in the eastern part of the Saugus Formation, near the former Whittaker-Bermite facility. Subsequent monitoring well installation has been completed; and a focused study of the Saugus Formation has ultimately been incorporated into the overall groundwater remediation and perchlorate containment. All remedial action has been reviewed by the DTSC.

Overall, the plans developed for groundwater operation will allow CLWA and the retail purveyors to meet near term and long term demand within the CLWA service area. Any well impacted by perchlorate will be removed from service in the near term and the loss of capacity will be met by near-term excess capacity in non-impacted wells or through the installation of replacement well(s), if necessary, until remediation alternatives, including wellhead treatment, and DPH approval is obtained for restoration of the impacted supply. The current removal of VWC Well 201 from service does not limit the reliability of the water supply since there is sufficient excess capacity in Saugus wells to meet water supply projections during the period required for its restoration. Therefore, no anticipated change in reliability or supply due to water quality is anticipated based on the present data, as is shown in Table 5-2.

TABLE 5-2
CURRENT AND PROJECTED WATER SUPPLY CHANGES DUE TO WATER QUALITY - PERCENTAGE CHANGE

Water source	2010	2015	2020	2025	2030	2035	2040	2045	2050
Groundwater									
Alluvial	0%	0%	0%	0%	0%	0%	0%	0%	0%
Saugus	16%[(a)]	0%	0%	0%	0%	0%	0%	0%	0%
Imported Water	0%	0%	0%	0%	0%	0%	0%	0%	0%
Recycled Water	0%	0%	0%	0%	0%	0%	0%	0%	0%
Banking Programs	0%	0%	0%	0%	0%	0%	0%	0%	0%

Note:

(a) The removal of VWC Well 201 would on a temporary basis reduce the quantity of water available from the Saugus Formation by 3,777 AFY in certain dry years. The 16% water supply impact shown in this table represents the percentage of VWC Well 201 capacity to the total 24,100 AFY single dry year well capacity from the Saugus Formation as indicated in Table 3-11. Table 8-3 illustrates that the removal of VWC Well 201 would not result in inadequate well capacity should a multi-year dry period occur in the near term. Further, Tables 6-4 and 6-5 illustrate that, for a single dry year, existing and planned water supplies exceed demand by more than 28,000 AFY and 36,000 AFY assuming 2015 levels of demand. In conclusion, the temporary loss of capacity from VWC Well 201, as discussed in Sections 3, 5, 6 and 8 and Appendices C and I, does not result in a shortage to the water suppliers.

Section 6: Reliability Planning

6.1 Overview

The Act requires urban water suppliers to assess water supply reliability that compares total projected water use with the expected water supply over the next twenty years in five year increments. The Act also requires an assessment for a single dry year and multiple dry years. This chapter presents the reliability assessment for CLWA's service area.

It is the stated goal of CLWA and the retail water purveyors to deliver a reliable and high quality water supply for their customers, even during dry periods. Based on conservative water supply and demand assumptions over the next forty years in combination with conservation of non-essential demand during certain dry years, the Plan successfully achieves this goal.

6.2 Reliability of Water Supplies

Each water supply source has its own reliability characteristics. In any given year, the variability in weather patterns around the state may affect the availability of supplies to the Valley differently. For example, from 2000 through 2002, southern California experienced dry conditions in all three years. During the same period, northern California experienced one dry year and two normal years. The Valley is typical in terms of water management in southern California; local groundwater supplies are used to a greater extent when imported supplies are less available due to dry conditions in the north, and larger amounts of imported water supplies are used during periods when northern California has wetter conditions. This pattern of "conjunctive use" has been in effect since SWP supplies first came to the Valley in 1980. SWP and other imported water supplies have supplemented the overall supply of the Valley, which previously depended solely on local groundwater supplies.

To supplement these local groundwater supplies, CLWA contracted with DWR for delivery of SWP water, providing an imported water supply to the Valley. However, the variability in SWP supplies affects the ability of the purveyors to meet the overall water supply needs for the service area. While each of the Valley's available supply sources has some variability, the variability in SWP supplies has the largest effect on overall supply reliability.

As discussed in Section 3.2, each SWP contractor's Water Supply Contract contains a Table A Amount that identifies the maximum amount of Table A water that contractor may request each year. However, the amount of SWP water actually allocated to contractors each year is dependent on a number of factors than can vary significantly from year to year. The primary factors affecting SWP supply availability include the availability of water at the source of supply in northern California, the ability to transport that water from the source to the primary SWP diversion point in the southern Delta and the magnitude of total contractor demand for that water. In many years, the availability of SWP supplies to CLWA and the other SWP contractors is less than their maximum Table A Amounts, and can be significantly less in very dry years.

DWR's *Reliability Report*, prepared biennially assists SWP contractors and local planners in assessing the reliability of the SWP component of their overall supplies. In its Reliability Reports, DWR presents the results of its analysis of the reliability of SWP supplies, based on

model studies of SWP operations. In general, DWR model studies show the anticipated amount of SWP supply that would be available for a given SWP water demand, given an assumed set of physical facilities and operating constraints, based on 82 years of historic hydrology. The results are interpreted as the capability of the SWP to meet the assumed SWP demand, over a range of hydrologic conditions, for that assumed set of physical facilities and operating constraints.

DWR's 2009 update of the *Reliability Report* presents the results of model studies for years 2009 and 2029. In these model studies, DWR assumed existing SWP facilities and operating constraints for both the 2009 and 2029 studies. The primary differences between the two studies are an increase in projected SWP contractor demands, an increase in projected upstream demands (which affects SWP supplies by reducing the amount of inflows available for the SWP), and the inclusion in the 2029 study of potential impacts on historic hydrology of the effects of climate change and accompanying sea level rise. In the report, DWR presents the SWP delivery capability resulting from these studies as a percent of maximum contractor Table A Amounts. To estimate supply capability in intermediate years between 2009 and 2029, DWR interpolates between the results of those studies.

6.3 Normal, Single-Dry, and Multiple-Dry Year Planning

The water suppliers have various water supplies available to meet demands during normal, single-dry, and multiple-dry years. The following sections elaborate on the different supplies available to the water suppliers including groundwater, recycled water and imported supplies.

6.3.1 Groundwater

In accordance with the groundwater operating plan for the basin, groundwater supplies for all uses from the Alluvial Aquifer are planned to be in the range 30,000 to 40,000 AFY in average years and 30,000 to 35,000 AFY in dry years; supplies from the Saugus Formation are projected to be 7,500 to 15,000 AFY in average years and 15,000 to 35,000 AFY in dry years. The updated Basin Yield analysis (LSCE and GSI, 2009) concluded pumping in those ranges to be sustainable. While there is sufficient Alluvial pumping capacity to achieve the Alluvial groundwater supply (Table 3-8), it is planned that VWC will develop some future capacity as it constructs municipal supply wells to replace existing agricultural wells when planned development converts existing agricultural land use to municipal land use. Existing Saugus pumping capacity is sufficient to achieve about 27,000 AFY (Table 3-9), or about 77 percent of the upper end of the Saugus operating plan. Hence, it is planned that restored capacity (VWC Well 201) and future Saugus pumping capacity (new wells) will be added to achieve the full range of the Saugus operating plan.

The existing and planned groundwater supplies used in this Plan are generally the pumping rates, within the operating plan ranges, that were analyzed in the Basin Yield update. As such, they tend toward the upper ends of the respective ranges except for normal year Saugus pumping, which is closer to mid-range of the Saugus operating plan. For the multiple-dry year period, it was assumed that pumping from the Saugus Formation would be governed by the groundwater operating plan summarized in Table 3-5, with average pumping over the 4-year dry period of about 21,500 AFY. Total projected Alluvial and Saugus pumping, including pumping by the purveyors and by agricultural and other users, is shown by year type in Tables 3-7 to

3-12 in Section 3. As shown there, total pumping in each year type remains within the pumping ranges in the groundwater operating plan.

6.3.2 Recycled Water

Recycled water is available from the Saugus WRP and Valencia WRP. Recycled water is also anticipated to be produced by the Newhall WRP for the Newhall Ranch Specific Plan development, as described in Section 4.

CLWA has completed construction of Phase I of its Recycled Plan, a multi-phased program to deliver recycled water in the Valley. Phase 1 can deliver 1,700 AFY of water through the VWC system. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips. In 2010, recycled water deliveries were approximately 325 AF.

CLWA completed a preliminary design report in 2009 on the second phase of the Recycled Plan (Phase 2A), which will take water from the Saugus WRP and distribute it to identified users to the north, across the Santa Clara River and then to the west and east. Large irrigation customers will be served with this expansion with a collective design that will increase recycled water deliveries by 500 AFY.

Recycled water will be further expanded within the region with the South End Recycled Water project (Phase 2C), which will expand the existing recycled water transmission and distribution system southerly to supply recycled water to additional VWC customers, as well as some customers served by NCWD and the SCWD. The Project includes the planning, designing and construction of Phase 2C of the region's Recycled Plan, with recycled water improvements including various recycled water pipelines and pumping stations resulting in the use of an estimated 910 AFY of recycled water.

Overall, the recycled water program is expected to ultimately deliver up to 22,800 AFY of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping and other non-potable uses. Of this total, 21,300 AFY is projected use by purveyor customers. This supply is assumed to be available in an average year, a single-dry year, and in each year of a multiple-dry year period.

6.3.3 State Water Project Table A Supply

For this Plan, the availability of SWP supplies to CLWA was based on DWR's 2009 *Reliability Report*, taken from more detailed results provided by DWR from the model studies presented in the 2009 *Reliability Report*. For the three hydrologic conditions evaluated here, the SWP deliveries to CLWA were taken from DWR's analyses based on the following: average/normal year based on the average deliveries over the studies' 82-year historical hydrologic study period (1922-2003), single-dry year based on a repeat of the worst-case historical hydrologic conditions of 1977, and multiple-dry year period based on a repeat of the historical four-year drought of 1931-1934.

As discussed in more detail in Section 3 (see Section 3.2.1.2.3), a planning effort to increase long-term supply reliability for both the SWP and CVP is taking place through the Bay Delta Conservation Plan (BDCP). While the proposed conveyance facilities that are part of the BDCP would increase SWP supply reliability, that increase is not included here. Any of the proposed

facilities that are completed would increase SWP reliability beyond the values used throughout this Plan.

6.3.3.1 Flexible Storage Account

Under the Water Supply Contracts with DWR for SWP water, the contractors that share in the repayment of Castaic Lake may access a portion of the storage in that reservoir. This accessible storage is referred to as "flexible storage." The contractors may withdraw water from flexible storage, in addition to their allocated Table A supplies, on an as-needed basis. A contractor must replace any water it withdraws from this storage within five years. As one of the three contractors sharing in the repayment of Castaic Lake, CLWA has access to this flexible storage. Its share of the total flexible storage is currently 4,684 AF. After negotiations with Ventura County water agencies in 2005, CLWA gained access to their 1,376 AF of flexible storage for ten years through 2015. While it is expected that CLWA and Ventura County will extend the existing flexible storage agreement beyond the 2015 term, in this Plan it is not assumed to be available beyond 2015.

CLWA plans to use this supply only in dry years. For the single-dry year condition, it was assumed the entire amount would be used. For the multiple-dry year condition, it was assumed that the entire amount would be used sometime during the four-year period, so the average annual supply during that period would be one fourth of the total. Any water withdrawn was assumed to be replaced in intervening average and wet years and would be available again for use in the next dry year.

6.3.4 Buena Vista-Rosedale

BVWSD and RRBWSD, both member districts of KCWA, have jointly developed a program that provides both a firm water supply of 11,000 AFY and a water banking component. This supply program provides a firm annual water supply available every year based on existing and long-standing Kern River water rights, which is delivered by exchange of Buena Vista's and Rosedale's SWP Table A supplies.

6.3.5 Nickel Water - Newhall Land

This supply is similar to Buena Vista-Rosedale supply both in regard to its source (Kern River water rights) and level of reliability. The supply from this program is up to 1,607 AFY of firm supply, which is available in every year. It was acquired by the developer of the Newhall Ranch project to supplement groundwater and recycled water sources of supply for that project, which is in the CLWA service area. In this Plan, it is anticipated that this water supply will be available to VWC.

6.3.6 Semitropic Banking Program

In 2002, CLWA stored 24,000 AF of its allocated SWP Table A supply through a groundwater banking agreement with Semitropic. In 2004, CLWA stored 32,522 AF of its 2003 allocated SWP Table A supply in a second Semitropic storage account. Under the terms of those agreements, and after consideration for losses within the groundwater basin, CLWA could withdraw up to 50,870 AF when needed within ten years of when the water was stored. Of this storage, CLWA withdrew 4,950 AF in 2009 and 2010, leaving 45,920 AF currently available for

withdrawal. CLWA executed an amendment for a ten-year extension of each banking agreement with Semitropic in April 2010.

In addition to this short-term storage for CLWA, Semitropic has a long-term groundwater banking program with several other partners. The facilities that Semitropic may use in the return of CLWA's banked water supply are the same facilities that Semitropic may use to return banked water to its long-term banking program partners. As a result, there may be competition for use of those facilities in a particularly dry year, which could limit CLWA's ability to access the water in that year.

CLWA plans to use this supply only in dry years. For the single dry year, it was assumed that competition among Semitropic's banking partners for use of return facilities would limit CLWA's supply to about one third of the storage available, or about 15,000 AF. For the multiple-dry year period, it was assumed that the entire amount would be accessible and used sometime during the four-year period, so the average annual supply during that period would be one fourth of the total available, or about 11,500 AF. Under the agreements for this program, including the agreement for the ten-year time extension, the stored water must be withdrawn within twenty years of when it was stored. Therefore, it was assumed that this supply is available only through 2023.

6.3.7 Semitropic Banking Program - Newhall Land

As was the case for the Nickel water, the banking program was entered into by the developer of the Newhall Ranch project to firm up the reliability of the water supply for the project, which is in the CLWA service area. The storage capacity of this program is 55,000 AF. Newhall Land currently has 18,892 AF stored in this program. It is anticipated that this supply will be available to VWC.

VWC plans to use this supply only in dry years. For the single-dry year, supplies were assumed at the program's maximum withdrawal capacity of 4,950 AFY. For the multiple-dry year period, supplies in each year of the dry period were assumed at the program's maximum withdrawal capacity of 4,950 AFY and that additional supplies would be banked during wetter years to allow withdrawal of this amount.

6.3.8 Rosedale-Rio Bravo Banking Program

RRBWSD has also developed a water banking and exchange program. CLWA has entered into a long-term agreement with RRBWSD which provides it with storage and withdrawal capacity of 20,000 AFY and up to 100,000 AF of storage capacity. Withdrawals from the program can be made by exchange of Rosedale's SWP Table A supply, or by pumpback into the California Aqueduct. CLWA began storing water in this program in 2005 and has since reached the program's maximum storage capacity, with 100,000 AF currently available for withdrawal.

CLWA plans to use this supply only in dry years. For the single-dry year, supplies were assumed at the program's maximum withdrawal capacity of 20,000 AF. For the multiple-dry year period, it was assumed that supplies would average at least 15,000 AFY over the dry period and that additional supplies would be banked during wetter years to allow withdrawal of at least this amount.

6.3.9 Additional Planned Banking

CLWA's 2009 update of its Reliability Plan identifies a need for additional banking programs to firm up the dry-year reliability of service area supplies, and includes an implementation schedule to increase both storage and pumpback capacity beginning in 2010 and incrementally increasing through 2050. While a specific banking program has not yet been identified, CLWA's plans call for development of additional groundwater banking programs with pumpback capacity of at least an additional 10,000 AF by 2025, and a second additional 10,000 AF by 2035. For the single-dry year, supplies were assumed at the programs' pumpback capacity. For the multiple-dry year period, it was assumed that supplies would average at least 75 percent of the pumpback capacity over the dry period.

6.4 Supply and Demand Comparisons

The available supplies and water demands for CLWA's service area were analyzed to assess the region's ability to satisfy demands during three scenarios: a normal water year, single-dry year and multiple-dry years. The tables in this section present the supplies and demands for the various drought scenarios for the projected planning period of 2015-2050 in five year increments. The available supplies and water demands broken down by purveyor during the same three scenarios were also analyzed over the project planning period, and these tables are provided in Appendix C. Table 6-1 presents the base years for the development of water year data. Tables 6-2, 6-3 and 6-4 at the end of this section summarize, respectively, Normal Water Year, Single-Dry Water Year and Multiple-Dry Year supplies.

The reader is referred to Chapter 2 for development of retail purveyor demands and current and projected water supplies are developed in Chapters 3 and 4.

TABLE 6-1
BASIS OF WATER YEAR DATA

Water Year Type	Base Years	Historical Sequence
Normal Water Year	Average	1922-2003
Single-Dry Water Year	1977	--
Multiple-Dry Water Years	1931-1934	--

6.4.1 Normal Water Year

Table 6-2 summarizes the water suppliers' supplies available to meet demands over the 40-year planning period during an average/normal year. As presented in the table, the water suppliers' water supply is broken down into existing and planned water supply sources, including wholesale (imported) water, local supplies and banking programs. Demands are shown with and without the urban demand reduction resulting from SBX7-7 conservation objectives.

See Appendix C for the breakdown by purveyor of supplies available to meet demands over the 40-year planning period during an average/normal year.

TABLE 6-2
PROJECTED AVERAGE/NORMAL YEAR SUPPLIES AND DEMANDS

	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies								
Existing Groundwater[a]								
Alluvial Aquifer	24,000	24,000	24,000	25,000	25,000	25,000	25,000	25,000
Saugus Formation[b]	9,225	10,225	10,225	10,225	10,225	10,225	10,225	10,225
Total Groundwater	**33,225**	**34,225**	**34,225**	**35,225**	**35,225**	**35,225**	**35,225**	**35,225**
Recycled Water[c]	325	325	325	325	325	325	325	325
Imported Water								
State Water Project[d]	58,100	57,900	57,600	57,400	57,400	57,400	57,400	57,400
Flexible Storage Accounts	-	-	-	-	-	-	-	-
Buena Vista-Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Total Imported	**70,707**	**70,507**	**70,207**	**70,007**	**70,007**	**70,007**	**70,007**	**70,007**
Banking Programs[e]								
Rosedale Rio-Bravo	-	-	-	-	-	-	-	-
Semitropic	-	-	-	-	-	-	-	-
Semitropic - Newhall Land	-	-	-	-	-	-	-	-
Total Banking	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total Existing Supplies	**104,257**	**105,057**	**104,757**	**105,557**	**105,557**	**105,557**	**105,557**	**105,557**
Planned Supplies								
Future Groundwater[f]								
Alluvial Aquifer	-	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Total Groundwater	**1,375**	**2,375**	**3,375**	**4,375**	**5,375**	**6,375**	**7,375**	**8,375**
Recycled Water[c]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975

	2015	2020	2025	2030	2035	2040	2045	2050
Banking Programs[e]	-	-	-	-	-	-	-	-
Total Planned Supplies	**2,350**	**5,100**	**8,600**	**12,150**	**15,650**	**20,150**	**24,650**	**29,350**
Total Existing and Planned Supplies	**106,607**	**110,157**	**113,357**	**117,707**	**121,207**	**125,707**	**130,207**	**134,907**
Demand w/o Conservation[g]	80,070	88,484	96,898	105,312	113,726	122,140	130,554	138,968
20x2020 Reduction[h]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[i]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[j]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation[k]	**72,343**	**71,908**	**80,236**	**88,564**	**96,892**	**105,220**	**113,549**	**121,877**

Notes:

(a) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.
(b) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.
(c) Recycled water projections from Table 4-3.
(d) SWP supplies are based on the Department of Water Resources "2009 State Water Project Delivery Reliability Report."
(e) Not needed in average/normal years.
(f) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation. As indicated in Table 3-10, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3- 5.
(g) Demand w/o Conservation data from Table 2-2.
(h) 20x2020 Reduction for the Region from Table 2-22.
(i) Recycled Water Reduction for the Region from Table 2-22; does not include demands from Honor Rancho.
(j) Reduction from Water Conservation calculation for Region from Table 2-22.
(k) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

6.4.2 Single-Dry Year

The water supplies and demands for the water suppliers over the 40-year planning period were analyzed in the event that a single-dry year occurs, similar to the drought that occurred in California in 1977. Table 6-3 summarizes the existing and planned supplies available to meet demands during a single-dry year. Base demand (demand without conservation) during dry years was assumed to increase by 10 percent. Demands are also shown with the urban demand reduction resulting from SBX7-7 conservation objectives.

See Appendix C for the breakdown by purveyor of supplies available to meet demands over the 40-year planning period during a single-dry year.

TABLE 6-3
PROJECTED SINGLE-DRY YEAR SUPPLIES AND DEMANDS

	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies								
Existing Groundwater[a]								
Alluvial Aquifer	20,300	20,250	20,200	21,050	21,050	21,025	21,000	20,650
Saugus Formation	20,400	20,400	20,400	20,400	20,400	20,400	20,400	20,400
Total Groundwater	**40,700**	**40,650**	**40,600**	**41,450**	**41,450**	**41,425**	**41,400**	**41,050**
Recycled Water[b]	325	325	325	325	325	325	325	325
Imported Water								
State Water Project[c]	11,900	11,000	10,000	9,100	9,100	9,100	9,100	9,100
Flexible Storage Accounts[d]	6,060	4,680	4,680	4,680	4,680	4,680	4,680	4,680
Buena Vista-Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Total Imported	**30,567**	**28,287**	**27,287**	**26,387**	**26,387**	**26,387**	**26,387**	**26,387**
Banking Programs								
Rosedale Rio-Bravo[e]	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Semitropic[f]	15,000	15,000	-	-	-	-	-	-
Semitropic - Newhall Land[g]	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Total Banking	**39,950**	**39,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**	**24,950**
Total Existing Supplies	**111,542**	**109,212**	**93,162**	**93,112**	**93,112**	**93,087**	**93,062**	**92,712**
Planned Supplies								
Future Groundwater[h]								
Alluvial Aquifer	200	1,250	2,300	3,850	4,850	5,875	6,900	7,750
Saugus Formation (Restored Well)	825	3,777	3,777	3,777	3,777	3,777	3,777	3,750
Saugus Formation (New Wells)	2,875	9,923	9,923	9,923	9,923	9,923	9,923	9,950
Total Groundwater	**3,900**	**14,950**	**16,000**	**17,550**	**18,550**	**19,575**	**20,600**	**21,450**
Recycled Water[b]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975

	2015	2020	2025	2030	2035	2040	2045	2050
Banking Programs[i]	-	-	10,000	10,000	20,000	20,000	20,000	20,000
Total Planned Supplies	**4,875**	**17,675**	**31,225**	**35,325**	**48,825**	**53,350**	**57,875**	**62,425**
Total Existing and Planned Supplies	**116,417**	**126,887**	**124,387**	**128,437**	**141,937**	**146,437**	**150,937**	**155,137**
Demand w/o Conservation[j]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
20x2020 Reduction[k]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[l]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[m]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation[n]	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**

Notes:

(a) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-11, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5. SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(b) Recycled water projections from Table 4-3.

(c) SWP supplies are based on the Department of Water Resources "*2009 State Water Project Delivery Reliability Report*."

(d) Includes both CLWA and Ventura County entities flexible storage accounts. Initial Term of agreement with Ventura County entities expires after 2015.

(e) CLWA has a maximum withdrawal capacity of 20,000 AFY and a storage capacity of 100,000 AF. As of 6/1/2011, there is 100,000 AF of recoverable water.

(f) CLWA has 45,920 AF of recoverable water as of 6/1/2011.

(g) Newhall Land has a maximum withdrawal capacity of 4,950 AFY and a storage capacity of 55,000 AF. As of 6/1/2011 there is 18,892 AF of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is assumed available to VWC.

(h) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation, including 3,777 AFY of restored capacity from VWC Well 201 and approximately 10,000 AFY of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1977 single dry-year levels identified in Table 3-8 of the 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-11, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(i) Includes banking programs with 10,000 AF of additional pumpback capacity by 2025 and a second additional 10,000 AF by 2035.

(j) Demand w/o Conservation data from Table 2-2. Includes a 10 percent increase in demand during dry years.

(k) 20x2020 Reduction for the Region from Table 2-22.

(l) Recycled Water Reduction for the Region from Table 2-22; does not include demands from Honor Rancho.

(m) Reduction from Water Conservation calculation for Region from Table 2-22.

(n) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

6.4.3 Multiple-Dry Year

The water supplies and demands for the water suppliers' water supply over the 40-year planning period were analyzed in the event that a four-year multiple-dry year event occurs, similar to the drought that occurred during the years 1931 to 1934. Table 6-4 summarizes the existing and planned supplies available to meet demands during multiple-dry years. Base demand during dry years was assumed to increase by 10 percent. Demands are also shown with the urban demand reduction resulting from SBX7-7 conservation objectives.

See Appendix C for the breakdown by purveyor of supplies available to meet demands over the 40-year planning period during a multiple-dry year.

TABLE 6-4
PROJECTED MULTIPLE-DRY YEAR SUPPLIES AND DEMANDS

	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies								
Existing Groundwater[a]								
Alluvial Aquifer	20,425	20,425	20,425	21,825	21,825	21,825	21,825	21,325
Saugus Formation	19,700	19,700	19,700	19,700	19,700	19,700	19,700	19,700
Total Groundwater	**40,125**	**40,125**	**40,125**	**41,525**	**41,525**	**41,525**	**41,525**	**41,025**
Recycled Water[b]	325	325	325	325	325	325	325	325
Imported Water								
State Water Project[c]	32,900	32,900	33,000	33,000	33,000	33,000	33,000	33,000
Flexible Storage Accounts[d]	1,510	1,170	1,170	1,170	1,170	1,170	1,170	1,170
Buena Vista-Rosedale	11,000	11,000	11,000	11,000	11,000	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Total Imported	**47,017**	**46,677**	**46,777**	**46,777**	**46,777**	**46,777**	**46,777**	**46,777**
Banking Programs								
Rosedale Rio-Bravo[e]	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Semitropic[f]	11,500	11,500	-	-	-	-	-	-
Semitropic - Newhall Land[g]	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
Total Banking	**31,450**	**31,450**	**19,950**	**19,950**	**19,950**	**19,950**	**19,950**	**19,950**
Total Existing Supplies	**118,917**	**118,577**	**107,177**	**108,577**	**108,577**	**108,577**	**108,577**	**108,077**
Planned Supplies								
Future Groundwater[h]								
Alluvial Aquifer	-	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Saugus Formation (Restored Well)	2,375	1,625	1,500	1,400	1,275	1,125	1,000	875
Saugus Formation (New Wells)	2,250	10,325	10,450	10,550	10,675	10,825	10,950	11,075
Total Groundwater	**4,625**	**12,950**	**13,950**	**14,950**	**15,950**	**16,950**	**17,950**	**18,950**
Recycled Water[b]	975	2,725	5,225	7,775	10,275	13,775	17,275	20,975

	2015	2020	2025	2030	2035	2040	2045	2050
Banking Programs[i]	-	-	7,500	7,500	15,000	15,000	15,000	15,000
Total Planned Supplies	**5,600**	**15,675**	**26,675**	**30,225**	**41,225**	**45,725**	**50,225**	**54,925**
Total Existing and Planned Supplies	**124,517**	**134,252**	**133,852**	**138,802**	**149,802**	**154,302**	**158,802**	**163,002**
Demand w/o Conservation[j]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
20x2020 Reduction[k]	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Reduction from Recycled Water[l]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Reduction from Water Conservation[m]	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation[n]	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**

Notes:

(a) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-12, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5. SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(b) Recycled water projections from Table 4-3.

(c) SWP supplies are based on the Department of Water Resources "*2009 State Water Project Delivery Reliability Report*."

(d) Includes both CLWA and Ventura County entities flexible storage accounts. Initial Term of agreement with Ventura County entities expires after 2015.

(e) CLWA has a maximum withdrawal capacity of 20,000 AFY and a storage capacity of 100,000 AF. As of 6/1/2011, there is 100,000 AF of recoverable water.

(f) CLWA has 45,920 AF of recoverable water as of 6/1/2011.

(g) Newhall Land has a maximum withdrawal capacity of 4,950 AFY and a storage capacity of 55,000 AF. As of 6/1/2011 there is 18,892 AF of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is assumed available to VWC.

(h) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation, including 3,777 AFY of restored capacity from VWC Well 201 and approximately 10,000 AFY of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1931-1934 multiple dry-year levels identified in Table 3-8 of the 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-12, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(i) Includes banking programs with 10,000 AF of additional pumpback capacity by 2025 and a second additional 10,000 AF by 2035.

(j) Demand w/o Conservation data from Table 2-2. Includes a 10 percent increase in demand during dry years.

(k) 20x2020 Reduction for the Region from Table 2-22.

(l) Recycled Water Reduction for the Region from Table 2-22; does not include demands from Honor Rancho.

(m) Reduction from Water Conservation calculation for Region from Table 2-22.

(n) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.

6.4.4 Summary of Comparisons

As shown in the analyses above, CLWA and the retail purveyors have adequate supplies to meet CLWA service area demands during normal, single-dry, and multiple-dry years throughout the 40-year planning period.

Section 7: Water Demand Management Measures

This section describes the water Demand Management Measures (DMMs) implemented by CLWA and the retail purveyors as a part of the effort to reduce water demand in the Valley.

7.1 Overview

CLWA and the retail purveyors are subject to the Urban Water Management Planning Act, AB1420 and SBX7-7 requirements, in addition to the commitment of compliance with the Best Management Practices (BMPs) as signatories to the Memorandum of Understanding Regarding Water Conservation in California (MOU). In the CLWA service area, demand management is addressed at both the local (retail agency) and regional (Santa Clarita Valley-wide) levels.

The MOU and BMPs were revised by the California Urban Water Conservation Council (CUWCC) in 2008. The revised BMPs now contain a category of "Foundational BMPs" that signatories are expected to implement as a matter of their regular course of business. These include Utility Operations (metering, water loss control, pricing, conservation coordinator, wholesale agency assistance programs and water waste ordinances) and Public Education (public outreach and school education programs). The remaining "Programmatic" BMPs have been placed into three categories: Residential, Large Landscape, and Commercial, Industrial, Institutional (CII) Programs and are similar to the original quantifiable BMPs. These revisions are reflected in the CUWCC reporting database starting with reporting year 2009 and the 2010 UWMP's DMM compliance requirements. The new category of foundational BMPs is a significant shift in the revised MOU. For CLWA and other wholesalers however, these changes do not represent a substantive shift in requirements.

A key intent of the recent MOU revision was to provide retail water agencies with more flexibility in meeting requirements and allow them to choose program options most suitable to their specific needs. Therefore, as alternatives to the traditional Programmatic BMP requirements, agencies may also implement the MOU Flex Track or GPCD options.

Under the Flex Track option, an agency is responsible for achieving water savings greater than or equal to those it would have achieved using only the BMP list items. The CUWCC has developed three Flex Track Menus – Residential, CII, and Landscape – and each provides a list of program options that may be implemented in part or any combination to meet the water savings goal of that BMP. Custom measures can also be developed and require documentation on how savings were realized and the method and calculations for estimating savings.

The GPCD option sets a water use reduction goal of 18 percent reduction by 2018. The MOU defines the variables involved in setting the baseline and determining final and interim targets. The GPCD option and requirements track well with the requirements of SBX7-7. All three retail suppliers – SCWD, VWC and NCWD – have chosen to implement the GPCD compliance option.

Signatories to the urban MOU are allowed by Water Code Section 10631(j) to include their biennial CUWCC BMP reports in an UWMP to meet the requirements of the DMM sections of the UWMP Act. The retail suppliers have chosen to comply with the requirements of the Act by providing the information required by the DMMs in this section of the Plan instead of attaching the 2009 and 2010 BMP Reports. CLWA has filed its 2009 and 2010 BMP reports (attached as Appendix E).

As a wholesaler MOU signatory, CLWA assists SCWD, VWC and NCWD with BMP implementation and reporting, although CLWA files BMP reports only for itself. LACWWD 36 BMP implementation and reporting is done by the County of Los Angeles on behalf of all its Waterworks Districts.

As the water wholesaler for the region, CLWA is responsible for the implementation of a subset of the BMPs. However, CLWA in partnership with the water purveyors has taken a leadership role in the implementation and support of a number of the BMPs that extend beyond a wholesaler's responsibilities in the MOU. The following sections provide more detail on the water suppliers' conservation programs and compliance with the BMPs.

7.2 Castaic Lake Water Agency

In 2001 CLWA became a signatory to the MOU and a member of the CUWCC, establishing a firm commitment to the implementation of the BMPs or DMMs. The CUWCC is a consensus-based partnership of agencies and organizations concerned with water supply and conservation of natural resources in California. By becoming a signatory, CLWA committed to implement a specific set of locally cost-effective conservation practices in its service area.

In addition to meeting its MOU commitments, CLWA is working with its retail purveyors to identify and implement water use efficiency programs that meet long-term reduction goals. In 2007, CLWA and the retail water purveyors entered into an MOU to prepare a Santa Clarita Valley Water Use Efficiency Strategic Plan (SCVWUESP). The purpose of the effort was to prepare a comprehensive long-term conservation plan for the Santa Clarita Valley by adopting objectives, policies and programs designed to promote proven and cost-effective conservation practices. A consultant was hired to prepare the SCVWUESP, which included input from stakeholders and the community at large. The SCVWUESP was completed in 2008 and provides a detailed study of existing residential and commercial water use, and recommends programs designed to reduce overall Valley-wide water demand by ten percent by 2030. The programs are designed to provide Valley residents with the tools and education to use water more efficiently. The seven programs identified in the SCVWUESP are:

1. HET Rebates (Single and Multi-Family)
2. Large Landscape Audits (with incentives)
3. CII Audits and Customized Incentives
4. Landscape Contractor Certification
5. HE Clothes Washer Rebates
6. New Construction Building Code
7. Valley-Wide Marketing

In addition to these seven programs, the SCVWUESP also identifies other key factors that will help reduce the Valley's overall water demand including passive conservation and new, more water efficient building ordinances. By 2009, CLWA and the water purveyors were implementing the majority of the programs identified in the SCVWUESP in some form.

Finally, the SCVWUESP includes an Appendix with more aggressive water use efficiency measures designed to meet a potential twenty percent reduction in water use by 2020. This

includes funding more active conservation programs, retrofit on resale ordinances, water rate reform, water budget based rates and a more aggressive recycled water program.

By implementing a portfolio of water use efficiency programs, Santa Clarita Valley water suppliers and their customers benefit in a number of ways:

- **Cost Avoidance for Purchased Water:** Although the Santa Clarita Valley has projected adequate water supply for the near future, the cost of water has risen dramatically and is expected to continue to rise. The best way to avoid purchasing expensive imported water is to use less through efficiency. Programs are an effective efficiency mechanism.
- **Limited State Resources:** California's water resources are becoming increasingly stretched due to population, housing growth and decreased water supply from state water projects. Agencies need to stretch water supplies and increase efficiencies.
- **Drought Preparedness:** It is inevitable that southern California, as well as the state, will experience another drought. The big question is when and how severe the next one will be. One way to lessen the severity of a drought's effect on Santa Clarita Valley is to prepare in advance for this event by creating a community that operates at a high level of efficiency.
- **Reduced Carbon Footprint:** The production and delivery of water requires a tremendous amount of energy on both a statewide and local level. The Santa Clarita Valley can do its part to reduce green house gases by using water more efficiently.
- **Reduced Waste Water Flows:** Sanitation plants and systems must be sized to meet historic and planned wastewater flows. Increasing the efficient use of water will result in a reduction of wastewater into the system.
- **Reduced Urban Runoff:** Achieving increased water use efficiency outdoors means less water running off landscaped areas into the streets, storm drains and ultimately into the Santa Clara River. Education efforts and installation of efficient technologies will ensure that more of our valuable water is delivered to appropriate landscaping and less of it as urban runoff.

The water suppliers are administering, managing and financing the SCVWUESP programs. Since the adoption of the SCVWUESP, SBX7-7 was enacted, which requires a more aggressive demand reduction target of 20 percent by 2020. CLWA and the purveyors are currently developing an implementation plan that builds on the SCVWUESP while accelerating and expanding its goals to identify other opportunities that will help meet long-term goals such as those required by SBX7-7. This UWMP provides an overview of the programs proposed for implementation to meet the SBX7-7 requirements.

7.2.1 Utility Operations

7.2.1.1 Conservation Coordinator

CLWA has one full time staff person that works in collaboration with its retail purveyors and exclusively on conservation programs. CLWA also employs a number of consultants to work on program development and implementation.

7.2.1.2 Wholesale Agency Assistance Programs

CLWA provides both technical and financial assistance to the retail purveyors. In addition to the requirements specified in the BMPs, CLWA provides the following support to its retail purveyors:

- **Program Planning:** CLWA hired consultants and worked closely with the purveyors to implement the programs in the SCVWUESP. CLWA is currently providing a similar service in developing implementation options for meeting SBX7-7 requirements.
- **Residential Landscape Program:** This program targets residential landscape maintenance providers in the Santa Clarita Valley and individual homeowners eligible to participate. It is primarily designed to provide gardeners incentives to install residential water efficiency devices such as weather-based irrigation controllers (WBIC). The program offers homeowners and gardeners free landscape classes. After completing the landscape class, a resident receives one free WBIC and gardeners can keep receiving WBICs after confirmation that the previous WBIC was installed properly on a property within CLWA service area. The program is projected to save 50 AF in the first year.
- **Large Landscape Program:** This program offers homeowners associations, parks and landscape maintenance divisions the opportunity for a CLWA representative to visit the site and develop a customized plan and offer rebates for items to further water conservation.
- **Commercial, Industrial and Institutional (CII) Audit and Customized Incentive Program:** The CII Program offers businesses and institutions the opportunity to save money and water by signing up for free water use check-ups. As part of the check-up, a CLWA representative visits the site and develops a customized plan and offers rebates for the items to further water conservation.
- **High Efficiency Toilet (HET) Replacement Program:** HET toilet replacement vouchers are provided to retail purveyors for distribution. Homes older than 1992 are eligible for up to $115 per toilet.
- **Landscape Education Program:** Free monthly workshops are provided in a classroom and garden setting for residents who want to learn more about gardening and conservation.
- **School and Public Information Programs:** See Section 7.2.2.

7.2.1.3 Water Loss Control

CLWA has completed AWWA's M36 Water Loss analysis, which consists of a component analysis of leaks into "revenue" and "non-revenue" categories, among others, and an economic analysis of recoverable loss. Pre-screen results range from 99.5 to 100 percent. CLWA's M36 'Reporting Worksheet' for 2010 is provided in Appendix E.

7.2.2 Education

7.2.2.1 Public Information

In 2008 CLWA hired a social marketing firm to develop a Valley-wide conservation outreach plan. The "What's your water number?" campaign had its kick-off that summer and focused on proper irrigation and landscape maintenance. The campaign utilizes radio, billboards, television

and print. CLWA also distributes a monthly electronic community newsletter that addresses water conservation.

In October 2010, CLWA conducted a phone survey to measure the response to the campaign's messages to determine the most successful outlets used to deliver the messages among Santa Clarita Valley residents. Results indicated that overall campaign messaging was effective, with more than one-third of respondents stating the conservation tips made them re-think their current water use. Respondents also reported a substantial decrease in their total outdoor water use versus 2008. Eighty-seven percent of single-family home respondents said they reduced outdoor water usage already or are likely to do so in the near future. Respondents also reported a strong recall of the campaign. The majority of respondents recalled seeing or hearing conservation tips in the past six months. Results suggest that residents who previously watered every day, water every other day post-campaign.

In addition to its conservation outreach campaign, CLWA has a water-efficient landscape demonstration garden open to the public and which hosts about 60 school classes each year. CLWA also maintains an active website and Facebook page with water saving tips for residents and businesses, conservation checklists and program and incentive information.

7.2.2.2 School Education

Started in 1993, CLWA's award-winning Education Program is dedicated to helping students in school learn through age-appropriate programs, from kindergarten all the way through high school. The program provides hands-on field trips and in-class presentations for elementary and junior high school students at public and private schools in the Santa Clarita Valley (Table 7-1). In 2008, CLWA provided almost 350 class presentations and hosted 14 teacher workshops. In addition to the presentations and field trips, CLWA's Education Department administers the local high school Water Challenge scholarship program, which is open to students in grades 9 through 12. Through 2010, the Education Program has educated more than 104,000 students about the importance of efficient water use.

TABLE 7-1
SCHOOL EDUCATION (NUMBER OF STUDENTS)

Grade Level	2006	2007	2008	2009	2010
K - 3	5,677	7,320	6,290	6,686	7,296
4 - 6	3,753	4,872	4,195	4,768	5,212
7 - 8	798	1,102	1,345	1,210	315
9 - 12	0	223	141	40	491
Totals	**10,228**	**13,517**	**11,971**	**12,704**	**13,314**

7.3 Regional BMP Implementation

In 2001, the CLWA Board approved signing the CUWCC's MOU on behalf of both the wholesale and retail service areas (CLWA and SCWD), thus meeting one of the recommendations of the 2000 UWMP. Los Angeles County signed the MOU prior to the 2000 UWMP on behalf of all its Waterworks Districts; NCWD signed the MOU on its own behalf in September 2002 and VWC signed in 2006. In 2009, the CUWCC changed its policy to specify that each signatory had to join individually and that a wholesaler could no longer be a signatory on behalf of its retailers.

The following sections provide a summary of the BMP status of the retail purveyors, in addition to the SCVWUESP activities.

7.4 Santa Clarita Water Division

Programs and planning efforts that focus on demand management have increased significantly since the 2005 UWMP. These efforts have been both by SCWD individually as well as regional approaches that involve CLWA and the retailers.

In 2001, the CLWA Board approved signing the CUWCC's MOU for both the wholesale and retail service areas (CLWA and SCWD). Since that time, SCWD has been reporting and filing BMP reports as a signatory. SCWD filed BMP reports through 2008. In 2009, the CUWCC changed its policy to specify that each signatory had to join individually and that a wholesaler could no longer be a signatory on behalf of its retailers. As a result, SCWD is no longer included as member of the CUWCC.

SCWD developed a Water Conservation Plan (WCP) in April 2009 to complement the SCVWUESP adopted by the CLWA Board of Directors in February 2009. In its WCP, SCWD recognizes the need to implement the urban water conservation BMPs as described by the CUWCC and identify additional conservation measures that could accelerate savings in the SCWD service area. The WCP identified the elements, processes, costs, staff resources and activities to further promote conservation and further complement the SCVWUESP. The WCP also identified activities not addressed in the regional plan.

SCWD is implementing all of the Foundational BMPs as required in the revised MOU and UWMP Act. The Programmatic BMPs are being implemented through a GPCD approach. The BMP and SBX7-7 goals and implementation plan are discussed further in Sections 7.4.2 and 7.4.3.

The following sections describe the various programs and conservation activities currently being implemented by SCWD.

7.4.1 Foundational BMPs

7.4.1.1 Utility Operations

Conservation Coordinator

SCWD's conservation program is staffed in various ways. Internally, management, administration and oversight are the responsibility of the Associate Water Resources Planner. In addition, SCWD has helped fund a conservation coordinator position at CLWA since 2004; this position supports regional planning and implementation. SCWD also utilizes consultant services to support program planning and management as well as to implement the various programs including residential landscape training as well as residential, CII and large landscape audits.

Water Waste Prevention

SCWD supports water waste prevention activities through both direct Board activities and in collaboration with the City of Santa Clarita.

On September 10, 2008, the CLWA Board of Directors signed Resolution No. 2605 declaring an Agency-wide water supply and conservation alert. The resolution encourages residents to follow the Voluntary Water Conservation Action Plan (Plan) and achieve a ten percent overall reduction in water demand. The Plan establishes voluntary water conservation measures to be taken by residents and businesses and includes a set of guidelines and recommendations for both indoor and outdoor water use improvements.

SCWD is also actively supporting the City and County in establishing terms of service for water efficient design in new development, complaint with AB 1881. SCWD participates in compliance review of new water efficient landscaping requirements, reviewing the Water Efficient Landscape Worksheet (WELW) and, after a project is completed, conducting periodic audits and tracking consumption to ensure the project remains in compliance with the water allowance requirements.

SCWD also has a Water Shortage Contingency Plan (see Appendix F) and works closely with the City and County in supporting all local ordinances that prohibit water waste.

Water Loss Control

SCWD monitors its water losses on a monthly basis. Production losses in 2008 and 2009 were estimated at 7.9 and 6.0 percent, respectively. SCWD has completed AWWA's M36 Water Loss analysis, which consists of a component analysis of leaks into "revenue" and "non-revenue" categories, among others, and an economic analysis of recoverable loss. SCWD's M36 'Reporting Worksheet' for 2009 is provided in Appendix E.

Results of the preliminary analysis show a water audit data validity score of 64 and an Infrastructure Leakage Index (ILI) of 3.79. A validity score between 51 and 70 indicates that the validity of the data is reasonable, with opportunity for improvement. According to general guidelines, an ILI between 3 and 5 is appropriate when water resources can be developed or purchased at a reasonable expense; existing water supply capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place; and water resources are believed to be sufficient but demand management measures are included in long-term planning. The audit highlights some strengths and weaknesses of the system. SCWD is evaluating the preliminary results and recommendations of the audit.

Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections

All of SCWD's customers are metered and billed volumetrically. Commercial, industrial and institutional accounts and parks are encouraged to have dedicated irrigation meters, and many do. In addition, SCWD has identified the Automated Meter Reading (AMR)/ Advanced Metering Infrastructure (AMI) technologies as a conservation priority. This technology is being implemented and will be very helpful in identifying leaks, mitigating losses, and monitoring customer usage.

Retail Conservation Pricing

All of SCWD's customers are metered and billed monthly. On January 1, 2010, SCWD migrated its residential customers to a tiered rate structure and its landscape customers to a fixed rate set at the highest tier rate.

Since 2007 the proportion of revenue from fixed charge has met the BMP requirement of not to exceed 30 percent. Table 7-2 shows the portion of revenues that come from fixed charges. Total revenue includes meter, consumption, energy, purchased water and other small miscellaneous charges. Note that 2010 data are only through September and do not reflect a full year's revenue; SCWD expects to meet the threshold requirements once a full year's data is incorporated.

TABLE 7-2
REVENUE

Operating Revenues	2007	2008	2009	2010[(a)]
Fixed Charges	$ 5,880,400	$ 6,282,400	$ 6,354,900	$ 5,500,100
Volumetric Charges	$ 13,629,600	$14,401,100	$ 15,516,300	$12,261,800
% Fixed Charges	**30%**	**30%**	**29%**	**31%**

Note:
(a) Reflects revenues only through September 2010. BMP requirement anticipated to be met with complete 2010 revenue accounted for.

7.4.1.2 Education

Public Information Programs

SCWD provides informational materials to customers through media events, neighborhood expos and other activities (Table 7-3). SCWD also communicates with its customers in coordination with CLWA through a variety of media outlets including Santa Clarita Valley TV, billboards, newspapers, magazines, radio, paid advertising, bill inserts, its website (http://www.scwater.org/) and public service announcements. Conservation messages are also included on customers' monthly bills. Two tips ran in October and December 2008 and one ran on every bill issued in 2009. In 2009 SCWD instituted an automatic calling campaign to alert its customers of dry conditions and the importance of conservation. Almost 70,000 calls were made between December 2009 and October 2010.

TABLE 7-3
SCWD OUTREACH EVENTS

2009	2010
Earth Day	Earth Day
Home and Garden Expo	Water Awareness
Water Awareness	River Rally
River Rally	Make a Difference Day
Neighborhood Expo (3): Canyon County, Saugus, Newhall	Realtors' Breakfast
Emergency Expo	

School Education Programs

SCWD implements its school programs in coordination with the CLWA, reaching almost 6,400 students a year since 2007 (Table 7-4). The CLWA's award winning program is available to grades K through 8 and includes in class presentations and field trips. See Section 7.2.2.2 for more information on CLWA's school programs.

TABLE 7-4
SCHOOL EDUCATION (NUMBER OF STUDENTS)

Grade Level	2007	2008	2009	2010
K - 3	2,474	2,694	3,300	2,947
4 - 6	2,656	1,600	2,412	2,063
7 - 8	335	860	605	94
9 - 12	63	141	40	348
Totals	**5,528**	**5,295**	**6,357**	**5,452**

7.4.2 Programmatic BMPs

Prior to 2007, SCWD focused most of its conservation programs on the Foundational type of activities. In 2007, SCWD starting expanding its programs by incorporating incentives and other elements. In 2009, the SCVWUESP was adopted by the CLWA Board of Directors in February and SCWD developed its own Water Conservation Plan (WCP) in April. These documents set, for the first time, water savings goals, identified activities to meet the goals and developed a long-term conservation program. In its WCP, SCWD recognizes the need to implement the BMPs and identify additional conservation measures that could accelerate savings in the SCWD service area.

The majority of SCWD's programmatic BMPs are being implemented in collaboration with CLWA. In order to maintain consistency the SBX7-7 planning process, SCWD has chosen the GPCD alternative for complying with the MOU.

The following sections describe the programs being implemented in the service area.

7.4.2.1 Residential Programs

The largest customer class in the SCWD service area is residential, accounting for approximately 90 percent of customers and 70 percent of total use. SCWD has about 21,200 SF and 4,700 MF residential accounts. SCWD is focusing the majority of its conservation efforts on residential use.

1) **Residential Audit Program**
   SCWD's indoor residential audit program is structured to respond to customer requests but does not currently actively promote indoor audits. SCWD provides water conservation items that include low-flow showerheads, conservation materials, hose nozzles and aerators. These items are provided at festivals, fairs and other events, and are available for pick up at the SCWD office. This distribution program started in 2008; SCWD distributed about 600 conservation items in 2009 and 2010.

2) **Landscape Training and Incentive Program**
   Residential landscapes are a significant use in SCWD's service area. SCWD is working with CLWA to offer a program that combines training and fixtures in the form of landscape classes and WBICs to its residential customers. The program offers homeowners and gardeners free landscape classes; after residents or their gardeners complete the training, they receive free WBICs. They also receive free inspections of their WBIC installations and programming to ensure they are properly installed and programmed. The classes are offered in both English and Spanish and have been very

popular with residents. At the end of 2010, six classes were held and 70 WBICs have been installed and inspected within the SCWD service area.

SCWD has focused its landscape surveys on its largest users, although all customers are welcome. These are typically homeowners associations (HOAs). HOA customers with dedicated irrigation meters are classified as "irrigation" customers rather than "residential" and the program is designed to develop an appropriate water budget and help them implement it. The program is further described in Section 7.4.2.3.

3) High Efficiency Toilet Rebate Program

The SCVWUESP estimates that in 2008 about 62 percent of residential toilets used 1.6 gallons per flush or less. A program at least as effective as a retrofit on resale, which is the BMP threshold, requires SCWD to provide about 200 rebates per year. SCWD is currently participating in CLWA's HET voucher rebate program and has provided 900 rebates since 2007, almost 70 percent of which were rebated in 2010. The program has been ramping up steadily and the goal is to provide 600 rebates a year. Incentives valued at $115 are provided for HETs replacing models that flush at 3.5 gpf or more.

In addition, SCWD will be realizing the benefits of SB 407, effective January 1, 2014. SB 407 requires that all pre-1994 residential, multi-family and commercial customers replace non-compliant plumbing fixtures (including toilets, faucets, and showerheads) with water-conserving fixtures when making certain improvements or alterations to a building. By 2017, all single-family homes must replace non-compliant plumbing fixtures and by 2019 all multifamily and commercial buildings must have compliant water-conserving plumbing fixtures in place.

4) WaterSense Specification for New Residential Development

SCWD is working closely with the City of Santa Clarita's response in its development and implementation of landscape requirements that comply with AB 1881.

SCWD is supporting adoption of the 2010 California Green Building Standards Code, which went into effect January 2011. The Code sets mandatory green building measures, including a twenty percent reduction in indoor water use, as well as dedicated meter requirements and regulations addressing landscape irrigation and design. Local jurisdictions, at a minimum, must adopt the mandatory measures; the Code also identifies voluntary measures that set a higher standard of efficiency, which can also be adopted. SCWD will review the proposed standards and determine the most appropriate approach.

7.4.2.2 Commercial, Industrial, and Institutional (CII) BMPs

CII use does not account for a large portion of consumption in SCWD's service area. SCWD has about 840 CII accounts which use about 1,900 AFY, or 7 percent of total use.

In FY 2010/11 the CLWA began implementing a CII Audit and Customized Incentive Program which offers comprehensive water audits with follow-up reports that provide recommendations, information on costs, savings, payback and other implementation-oriented information. The program targets high use and high savings potential customers such as amusement parks, colleges and universities, hotels and hospitals. Recommendations include both site-specific and general opportunities. The key decision makers are identified and contacted to enlist

participation. The goal is to tailor the amount of incentive to the water savings based upon the findings of the audit. Customers are eligible to receive financial incentives to offset any investments in water use efficiency in the amount of up to $300 per AF of water saved.

To date forty large water users have been contacted and twenty within SCWD service area are moving forward.

7.4.2.3 Landscape

SCWD encourages installation of dedicated irrigation meters on all commercial, industrial and institutional accounts, parks and city landscaping. SCWD has 864 dedicated irrigation accounts, the majority of which are HOAs.

SCWD is working on developing water budgets for all its dedicated irrigation accounts; to date 188 accounts have water budgets. The budgets are developed based on historical water use data, landscape acreage and the Maximum Applied Water Allowance as defined by DWR. If the accounts exceed their budgets, SCWD contacts the customer with offers of a free audit, nozzles and/or WBICs (when available) as well as a free walk-through with the landscape contractor followed up with a report containing findings and recommendations.

SCWD is also participating in the CLWA-sponsored large landscape program which offers audits to its large landscape customers. Currently forty sites are enrolled; eighteen are within the SCWD service area where the focus is on HOA customers. The program offers large landscape customers such as HOAs, parks and landscape maintenance districts the opportunity to receive free water-use and cost-benefit analysis reports, free workshops for property management and landscapers and rebates for water-saving measures and devices. Customers are also eligible to receive financial incentives to offset any investments in landscape efficiency in the amount of up to $300 per AF of water saved. CLWA works with its retailers to select sites that meet the large landscape specifications.

To date, five sites have final reports; one site has completed recommended infrastructure modifications and has received the rebate based on an estimated potential savings of 4.21 AFY. The others will complete modifications throughout 2011 and 2012.

7.4.3 SCWD DMM and SBX7-7 Implementation Plan

SCWD recognizes the need to expand conservation programs and efforts in order to meet both its SBX7-7 and DMM requirements.

The SBX7-7 baseline and target calculations are addressed in Chapter 2. The DMM GPCD goals, shown in Table 7-5 are determined by calculating the following:

1. *Baseline GPCD = average annual Potable Water GPCD for the years 1997 through 2006*

2. *2018 GPCD Target = Baseline GPCD multiplied by 0.82 (an 18% reduction)*

3. *Biennial GPCD Targets = Baseline GPCD multiplied by that year's Target (% Baseline). A retail water agency may choose a starting point as either its Baseline GPCD or its 2006 Potable Water GPCD.*

TABLE 7-5
DMM GPCD TARGET CALCULATIONS

Year	Per Capita Water Use (GPCD)
1997	237
1998	210
1999	247
2000	242
2001	234
2002	251
2003	232
2004	239
2005	227
2006	229
Baseline	**234**
Target (2018)	**192**

Compliance is evaluated in relation to the Compliance Table below (Table7-6) and relative progress toward the goal will be acknowledged in Council Compliance Reports. The compliance tables are read as five increments with reporting goals relative to their first through fifth Compliance reports.

TABLE 7-6
ANNUAL COMPLIANCE TARGETS (IN GPCD)

Year	Compliance Report	Target	Highest Acceptable Bound
2010	1	220	234
2012	2	217	225
2014	3	209	217
2016	4	200	209
2018	5	192	192

The GPCD option for MOU compliance and the SBX7-7 targets are consistent with one another (Table 7-7) and SCWD is utilizing the SCVWUESP as well as its own WCP to implement programs that meet these goals.

TABLE 7-7
COMPLIANCE TARGETS

		Target GPCP		
	Baseline GPCD	**2015**	**2018**	**2020**
MOU/AB 1420	234		192	
SBX7-7	235	211		188

In the 2008 SCVWUESP, a comprehensive assessment of SCWD's demographics, levels of past conservation, age of housing, natural turnover, the effects of plumbing codes and more was completed to determine the potential of future conservation activities and programs.

SCWD has already begun implementing five of the seven programs identified in the SCVWUESP: HET rebates (Single family), large landscape audits (with incentives), CII audits and customized incentives, landscape contractor certification and valley-wide marketing; HET clothes washer rebates and multi-family HET rebates are planned for implementation in 2011.

Both the regional SCVWUESP and SCWD's WCP recognize the need to expand conservation programs and efforts. The adoption of SBX7-7 has increased the urgency for implementation. CLWA is in the process of reviewing its incentive programs and SCWD is currently working with CLWA as well as the other purveyors to identify programs that could be implemented regionally.

The programs identified to meet future requirements combine financial incentives, regulation and information elements, and building onto existing activities. Included in the programs being considered for implementation are the following:

Financial Incentives

1) High-Efficiency Clothes Washers (HECWs): Clothes washer rebates are on the list of programs identified for implementation in the SCVWUESP. CLWA will be expanding its program to include clothes washer rebates in FY 2011/12 and SCWD will participate.

2) Zero and Low-Flow Urinal Rebates: Rebates will include CII fixtures such as zero consumption and ultra low volume urinals as well as CII specific HETs. This program will launch in FY 2011/12.

3) Expansion of fixture rebates to CII and Multi-family customers: Currently the toilet rebate program is only available to single-family residential customers. Starting 2011, the programs will be expanded to all customers and there will be increased focus on marketing to large HOA accounts.

4) Expand rebates to include a larger variety of fixtures: Being considered for inclusion are hot water distribution tanks, pressurized water brooms and high-pressure spray nozzles.

5) Cash for Grass Rebate: Customers will be provided with an incentive of up to $1 per acre-foot of turf removed and replaced with landscape appropriate plants. The program is being considered for both residential and CII customers.

6) Expansion of large landscape program: The purveyors will be evaluating the effectiveness of the current landscape program in FY 2011/12 and adjusting depending on the results. If the program is found to be successful at meeting reduction targets, the program will be accelerated and more devices will be offered, such as Precision Nozzles.

Building Code/New Standards

The SCVWUESP developed a comprehensive list of new building standards, beyond those currently in code. Code changes that improve the efficiency of fixtures and design account for about 60 percent of the expected reduction in demand, and will therefore be a significant program priority. Some of the changes proposed will be captured in the State Model Efficient Landscape Ordinance effective January 2010, CAL Green Building Code adopted January 2011, and SB 407 and standard updates for toilets and washers that are being phased in.

Information/Tracking

Information and tracking represents a new element to the existing programs focusing on collecting and processing information and ensuring that the programs are on track to meet the goals. These activities will also help in program design by providing more robust information about customers and their water use patterns. The immediate priorities include:

1) Automatic Meter Reading (AMR): SCWD has identified AMR as a priority in its WCP and critical to obtaining real time data for water usage and utilizing it to identify customer-side leaks. This information can also help SCWD monitor the impacts of existing programs, make adjustments where necessary and develop new programs.

2) Water Use Tracking Tools: Another WCP priority, SCWD plans to design and develop database tracking tools for water savings associated with its conservation plans and increase flexibility by adding or changing program elements.

SCWD is developing a plan that includes accelerating the current programs, adding additional elements that include programmatic, regulatory and information-based activities to meet the requirements of SBX7-7. This planning process was started in 2010 and implementation will begin in 2011.

Evaluating Effectiveness of the DMMs

SCWD will continue to track all program activities including outreach activities, rebate distribution and audits. Program effectiveness and per capita use will be monitored through the billing and consumption system.

Impacts of Conservation

It is not expected that, at this time, the conservation programs currently being implemented or scheduled for implementation will have any significant negative effect on water use within SCWD's service area or affect SCWD's ability to further reduce demand. The funding for current and future programs is being identified.

Economic Impacts

Analysis of the requirements for BMP compliance yields program costs of roughly $500,000.

7.5 Valencia Water Company

VWC recognizes that conserving water is an integral component of a responsible water strategy and is committed to providing education, tools and incentives to help its customers reduce the amount of water they use. VWC is implementing programs locally as well as leveraging the conservation resources available through CLWA. In 2006, VWC became a signatory to the CUWCC MOU, establishing a firm commitment to the implementation of the BMPs or DMMs. Prior to signing the MOU, VWC had been actively engaged in conservation and implemented several of the CUWCC recommended conservation programs.

In 2007, VWC coordinated the development and execution of a MOU with the other retail water purveyors and CLWA to prepare the SCVWUESP. VWC served as the project administrator for

the Santa Clarita Valley water suppliers in developing the SCVWUESP. The SCVWUESP recommended programs to reduce the overall valley wide water demand by ten percent by 2030 (see Section 7.2 for more information), but also included more aggressive programs to achieve greater demand reductions at an accelerated pace. These programs were designed to provide Valley residents and businesses with the tools and education to use water more efficiently.

Since 2002, VWC's focus on demand management has continued to increase. In addition to the activities identified in the SCVWUESP, VWC has implemented a number of other conservation activities to meet the requirements of the MOU and SBX7-7 goals. VWC has an internal Water Use and Energy Efficiency Plan (WUEEP). The WUEEP provides a broad framework defining VWC's conservation policies as well as detailed conservation programs. The WUEEP is reviewed annually and updated every three years.

VWC is implementing all of the Foundational BMPs as required in the revised MOU and UWMP Act. The Programmatic BMPs are being implemented through a GPCD approach. The BMP and SBX7-7 goals and implementation plans are discussed further in Section 7.5.2 and 7.5.3.

The following sections describe the various programs and conservation activities implemented by VWC.

7.5.1 Foundational BMPs

7.5.1.1 Utility Operations

Conservation Coordinator

VWC has had a full-time conservation coordinator since 2005 and added a second in 2009; there are currently two full-time equivalent (FTE) positions dedicated to conservation. The coordinators manage BMP implementation and other water conservation implementation and planning activities. VWC also utilizes consultant services to implement the various programs including water audits, landscape training and public outreach. In the future, VWC plans to establish a third conservation position to focus on CII activities.

Water Waste Prohibition

VWC operates under CPUC-approved rules that include Rule No. 14.1, the Water Conservation and Rationing Plan, and Rule 11, Discontinuance and Restoration of Service.

Rule 11, Discontinuance and Restoration of Service, allows the company to restrict and/or disconnect water service for customers using water in a wasteful manner.

The PUC's methodology for water utilities to implement water conservation plans is documented in Standard Practice U-40-W, "Instructions for Water Conservation, Rationing, and Service Connection Moratoria." Water shortage contingency plans must be approved by the PUC prior to implementation by VWC. As stated in the Standard Practice U-40-W, the PUC shall authorize mandatory conservation and rationing by approving Schedule No. 14.1, Mandatory Water Conservation and Rationing. Schedule No. 14.1 sets forth water use violation fines, charges for removal of flow restrictors, and the period during which mandatory conservation and rationing measures will be in effect.

Water Loss Control

VWC's overall water delivery system is relatively new with a weighted average plant in service life of 11 years. As a newer system, VWC doesn't experience a significant amount of water loss. Nonetheless, VWC conducts quarterly pre-screening system audits which calculate verifiable use as a percent of total production. VWC's historic annual water loss since 2000, as a percent of total production, ranged from one to seven percent.

VWC has completed AWWA's M36 Water Loss analysis, which consists of a component analysis of leaks into "revenue" and "non-revenue" categories, among others, and an economic analysis of recoverable loss. VWC's M36 'Reporting Worksheet' for 2009 and 2010 are provided in Appendix E. Results of the preliminary audits show a water audit validity score of 89 for both 2009 and 2010 and ILI of 0.62 and 0.20 for 2009 and 2010, respectively. VWC intends to refine and improve its assumptions used per M36 manual as its system expands and matures.

VWC's maintenance program also helps minimize water losses. This program helps keep the VWC production system in optimal condition, thus reducing water losses. This program includes, among other things, daily inspections of water wells and pumping equipment, weekly inspections of water tanks and exercising critical system valves. VWC also calibrates its production meters annually.

When a leak occurs, VWC responds quickly to isolate the leak and repair it. VWC tracks leaks in its GIS system, which gives it the ability to visually monitor leak locations and identify potential problem areas or trends.

VWC's meter change-out program replaces its older water meters on a regular basis to ensure metering accuracy. Based on AWWA standards and VWC's experience, this program targets change-outs at 15 years or less.

Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections

All of VWC's customers are metered and billed volumetrically on a monthly basis.

Monthly water allocations (i.e., water budgets) were introduced in late 2009 under the new WaterSMART Allocation program, in which individually metered residential customers receive their monthly allocations on billing statements. In, 2011 a tiered pricing structure based on WaterSMART allocations was implemented.

Retail Conservation Pricing

On February 1, 2011 VWC changed its single volumetric rate structure to a tiered structure (Table 7-8). The tiered system was designed to support the WaterSMART Allocation (WSA) program, which sets customer specific allocations for all individually metered residential customers. Starting in 2009, customer bills included information on their allocation, allowing time for acclimation to the new approach before it was fully implemented with tiered rates in 2011.

The rate structure is designed to provide support and encourage appropriate use. If a customer's water use is within the designated "efficient" range for their allocated volume, the customer is charged standard rates. If the customer uses less than the efficient limit, the

customer is charged at a lower rate and, conversely, if the customer uses more, the customer is charged at the higher rates. There are five (5) tiers, ranging from Super Efficient at $1.144/CCF to Wasteful at $2.878/CCF. Customers are encouraged to access their allocation and billing information on the company's website.

Residential class customers were the first to be placed on WSA and the tiered rate structure as this group represents approximately 54 percent of VWC's total consumption. Dedicated landscape irrigation meters, including those at CII customer locations will be placed on WSA with a tiered rate structure in 2012. VWC will evaluate the challenges of migrating the remaining customer classifications to WSA and tiered rates in the future.

TABLE 7-8
QUANTITY RATES AND SERVICE CHARGES

		Quantity rates:
Tier Name	**Level**	**Rate per 100 cubic feet**
Super Efficient	Tier 1: Indoor monthly water allocation	$1.144
Efficient	Tier 2: Outdoor monthly water allocation (Tiers 1+2=100% of monthly allocation)	$1.362
Inefficient	Tier 3: 101% to 150% of monthly water allocation	$1.703
Excessive	Tier 4: 151%-200% of monthly water allocation	$2.214
Wasteful	Tier 5: Use in excess of 200% of monthly water allocation	$2.878
Non-residential	(not applicable)	$1.362

The proportion of revenue from volumetric charges meets the BMP requirement at about 71 to 73 percent (Table 7-9).

TABLE 7-9
REVENUE

	2006	2007	2008	2009	2010
Fixed Charges	NR	$5,258,800	$6,122,000	$6,150,500	$6,153,500
Volumetric Charges	NR	$13,921,300	$14,788,900	$14,784,500	$15,287,500
Total Revenue	NR	$19,180,100	$20,910,900	$20,935,000	$21,441,000
% Volumetric	**NR**	**73%**	**71%**	**71%**	**71%**

7.5.1.2 Education

Public Information

VWC implements public outreach in coordination with CLWA. See Section 7.2.2.1 for detail on specific programs administered by CLWA.

In addition to the regional activities, VWC provides information on efficient water use on customer bills and on its website. Bills show current water usage in comparison with the previous year's usage for that period, and for residential customers it shows their WaterSMART allocations. VWC maintains an active website that provides information on the various programs available to customers, conservation tips, links and full details on the WaterSMART program. In addition, VWC representatives promote conservation at local special events,

including the Emergency Expo, Earth/Arbor Day, CLWA Water Awareness, River Rally and Make a Difference Day. Outreach activities are summarized in Table 7-10.

TABLE 7-10
SUMMARY OF OUTREACH ACTIVITIES

Item	2006	2007	2008	2009	2010
Bill Inserts / Newsletters / Brochures	NR	0	1	2	1
Bill showing current water usage in comparison with prior year usage	NR	Yes	Yes	Yes	Yes
Special Events	NR	4	4	3	4
Program to coordinate with other government agencies, industry, public interest groups and media	NR	Yes	Yes	Yes	Yes

School Education

VWC's school education program is implemented in coordination with CLWA at no cost to school districts. The CLWA's award winning program is available to grades K through 12 and includes in class presentations and field trips (Table 7-11). See Section 7.2.2.2 for more information on CLWA's school programs.

VWC previously contracted with Resource Action Programs, partnering with Southern California Edison (SCE) and Southern California Gas Company (SCGC) to implement the Living Wise Program. This program was designed to teach communities about conservation and increase environmental awareness. Sixth graders received Resource Action Living Wise Activity Kits, which enabled them to perform home water/energy audits. The program was active thru mid-2009.

TABLE 7-11
SCHOOL EDUCATION (NUMBER OF STUDENTS)

Grades	2006	2007	2008	2009	2010
K-3	1,984	3,501	2,372	2,115	3,016
4 - 6	1,559	1,593	1,895	1,577	2,176
7 - 8	527	737	485	350	0
9 - 12	0	160	0	0	143
Totals	**4,070**	**5,991**	**4,752**	**4,042**	**5,335**

7.5.2 Programmatic BMPs

VWC is pursuing a GPCD approach to complying with the Programmatic BMPs. The following section describes VWC program activities.

7.5.2.1 Residential Programs

Almost 54 percent of VWC's total water use is residential, the majority of which are single-family accounts.

1) Residential Survey and Retrofit Programs

VMC has two programs that address residential surveys, – a traditional audit program and a leak only audit – to best address specific customer needs, increase responsiveness and improve water use efficiency.

Since 2007, VWC has offered a free residential water audits to its residential customers, which include both an indoor and landscape element. The program is administered and implemented by a consultant. Customers are notified of the program by consultant outreach efforts, VWC referrals and advertisement on VWC's website, reception area and at community events. The goals of the program are to provide customers with a better understanding of their water use; identify inefficient uses; and offer incentives for replacement of high-water use devices such as toilets and WBICs. The number of surveys that were conducted is summarized in Table 7-12.

In addition to the full audit, VWC initiated a supplemental program in January 2011 to specifically address leaks. This program was developed to be cost-effective, and to respond quickly and mitigate unnecessary losses resulting from leaks and other unintentional water consumption. In order to better serve its customers, VWC combines smart Automated Meter Reading (AMR) and current manual read systems to notify customers when their consumption has either registered higher than normal or if continuous flow has been detected by the meter (alerts automatically occur when the meter registers continuous flow for 24 consecutive hours). VWC customers can respond to the notification by requesting a Leak Only audit or a full residential audit to assist with the identification and quantification of the abnormal water use and to provide instructions to stabilize or reduce consumption.

VWC's device distribution programs have continued over the years (Table 7-12); devices are distributed as part of the surveys as well as through community events and the Living Wise program (described below). Devices include low-flow showerheads and aerators. In addition, CLWA distributes free water-saving devices to Valley residents at community events.

VWC previously benefited from audits conducted by students through the Living Wise Program in schools (see Section 7.5.1.2). The Living Wise surveys are each counted as the equivalent of one-third of a survey in terms of BMP reporting (only indoor use is evaluated in the program). The program was active through 2009.

TABLE 7-12
RESIDENTIAL SURVEYS AND RETROFITS

	2006	2007	2008	2009	2010
Single Family Accounts					
Surveys Offered	NR	2,520	13,969	4,308	20,901
Surveys Completed	NR	542	813	528	238
Multi-Family Accounts					
Surveys Offered	NR	0	156	0	0
Surveys Completed	NR	0	126	0	0
Devices					
Showerheads	NR	1,583	2,357	1,303	460
Aerators	NR	3,154	4,610	2,473	564

Audit and retrofit program participation is tracked through a manual spreadsheet; water savings are estimated at 32 AFY.

2) **Residential Landscape Water Survey Program**
VWC has identified landscape conservation as a priority program and has developed various tools to address irrigation use. Section 1) above describes the residential water audit programs, including both the full audit and leak only programs, which are a combined indoor and landscape audit. In addition to those programs, VWC is working with CLWA to offer a program that combines training and fixtures in the form of landscape classes and WBICs to its residential customers.

The CLWA sponsored WBIC program began in 2009. It offers homeowners and gardeners free landscape classes and, after residents or their gardeners complete the training, they receive free WBICs. The classes have been very popular with Valley residents. Classes are offered in both English and Spanish and, after completing the training, attendees, as well as their gardeners, receive official certification for attending the workshop and committing to water efficient practices at their sites. VWC is working with CLWA and the other retailers to track program participation and actual water savings in this first year of the program, and will make adjustments to the program as necessary.

For VWC customers who take the CLWA class and receive a WBIC, VWC provides free installation and programming service, which is not part of the CLWA program. At the end of 2010, there have been six classes, and 70 WBICs that have been distributed to VWC customers through the CLWA WBIC program. VWC has installed four of these WBICs through this program in December 2010. VWC encourages participation in CLWA's program.

From 2007 to late 2010, VWC held landscape irrigation courses and provided free WBICs, including installation, to customers with irrigated areas greater than 2,500 square feet. VWC terminated the WBIC program during 2010 to gain efficiencies by combining this program with the CLWA WBIC program. The VWC standalone WBIC program resulted in 338 installed WBICs at customer homes over the four years of the program. Additionally, since 2007 VWC has required developers to install WBICs in all new residential homes constructed in its service area.

3) **WaterSense Specification Toilets**
VWC and CLWA both offer rebates to VWC customers for purchase and installation of high-efficiency toilets (HETs) using 1.28 gpf or less. Rebates are up to $115 for homes built before 1993, or $50 for homes built after that year.

A summary of rebates that have been issued is provided in Table 7-13.

TABLE 7-13
TOILET REBATE AND REPLACEMENT PROGRAMS

Type	2006	2007	2008	2009	2010
Single-Family					
HET Rebate	NR	33	110	477	1,200
Multi-Family					
HET Distribution	NR	0	87	0	0

Customers are notified about the program through advertising in the lobby, high bill inquiries, water audits consultants, community events, in-store promotions and through VWC website; the program is also marketed regionally by CLWA. Program participation is being tracked through VWC. VWC is exceeding the BMP requirement by about 270 retrofits per year, and estimates that the program will provide about 300 AF of water savings (cumulative) through 2020. Additionally, in 2008 VWC provided a one-time incentive at a multi-family senior center complex and replaced 87 toilets with 1.28 gallons per flush HETs.

In addition to the rebates, VWC will be realizing the benefits of SB 407, effective January 1, 2014. SB 407 requires installation of water-conserving plumbing fixtures (including toilets, faucets, and showerheads). The saturation rate of conservation fixtures will be accelerated by compliance with SB 407. This regulation requires all residential, multi-family and commercial customers with pre-1994, non-compliant fixtures to replace them with water-conserving fixtures when making certain improvements or alterations to a building. By 2017, all single-family homes must replace non-compliant plumbing fixtures and, by 2019, all multifamily and commercial buildings must have compliant water-conserving plumbing fixtures in place.

7.5.2.2 Commercial, Industrial, and Institutional (CII)

CII water use accounts for about 44 percent of VWC's total water use. These accounts have been identified and ranked by water use.

VWC has identified approximately 1,250 meters in its CII accounts that are dedicated to irrigating landscapes. During 2011, simply as an administrative procedure, VWC will move these metered accounts from CII to Landscape customers. Regardless of the current customer classification, VWC will target its Large Landscape conservation programs to all meters that are dedicated to landscape irrigation, including those currently included in CII.

VWC provides free audits for CII customers through CLWA's Water Checkup Program (Table 7-14). The audits focus on five areas: irrigation, plumbing fixtures, cooling towers (HVAC systems), manufacturing processes and other efficiency opportunities. After audits are completed, reports are created that summarize findings and suggestions and these are discussed in-person with the customers. Customers that complete and implement the recommended conservation upgrades are eligible for $300 per AF saved rebates. Five industries with the most promising opportunities to provide water savings have been targeted for the program:

- Amusement Park
- Colleges and Universities
- Hotels (Hospitality Industry)
- Hospitals
- Restaurants

Prior to the Water Checkup Program VWC provided free indoor and landscape water audits to CII customers through a program that ended in mid-2009 (Table 7-14). The audit included testing equipment, reviewing water use patterns and sharing water use efficiency information

with the customer. After the audit, the customer received a report identifying water efficiency opportunities, recommending courses of action, estimating water savings, and providing a cost benefit analysis. The recommended efficiency measures included devices such as pre-rinse spray nozzles, efficient toilets and urinals, cooling tower conductivity controllers, high-efficiency clothes washers, irrigation clock management and use of drought tolerant plants. Audits were provided to a wide variety of customers including restaurants, schools, hotels, manufacturing companies and others.

Customers are notified about the CLWA program through VWC's website, referrals by VWC and through direct contacts from the contractor. Program participation and estimated savings for 2010 are tracked by CLWA; prior to 2010, the program participation was tracked by VWC. Limited follow-up for the CII surveys occurred during the transitional years 2009 and 2010. The CLWA program includes follow-up, so VWC anticipates customers receiving surveys will be contacted thereafter.

TABLE 7-14
CII SURVEY PROGRAM

CII Surveys	2006	2007	2008	2009	2010
Surveys Offered					
Commercial	NR	62	30	15	6
Industrial	NR	61	48	5	1
Institutional	NR	0	0	0	4
Mixed Use/Landscape	NR	124/0	86/0	8/18	4/8
Surveys Completed					
Commercial	NR	0	6	15	1
Industrial	NR	7	12	5	0
Institutional	NR	0	0	0	2
Mixed Use/Landscape	NR	7/0	20/0	8/18	0/4
Follow-up within 1 year					
Commercial	NR	2	0	0	0
Industrial	NR	3	3	0	0
Institutional	NR	2	0	0	0

7.5.2.3 Large Landscape

VWC has 13 metered accounts dedicated to irrigation in 2010 that are classified as Landscape and that account for approximately two percent of total water use. This is comprised of three potable meters and ten recycled water meters. The ten recycled water users consist of one golf course and nine street medians.

Additionally, VWC has identified approximately 1,250 meters included in its CII accounts that are dedicated to irrigating landscapes. VWC will target its Large Landscape conservation programs to all meters that are dedicated to irrigating landscapes, including those currently included in CII.

VWC is participating in the CLWA-sponsored large landscape program that offers audits to its large landscape customers. Currently 40 sites are enrolled in the program, including 17 within the VWC service area, where the focus is primarily HOA customers. The program offers large landscape customers such as HOAs and parks and landscape maintenance districts the

opportunity to receive free water-use and cost/benefit analysis reports, free workshops for property management and landscapers and rebates for water-saving measures and devices.

Targeted customers, both public and private sector, are contacted by phone to solicit participation. During the audit, the efficiency of the irrigation system is assessed and leaks and repair needs may be identified. Following the site visit, irrigation system efficiency is evaluated to determine an effective watering schedule, and a water budget is developed based on the size of the landscape. The audit report includes upgrade recommendations, available incentives, new irrigation schedules, the water budget and a benefit/cost analysis. The report is delivered in person to further educate the customer.

Customers are eligible to receive financial incentives to offset investments in landscape efficiency of up to $300 per AF of water saved. CLWA works with its retailers to select sites that meet the large landscape specifications. To date, final reports have been generated for five sites; recommended infrastructure modifications have been completed and five rebates were issued. Modifications at another site will be implemented throughout 2011 and 2012.

Currently, customers are notified about the program through VWC's website, referrals or through direct contact from the contractor. Program participation and estimated savings are tracked through the contractor administering the program.

Prior to 2010, the Large Landscape Audit program was conducted and monitored by VWC. The results of these surveys are included in Table 7-14 above.

7.5.3 VWC DMM and SBX7-7 Implementation Plan

VWC recognizes the need to expand conservation programs and efforts in order to meet both its SBX7-7 and DMM requirements.

The SBX7-7 baseline and target calculations are addressed in Chapter 2. The DMM GPCD goals, shown in Table 7-15, are determined by calculating the following:

1. *Baseline GPCD = average annual Potable Water GPCD for the years 1997 through 2006*

2. *2018 GPCD Target = Baseline GPCD multiplied by 0.82 (an 18% reduction)*

3. *Biennial GPCD Targets = Baseline GPCD multiplied by that year's Target (% Baseline). A retail water agency may choose a starting point as either its Baseline GPCD or its 2006 Potable Water GPCD.*

TABLE 7-15
DMM GPCD TARGET CALCULATIONS

Year	Per Capita Water Use (GPCD)
1997	314
1998	257
1999	277
2000	290
2001	261
2002	280
2003	266
2004	263
2005	246
2006	253
Baseline	**271**
Target (2018)	**222**

Compliance is evaluated in relation to the Compliance Table below (Table 7-16) and relative progress toward the goal will be acknowledged in Council Compliance Reports. The compliance tables are read as five increments with reporting goals relative to their first through fifth Compliance reports.

TABLE 7-16
ANNUAL COMPLIANCE TARGETS (IN GPCD)

Year	Compliance Report	Target	Highest Acceptable Bound
2010	1	254	271
2012	2	251	261
2014	3	241	251
2016	4	232	241
2018	5	222	222

The GPCD option for MOU compliance and the SBX7-7 targets are consistent with one another (Table 7-17) and VWC is currently building on the SCVWUESP as well as its WUEEP to implement programs that meet these goals.

TABLE 7-17
COMPLIANCE TARGETS

		Target GPCD		
	Baseline GPCD	2015	2018	2020
MOU/AB 1420	271		222	
SBX7-7	278	250		222

The SCVWUESP recognizes the need to expand conservation programs and efforts. The adoption of SBX7-7 and the twenty percent reduction goal has increased the urgency for

implementation. CLWA is in the process of reviewing its incentive programs and VWC is currently working with CLWA as well as the other purveyors to identify programs that could be implemented regionally. Conservation programs identified to meet future requirements combine financial incentives, regulations and informational elements, and build on the existing activities. Included in the programs considered for implementation are the following:

Financial Incentives

1) High-Efficiency Clothes Washers (HECWs): Clothes washer rebates are on the list of programs identified for implementation in the SCVWUESP. CLWA will be expanding its program to include clothes washer rebates in FY 2011/12 and VWC will participate.

2) Zero and Low-Flow Urinal Rebates: Rebates will include CII fixtures such as zero consumption and ultra low volume urinals as well as CII specific HETs. This program will launch in FY 2011/12.

3) Expansion of Fixture Rebates to CII and Multi-family Customers: Currently the CLWA toilet rebate program is only available to single-family residential customers. Starting 2011, the programs will be expanded to all customers and there will be increased focus on marketing to large HOA accounts.

4) Expand Rebates to Include a Larger Variety of Fixtures: Being considered for inclusion are hot water storage tanks, pressurized water brooms and high-pressure spray nozzles.

5) Cash for Grass Rebate: Customers would be provided with an incentive of up to $1 per square foot of turf removed and replaced with climate appropriate plants. The program is being considered for both residential and CII customers.

6) Expansion of Large Landscape Program: The purveyors will be evaluating the effectiveness of the current landscape program in FY 2011/12 and making adjustments depending on the results. If the program is found to be successful at meeting reduction targets, the program will be accelerated and more devices will be offered, such as Precision Nozzles.

Building Code/New Standards

The SCVWUESP developed a comprehensive list of new building standards beyond those currently in the building code. Code changes that improve the efficiency of fixtures and design account for about 60 percent of the expected reduction in demand, and will therefore be a significant program priority. Some of the proposed changes will be captured in the State Model Efficient Landscape Ordinance effective January 2010, CAL Green Building Code adopted in January 2011, and SB 407 and standard updates for toilets and washers that are being phased in.

In addition to conservation programs, VWC is committed to expanding recycled water in its service area to offset potable water use for landscape irrigation. Currently recycled water provides about 325 AFY. VWC plans to expand its recycled water use to 2,000 AFY by 2020.

The near term plans to expand recycled water are discussed in Section 6. Recycled water will be further expanded with the South End Recycled Water project (Phase 2C), which will expand the existing recycled water transmission and distribution system southerly to supply recycled

water to VWC, NCWD and SCWD customers. The project will result in the use of approximately 910 AFY of recycled water.

Information/Tracking

Information and tracking represents a new element to the existing programs focusing on collecting and processing information and ensuring that the programs are on track to meet the goals. VWC has already initiated this tool with the WaterSMART Allocation program for its individually metered residential customers. VWC will be expanding the WaterSMART Allocation program to its meters that are dedicated to irrigating landscapes. These activities will help program development by providing more robust information about customers and their water use patterns.

Evaluating Effectiveness of the DMMs

VWC will continue to track all program activities including outreach activities, rebate distribution, audits and leak interventions. Program effectiveness and per capita use will be monitored through the billing and consumption system.

VWC will monitor its WaterSMART Allocation program to measure its effectiveness in assisting customers to use water more efficiently.

Impacts of Conservation

It is not expected that, at this time, the conservation programs currently being implemented or scheduled for implementation will have any significant negative effect on water use within VWC's service area or affect VWC's ability to further reduce demand. The funding for current and future programs is being identified.

Economic Impacts

Analysis of the requirements for BMP compliance yields program costs of roughly $450,000 per year.

7.6 Newhall County Water District

NCWD is implementing programs locally as well as leveraging the conservation resources available through CLWA.

In 2002, NCWD became a signatory to the CUWCC MOU, establishing a firm commitment to the implementation of the BMPs or DMMs. Many of NCWD's conservation programs have been ongoing since 2003 or earlier.

NCWD subsequently joined CLWA and the other retail water purveyors in signing a 2007 MOU to prepare the SCVWUESP. The SCVWUESP recommended programs to reduce the overall valley wide water demand by ten percent by 2030 (see Section 7.2 for more information). These programs were designed to provide Valley residents with the tools and education to use water more efficiently.

NCWD is currently implementing all of the Foundational BMPs as required in the revised MOU and UWMP Act. The Programmatic BMPs are being implemented through a BMP approach. The BMP and SBX7-7 goals and implementation plan are discussed further in Sections 7.6.2 and 7.6.3.

7.6.1 Foundational BMPs

7.6.1.1 Utility Operations

Conservation Coordinator

NCWD has had a conservation coordinator since 2002, when it was half a full-time equivalent (FTE) position. The coordinator manages BMP implementation and other water conservation implementation and planning activities. Including the coordinator, NCWD has four FTE staff positions that focus part-time on conservation.

Water Waste Prohibition

NCWD adopted a water conservation ordinance in 1991. The ordinance was revised in 2005 due to water supply conditions at that time. The ordinance provides a water conservation plan to minimize the effect of water shortages on customers. It lists prohibited uses, sets irrigation hours and schedules to optimize water efficiency and states that inspection for leaks and repairs are everyone's responsibility. In addition, State of California, County of Los Angeles, and City of Santa Clarita ordinances also apply to NCWD customers.

Water Loss Control

NCWD conducts annual pre-screening system audits which calculate verifiable use as a percent of total production. NCWD also compares production and sales records monthly to identify losses.

NCWD has completed AWWA's M36 Water Loss analysis, which consists of a component analysis of leaks into "revenue" and "non-revenue" categories, among others, and an economic analysis of recoverable loss. NCWD's M36 'Reporting Worksheet' for 2010 is provided in Appendix E. Results of the preliminary analysis show an Infrastructure Leakage Index (ILI) of 1.8 and a score of 96, which indicates appropriate loss control. NCWD will continue its water loss practices and review the recommendations, which include annual audits and other incremental improvements.

Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections

All of NCWD's customers are metered and billed volumetrically on a monthly basis. All meters have been replaced in the past ten years and NCWD is currently updating its maintenance plans.

Retail Conservation Pricing

Since 2005, NCWD has employed a four-tier increasing block rate structure for individually three-quarter inch metered residential accounts that is designed to promote water use efficiency and conservation. Rates range from $0.80 per CCF in the first tier to $1.456 per CCF in the fourth tier. The tiers are structured differently depending on meter size.

Non-residential accounts are charged for consumption at a uniform volumetric rate. All accounts are charged a flat fee for water availability, plus variable charges based on usage for energy, infrastructure and purchased water form CLWA. The proportion of revenue from variable charges meets the BMP requirement of 70 percent Table 7-18.

TABLE 7-18
REVENUE

	2006	2007	2008	2009	2010
Fixed: Service Charge	$2,160,400	$2,619,900	$2,808,100	$2,831,100	$2,834,600
Variable	$6,056,900	$7,166,200	$7,202,900	$6,982,900	$6,656,800
Total Revenue	$8,217,300	$9,786,100	$10,011,000	$9,814,000	$9,491,300
Percentage Variable	**74%**	**73%**	**72%**	**71%**	**70%**

7.6.1.2 Education

Public Information

NCWD has had a public information program since the late 1990s. Activities are summarized in Table 7-19. NCWD distributes conservation information to new residential customers as part of a welcome package and to children through free activity books. NCWD participates in community outreach events, mails its customers quarterly newsletters that include conservation tips and provide information on available rebate programs, conservation tips and links to other conservation resources on its website. Water bills were redesigned in 2010 to show water usage for the prior 13 months and suggest potential conservation actions.

Further outreach is implemented in coordination with CLWA. Refer to the Public Information section of CLWA's DMM summary for information on specific programs administered by CLWA.

TABLE 7-19
SUMMARY OF OUTREACH ACTIVITIES

Item	2006	2007	2008	2009	2010
Paid advertising	0	0	5	2	2
Bill Inserts / Newsletters / Brochures	4	4	4	4	4
Bill showing current water usage in comparison with prior year usage	Yes	Yes	Yes	Yes	Yes
Demonstration gardens	1	1	1	1	1
Special Events	3	3	3	4	4
Program to coordinate with other government agencies, industry, public interest groups and media	Yes	Yes	Yes	Yes	Yes

School Education

NCWD's school education program is implemented by CLWA at no cost to school districts and has reached over 10,000 students in NCWD's service area since 2006 (Table 7-20). Refer to the Section 7.2.2 for CLWA's DMM summary of detailed information on age-appropriate presentations, activities and field trips offered to schools, as well as the Water Challenge scholarship program.

TABLE 7-20
SCHOOL EDUCATION (NUMBER OF STUDENTS)

Grade Level	2006	2007	2008	2009	2010
K-3	1,325	1,345	1,224	1,271	1,333
4 - 6	954	623	700	779	973
7 - 8	100	30	0	255	221
9 - 12	0	0	0	0	0
Totals	**2,379**	**1,998**	**1,924**	**2,305**	**2,527**

7.6.2 Programmatic BMPs

The Programmatic BMPs are described below. NCWD is pursuing a GPCD approach to complying with the Programmatic BMPs. The following section describes NCWD program activities.

7.6.2.1 Residential Programs

The largest customer class in the NCWD service area is residential users, accounting for approximately 72 percent of total use.

1) **Residential Survey and Retrofit Programs**
In 2007, NCWD sent all of its single family residential customers a water use self survey that reflected the information requirements of BMPs 1 and 2. Each customer that returned a completed survey received $10 (Table 7-21). NCWD tracked the survey results with a database developed for that purpose.

TABLE 7-21
RESIDENTIAL SURVEYS AND RETROFITS

	2006	2007	2008	2009	2010
Accounts					
Surveys Offered	0	7,000	0	0	0
Surveys Completed	0	375	216	0	0
Devices					
Showerheads	105	400	171	263	312
Aerators	122	184	184	148	173

Water-saving devices are distributed by mail following surveys, or picked up at local events and from the District office; recipients of these devices are tracked in a database. NCWD customers

also receive devices from CLWA, which distributes free water-saving devices to Santa Clarita Valley residents at community events.

2) Residential Landscape Water Survey Program

NCWD's residential landscape water survey program was combined with the indoor water surveys described in Section 1), which are a combined indoor and landscape audit. NCWD has identified landscape conservation as a priority program and has developed various tools to address irrigation use.

NCWD offers its residential customers an ET Controller (Smart Sprinkler) Rebate Program, which started in 2006. The program is available to single family homeowners with a minimum of 1,200 square feet of irrigated landscapes and working in-ground irrigation systems operated by working timers and controllers. The rebate is $40 per active valve, up to a maximum of $480 per residence. NCWD also pays up to $120 for standard installation. At the end of 2010 there have been 48 WBICs installed and inspected within the NCWD service area.

NCWD also provides a free nozzle for each purchased spray head to replace all the sprinklers in a residential front yard turf area. These nozzles have 1/3 the flow of a conventional sprinkler and reduce irrigation application rates to less than 1 inch per hour. This reduces both water use and runoff losses. At the end of 2010 there have been 182 nozzles installed within the NCWD service area.

NCWD is also working with CLWA to offer a program that combines training and fixtures in the form of landscape classes and WBICs give-aways to its residential customers. The program offers homeowners and gardeners free landscape classes; after residents or their gardeners complete the training, they receive free WBICs. They also receive free inspections of their WBIC installations and programming to ensure they are properly installed. The classes are offered in both English and Spanish and have been very popular with residents. At the end of 2010, there have been six classes, and 13 WBICs have been installed and inspected within the NCWD service area.

After completing the training, attendees, as well as their gardeners, receive official certification for attending the workshop and committing to water efficient practices at their sites.

3) WaterSense Specification Toilets

NCWD participates in toilet rebate program sponsored by CLWA, which provides $50 per qualifying toilet. NCWD is also offering HET rebates of up to $115 for single family homes built prior to 1993. The EPA's list of WaterSense labeled products is used to identify qualifying equipment. As of 2008, NCWD had achieved about 65 percent saturation of ULFTs in single family homes and 48 percent in multi-family homes. A summary of rebates that have been issued is provided in Table 7-22. In 2006 NCWD stopped offering ULFT rebates and migrated its incentive program towards HETs.

Compliance with the BMP requires that NCWD rebate about 700 toilets over 10 years, for a total water savings of about 78 AF by 2020. Since 2008, NCWD rebates have been on track to meet the coverage requirement.

TABLE 7-22
TOILET REBATE PROGRAMS

Toilet Type	2006	2007	2008	2009	2010
HET (1.28 gal/flush)				126	227
ULFT Rebates (1.6 gal/flush)	26	13	126		

In addition, NCWD will be realizing the benefits SB 407, effective January 1, 2014. SB 407 requires that all pre-1994 residential, multi-family and commercial customers replace non-compliant plumbing fixtures (including toilets, faucets, and showerheads) with water-conserving fixtures when making certain improvements or alterations to a building. By 2017, all single-family homes must replace non-compliant plumbing fixtures, and by 2019, all multifamily and commercial buildings must have compliant water-conserving plumbing fixtures in place.

7.6.2.2 Commercial, Industrial, and Institutional (CII)

NCWD has about 470 CII accounts, which use about 1,300 AFY, or about 12 percent of NCWD's total water use. These accounts have been identified and ranked by water use.

NCWD provides free audits for CII customers through CLWA's Water Checkup Program. The audits focus on five areas: irrigation, plumbing fixtures, cooling towers (HVAC systems), manufacturing processes and other efficiency opportunities. After the audit is complete, a report is created that summarizes findings and suggestions, and these are discussed with the customer in-person. The report also identifies rebates that are available to provide motivation for implementing the recommended retrofits. Customers are eligible to receive financial incentives to offset any investment in efficiency opportunities in the amount of up to $300 per AF of water saved.

Customers are notified about the CLWA program through bill inserts, the District's website and direct contact from the contractor. Program participation and estimated savings are tracked by CLWA. To date two audits within the NCWD's service have been completed, both for schools.

7.6.2.3 Large Landscape

NCWD has about 230 dedicated irrigation meter accounts that use almost 1,700 AFY, or 15 percent of total use. NCWD customers can take advantage of CLWA's Water Use Efficiency Program for Large Landscapes. Currently 40 sites are enrolled in the program, including four within the NCWD service area where the focus is primarily HOA customers. The program offers large landscape customers such as HOAs, parks and landscape maintenance districts the opportunity to receive free water-use and cost-benefit analysis reports, free workshops for property management and landscapers, and rebates for water-saving measures and devices.

Targeted customers are contacted via phone to solicit participation. During the audit, the efficiency of the irrigation system is assessed and leaks and repair needs may be identified. Following the site visit, irrigation system efficiency is evaluated to determine an effective watering schedule, and a water budget is developed based on the size of the landscape. The audit report includes upgrade recommendations, available incentives, new irrigation schedules, the water budget and a benefit/cost analysis. The report is delivered in person to further educate the customer.

Customers are eligible to receive financial incentives to offset any investment in landscape efficiency in the amount of up to $300 per AF of water saved. CLWA works with its retailers to select sites that meet the large landscape specifications. To date, final reports have been generated for two sites.

Customers are notified about the program through bill inserts, the website and direct contact from the contractor. Program participation and estimated savings are tracked through the contractor administering the program.

7.6.3 NCWD DMM and SBX7-7 Implementation Plan

NCWD recognizes the need to expand conservation programs and efforts in order to meet both its SBX7-7 and DMM requirements.

The SBX7-7 baseline and target calculations are addressed in Chapter 2. The DMM GPCD goals, shown in Table 7-23 are determined by calculating the following:

1. *Baseline GPCD = average annual Potable Water GPCD for the years 1997 through 2006*

2. *2018 GPCD Target = Baseline GPCD multiplied by 0.82 (an 18% reduction)*

3. *Biennial GPCD Targets = Baseline GPCD multiplied by that year's Target (% Baseline). A retail water agency may choose a starting point as either its Baseline GPCD or its 2006 Potable Water GPCD.*

TABLE 7-23
DMM GPCD TARGET CALCULATIONS

Year	Per Capita Water Use (GPCD)
1997	242
1998	220
1999	249
2000	254
2001	243
2002	253
2003	242
2004	247
2005	230
2006	241
Baseline	**242**
Target (2018)	**199**

Compliance is evaluated in relation to the Compliance Table below (Table 7-24) and relative progress toward the goal will be acknowledged in Council Compliance Reports. The compliance tables are read as five increments with reporting goals relative to their first through fifth Compliance reports.

TABLE 7-24
ANNUAL COMPLIANCE TARGETS (GPCD)

Year	Compliance Report	Target	Highest Acceptable Bound
2010	1	228	242
2012	2	225	233
2014	3	216	225
2016	4	207	216
2018	5	199	199

The GPCD option for MOU compliance and the SBX7-7 targets are consistent with one another (Table 7-25).

TABLE 7-25
COMPLIANCE TARGETS

		Target GPCD		
	Baseline GPCD	2015	2018	2020
MOU/AB 1420	242		199	
SBX7-7	244	220		195

The regional plan, the SCVWUESP, recognizes the need to expand conservation programs and efforts. The adoption of SBX7-7 and the twenty percent reduction goal has increased the urgency for implementation. CLWA is in the process of reviewing its incentive programs, and NCWD is currently working with CLWA as well as the other purveyors to identify programs that could be implemented regionally.

Programs that NCWD has identified to meet future requirements combine financial incentives, advances in building codes and improved implementation tracking. NCWD is considering implementing of the following:

Financial Incentives

1) High-Efficiency Clothes Washers (HECWs): Clothes washer rebates are on the list of programs identified for implementation in the SCVWUESP. CLWA will be expanding its program to include clothes washer rebates in FY 2011/12 and NCWD will participate.

2) Zero and Low-Flow Urinal Rebates: Rebates will include CII fixtures such as zero consumption and ultra low volume urinals as well as CII specific HETs. This program will launch in FY 2011/12.

3) Expansion of Fixture Rebates to CII and Multi-family Customers: Currently the toilet rebate program is only available to single-family residential customers. Starting 2011, the programs will be expanded to all customers and there will be increased focus on marketing to large HOA accounts.

4) Expand Rebates to Include a Larger Variety of Fixtures: Being considered for inclusion are hot water distribution tanks, pressurized water brooms and high-pressure spray nozzles.

5) Cash for Grass Rebate: Customers will be provided with an incentive of up to $1 per acre-foot of turf removed and replaced with landscape appropriate plants. The program is being considered for both residential and CII customers.

6) Expansion of Large Landscape Program: The purveyors will be evaluating the effectiveness of the current landscape program in FY 2011/12 and adjusting depending on the results. If the program is found to be successful at meeting reduction targets, the program will be accelerated and more devices will be offered, such as Precision Nozzles.

Building Codes/New Standards

The SCVWUESP developed a comprehensive list of new building standards beyond those currently in the building code. Code changes that improve the efficiency of fixtures and design account for about 60 percent of the expected reduction in demand, and will therefore be a significant program priority. Some of the proposed changes will be captured in the State Model Efficient Landscape Ordinance effective January 2010, CAL Green Building Code, adopted in January 2011 and SB 407 and standard updates for toilets and washers that are being phased in.

Implementation Tracking

Tracking is intended to bring new accountability to existing programs. This is implemented by collecting and processing information to ensure that the programs are on track to meet the defined goals.

Evaluating Effectiveness of the DMMs

NCWD will continue to track all program activities including outreach activities, rebate distribution, audits, water-saving device distribution and ET controller distribution. Program effectiveness and per capita use will be monitored through the billing and consumption system.

Impacts of Conservation

It is not expected, at this time, that conservation programs that are currently being implemented or are scheduled for implementation will have any significant negative impact on water use within NCWD's service area or will affect NCWD's ability to further reduce demand. The funding for current and future programs is being identified.

Economic Impacts

Analysis of the requirements for BMP compliance yields program costs of roughly $430,000.

Section 8: Water Shortage Contingency Planning

8.1 Overview

Water supplies may be interrupted or reduced significantly in a number of ways, such as a drought that limits supplies, an earthquake that damages water delivery or storage facilities, a regional power outage or a toxic spill that affects water quality. This chapter of the Plan describes how CLWA and the retail water purveyors plan to respond to such emergencies promptly and equitably.

To date, both a Water Shortage Contingency Plan and a Drought Emergency Water Sharing Agreement have been prepared by CLWA and the retail purveyors. Prohibitions, penalties and financial impacts of shortages have been developed by SCWD, NCWD, and VWC and are summarized in this chapter.

8.2 Coordinated Planning

CLWA and the purveyors have coordinated efforts in the past to meet water shortages. During 1991 (the fifth year of a six-year drought), the purveyors and CLWA prepared a Water Shortage Contingency Plan. Since this plan was first prepared, the Valley has experienced two water shortages: in 1991-1992 due to the continuation of the 1987-1992 drought and in 1994 due to the January 17, 1994 Northridge earthquake. The plan worked extremely well in both instances, and minor updates were made to incorporate actual experience during these two periods. It is envisioned that the Water Shortage Contingency Plan will be implemented whenever needed in the future.

8.2.1 CLWA and the Retail Water Purveyors

During times of normal supply, the local water suppliers meet periodically to review total water supply and demand in the Valley and any new regulations affecting the water industry.

During the drought year of 1991, the local purveyors met more frequently (about once per month). Monthly water production and demand reports were produced and shared with the City of Santa Clarita Drought Committee. After the 1987-1992 drought, CLWA and the retail purveyors cooperated in sharing available water from all sources without regard to contractual or other water rights for the duration of the emergency, and to facilitate among themselves water transfers, exchanges and arrangements to use each others' distribution facilities. During the recent 2007 to 2009 drought period, the purveyors resumed the monthly meetings and monitored valley-wide water demand, and strengthened conservation planning and response planning.

8.3 Stages of Action to Respond to Water Shortages

The Saugus Formation has underground storage of approximately 1.65 MAF. In times of continued drought, the Saugus Formation can be pumped for temporary periods above its normal year production. During a dry year or an extended drought, the purveyors would temporarily increase pumping in the Saugus Formation above the normal-year production of 7,500 to 15,000 AFY, and plan to upgrade the pumping capacity of their wells, restore lost

capacity and drill additional wells to enable this increased pumping. As developed in the Valley's groundwater operating plan and presented in Table 3-5 in Section 3, production in the Saugus Formation can be as high as 25,000 to 35,000 AFY during multiple-dry year periods.

The Alluvium would be most affected by a continued local drought. As developed in the Valley's groundwater operating plan and further presented in Table 3-5, sustainable production during normal years can range from 30,000 to 40,000 AFY. However, due to operational constraints in the eastern part of the Basin, production would be reduced to approximately 30,000 to 35,000 AFY during locally dry years.

Table 8-1 presents the four-stage rationing and demand reduction goals for the Valley[24].

TABLE 8-1
RATIONING AND REDUCTION GOALS

Deficiency	Stage	Demand Reduction Goal	Type of Program
Up to 15%	1	15% reduction	Voluntary
15-25%	2	25% reduction	Mandatory
25-35%	3	35% reduction	Mandatory
35-50%	4	50+% reduction	Mandatory

Priorities for use of available water, based on Chapter 3 of the California Water Code, are:

- Health and Safety: Interior residential, sanitation and fire protection
- Commercial, Industrial, and Governmental: Maintain jobs and economic base
- Existing Landscaping: Especially trees and shrubs
- New Demand: Projects with permits when shortage declared

Water quantity calculations used to determine the interior household GPCD requirements for health and safety are provided in Table 8-2. As developed in Table 8-2, the California Water Code Stage 2, 3, and 4 health and safety allotments are 68 GPCD, or 33 CCF (100 cubic feet) per person per year. When considering this allotment and the Valley population of 286,750 in 2010 as presented in Section 2 (Table 2-8), the total annual water supply required to meet the first priority use during a water shortage is approximately 21,839 AFY.

[24] LACWWD has a nine-stage rationing and demand reduction method plan. Anticipated shortages that trigger the phases of action range from 10 percent to 50 percent, while associated conservation target reductions similarly range from 10 percent to 50 percent, with mandatory rationing after Stage 2.

TABLE 8-2
PER CAPITA HEALTH AND SAFETY WATER QUANTITY CALCULATIONS

	Non-Conserving Fixtures		Habit Changes		Conserving Fixtures	
Toilets	5 flushes x 5.5 gpf =	27.5	3 flushes x 5.5 gpf =	16.5	5 flushes x 1.6 gpf =	8.0
Showers	5 min x 4.0 gpm =	20.0	4 min x 3.0 gpm =	12.0	5 min x 2.0 gpm =	10.0
Washers	12.5 GPCD (1/3 load) =	12.5	11.5 GPCD (1/3 load) =	11.5	11.5 GPCD (1/3 load) =	11.5
Kitchens	4 GPCD =	4.0	4 GPCD =	4.0	4 GPCD =	4.0
Other	4 GPCD =	4.0	4 GPCD =	4.0	4 GPCD =	4.0
Total GPCD		68.0		48.0		37.5
CCF per capita per year		33.0		23.0		18.0

8.4 Minimum Water Supply Available During Next Three Years

The minimum water supply available during the next three years would occur during a three-year multiple-dry year event between the years 2011 and 2013. As shown in Table 8-3, the total water supply available during each of the next three years is about 128,400 AFY. When comparing these supplies to the demand projections provided in Chapter 2 of this Plan, CLWA and the purveyors have adequate supplies available to meet projected demands should a multiple-dry year period occur during the next three years.

TABLE 8-3
ESTIMATE OF MINIMUM SUPPLY FOR THE NEXT THREE YEARS

	Supply (AF)		
Source	**2011**	**2012**	**2013**
Wholesale (Imported)			
SWP Table A Supply[a]	30,700	30,700	30,700
Buena Vista-Rosedale	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607
Flexible Storage Account (CLWA)[b]	1,560	1,560	1,560
Flexible Storage Account (Ventura County)[b]	460	460	460
Total Imported Supplies	*45,327*	*45,327*	*45,327*
Local Supplies			
Groundwater Supplies			
Alluvial Aquifer[c]	20,425	20,425	20,425
Saugus Formation[c]	19,700	19,700	19,700
Recycled Water	325	325	325
Total Local Supplies	*40,450*	*40,450*	*40,450*
Banking Programs			
Semitropic Water Bank[d]	15,300	15,300	15,300
Rosedale-Rio Bravo[e]	20,000	20,000	20,000
Semitropic Water Bank - Newhall Land[e]	4,950	4,950	4,950
Total Banking Programs	*40,250*	*40,250*	*40,250*
Total Supplies	**126,027**	**126,027**	**126,027**

Notes:
(a) SWP supplies to CLWA based on detailed delivery results provided by DWR from the analyses presented in DWR's *2009 SWP Delivery Reliability Report*, for the worst case three-year dry period of 1990-1992. SWP deliveries to CLWA over this three year period average 32% of CLWA's 95,200 AF of Table A Amount.
(b) Based on total amount of storage available divided by 3 (3-year dry period).
(c) Based on existing groundwater supplies available during a multiple-dry year period.
(d) Based on total amount of water currently in storage (45,920 AF) divided by 3 (3-year dry period).
(e) Based on maximum annual pumpback capacity.

8.5 Actions to Prepare for Catastrophic Interruption

8.5.1 General

The Valley is located approximately 20 miles southwest of the San Andreas Fault, which traverses the length of the southern San Joaquin Valley. A major earthquake along this portion of the San Andreas Fault would affect the Valley. The California Division of Mines and Geology has stated that two of the aqueduct systems that import water to southern California (including the California Aqueduct) could be ruptured by displacement on the San Andreas Fault. The situation would be further complicated by physical damage to pumping equipment and local loss of electrical power.

DWR has an Aqueduct Outage Plan for restoring the California Aqueduct to service should a major break occur, which it estimates would take approximately four months to repair.

Limitations on supplies of groundwater and/or imported water for an extended period, due to power outages and/or equipment damage, could result in severe water shortages until the supplies could be restored.

Combined water storage of the local water suppliers totals approximately 190 MG of water in storage tanks, which can be gravity fed to Valley businesses and residences, even if there is a power outage. The public would be asked to reduce consumption to minimum health and safety levels, extending the supply to a minimum of seven days. This would provide sufficient time to restore a significant amount of groundwater production. After the groundwater supply is restored, the pumping capacity of the four retail purveyors could meet the reduced demand until such time that the imported water supply was reestablished. Updates on the water situation would be made as often as necessary.

The Valley's water sources are generally of good quality, and no insurmountable problems resulting from industrial or agricultural contamination are foreseen. If contamination did result from a toxic spill or similar accident, the contamination would be isolated and should not significantly impact the total water supply. In addition, such an event would be covered by the purveyors Emergency Response Plan.

8.5.2 SWP Emergency Outage Scenarios

In addition to earthquakes, the SWP could experience other emergency outage scenarios. Past examples include slippage of aqueduct side panels into the California Aqueduct near Patterson in the mid-1990s, the Arroyo Pasajero flood event in 1995 (which also destroyed part of Interstate 5 near Los Banos) and various subsidence repairs needed along the East Branch of the Aqueduct since the 1980s. All these outages were short-term in nature (on the order of weeks), and DWR's Operations and Maintenance Division worked diligently to devise methods to keep the Aqueduct in operation while repairs were made. Thus, the SWP contractors experienced no interruption in deliveries.

One of the SWP's important design engineering features is the ability to isolate parts of the system. The Aqueduct is divided into "pools." Thus, if one reservoir or portion of the California Aqueduct is damaged in some way, other portions of the system can still remain in operation. The principal SWP facilities are shown on Figure 8-1.

FIGURE 8-1
PRIMARY SWP FACILITIES

Other events could result in significant outages and potential interruption of service. Examples of possible nature-caused events include a levee breach in the Delta near the Harvey O. Banks Pumping Plant, a flood or earthquake event that severely damages the Aqueduct along its San Joaquin Valley traverse, or an earthquake event along either the West or East Branches. Such events could impact some or all SWP contractors south of the Delta.

The response of DWR, CLWA and other SWP contractors to such events would be highly dependent on the type and location of any such events. In typical SWP operations, water flowing through the Delta is diverted at the SWP's main pumping facility, located in the southern Delta, and is pumped into the California Aqueduct. During the relatively heavier runoff period in the winter and early spring, Delta diversions generally exceed SWP contractor demands and the excess is stored in San Luis Reservoir. Storage in SWP aqueduct terminal reservoirs, such as Pyramid and Castaic Lakes, is also refilled during this period. During the summer and fall, when diversions from the Delta are generally more limited and less than contractor demands, releases from San Luis Reservoir are used to make up the difference in deliveries to contractors. The SWP share of maximum storage capacity at San Luis Reservoir is 1,062,000 AF.

CLWA receives its SWP deliveries through the West Branch of the California Aqueduct at Castaic Lake. The only other contractors receiving deliveries from the West Branch are Metropolitan and Ventura County Watershed Protection District (formerly known as the Ventura County Flood Control District). The West Branch has two terminal reservoirs, Pyramid Lake and Castaic Lake, which were designed to provide emergency storage and regulatory storage (i.e., storage to help meet peak summer deliveries) for CLWA and the other two West Branch contractors. Maximum operating capacity at Pyramid and Castaic lakes is 169,900 and 323,700 AF, respectively.

In addition to SWP storage south of the Delta in San Luis and the terminal reservoirs, a number of contractors have stored water in groundwater banking programs in the San Joaquin Valley, and many also have surface and groundwater storage within their own service areas.

Three scenarios that could impact the delivery to CLWA of its SWP supply, previously banked supplies or other supplies delivered to it through the California Aqueduct are described below. For each of these scenarios, it was assumed that an outage of six months could occur. CLWA's ability to meet demands during the worst of these scenarios is presented following the scenario descriptions.

8.5.2.1 Scenario 1: Levee Breach Near Banks Pumping Plant

As demonstrated by the June 2004 Jones Tract levee breach and previous levee breaks, the Delta's levee system is fragile. The SWP's main pumping facility, Banks Pumping Plant, is located in the southern Delta. Should a major levee in the Delta near these facilities fail catastrophically, salt water from the eastern portions of San Francisco Bay would flow into the Delta, displacing the fresh water runoff that supplies the SWP. All pumping from the Delta would be disrupted until water quality conditions stabilized and returned to pre-breach conditions. The re-freshening of Delta water quality would require large amounts of additional Delta inflows, which might not be immediately available, depending on the time of year of the levee breach. The Jones Tract repairs took several weeks to accomplish and months to complete; a more severe breach could take much longer, during which time pumping from the Delta might not be available on a regular basis.

Assuming that the Banks Pumping Plant would be out of service for six months, DWR could continue making at least some SWP deliveries to all southern California contractors from water stored in San Luis Reservoir. The water available for such deliveries would be dependent on the storage in San Luis Reservoir at the time the outage occurred and could be minimal if it occurred in the late summer or early fall when San Luis Reservoir storage is typically low. In addition to supplies from San Luis Reservoir, water from the West Branch terminal reservoirs would also be available to the three West Branch contractors, including CLWA. CLWA water stored in groundwater banking programs in the San Joaquin Valley may also be available for withdrawal and delivery to CLWA.

8.5.2.2 Scenario 2: Complete Disruption of the California Aqueduct in the San Joaquin Valley

The 1995 flood event at Arroyo Pasajero demonstrated vulnerabilities of the California Aqueduct (the portion that traverses the San Joaquin Valley from San Luis Reservoir to Edmonston Pumping Plant). Should a similar flood event or an earthquake damage this portion of the aqueduct, deliveries from San Luis Reservoir could be interrupted for a period of time. DWR has informed the SWP contractors that a four-month outage could be expected in such an event. CLWA's assumption for this Plan is a more conservative six-month outage.

Arroyo Pasajero is located downstream of San Luis Reservoir and upstream of the primary groundwater banking programs in the San Joaquin Valley. Assuming an outage at a location near Arroyo Pasajero that takes the California Aqueduct out of service for six months, supplies from San Luis Reservoir would not be available to those SWP contractors located downstream of that point. However, CLWA water stored in groundwater banking programs in the San Joaquin Valley could be withdrawn and delivered to CLWA, and water from the West Branch terminal reservoirs would also be available to the three West Branch contractors, including CLWA. Assuming an outage at a location on the California Aqueduct south of the groundwater banking programs in the San Joaquin Valley, these supplies would not be available to CLWA, but water from the West Branch terminal reservoirs would be available to the three West Branch contractors, including CLWA.

8.5.2.3 Scenario 3: Complete Disruption of the West Branch of the California Aqueduct

The West Branch of the California Aqueduct begins at a bifurcation of the Aqueduct south of Edmonston Pumping Plant, which pumps SWP water through and across the Tehachapi Mountains. From the point of bifurcation, the West Branch is an open canal through Quail Lake, a small flow regulation reservoir, to the Peace Valley Pipeline, which conveys water into Pyramid Lake. From Pyramid Lake, water is released into the Angeles Tunnel, through Castaic Powerplant into Elderberry Forebay, and then into Castaic Lake.

If a major earthquake (an event similar to or greater than the 1994 Northridge earthquake) were to damage a portion of the West Branch, deliveries could be interrupted. The exact location of such damage along the West Branch would be key to determining emergency operations by DWR and the three West Branch SWP contractors. For this scenario, it was assumed that the West Branch would suffer a single-location break and deliveries of SWP water from north of the Tehachapi Mountains or of CLWA water stored in groundwater banking programs in the San Joaquin Valley would not be available. It was also assumed that Pyramid and Castaic dams would not be damaged by the event and that water in Pyramid and Castaic Lakes would be available to the three West Branch SWP contractors, including CLWA.

In any of these three SWP emergency outage scenarios, DWR and the SWP contractors would coordinate operations to minimize supply disruptions. Depending on the particular outage scenario or outage location, some or all of the SWP contractors south of the Delta might be affected. But even among those contractors, potential impacts would differ given each contractor's specific mix of other supplies and available storage. During past SWP outages, the SWP contractors have worked cooperatively to minimize supply impacts among all contractors. Past examples of such cooperation have included certain SWP contractors agreeing to rely more heavily on alternate supplies, allowing more of the outage-limited SWP supply to be delivered to other contractors, and exchanges among SWP contractors, allowing delivery of one contractor's SWP or other water to another contractor, with that water being returned after the outage was over.

8.5.2.4 Assessment of Worst-Case Scenario

Of these three SWP outage scenarios, the West Branch outage scenario presents the worst-case scenario for the CLWA service area. In this scenario, the water suppliers would rely on local supplies and water available to CLWA from Pyramid and Castaic Lakes. See Section 8.5.3 below regarding recommendations for emergency outage storage using co-agreements with other SWP contractors and individual groundwater banking programs. An assessment of the supplies available to meet demands in CLWA's service area during a six-month West Branch outage and the additional levels of conservation projected to be needed are presented in Table 8-4 for 2010 through 2050.

During an outage, the local supplies available would consist of groundwater from the Alluvial Aquifer and the Saugus Formation, as well as recycled water. It was assumed that local well production would be unimpaired by the outage and that the outage would occur during a year when average/normal supplies would be available from the Alluvial Aquifer. Pumping from the Saugus was assumed to be one-half of the single-dry year supplies. Note that adequate well and aquifer capacity exists to pump at levels higher than those assumed in this assessment, particularly during a temporary period such as an outage. However, to be conservative, groundwater production was assumed to be one-half of annual supplies. Based on the assumption that additional voluntary conservation could reduce the amount of waste discharge, and therefore the amount of recycled water available, the amount of recycled water available is assumed to be available 25 percent less than average/normal year supplies.

The water available to CLWA from Pyramid and Castaic Lakes includes flexible storage available to CLWA at Castaic Lake and emergency and potentially regulatory storage available in both Pyramid and Castaic Lakes. Regulatory storage, which is used to help meet high peak summer deliveries, may or may not be available depending on what time of year an outage occurs. For this assessment, regulatory storage was assumed to be unavailable. The amount of emergency storage assumed to be available to CLWA was based on CLWA's proportionate share of usable storage in each reservoir, where usable storage is maximum operating storage, less regulatory and dead pool storage. At Castaic Lake, this usable storage determination also excludes the three West Branch contractors' total Flexible Storage Accounts. CLWA's proportionate share of usable storage was assumed to be slightly less than three percent, based on its share of capital cost repayment at each reservoir. On this cost repayment basis, the proportionate shares of the Metropolitan and Ventura County Watershed Protection District are about 96 percent and one percent, respectively.

Table 8-4 shows that, for a six-month emergency outage, additional conservation beyond SBX7-7 conservation objectives described in Chapter 2 would be required, with the additional

demand reductions ranging from one to 11 percent of total demand beginning in 2035. It is likely that potential cooperation among SWP contractors and/or temporarily increased purveyor groundwater production during such an outage could increase supplies so that lower amounts, or even no amount, of additional conservation would be needed. Further, the acquisition of emergency storage, as discussed in Section 8.5.3, could reduce or eliminate the need for additional conservation. However, even without such supply increases, these levels of additional conservation would be readily achievable. In an emergency such as this, these levels of additional conservation would likely be achieved through voluntary conservation, but mandatory measures would be enacted if needed.

TABLE 8-4
PROJECTED SUPPLIES AND DEMANDS DURING SIX MONTH DISRUPTION OF IMPORTED SUPPLY (AF)[a]

Water Supply Sources	2015	2020	2025	2030	2035	2040	2045	2050
Existing Supplies								
Groundwater								
Alluvial Aquifer[b]	12,000	12,000	12,000	12,500	12,500	12,500	12,500	12,500
Saugus Formation[c]	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200
Recycled Water[d][e]	120	120	120	120	120	120	120	120
Planned Supplies								
Future Groundwater								
Alluvial Aquifer[b]	-	500	1,000	1,500	2,000	2,500	3,000	3,500
Saugus Formation (Restored Well)[c]	425	1,900	1,900	1,900	1,900	1,900	1,900	1,875
Saugus Formation (New Wells)[c]	1,475	4,950	4,950	4,950	4,950	4,950	4,950	4,975
Recycled Water[d]	370	1,020	1,960	2,920	3,850	5,170	6,480	7,870
Total Existing and Planned Supplies	***24,590***	***30,690***	***32,130***	***34,090***	***35,520***	***37,340***	***39,150***	***41,040***
SWP West Branch Storage Available								
SWP Flexible Storage Accounts[f]	6,060	4,680	4,680	4,680	4,680	4,680	4,680	4,680
Emergency Storage								
Pyramid Lake[g]	4,370	4,370	4,370	4,370	4,370	4,370	4,370	4,370
Castaic Lake[h]	3,370	3,370	3,370	3,370	3,370	3,370	3,370	3,370
Total West Branch Storage	***13,800***	***12,420***	***12,420***	***12,420***	***12,420***	***12,420***	***12,420***	***12,420***
Total Local Supplies and West Branch Storage	**38,390**	**43,110**	**44,550**	**46,510**	**47,940**	**49,760**	**51,570**	**53,460**
Demands[i]								
Total Demand w/o Conservation	40,035	44,242	48,449	52,656	56,863	61,070	65,277	69,484
20x2020 Reduction	4,514	9,813	10,583	11,385	12,171	12,957	13,743	14,529
Reduction from Recycled Water	650	1,525	2,775	4,050	5,300	7,050	8,800	10,650
Reduction from Water Conservation	3,864	8,288	8,331	8,374	8,417	8,460	8,503	8,546
Total Demand w/ Conservation	**36,172**	**35,954**	**40,118**	**44,282**	**48,447**	**52,611**	**56,775**	**60,939**
Additional Conservation Required[j]	0	0	0	0	507	2,851	5,205	7,479
Additional Conservation as Percent of Demand[k]	0%	0%	0%	0%	1%	5%	8%	11%

Notes:
(a) Assumes complete disruption in SWP supplies and in deliveries through the California Aqueduct for six months.
(b) Pumping from the Alluvial Aquifer is assumed to be one-half of the average normal year supplies (see Table 6-2).
(c) Pumping from the Saugus Formation is assumed to be one-half of the single-dry year supplies (see Table 6-3).
(d) Recycled water supply is based on one-half of projected use.
(e) Assumes 25% reduction in waste discharge, and therefore in recycled water availability, due to additional voluntary conservation.
(f) Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with the Ventura County entities expires after 2015.
(g) CLWA's share of usable storage at Pyramid Lake, based on its 2.817% proportionate share of capital cost repayment of the reservoir, and assumed usable storage of 155,100 AF.
(h) CLWA's share of usable storage at Castaic Lake, based on its 2.927% proportionate share of capital cost repayment of the reservoir, and assumed usable storage of 115,100 AF.
(i) All demand data are assumed to be one-half of average/normal year Regional Summary demands from Table 2-22.
(j) Additional Conservation Required is difference between Total Demand w/ Conservation and Total Local Supplies and West Branch Storage. A portion or all of this could be met with the acquisition of emergency storage (see Section 8.5.3).
(k) Expressed as percent of Total Demand w/o Conservation.

8.5.3 Recommendations for Emergency Storage

The various outage scenarios described in Section 8.5.2 highlight the benefit of CLWA having water stored in multiple banking programs south of the Delta. Banking programs located in Kern County, which have access to the California Aqueduct, are ideally suited to meet at least part of CLWA's emergency needs. The worst-case scenario described above (a complete disruption on the West Branch of the aqueduct) demonstrates the desirability that CLWA also has water stored in at least one water banking program geographically located south of the Tehachapi Mountains.

Storage located south of the Tehachapi Mountains may necessitate an exchange agreement with another West Branch contractor so that the contractor could be served from CLWA's banked water, and CLWA could be served by a portion of the contractor's water in Pyramid or Castaic Lake (this worst case scenario also assumes that CLWA has access to its full Flexible Storage Account in Castaic Lake, in addition to emergency storage).

The most likely and utilizable arrangement would be with the Metropolitan Water District, which retains a significant portion of the storage capacity in Castaic Lake. CLWA could store varying amounts of its water in groundwater storage or banking programs within or adjacent to Metropolitan's service area. In the event of an outage or other emergency, Metropolitan would serve its customers with CLWA's stored water and CLWA would serve its customers with a like amount of Metropolitan's water in Castaic Lake. Amounts of storage required and locations of potential banking programs are as follows:

- Emergency outage storage capacity: 5,000 AF of storage capacity in 2010, increasing to approximately 14,000 AF by 2050.
- Emergency pumpback capacity: approximately 1,000 AF per month of pumpback capacity in 2010, increasing to 2,300 AF per month by 2050.

Potential banking programs, where CLWA could be served by a portion of the contractor's water in Pyramid or Castaic Lake for a potential exchange of emergency outage storage include the following locations:

- **Semitropic-Rosamond Water Bank Authority**
  - This project is located in eastern Kern County, in the northern portion of the Antelope Valley. It is adjacent to both the East Branch of the California Aqueduct and the Los Angeles Aqueduct. This program is active and is seeking participants.
- **Antelope Valley-East Kern Water Agency Water Supply Stabilization Program and Groundwater Recharge Project**
  - This is a project proposed by the Antelope Valley-East Kern Water Agency (AVEK), a SWP wholesaler located in the Antelope Valley area of southeastern Kern County and northern Los Angeles County. The project is adjacent to the East Branch of the California Aqueduct. AVEK is conducting the environmental analysis for the proposed project.
- **Calleguas Municipal Water District Las Posas Groundwater Recharge Project**
  - This project is an in-lieu and Aquifer Storage and Recovery project located in central Ventura County, within the service area of Metropolitan. CLWA could purchase or store water in the program and in the event of an emergency outage, would

exchange the water for use in Metropolitan's service area. CLWA would then utilize a like amount of Metropolitan's water stored in Castaic Lake. This is a conceptual project.

8.5.4 Regional Power Outage Scenarios

For a major emergency such as an earthquake, Southern California Edison (Edison) has declared that in the event of an outage, power would be restored within a 24 hour period. Following the Northridge earthquake, Edison was able to restore power within 19 hours. Edison experienced extensive damage to several key power stations, yet was still able to recover within a 24-hour timeframe.

8.5.4.1 CLWA

To specifically address the concern of water outages due to loss of power, CLWA has equipped its two treatment plants with generators to produce power for treating water to comply with the California Safe Drinking Water Act and the Health and Safety Code. The Rio Vista Water Treatment Plant and Intake Pump Station emergency generator system provides electrical power to treat 30 MGD for 72 hours without fuel replacement. The Earl Schmidt Filtration Plant emergency generator system provides electrical power to treat 33 MGD for 72 hours without fuel replacement.

8.5.4.2 SCWD

SCWD has prepared emergency operations procedures for the effective use of resources during various emergency situations. Emergency situations include but are not limited to earthquakes, major fire emergencies, water outages due to loss of power, localized flooding, water contamination and acts of sabotage.

To specifically address the concerns of water outages due to loss of power, SCWD has purchased and maintains five mobile generators and has the ability to obtain emergency access to others. The current generators are trailer mounted and have the capability of supplying up to 450 Kilovolt-Amperes (KVA). This capacity provides the capability to run any facility within its service area. Most primary pumping facilities are equipped with emergency transfer switches and SCWD employees are trained regularly to install and operate the generators. The generator's run time is only limited by the amount of available diesel fuel.

SCWD has an above-ground diesel fuel storage tank with a capacity of 1,000 gallons located at its warehouse in the City of Santa Clarita. SCWD also has the assistance of a commercial fuel supplier when needed. SCWD maintains a trailer-mounted 100-gallon diesel tank that will be deployed as required to preserve services. SCWD would respond to power outages on a prioritized basis and would continue its response to the power emergency as long as necessary. In addition to the generators, SCWD has a gas driven pump capable of delivering a maximum 2,000 gpm. This pump can be installed at select facilities and run as required.

8.5.4.3 NCWD

NCWD has procedures for earthquakes, major fire emergencies, water outages due to loss of power, localized flooding, water contamination and acts of sabotage. To specifically address the concerns of water outages due to loss of power, NCWD has purchased and maintains three

mobile generators. The generators are trailer mounted and have the following capacities: 600 KVA; 300 KVA; and 180 KVA.

These capacities provide the capability to run any facility within NCWD's service area. All primary pumping facilities are equipped with emergency transfer switches, and NCWD employees are trained regularly to maximize the speed to install and operate the generators. The generator run time is only limited by the amount of available diesel fuel.

NCWD has an above ground diesel fuel storage tank with a capacity of 1,000 gallons located at its main office in the City of Santa Clarita. Multiple crew trucks are equipped with 100 gallon diesel tanks and the necessary fueling equipment to refill the generators. NCWD would respond to power outages on a prioritized basis and would continue its response to the power emergency as long as necessary. In addition to the generators, NCWD has one gas driven pump and one diesel driven pump capable of delivering 600 gpm and 1,200 gpm, respectively. All NCWD pumping facilities have been equipped with the necessary appurtenances to quickly connect the portable pumps to restore pumping operations.

8.5.4.4 VWC

In the event that a power outage occurs, VWC has two mobile generators capable of powering any of VWC's wells, turnouts or booster stations. VWC would use the generators as back-up to ensure water service remained until Edison was able to restore power. Besides the significant fuel storage capacity of each generator, VWC has access multiple sources for fuel as needed. For regional power outages, VWC would rely on Edison's reliability criteria for restoring service with the longest outage assumed not to exceed 24 hours. This length of outage would not have a significant impact on water service.

8.6 Mandatory Prohibitions During Shortages

All Valley residents live within the boundaries of the City of Santa Clarita or Los Angeles County. Several ordinances were passed in 1991, during the last long-term drought, by the various governmental entities in the Santa Clarita Valley outlawing wasteful water practices. It is expected that, if the Valley experienced another dry-year period, the same ordinances passed in 1991 would be reactivated, as follows:

- On February 14, 1991, the NCWD Board of Directors adopted Resolution No. 101 outlawing wasteful water practices. The ordinance was amended on October 15, 1991, with the adoption of Ordinance No. 102, and further amended on July 14, 2005, with the adoption of Ordinance No. 112.

- On March 13, 1991, the City of Santa Clarita adopted Ordinance No. 91-16 outlawing wasteful water practices and calling for voluntary water conservation. The ordinance was amended on October 8, 1991 by the adoption of Ordinance No. 91-48.

- On March 21, 1991, the Los Angeles County Board of Supervisors adopted Ordinance No. 91-0046U, which prohibits wasteful water practices. The Water Conservation Requirements (Ordinance No. 2008-00052U) was amended by the Los Angeles County Board of Supervisors on October 7, 2008.

Most of the ordinances mentioned above had sunset provisions that were effective January 1, 1992; however, these ordinances could be reinstituted as needed. During more recent conditions of limited supply, in 2008, CLWA adopted Resolution No. 2605 mandating a voluntary program of water conservation in the Santa Clarita Valley.

8.7 Consumptive Reduction Methods During Restrictions

8.7.1 Supply Shortage Triggering Levels

The Santa Clarita Valley water suppliers will manage water supplies to minimize the social and economic impact of water shortages. The supply shortage strategy is designed to provide a minimum 50 percent of normal supply during a severe or extended water shortage.

Demand reduction stages may be triggered by a shortage in any one of the water sources in the Valley or by shortages in a combination of supplies. The guidelines for triggering the stages are listed in Table 8-5. However, circumstances may arise where the purveyors may deviate from these guidelines, such as in a case where the Governor declares a water shortage emergency and/or institutes a statewide rationing program.

TABLE 8-5
WATER DEFICIENCY TRIGGERING LEVELS

Stage	Percent Shortage
1	Up to 15% water deficiency
2	15 to 25% water deficiency
3	25 to 35% water deficiency
4	35 to 50+% water deficiency

8.7.2 Consumption Limits

The Valley-wide consumption allocation method for each customer type is as follows:

- Single Family Hybrid of Per-capita and Percentage Reduction
- Multi Family Hybrid of Per-capita and Percentage Reduction
- Commercial Percentage Reduction
- Industrial Percentage Reduction
- Governmental Percentage Reduction
- Recreational Percentage Reduction
- Irrigation Percentage Reduction

The percentage reductions at each stage and for each customer type correspond to the figures listed in Table 8-5. In a drought situation (multiple-dry year period), individual customer allotments will be based on a normal year consumption table. The water purveyors will classify each customer and calculate each customer's allotment according to Table 8-5. Each customer will be notified of its classification and allotment by mail before the implementation of a mandatory program. New customers and connections will be notified at the time service

commences if a mandatory program is in effect. Any customer may appeal its classification on the basis of use or the allotment on the basis of incorrect calculation.

In a disaster, prior notice of allotment may not be possible. Notice will be provided by the most efficient means available, if necessary, through the terms of the water suppliers' emergency response plans.

8.7.3 New Demand

During any declared water shortage emergency requiring mandatory rationing, CLWA and the retail purveyors recommend that the City and County building departments continue to process applications for grading and building permits, but not issue the actual permits until mandatory rationing is rescinded. In Stages 3 and 4, it may be necessary to discontinue all use of grading water, even if permits have been issued, and consider banning all use of water for non-essential uses, such as new landscaping and pools.

8.8 Penalties for Excessive Use

The following section provides a summary of the penalties, if any, that are implemented for excessive water use for SCWD, NCWD and VWC.

8.8.1 SCWD

In September 2009, the CLWA Board of Directors adopted Resolution No. 2678 establishing retail water rates that encourage the responsible use of water resources. These rates took effect January 1, 2010. For single family residential customers, SCWD implemented a three tiered rate structure allowing every customer the choice to use water efficiently or pay a premium. Excessive water use results in higher cost per unit of water. Irrigation customers have a separate uniform water rate comparable to the highest Tier 3 (conservation) rate for the single family. All other customers have a uniform flat rate equal to the Tier 2 rate for the single family.

This rate structure is designed to minimize water waste; other than the rate structure, there are no excessive use penalties in place.

8.8.2 NCWD

In July 2005, NCWD's Board of Directors adopted Ordinance No. 112, which addresses water conservation, shortage, drought and emergency response procedures. NCWD's Water Conservation Action Plan states that no water user shall waste water or make, cause or permit the use of water for any purpose contrary to any provision of Ordinance No. 112, or in quantities in excess of the use permitted by the conservation stage in effect. If excessive use (water leaks and/or waste) is detected from any water user, the following enforcement plan will be followed:

- **Efficient Water Use and Stage 1 Enforcement:**
  - Any sign of water leaks and/or waste will be documented.
  - NCWD will then determine the appropriate level of action to inform the water user of the guidelines in Ordinance No. 112 and will encourage more efficient water use.

- **Stages 2, 3, and 4 Enforcement:**
  - First Violation: NCWD shall issue a verbal warning to the water user and recommend corrective action.
  - Second Violation: NCWD shall issue a written warning to the water user, and a fine of $40 shall be added to the water user's bill if the corrective action is not taken within 30 days after receiving the written warning.
  - Third Violation: A fine of $100 shall be added to the water user's bill if the corrective action is not taken within 30 days after receiving the written warning. In addition, the NCWD Board or General Manager may require installation of a flow-restricting device on the water user's service connection.
  - Fourth Violation: For the fourth and any additional violations, a fine of $250 shall be added to the water user's bill at the property where the violation occurred. NCWD may also discontinue the water user's water service at the property where the violation occurred. Reconnection shall be permitted only when there is reasonable protection against future violations, such as a flow-restricting device on the customer's service connection, as determined at NCWD's discretion.

- **NCWD Enforcement Costs:**
  - NCWD shall be reimbursed for its costs and expenses in enforcing the provisions of Ordinance No. 112, including costs incurred for staff to investigate and monitor the water user's compliance with the terms of the Ordinance. Charges for installation of flow-restricting devices or for discontinuing or restoring water service, as NCWD incurs those charges, shall be added to the water user's bill at the property where the enforcement costs were incurred.

8.8.3 VWC

VWC is regulated by the PUC. During times of threatened or actual water shortage, the PUC will require that VWC apportion its available water supply among its customers. In the absence of direction from the PUC, VWC will apportion the supply in the manner that appears most equitable under circumstances then prevailing and with the cooperation of the Valley water purveyors with due regard to public health and safety.

The PUC's methodology for water utilities to implement Water Conservation Plans is documented in Standard Practice U-40-W, "Instructions for Water Conservation, Rationing, and Service Connection Moratoria." Water shortage contingency plans must be approved by the PUC prior to implementation by VWC. As stated in the Standard Practice U-40-W, the PUC shall authorize mandatory conservation and rationing by approving Schedule No. 14.1, Mandatory Water Conservation and Rationing. Schedule No. 14.1 sets forth water use violation fines, charges for removal of flow restrictors, and the period during which mandatory conservation and rationing measures will be in effect.

8.9 Financial Impacts of Actions During Shortages

The following section addresses the financial impacts of actions during water shortages for SCWD, NCWD and VWC.

8.9.1 SCWD

SCWD's rates were developed to meet the cost of service. The retail water bill includes two components: a meter service charge and a commodity charge. For the FY 2010/11 Budget, the meter service charge accounts for 31 percent of SCWD's revenues and the commodity charge accounts for 69 percent of SCWD's revenues. The meter service charge is fixed and is based on the meter size. The commodity charge is variable and includes the cost for water consumption and pass-through charges for purchased water and electricity for pumping. Variable costs increase or decrease in direct proportion with the increase or decrease of water used by customers. Customers who use more water will pay a proportionately higher percentage of these costs.

Approximately 44 percent of SCWD's expenses are variable and will be reduced proportionately with any reduction of sales. Since 69 percent of SCWD's revenues are estimated to come from the commodity charges, a supply reduction of 25 percent or more would affect the financial stability of SCWD and impact its ability to meet payment obligations. A Rate Stabilization Fund was established in January 2004 and is to be funded over a ten year period. This fund is to be used when there are variations in water sales resulting from unusual seasons, major consumption reduction due to voluntary or mandatory conservation or to correct for a net loss of revenues in the event of a catastrophic loss of imported water supplies. The Rate Stabilization Fund is used to defer rate increases due to temporary reductions in water sales. Currently the Rate Stabilization Fund is set at 2 percent of annual revenues.

8.9.2 NCWD

NCWD's rates are designed with the intent that NCWD will generate adequate revenues to meet the costs of operating the water system. For FY 2010/11, it is expected that 28 percent of NCWD's total water revenues will come from the service charge and about 72 percent of the total revenues will come from the commodity charge. The service charge is based on meter size and the commodity charge is based on the quantity of water consumed.

The nature of NCWD's operation (as with any water utility) is that the majority of the operating costs are fixed in nature and do not increase or decrease in direct proportion with increases or decreases in water use by customers. For NCWD, fixed costs constitute about 57 percent of its total operating costs in a normal year. If water availability issues or shortages cause NCWD to request a voluntary reduction in the customer's water use, 57 percent of the operating costs will remain the same even though less water is sold. This would result in a substantial revenue shortfall.

In an effort to address this shortfall, NCWD established a reserve policy (Resolution 2009-10) that includes a "rate stabilization" fund to be used in situations where actual consumption of water is reduced as a direct result of a water shortage situation as defined in Table 8-1 of this Plan.

In the event of a declaration of a water shortage situation, NCWD's Board of Directors will consider options and actions intended to replenish the rate stabilization reserve to its ideal level. These actions may include but are not limited to rate increases or surcharges, per customer assessments and utilization of other reserve funds.

8.9.3 VWC

The PUC allows the investor owned water utilities it regulates to track and seek recovery of lost revenues and expense increases due to mandatory or voluntary water rationing during a drought. PUC regulated utilities' rates are set based on an assumed level of customer water usage during normal weather conditions. Therefore, when a drought occurs and customers conserve water, a utility's revenue declines and it is difficult for the utility to fully fund its operating expenses. In order to provide an incentive for utilities to promote water conservation during periods of drought, the PUC developed a mechanism whereby utilities can track lost revenues, net of reduced water production costs, as well as increases in expenses due to drought conditions. Utilities can then recover a portion of their lost revenues and expense increases via a surcharge to customers. This reduces the financial strain conservation programs place on investor owned utilities while furthering the statewide goal of water conservation during periods of drought.

8.10 Water Shortage Contingency Resolution

If a water shortage crisis reoccurs, such as the 1987-1992 drought, the Santa Clarita Valley water suppliers would call a public hearing to declare a water shortage pursuant to Sections 351 and 352 of the California Water Code.

The Los Angeles County Board of Supervisors (on behalf of LACWWD 36) and NCWD's and CLWA's (including SCWD) respective Boards of Directors would adopt ordinances, similar to those adopted in 1991, implementing the Water Shortage Contingency Plan. In February 1991 the CLWA Board of Directors adopted Resolution No. 804, which recognized reductions in requested delivery of SWP supply and mandated water conservation in the Valley.

VWC would file an advice letter with the CPUC implementing the Water Shortage Contingency Plan. The Water Shortage Contingency would become VWC's Schedule 14.1.

8.11 Mechanism to Determine Reductions in Water Use

8.11.1 Demand

NCWD, SCWD, and VWC bill their customers on a monthly basis. The prior year's consumption is included on most customer bills. This allows comparison of the total consumption from each billing period to the same billing period from the prior year.

8.11.2 Production

Under normal conditions, CLWA, NCWD, SCWD, and VWC prepare monthly production reports, which are reviewed and compared to production reports and pumping statistics from the same period of the prior year. Under water shortage conditions, these production reports could be prepared as often as daily.

8.11.3 Stage 1 and 2 Water Shortages

During Stages 1 and 2 Water Shortages, retail purveyors would review selected production reports on a daily basis, and CLWA would provide each retail purveyor with a copy of its daily

production report. The water suppliers would meet as frequent a basis as necessary to review water supply and demand in the Valley. Billing reports would be reviewed to identify users who are not abiding by the plan.

8.11.4 Stage 3 and 4 Water Shortages

During Stages 3 and 4 Water Shortages, the retail purveyors would review all production reports and pumping statistics on a daily basis. The water suppliers would continue to monitor the supply and demand in the Valley. Water transfers and agreements to use each other's distribution facilities would be implemented as needed. Billing reports would be reviewed to identify users who are not abiding by the plan.

8.11.5 Disaster Shortage

During a disaster shortage, the Santa Clarita Valley water suppliers would continually monitor production figures, and will work to transfer water and use each other's distribution facilities where feasible.

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Appendix A

DWR Checklist

APPENDIX A
Urban Water Management Plan Checklist (Organized by Legislation)

No.	UWMP requirement [a]	Calif. Water Code Reference	UWMP Location by Retail Purveyor			
			Castaic Lake Water Agency	Newhall County Water District	CLWA Santa Clarita Water Division	Valencia Water Company
1	Provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.	10608.20(e)	NA, Wholesale District	2.6.2, Tables 2-15 & 2-16, pgs 2-18 & 2-19	2.6.2, Tables 2-17 & 2-18, pg 2-19	2.6.2, Tables 2-19 & 2-20, pg 2-20
2	*Wholesalers:* Include an assessment of present and proposed future measures, programs, and policies to help achieve the water use reductions. *Retailers:* Conduct at least one public hearing that includes general discussion of the urban retail water supplier's implementation plan for complying with the Water Conservation Bill of 2009.	10608.36 10608.26(a)	7.2, 7.3	1.3.3, Table 1-2, 7.6.3, pgs 1-6 to 1-8 & 7-32 to 7-34	1.3.3, Table 1-2, 7.4.3, pgs 1-6 to 1-8 & 7-11 to 7-14	1.3.3, Table 1-2, 7.5.3, pgs 1-6 to 1-8 & 7-23 to 7-26
3	Report progress in meeting urban water use targets using the standardized form.	10608.4	NA	NA	NA	NA
4	Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	10620(d)(2)	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8
5	An urban water supplier shall describe in the plan water management tools and options used by that entity that will maximize resources and minimize the need to import water from other regions.	10620(f)	1.3.4, pg 1-8	1.3.4, pg 1-8	1.3.4, pg 1-8	1.3.4, pg 1-8
6	Every urban water supplier required to prepare a plan pursuant to this part shall, at least 60 days prior to the public hearing on the plan required by Section 10642, notify any city or county within which the supplier provides water supplies that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. The urban water supplier may consult with, and obtain comments from, any city or county that receives notice pursuant to this subdivision.	10621(b)	1.3.3, Table 1-1, pgs 1-3 to 1-8, Appendix B	1.3.3, Table 1-1, pgs 1-3 to 1-8, Appendix B	1.3.3, Table 1-1, pgs 1-3 to 1-8, Appendix B	1.3.3, Table 1-1, pgs 1-3 to 1-8, Appendix B
7	The amendments to, or changes in, the plan shall be adopted and filed in the manner set forth in Article 3 (commencing with Section 10640).	10621(c)	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8	1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8
8	Describe the service area of the supplier	10631(a)	1.4.1, Fig. 1-1, pgs 1-8 to 1-11	1.4.2, Fig. 1-1, pgs 1-10 to 1-11	1.4.2, Fig. 1-1, pgs 1-10 to 1-11	1.4.2, Fig. 1-1, pgs 1-10 to 1-11
9	(Describe the service area) climate	10631(a)	1.5, Table 1-4, pgs 1-12 to 1-13	1.5, Table 1-4, pgs 1-12 to 1-13	1.5, Table 1-4, pgs 1-12 to 1-13	1.5, Table 1-4, pgs 1-12 to 1-13
10	(Describe the service area) current and projected population . . . The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier . . .	10631(a)	2.5; Tables 2-7, 2-8, & 2-9; pgs 2-9 to 2-14	2.5; Tables 2-7, 2-8, & 2-9; pgs 2-9 to 2-14	2.5; Tables 2-7, 2-8, & 2-9; pgs 2-9 to 2-14	2.5; Tables 2-7, 2-8, & 2-9; pgs 2-9 to 2-14
11	. . . (population projections) shall be in five-year increments to 20 years or as far as data is available.	10631(a)	Table 2-9, pg 2-13	Table 2-9, pg 2-13	Table 2-9, pg 2-13	Table 2-9, pg 2-13
12	Describe . . . other demographic factors affecting the supplier's water management planning	10631(a)	2.2, pgs 2-1 to 2-2	2.2, pgs 2-1 to 2-2	2.2, pgs 2-1 to 2-2	2.2, pgs 2-1 to 2-2

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No.	UWMP requirement [a]	Calif. Water Code Reference	UWMP Location by Retail Purveyor			
			Castaic Lake Water Agency	Newhall County Water District	CLWA Santa Clarita Water Division	Valencia Water Company
13	Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments described in subdivision (a).	10631(b)	Table 3-1, pg 3-2	Table 3-1, pg 3-2	Table 3-1, pg 3-2	Table 3-1, pg 3-2
14	(Is) groundwater . . . identified as an existing or planned source of water available to the supplier . . .?	10631(b)	□3.3, pgs 3-15 to 3-37	□3.3, pgs 3-15 to 3-37	□3.3, pgs 3-15 to 3-37	□3.3, pgs 3-15 to 3-37
15	(Provide a) copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management. Indicate whether a groundwater management plan been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	10631(b)(1)	Appendix G, □3.3.2, pg 3-15	Appendix G, □3.3.2, pg 3-15	Appendix G, □3.3.2, pg 3-15	Appendix G, □3.3.2, pg 3-15
16	(Provide a) description of any groundwater basin or basins from which the urban water supplier pumps groundwater.	10631(b)(2)	□□3.3.1 & 3.3.2, Fig. 3-1, pgs 3-15 to 3-33	□□3.3.1 & 3.3.2, Fig. 3-1, pgs 3-15 to 3-33	□□3.3.1 & 3.3.2, Fig. 3-1, pgs 3-15 to 3-33	□□3.3.1 & 3.3.2, Fig. 3-1, pgs 3-15 to 3-33
17	For those basins for which a court or the board has adjudicated the rights to pump groundwater, (provide) a copy of the order or decree adopted by the court or the board	10631(b)(2)	NA	NA	NA	NA
18	(Provide) a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree.	10631(b)(2)	NA	NA	NA	NA
19	For basins that have not been adjudicated, (provide) information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.	10631(b)(2)	□3.3.2, pgs 3-15 to 3-33	□3.3.2, pgs 3-15 to 3-33	□3.3.2, pgs 3-15 to 3-33	□3.3.2, pgs 3-15 to 3-33
20	(Provide a) detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.	10631(b)(3)	□□3.3.2.2 & 3.3.2.3; Table 3-6; pgs 3-22, 3-24 to 3-33	□□3.3.2.2 & 3.3.2.3; Table 3-6; pgs 3-22, 3-24 to 3-33	□□3.3.2.2 & 3.3.2.3; Table 3-6; pgs 3-22, 3-24 to 3-33	□□3.3.2.2 & 3.3.2.3; Table 3-6; pgs 3-22, 3-24 to 3-33
21	(Provide a) detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.	10631(b)(4)	□3.3.2; Tables 3-5 & 3-7; pgs 3-15 to 3-33	□3.3.2; Tables 3-5 & 3-7; pgs 3-15 to 3-33	□3.3.2; Tables 3-5 & 3-7; pgs 3-15 to 3-33	□3.3.2; Tables 3-5 & 3-7; pgs 3-15 to 3-33
22	Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following: (A) An average water year, (B) A single dry water year, (C) Multiple dry water years.	10631(c)(1)	□□3.2.1.1.3, 3.2.1.2; pgs 3-5 to 3-9, □□3.3.2.2, 3.3.2.3, 6.4.1, 6.4.2, 6.4.3; pgs 3-24 to 3-33 & 6-6 to 6-14, Appendix C	□□3.2.1.1.3, 3.2.1.2; pgs 3-5 to 3-9, □□3.3.2.2, 3.3.2.3, 6.4.1, 6.4.2, 6.4.3; pgs 3-24 to 3-33 & 6-6 to 6-14, Appendix C	□□3.2.1.1.3, 3.2.1.2; pgs 3-5 to 3-9, □□3.3.2.2, 3.3.2.3, 6.4.1, 6.4.2, 6.4.3; pgs 3-24 to 3-33 & 6-6 to 6-14, Appendix C	□□3.2.1.1.3, 3.2.1.2; pgs 3-5 to 3-9, □□3.3.2.2, 3.3.2.3, 6.4.1, 6.4.2, 6.4.3; pgs 3-24 to 3-33 & 6-6 to 6-14, Appendix C

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No.	UWMP requirement [a]	Calif. Water Code Reference	UWMP Location by Retail Purveyor			
			Castaic Lake Water Agency	Newhall County Water District	CLWA Santa Clarita Water Division	Valencia Water Company
23	For any water source that may not be available at a consistent level of use - given specific legal, environmental, water quality, or climatic factors - describe plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.	10631(c)(2)	3.3.2.2, 3.3.2.3; pgs 3-28 to 3-29, 3-33, 5.7; pgs 5-12 to 5-13; 6.2; pgs 6-1 to 6-2	3.3.2.2, 3.3.2.3; pgs 3-28 to 3-29, 3-33, 5.7; pgs 5-12 to 5-13; 6.2; pgs 6-1 to 6-2	3.3.2.2, 3.3.2.3; pgs 3-28 to 3-29, 3-33, 5.7; pgs 5-12 to 5-13; 6.2; pgs 6-1 to 6-2	3.3.2.2, 3.3.2.3; pgs 3-28 to 3-29, 3-33, 5.7; pgs 5-12 to 5-13; 6.2; pgs 6-1 to 6-2
24	Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.	10631(d)	3.4, pgs 3-37 & 3-38	3.4, pgs 3-37 & 3-38	3.4, pgs 3-37 & 3-38	3.4, pgs 3-37 & 3-38
25	Quantify, to the extent records are available, past and current water use, and projected water use (over the same five-year increments described in subdivision (a)), identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses: (A) Single-family residential; (B) Multifamily; (C) Commercial; (D) Industrial; (E) Institutional and governmental; (F) Landscape; (G) Sales to other agencies; (H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof;(I) Agricultural.	10631(e)(1)	NA	2.4.1, Table 2-4, pg 2-6	2.4.1, Table 2-5, pg 2-7	2.4.1, Table 2-6, pg 2-8
26	(Describe and provide a schedule of implementation for) each water demand management measure that is currently being implemented, or scheduled for implementation, including the steps necessary to implement any proposed measures, including, but not limited to, all of the following: (A) Water survey programs for single-family residential and multifamily residential customers; (B) Residential plumbing retrofit; (C) System water audits, leak detection, and repair; (D) Metering with commodity rates for all new connections and retrofit of existing connections; (E) Large landscape conservation programs and incentives; (F) High-efficiency washing machine rebate programs; (G) Public information programs; (H) School education programs; (I) Conservation programs for commercial, industrial, and institutional accounts; (J) Wholesale agency programs; (K) Conservation pricing; (L) Water conservation coordinator; (M) Water waste prohibition;(N) Residential ultra-low-flush toilet replacement programs.	10631(f)(1)	7.2 & 7.3, pgs 7-2 to 7-5	7.6, pgs 7-26 to 7-34	7.4, pgs 7-6 to 7-14	7.5, pgs 7-14 to 7-26
27	A description of the methods, if any, that the supplier will use to evaluate the effectiveness of water demand management measures implemented or described under the plan.	10631(f)(3)	7.2 & 7.3, pgs 7-2 to 7-5	7.6.3, pg 7-34	7.4.3, pg 7-14	7.5.3, pg 7-26
28	An estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the supplier's ability to further reduce demand.	10631(f)(4)	7.2 & 7.3, pgs 7-2 to 7-5	7.6.3, pg 7-34	7.4.3, pg 7-14	7.5.2.3, pg 7-26
29	An evaluation of each water demand management measure listed in paragraph (1) of subdivision (f) that is not currently being implemented or scheduled for implementation. In the course of the evaluation, first consideration shall be given to water demand management measures, or combination of measures, that offer lower incremental costs than expanded or additional water supplies. This evaluation shall do all of the following: (1) Take into account economic and noneconomic factors, including environmental, social, health, customer impact, and technological factors; (2) Include a cost-benefit analysis, identifying total benefits and total costs; (3) Include a description of funding available to implement any planned water supply project that would provide water at a higher unit cost; (4) Include a description of the water supplier's legal authority to implement the measure and efforts to work with other relevant agencies to ensure the implementation of the measure and to share the cost of implementation.	10631(g)	7.2 & 7.3, pgs 7-2 to 7-5	7.6.2, pgs 7-29 to 7-32, NCWD is using GPCD approach to comply with CUWCC MOU	7.4.2, pgs 7-9 to 7-11, SCWD is using GPCD approach to comply with CUWCC MOU	7.5.2, pgs 7-18 to 7-23, VWC is using GPCD approach to comply with CUWCC MOU

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No.	UWMP requirement [a]	Calif. Water Code Reference	UWMP Location by Retail Purveyor			
			Castaic Lake Water Agency	Newhall County Water District	CLWA Santa Clarita Water Division	Valencia Water Company
30	(Describe) all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single-dry, and multiple-dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.	10631(h)	3.4, 3.5, & 3.6; pgs 3-37 to 3-41; 4.4, Table 4-3, pgs 4-8 to 4-9	3.4, 3.5, & 3.6; pgs 3-37 to 3-41; 4.4, Table 4-3, pgs 4-8 to 4-9	3.4, 3.5, & 3.6; pgs 3-37 to 3-41; 4.4, Table 4-3, pgs 4-8 to 4-9	3.4, 3.5, & 3.6; pgs 3-37 to 3-41; 4.4, Table 4-3, pgs 4-8 to 4-9
31	Describe the opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply.	10631(i)	3.7, pgs 3-41 to 3-42	3.7, pgs 3-41 to 3-42	3.7, pgs 3-41 to 3-42	3.7, pgs 3-41 to 3-42
32	Include the annual reports submitted to meet the Section 6.2 requirement (of the MOU), if a member of the CUWCC and signer of the December 10, 2008 MOU.	10631(j)	7, Appendix E	7	7	7
33	Urban water suppliers that rely upon a wholesale agency for a source of water shall provide the wholesale agency with water use projections from that agency for that source of water in five-year increments to 20 years or as far as data is available. The wholesale agency shall provide information to the urban water supplier for inclusion in the urban water supplier's plan that identifies and quantifies, to the extent practicable, the existing and planned sources of water as required by subdivision (b), available from the wholesale agency to the urban water supplier over the same five-year increments, and during various water-year types in accordance with subdivision (c). An urban water supplier may rely upon water supply information provided by the wholesale agency in fulfilling the plan informational requirements of subdivisions (b) and (c).	10631(k)	Table 3-4, pg 3-15	NA	NA	NA
34	The water use projections required by Section 10631 shall include projected water use for single-family and multifamily residential housing needed for lower income households, as defined in Section 50079.5 of the Health and Safety Code, as identified in the housing element of any city, county, or city and county in the service area of the supplier.	10631.1(a)	2.6.3.1, pg 2-23 to 2-24	2.6.3.1, Table 2-23, pgs 2-23 to 2-24	2.6.3.1, Table 2-23, pgs 2-23 to 2-24	2.6.3.1, Table 2-23, pgs 2-23 to 2-24
35	Stages of action to be undertaken by the urban water supplier in response to water supply shortages, including up to a 50 percent reduction in water supply, and an outline of specific water supply conditions which are applicable to each stage.	10632(a)	8.3, Table 8-1, pgs 8-1 to 8-3	8.3, Table 8-1, pgs 8-1 to 8-3	8.3, Table 8-1, pgs 8-1 to 8-3	8.3, Table 8-1, pgs 8-1 to 8-3
36	Provide an estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency's water supply.	10632(b)	8.4, Table 8-3, pg 8-3	8.4, Table 8-3, pg 8-3	8.4, Table 8-3, pg 8-3	8.4, Table 8-3, pg 8-3
37	(Identify) actions to be undertaken by the urban water supplier to prepare for, and implement during, a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.	10632(c)	8.5, pgs 8-4 to 8-12	8.5, pgs 8-4 to 8-12	8.5, pgs 8-4 to 8-12	8.5, pgs 8-4 to 8-12
38	(Identify) additional, mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning.	10632(d)	8.6, pg 8-12	8.6, pg 8-12	8.6, pg 8-12	8.6, pg 8-12
39	(Specify) consumption reduction methods in the most restrictive stages. Each urban water supplier may use any type of consumption reduction methods in its water shortage contingency analysis that would reduce water use, are appropriate for its area, and have the ability to achieve a water use reduction consistent with up to a 50 percent reduction in water supply.	10632(e)	8.7, pgs 8-13 to 8-14	8.7, pgs 8-13 to 8-14	8.7, pgs 8-13 to 8-14	8.7, pgs 8-13 to 8-14

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No.	UWMP requirement [a]	Calif. Water Code Reference	UWMP Location by Retail Purveyor			
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40	(Indicated) penalties or charges for excessive use, where applicable.	10632(f)	8.8.1, pg 8-14	8.8.2, pgs 8-14 to 8-15	8.8.1, pg 8-14	8.8.3, pg 8-15
41	An analysis of the impacts of each of the actions and conditions described in subdivisions (a) to (f), inclusive, on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts, such as the development of reserves and rate adjustments.	10632(g)	Appendix F	8.9.2, pg 8-16	8.9.1, pg 8-15 to 8-16	8.9.3, pg 8-16
42	(Provide) a draft water shortage contingency resolution or ordinance.	10632(h)	Appendix F	Appendix F	Appendix F	Appendix F
43	(Indicate) a mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis.	10632(i)	8.11, pgs 8-17 to 8-18	8.11, pgs 8-17 to 8-18	8.11, pgs 8-17 to 8-18	8.11, pgs 8-17 to 8-18
44	Provide, to the extent available, information on recycled water and its potential for use as a water source in the service area of the urban water supplier. The preparation of the plan shall be coordinated with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area	10633	4.4, Table 4-3, pgs 4-8 to 4-9	4.4, Table 4-3, pgs 4-8 to 4-9	4.4, Table 4-3, pgs 4-8 to 4-9	4.4, Table 4-3, pgs 4-8 to 4-9
45	(Describe) the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.	10633(a)	4.2, pgs 4-4 to 4-5	4.2, pgs 4-4 to 4-5	4.2, pgs 4-4 to 4-5	4.2, pgs 4-4 to 4-5
46	(Describe) the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	10633(b)	4.2, Table 4-3, pgs 4-4 to 4-5 and 4-9	4.2, Table 4-3, pgs 4-4 to 4-5 and 4-9	4.2, Table 4-3, pgs 4-4 to 4-5 and 4-9	4.2, Table 4-3, pgs 4-4 to 4-5 and 4-9
47	(Describe) the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.	10633(c)	4.2 and 4.7, pgs 4-4 to 4-5 & 4-13	4.2 and 4.7, pgs 4-4 to 4-5 & 4-13	4.2 and 4.7, pgs 4-4 to 4-5 & 4-13	4.2 and 4.7, pgs 4-4 to 4-5 & 4-13
48	(Describe and quantify) the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.	10633(d)	4.6, pg 4-12	4.6, pg 4-12	4.6, pg 4-12	4.6, pg 4-12
49	(Describe) The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected pursuant to this subdivision.	10633(e)	4.4 & 4.7, Table 4-3, pgs 4-8 to 4-11 & 4-13	4.4 & 4.7, Table 4-3, pgs 4-8 to 4-11 & 4-13	4.4 & 4.7, Table 4-3, pgs 4-8 to 4-11 & 4-13	4.4 & 4.7, Table 4-3, pgs 4-8 to 4-11 & 4-13
50	(Describe the) actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.	10633(f)	4.8, pg 4-13	4.8, pg 4-13	4.8, pg 4-13	4.8, pg 4-13
51	(Provide a) plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.	10633(g)	4.4.1, pgs 4-11 to 4-12, 4.9, pgs 4-13 to 4-14, 4.10, pgs 4-15 to 4-19	4.4.1, pgs 4-11 to 4-12, 4.9, pgs 4-13 to 4-14, 4.10, pgs 4-15 to 4-19	4.4.1, pgs 4-11 to 4-12, 4.9, pgs 4-13 to 4-14, 4.10, pgs 4-15 to 4-19	4.4.1, pgs 4-11 to 4-12, 4.9, pgs 4-13 to 4-14, 4.10, pgs 4-15 to 4-19
52	The plan shall include information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments as described in subdivision (a) of Section 10631, and the manner in which water quality affects water management strategies and supply reliability.	10634	5.7, Table 5-2, pg 5-12-13, Appendix I	5.7, Table 5-2, pg 5-12-13, Appendix I	5.7, Table 5-2, pg 5-12-13, Appendix I	5.7, Table 5-2, pg 5-12-13, Appendix I

APPENDIX A
Urban Water Management Plan Checklist (Organized by Legislation)

No.	UWMP requirement [a]	Calif. Water Code Reference	UWMP Location by Retail Purveyor			
			Castaic Lake Water Agency	Newhall County Water District	CLWA Santa Clarita Water Division	Valencia Water Company
53	Every urban water supplier shall include, as part of its urban water management plan, an assessment of the reliability of its water service to its customers during normal, dry, and multiple dry water years. This water supply and demand assessment shall compare the total water supply sources available to the water supplier with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years. The water service reliability assessment shall be based upon the information compiled pursuant to Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.	10635(a)	6.4, Tables 6-2 to 6-4, pgs 6-6 to 6-15, Appendix C	6.4, Tables 6-2 to 6-4, pgs 6-6 to 6-15, Appendix C	6.4, Tables 6-2 to 6-4, pgs 6-6 to 6-15, Appendix C	6.4, Tables 6-2 to 6-4, pgs 6-6 to 6-15, Appendix C
54	The urban water supplier shall provide that portion of its urban water management plan prepared pursuant to this article to any city or county within which it provides water supplies no later than 60 days after the submission of its urban water management plan.	10635(b)	1.3.3, pgs 1-6 to 1-8, Appendix B	1.3.3, pgs 1-6 to 1-8, Appendix B	1.3.3, pgs 1-6 to 1-8, Appendix B	1.3.3, pgs 1-6 to 1-8, Appendix B
55	Each urban water supplier shall encourage the active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan.	10642	1.3.1 &1.3.3, Table 1-2, pgs 1-3 to 1-8	1.3.1 &1.3.3, Table 1-2, pgs 1-3 to 1-8	1.3.1 &1.3.3, Table 1-2, pgs 1-3 to 1-8	1.3.1 &1.3.3, Table 1-2, pgs 1-3 to 1-8
56	Prior to adopting a plan, the urban water supplier shall make the plan available for public inspection and shall hold a public hearing thereon. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned water supplier pursuant to Section 6066 of the Government Code. The urban water supplier shall provide notice of the time and place of hearing to any city or county within which the supplier provides water supplies. A privately owned water supplier shall provide an equivalent notice within its service area.	10642	1.3.1 & 1.3.3, Table 1-2, pgs 1-3 to 1-8, Appendix B	1.3.1 & 1.3.3, Table 1-2, pgs 1-3 to 1-8, Appendix B	1.3.1 & 1.3.3, Table 1-2, pgs 1-3 to 1-8, Appendix B	1.3.1 & 1.3.3, Table 1-2, pgs 1-3 to 1-8, Appendix B
57	After the hearing, the plan shall be adopted as prepared or as modified after the hearing.	10642	1.3.2, Table 1-2, pgs 1-6 to 1-7	1.3.2, Table 1-2, pgs 1-6 to 1-7	1.3.2, Table 1-2, pgs 1-6 to 1-7	1.3.2, Table 1-2, pgs 1-6 to 1-7
58	An urban water supplier shall implement its plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan.	10643	1.3, pgs 1-3 to 1-8	1.3, pgs 1-3 to 1-8	1.3, pgs 1-3 to 1-8	1.3, pgs 1-3 to 1-8
59	An urban water supplier shall submit to the department, the California State Library, and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. Copies of amendments or changes to the plans shall be submitted to the department, the California State Library, and any city or county within which the supplier provides water supplies within 30 days after adoption.	10644(a)	Table 1-2, pg 1-7	Table 1-2, pg 1-7	Table 1-2, pg 1-7	Table 1-2, pg 1-7
60	Not later than 30 days after filing a copy of its plan with the department, the urban water supplier and the department shall make the plan available for public review during normal business hours.	10645	1.3.3, pgs 1-6 to 1-8	1.3.3, pgs 1-6 to 1-8	1.3.3, pgs 1-6 to 1-8	1.3.3, pgs 1-6 to 1-8

Appendix B

Public Outreach Materials

Public Outreach Record

2010 Santa Clarita Valley Urban Water Management Plan

Master List for 2010 SCV UWMP Notification of Workshops and Draft Availability

Jarrod Degonia Assemblymember Cameron Smyth 23734 Valencia Blvd. #303 Santa Clarita, CA 91355	Ernie Villegas Assemblymember Jeff Gorell 2659 Townsgate Road, Suite 236 Westlake Village, CA 91361
Dana Nielsen Assemblymember Audra Strickland 2659 Townsgate Road, Suite 236 Westlake Village, CA 91361	Kevin Korenthal Associated Builders & Contractors of CA; ABC-CCC 28005 Smyth Dr., Suite 129 Valencia, CA 91355
Holly Schroeder BIA - Los Angeles/Ventura Chapter 28480 Avenue Stanford, Suite 240 Santa Clarita, CA 91355	Sandy Sanchez BIA - Los Angeles/Ventura Chapter 28481 Avenue Stanford, Suite 240 Santa Clarita, CA 91355
David Inouye CA Department of Water Resources 770 Fairmont Avenue, Suite 102 Glendale, CA 91203-1035	Robert Kelly Castaic Area Town Council P.O. Box 325 Castaic, CA 91310
Mike Murphy City of Santa Clarita 23920 Valencia Blvd.#300 Santa Clarita, CA 91355	Jason Smisko City of Santa Clarita 23920 Valencia Blvd.#300 Valencia, CA 91355
Bruce Fortine College of the Canyons 24153 Tossano Drive Valencia, CA 91355-2010	Bob Haueter Congressman Howard McKeon 26650 The Old Road # 203 Santa Clarita, CA 91355
Chris Stephens County of Ventura Resource Management Agency 800 South Victoria Ave Ventura, CA 93009	Ron Bottorff Friends of the Santa Clara River 660 Randy Drive Newbury Park, CA 91320-3036

Mark Pestrella LA County Department of Public Works 900 South Fremont Ave Alhambra, CA 91803	Richard Bruckner LA County Department of Regional Planning 1390 Hall of Records, 320 West Temple Street Los Angeles, CA 90012
Jessica Bunker LA County WWD P.O. Box 1460 Alhambra, CA 91802-1460	Lynn Plambeck Santa Clarita Organization for Planning the Environment - SCOPE P.O. Box 1182 Canyon Country, CA 91386-1182
Robert Fleck Santa Clarita Valley Well Owners Association 16654 Soledad Canyon Road Santa Clarita, CA 91387	Terry Kingery SCV Chamber of Commerce 27451 Tourney Road, #160 Santa Clarita, CA 91355
Ed Masterson SCV Chamber of Commerce 27451 Tourney Road, #160 Santa Clarita, CA 91355	Sierra Club Angeles Chapter 3435 Wilshire Blvd # 320 Los Angeles, CA 90010-1904
Mark Butala Southern CA Association of Governments 818 W. Seventh Street, 12th Floor Los Angeles, CA 90017	Jackie Bick State Senator George Runner 23920 Valencia Blvd. Ste. 250 Santa Clarita, CA 91355
Jackie Bick State Senator Sharon Runner 23920 Valencia Blvd. Ste. 250 Santa Clarita, CA 91355	Scott Wilk Jr. State Senator Tony Strickland 2655 First St., Suite 230 Simi Valley, CA 93065
David Perry Supervisor Michael Antonovich, 5th District 23920 Valencia Blvd. # 265 Santa Clarita, CA 91355	Rosalind Wayman Supervisor Michael Antonovich, 5th District 23920 Valencia Blvd. # 265 Valencia, CA 91355

E. Michael Solomon United Water Conservation District 106 N 8th Street Santa Paula, CA 93060		Kathy Norris Valley Industrical Association of Santa Clarita (VIA) 25709 Rye Cyn Rd #105 Santa Clarita, CA 91355
Ron Mechsner West Ranch Town Council 25876 The Old Road #213 Stevenson Ranch, CA 91381		*** Orgs shaded above will receive letter return receipt requested

May 2010 UWMP Workshop
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations

May 10, 2010

«AddressBlock»

Subject: 2010 Urban Water Management Plan

«GreetingLine»

The Santa Clarita Valley's water agencies, Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company have begun to prepare the 2010 Urban Water Management Plan (UWMP). The Urban Water Management Plan, mandated by the State of California, presents a picture of the valley's water situation through the year 2035. It describes the long-range water needs of the community and the means to supply the necessary water.

In an effort to ensure all interested parties are fully informed and involved in our process, we have scheduled the first of several community workshops as follows:

Date:	Tuesday, May 25, 2010
Time:	4:00 pm
Location:	Castaic Lake Water Agency 27234 Bouquet Canyon Road

The purpose of this kick-off workshop is to present an overview of the state requirements and outline of the contents of the 2010 Urban Water Management Plan. I encourage your participation and look forward to seeing you then. If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV UWMP

Government Affairs, Public Relations & Communication
P.O. Box 55745, Valencia, CA 91385 [818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

Santa Clarita Valley
2010 Urban Water Management Plan

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

The Signal
5-18-10

Announce the preparation of the
2010 Urban Water Management Plan

The Urban Water Management Plan. mandated by the State of California, presents a picture of the valley's water situation through the year 2035. It describes the long-range water needs of the community and the means to supply the necessary water. We encourage your input, interest and involvement.

Kick Off Community Workshop

Date: **Tuesday, May 25, 2010**

Time: **4:00 pm**

Location: **Castaic Lake Water Agency**
27234 Bouquet Canyon Road

Purpose:

This kick-off workshop will present an overview of the state requirements and provide an outline of the content of the 2010 UWMP. Our team will provide an overview of the many opportunities for public comment and will also be available for questions. We encourage public participation and input.

For more information
please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

Santa Clarita Valley
2010 Urban Water Management Plan

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

The Signal
Sunday
5-23-2010

Announce the preparation of the
2010 Urban Water Management Plan

The Urban Water Management Plan, mandated by the State of California, presents a picture of the valley's water situation through the year 2035. It describes the long-range water needs of the community and the means to supply the necessary water. We encourage your input, interest and involvement

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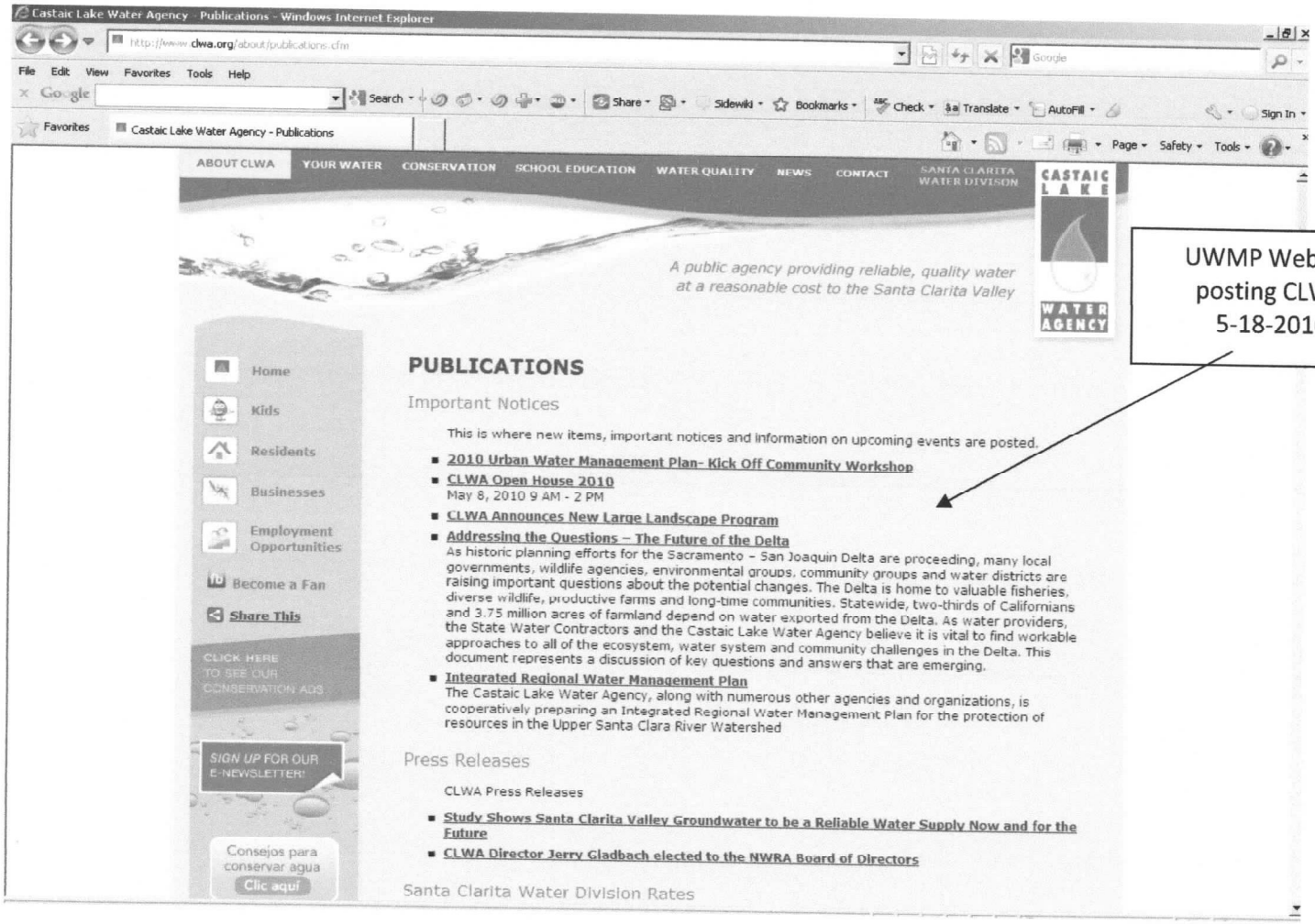
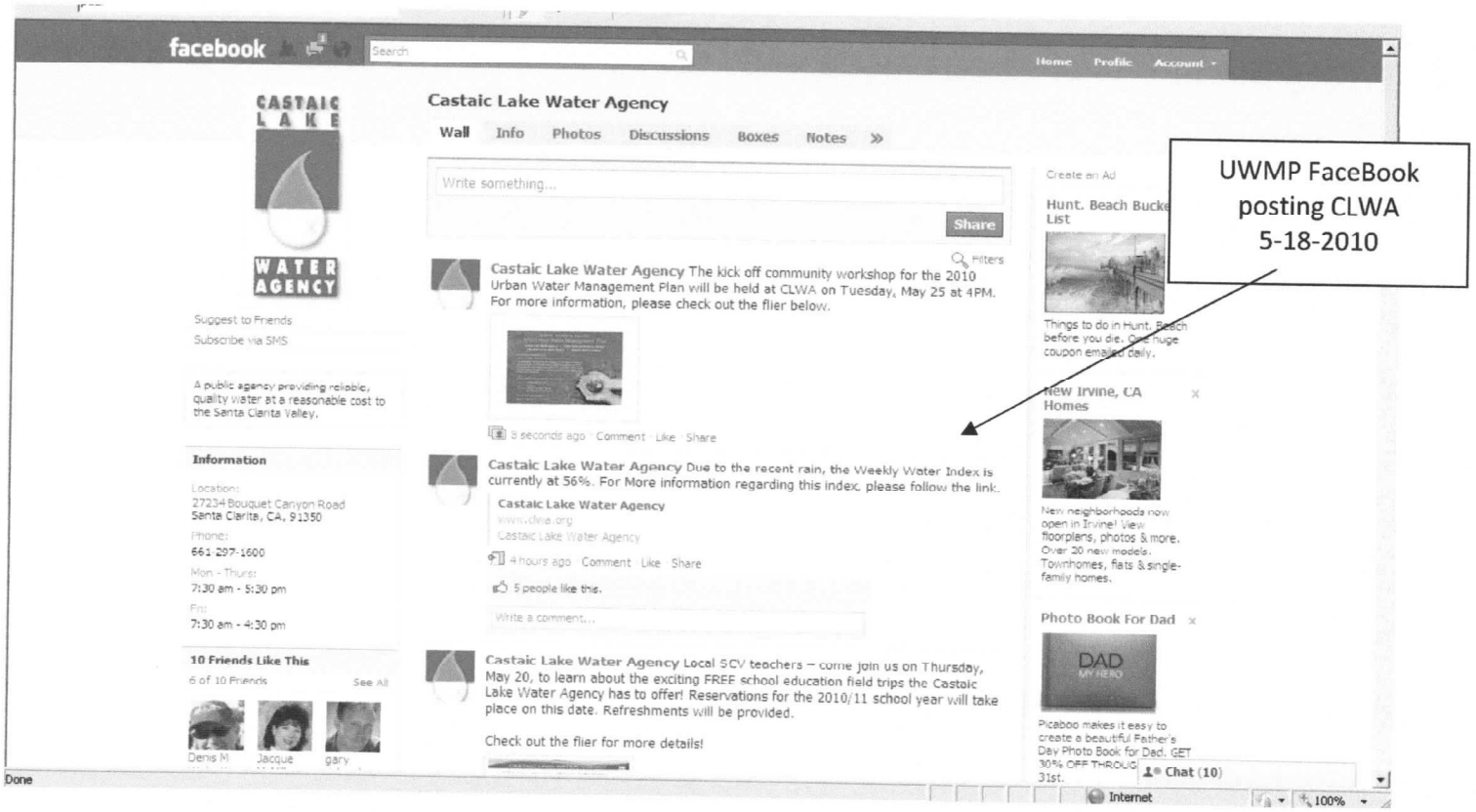
please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

UWMP May 25, 2010 Kick-off workshop
CLWA website & FaceBook postings



UWMP Website posting CLWA 5-18-2010



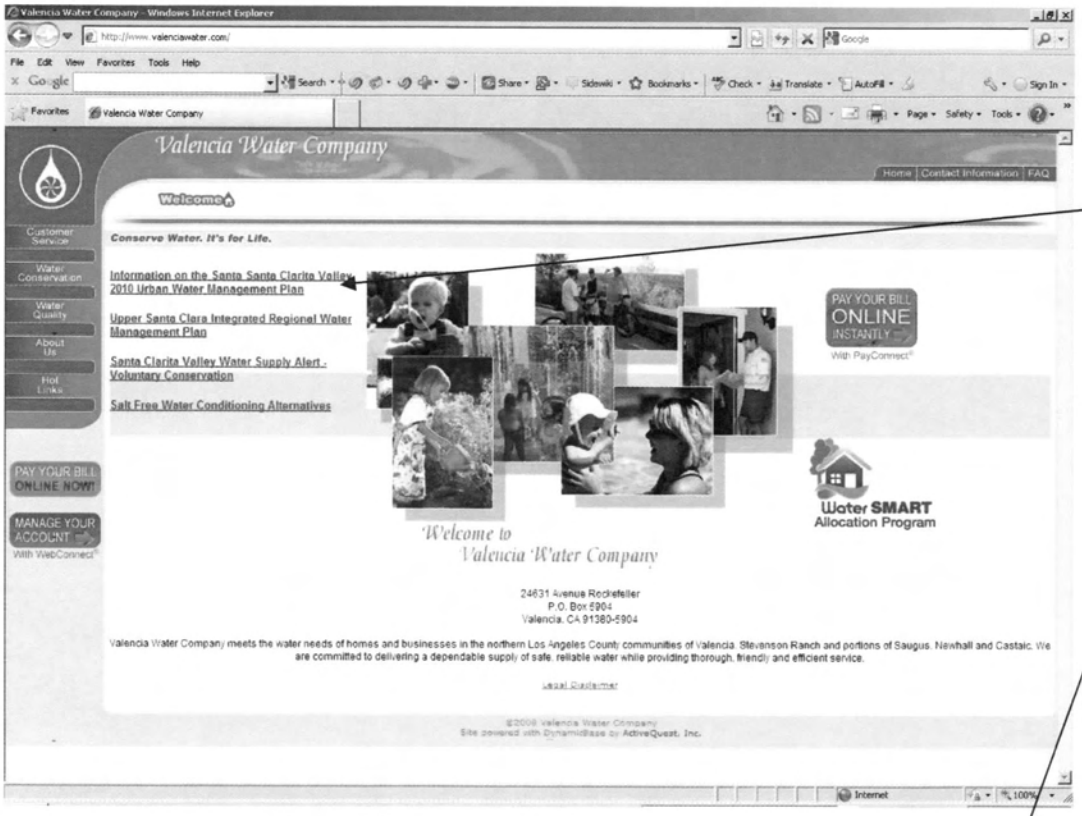
UWMP FaceBook posting CLWA 5-18-2010

UWMP May 25, 2010 Kick-off workshop
Newhall County Water District Website & FaceBook posting

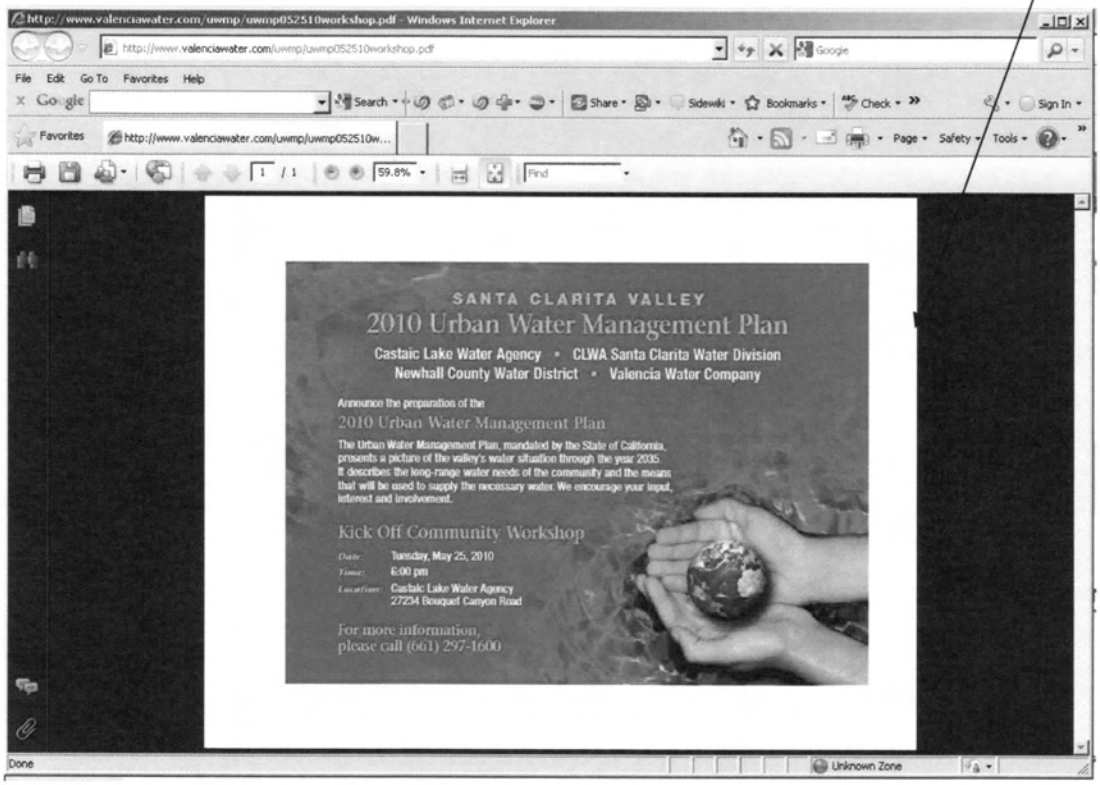
UWMP May 25, 2010 Kick-off workshop
Santa Clarita Water Division (SCWD) website postings

Valencia Water Co Website Posting

May 25, 2010 - UWMP Kick Off Community Workshop



UWMP Website posting
Valencia Water Co
5-17-2010



SANTA CLARITA VALLEY

2010 Urban Water Management Plan

Castaic Lake Water Agency • CLWA Santa Clarita Water Division
Newhall County Water District • Valencia Water Company

Announce the preparation of the

2010 Urban Water Management Plan

The Urban Water Management Plan, mandated by the State of California, presents a picture of the valley's water situation through the year 2035. It describes the long-range water needs of the community and the means that will be used to supply the necessary water. We encourage your input, interest and involvement.

Kick Off Community Workshop

Date: Tuesday, May 25, 2010
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

For more information,
please call (661) 297-1600

2

UWMP Kick-Off Workshop Agenda

- Introductions
- What is an UWMP?
- Who is required to submit an UWMP?
- Why are UWMPs developed?
- When are the UWMPs developed?
- Existing and new requirements of UWMPs
- Q&A

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2

What is an Urban Water Management Plan?

- An Urban Water Management Plan is a comprehensive planning process whereby urban water suppliers describe and evaluate sources of water supply, efficient uses of water, demand management measures, implementation strategy and schedule, and other relevant information and programs.

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4

Who is required to prepare an UWMP?

- Publicly or privately owned water suppliers (including wholesalers), providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet annually.

CASTAIC LAKE WATER AGENCY | NCWD | SCWD

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5

Why are UWMPs Developed?

- In adherence to the 1983 Urban Water Management Planning (UWMP) Act and subsequent legislation
- To develop a framework for agencies to integrate programs and projects that enhance the quality and quantity of regional water supplies
- To identify gaps between supply and demand through time (20-year analysis required)
- To provide detailed description of all supply sources (surface, recycled, groundwater)

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Why are UWMPs Developed? (Cont'd.)

- To identify Demand Management Measures (water conservation programs)
- To address water quality issues
- To develop water shortage contingency planning
- To describe how demand will be met through time, in all hydrologic year types (normal, multiple dry, critical dry)

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7

When are UWMP Plans Developed?

- Suppliers are required to update UWMP every five-years (years ending in 0 or 5).
- 2010 – current update
- July 1, 2011 for retailers (SBx7-7 extended UWMP deadline for retailers but silent on extension for wholesalers.)
  - Under current UWMP Act, wholesalers should complete UWMP by December 31, 2010. But "cleanup legislation" (AB 2776 and SB 1478) anticipated that will extend deadline to July 1, 2011 for wholesalers.

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8

Coordination and Notification Requirements

"Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practical."

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9

Coordination and Notification Requirements

Other:

- Must hold public hearing prior to adoption of UWMP
- Must give cities and counties in service area 60 days notice prior to public hearing
- Must provide cities and counties and LAFCO in service area with copies of UWMP within 30 days of adoption

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10

Penalties

- Ineligible for State Grant and Loan Funding (at least until plan is completed to DWR satisfaction)

11

What, Who, Why, When, etc…

- Q&A/Discussion

12

New Requirements for 2010 UWMP

- New Law: SBX7-7 ("20% x 2020"), reporting starts with 2010 UWMPs
  - Base gross water use in gpcd: must be calculated using one of three methodologies
  - Target reduction from base by 2020: reporting requirements differ for retailers vs. wholesalers
  - Must be calculated using one of four methodologies
  - Agencies must hold public hearing to explain how targets will be met (can be held as part of UWMP hearing)

13

New UWMP Requirements

- Base gross water use in gpcd: calculation

  Total volume of water (treated or not) entering the retail distribution system, divided by the total population of the service area

  (Excludes: recycled water, net volume into long-term storage, water conveyed to another retailer, agricultural water)

14

New UWMP Requirements

- Base gross water use in gpcd: methodologies
  - 10-year average
    - *ending no earlier than 2004 – no later than 2010*
  - 15-year average if 10% of 2008 demand met by recycled water
    - *get to add 5 years to calculation*
  - 5-year average if agency is already close to target
    - *100 gpcd; at least 5% reduction*
    - *ending no earlier than 2007 – no later than 2010*

15

New UWMP Requirements

- Base gross water use in gallons per capita per day (gpcd)
  - Averages are determined on a rolling basis
  - Should review demands over various periods to determine hydrologic and demand year types
  - Recent economic impacts and drought response may have reduced demand!

16

New UWMP Requirements

- Target reduction methodology options
  1. 20% reduction from base (i.e., 80% of average gross water use in gpcd)
  2. Combination of state standards:
     - 55 gpcd indoor residential + landscape use at 70% -80% ETo + 10% reduction in commercial/industrial/institutional use
  3. DWR 20x2020 hydrologic region target (South Coast region = 149 gpcd)
  4. Option to be developed by October 2010

17

New UWMP Requirements

- Reduction Target Option 4
  - Subject to DWR public process during 2010
  - Will identify targets to achieve cumulative statewide 20% reduction
  - Must allow flexibility for water supplier service area characteristics

18

New UWMP Requirements

- Proposals for Option 4
  - DWR: developing a methodology for public review
  - CA Urban Water Conservation Council: all agencies in CA follow terms and options of the Urban MOU
  - ACWA: submitted Option 4 proposal
    - Relies on comparison to a Reference Area (an area that has met/nearly met hydrologic region target).

19

New UWMP Requirements

- Issues: DWR will derive methodologies for calculations: population, base water use, gross water use, sector water use, Option 4, others
  - If DWR derives new methodology standards, agencies may be required to use them
  - Won't be final until October 2010 (ps. December)
  - If work has already been done, it may need to be repeated
  - If agency has already adopted UWMP, it may need to be amended
  - = Reason for UWMP deadline extension to July 1, 2011

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20

New UWMP Requirements

- Other
  - SB 1087 (Florez) - requires an UWMP to include projected water use for single-family and multi-family residential housing for lower income households as identified in the housing element of any city, county, or city and county in the service area of the supplier.

Enduring Relationships - Trusted Expertise - Promises Delivered

21

Consultant Team

- Kennedy/Jenks Consultants
- Luhdorff and Scalmanini
- Nancy Clemm, P.E.
- Stacy Miller Public Affairs

Enduring Relationships - Trusted Expertise - Promises Delivered

Santa Clarita Valley Urban Water Management Plan
May 25, 2010 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	David Inouye	DWR. So. Region	Chief, Water Conserv. Sec.	(818) 500-1615, x246	davidi@water.ca.gov
2.	RONALD MECHSNER	WEST RANCH TOWN COUNCIL	PRESIDENT	661.753.6182	RMECHSNER@westranchtowncouncil.com
3.	Cathy Holloman	SCWD	Assoc	661-259-2737	cholloman@scwater.org
4.	Mauricio Guardado	SCWD	Retail MGR	"	mguardado@scwater.org
5.	Mary Lu Cotter	KCS			
6.	Patrick Bryant	City of Santa Clarita	Admin. Analyst	661-255-4902	pbryant@santa-clarita.com
7.	Jeggian Bunker	LAC WWD	Civil Engr - Water Resources Unit	626-300-3315	jbunker@ladpw.org
8.	Bruce Fortine	COC	Trustee	661-253-0060	fortine@earthlink.net
9.	Keo in Korenthel	ABL-CCC	E.D.	(661)310-0769	kkorenthel@abc-ccc.org
10.	JANET KEITH	VWC	CONSER COORD.	661 295-6531	jkeith@valenciawater.com
11.	Brett Walter	Buck McKeon	Senior Field Rep	661-254-2111	brett.walter@mail.house.gov
12.	Jason Swisloo	Santa Clarita	Senior Planner	661-255-4306	jswisloo@santa-clarita.com
13.	Jerry Gladbach	CLWA			
14.	DIANA SHAW	DIANA SHAW for 38th Assembly	candidate		ElectDianaShaw.com
15.	Bob Diprimio	Valencia Water Co.	President	(661)295-6501	rdiprimio@valenciawater.com
16.	ED MASTERSON	SCV CHAMBER	PRES. / CEO	(661) 702-6977	EMASTERSON@SCVCHAMBER.COM
17.	Jackie Bick	Sen. Runner	Dist Rep	661-286-1471	JACKIE.BICK@SEN.CA.GOV
18.					

July 2010 UWMP Workshop
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations

July 6, 2010

«AddressBlock»

Subject: 2010 Urban Water Management Plan Workshop

«GreetingLine»

The Santa Clarita Valley's water agencies, Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company are currently preparing the 2010 Urban Water Management Plan (UWMP).

In an effort to ensure all interested parties are fully informed and involved in this process, we have scheduled our second community workshop as follows and welcome your participation:

Date:	Tuesday, July 27, 2010
Time:	4:00 pm
Location:	Castaic Lake Water Agency 27234 Bouquet Canyon Road

The Urban Water Management Plan presents a picture of the valley's water situation through the year 2035, describes the long-range water needs of the community and the means to supply the necessary water. This workshop will provide the most current information on components of the 2010 UWMP.

I encourage your participation and look forward to seeing you then. If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Government Affairs, Public Relations & Communication
P.O. Box 55745, Valencia, CA 91385 [818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

Post card sent to all entities with water connections in the CLWA, CLWA SCWD, VWC and NCWD service areas

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

Castaic Lake Water Agency • CLWA Santa Clarita Water Division
Newhall County Water District • Valencia Water Company

2010 Urban Water Management Plan

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Upcoming Community Workshops

Date: Tuesday, July 27, 2010
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

Date: Tuesday, September 28, 2010
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

For more information, please call (661) 297-1600

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

The Signal 7-25-10

Date: Tuesday, July 27, 2010

Time: 4:00 pm

Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

This workshop will provide the most current information on components of the 2010 UWMP. Our team will provide an overview of the opportunities for public comment and will also be available for questions.

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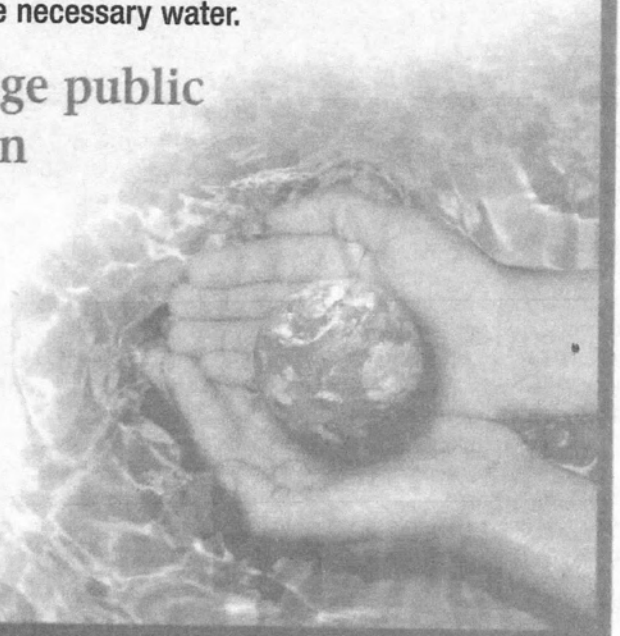
We encourage public participation and input



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Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

The Signal 7-20-10

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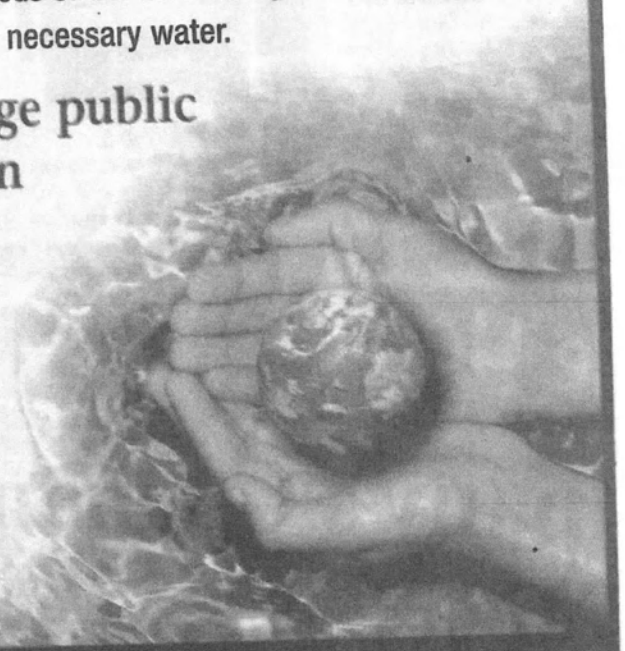

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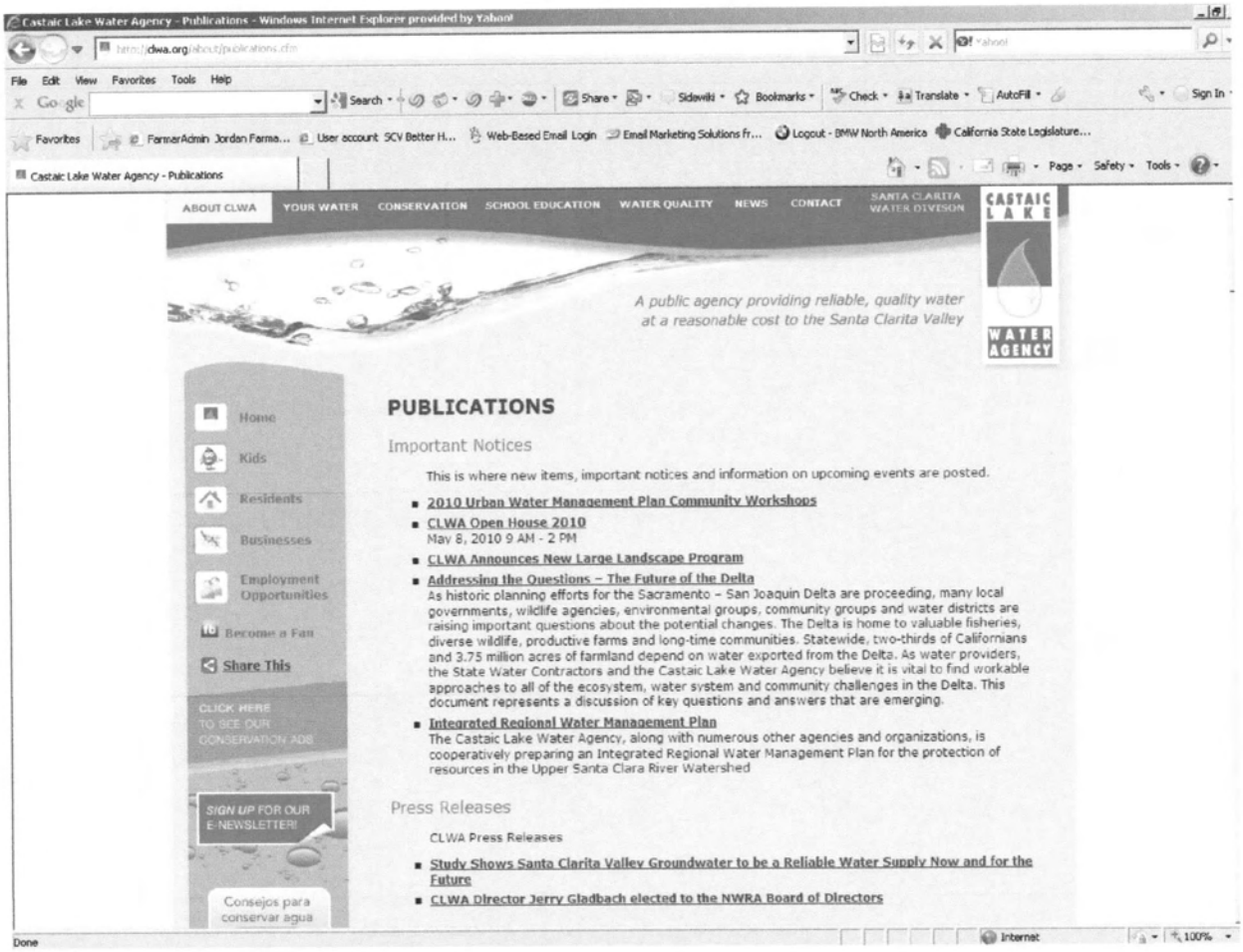
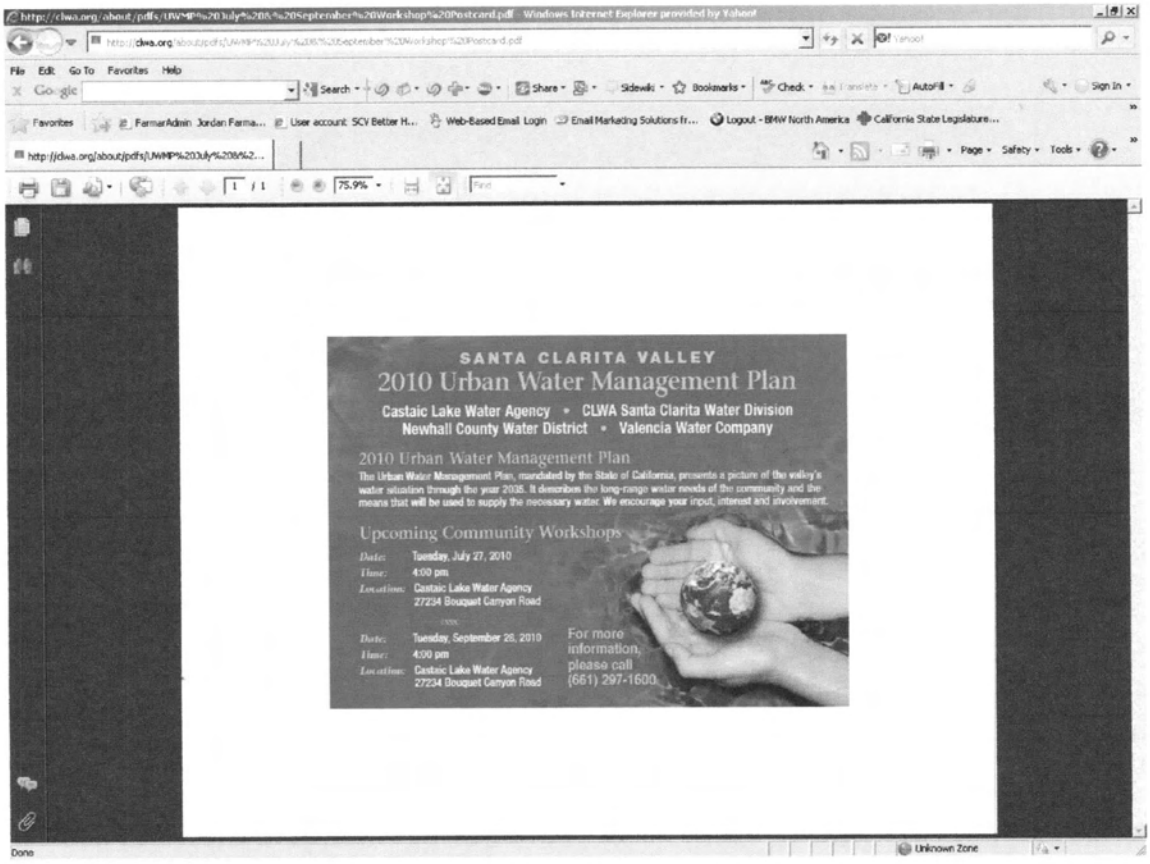
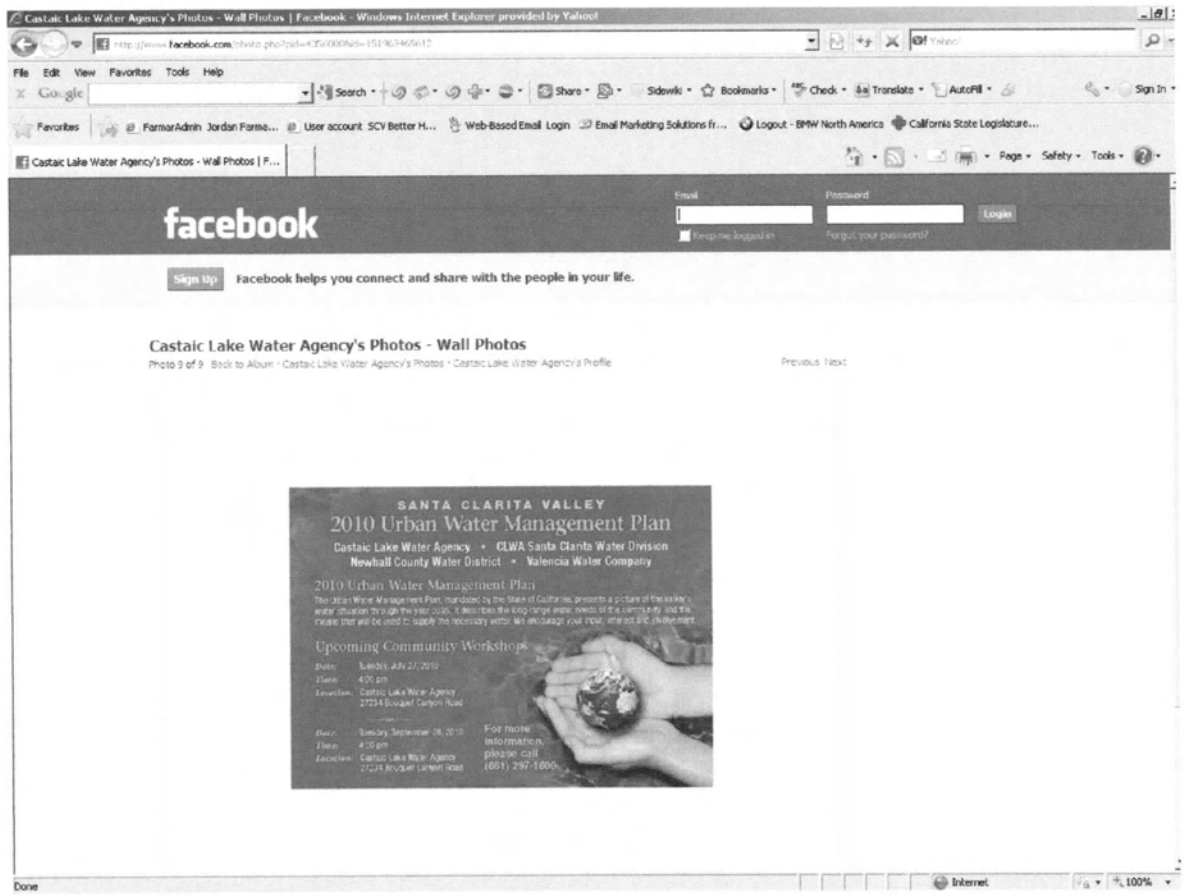
Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

UWMP July & September 2010 Community Workshop Announcements
CLWA Website - June 28, 2010

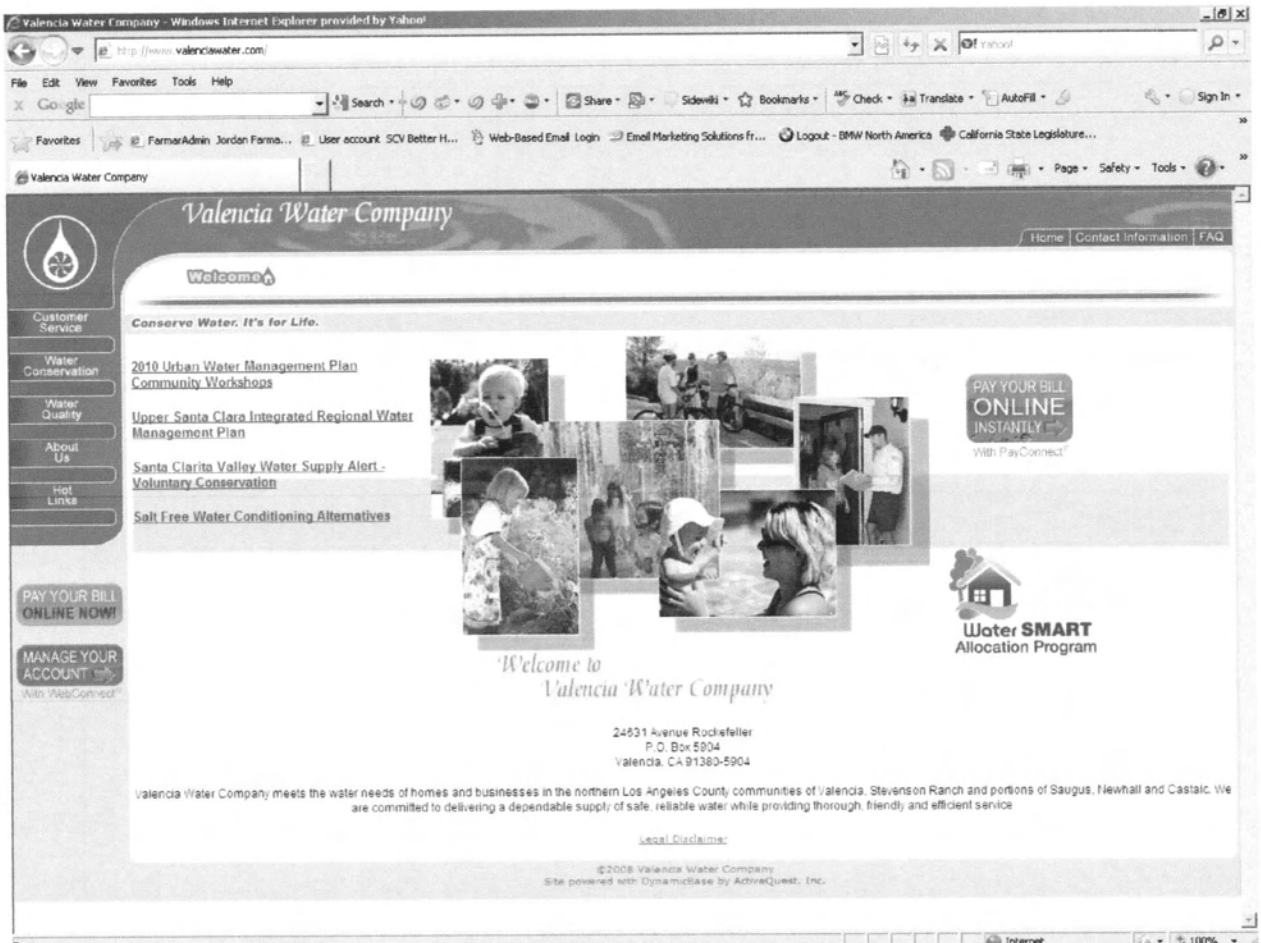


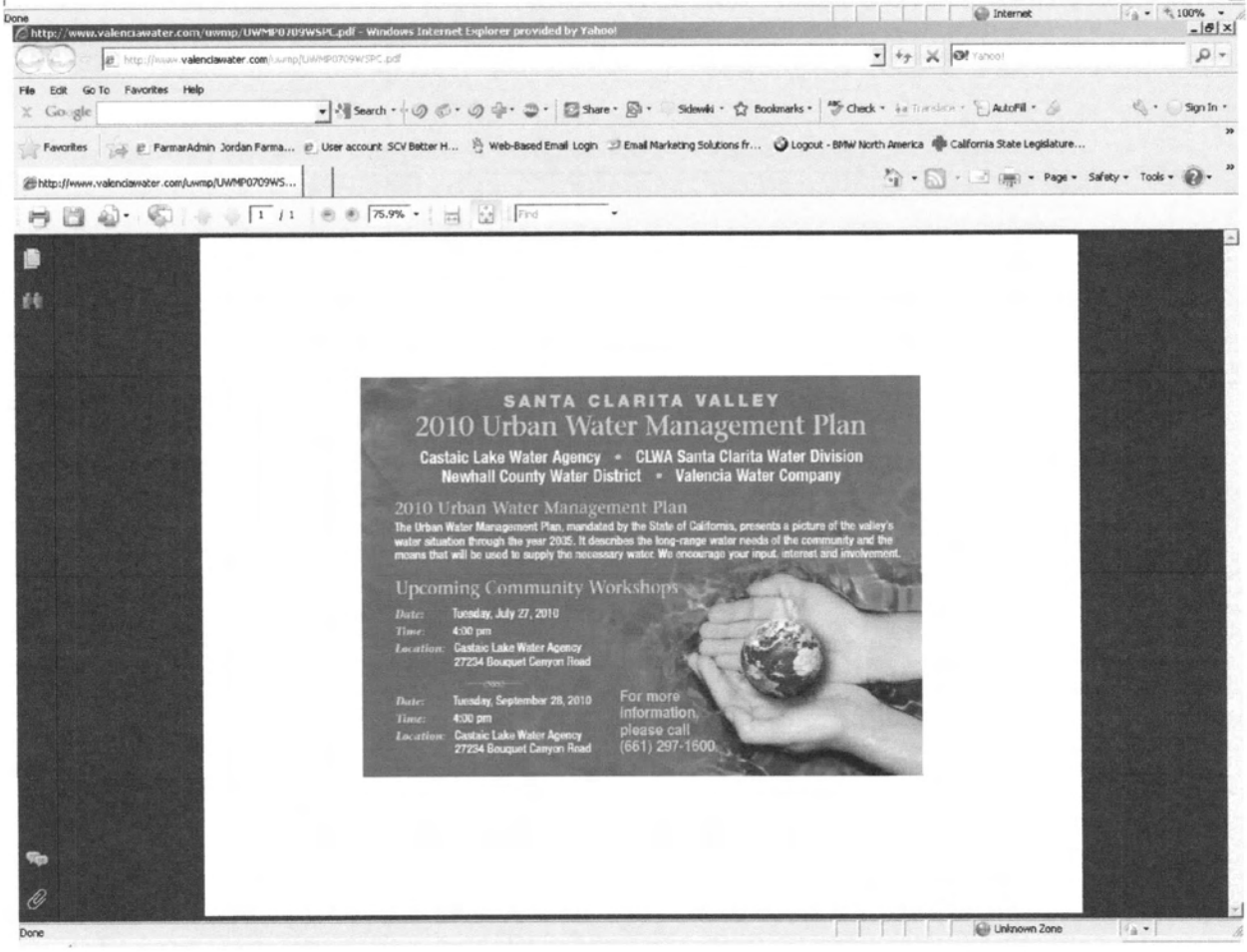


UWMP July & September 2010 Community Workshop Announcements
CLWA Facebook Post - June 28, 2010

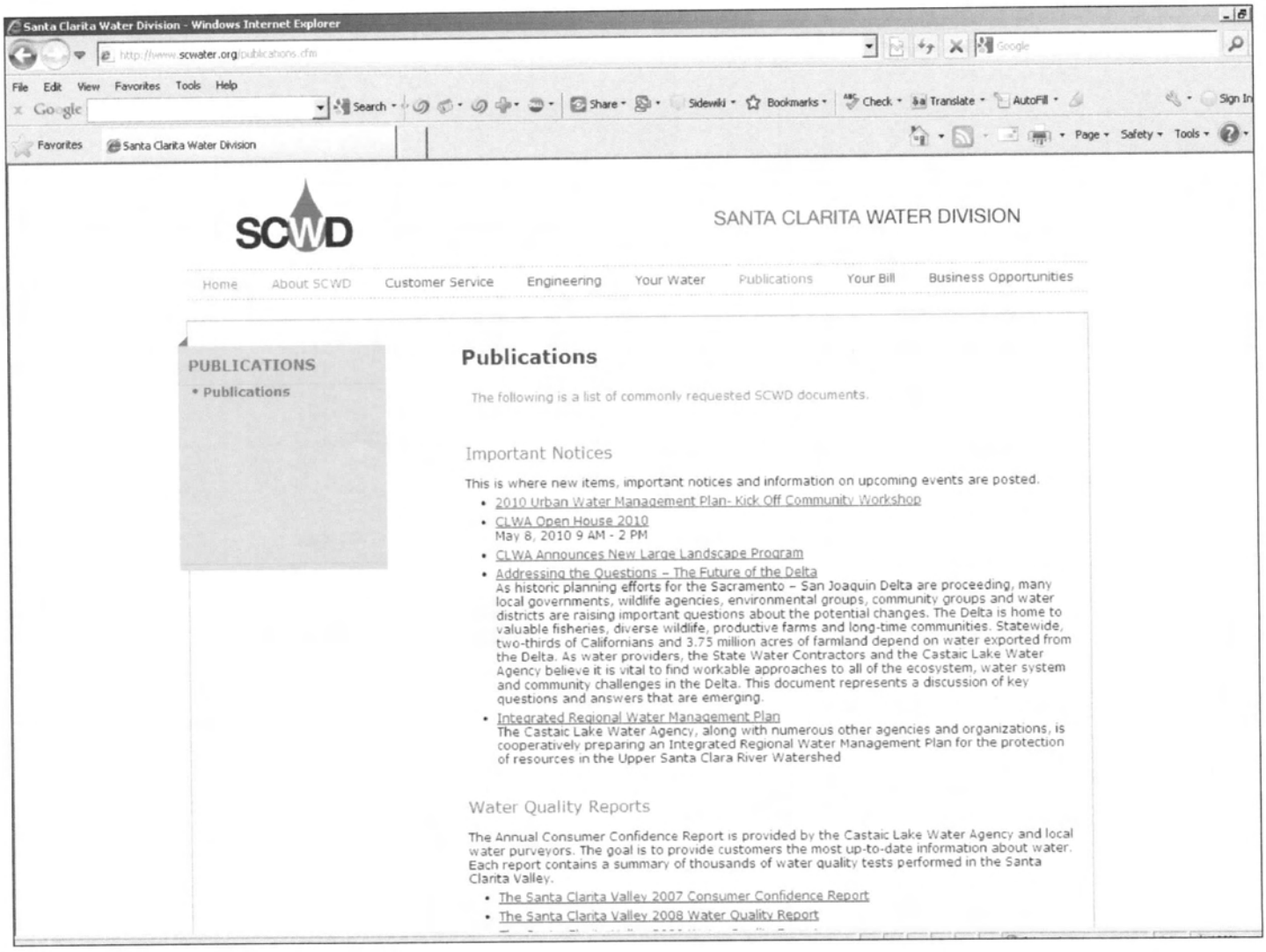


UWMP July & September 2010 Community Workshop Announcements
Valencia Water Co Website - June 28, 2010

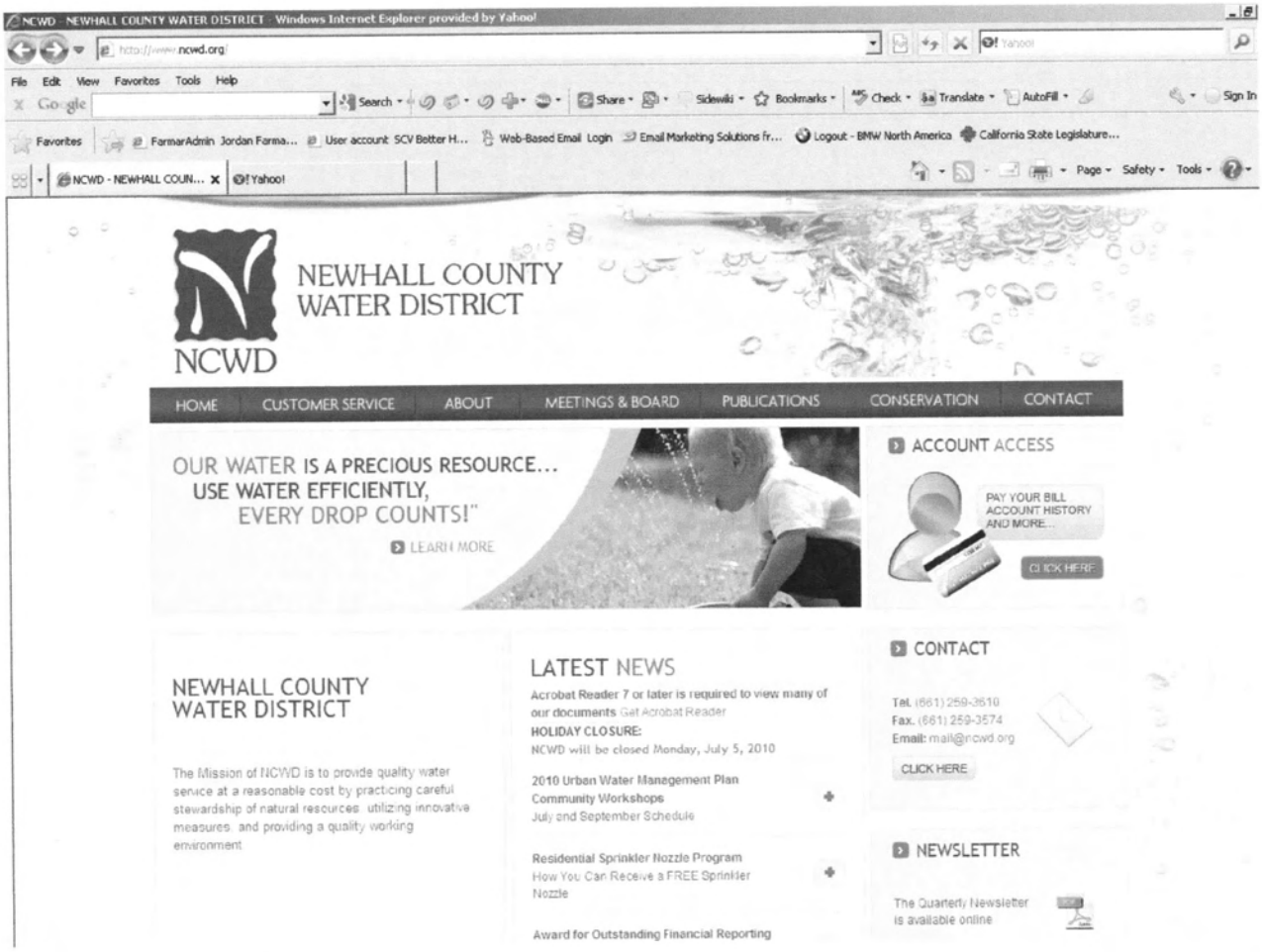


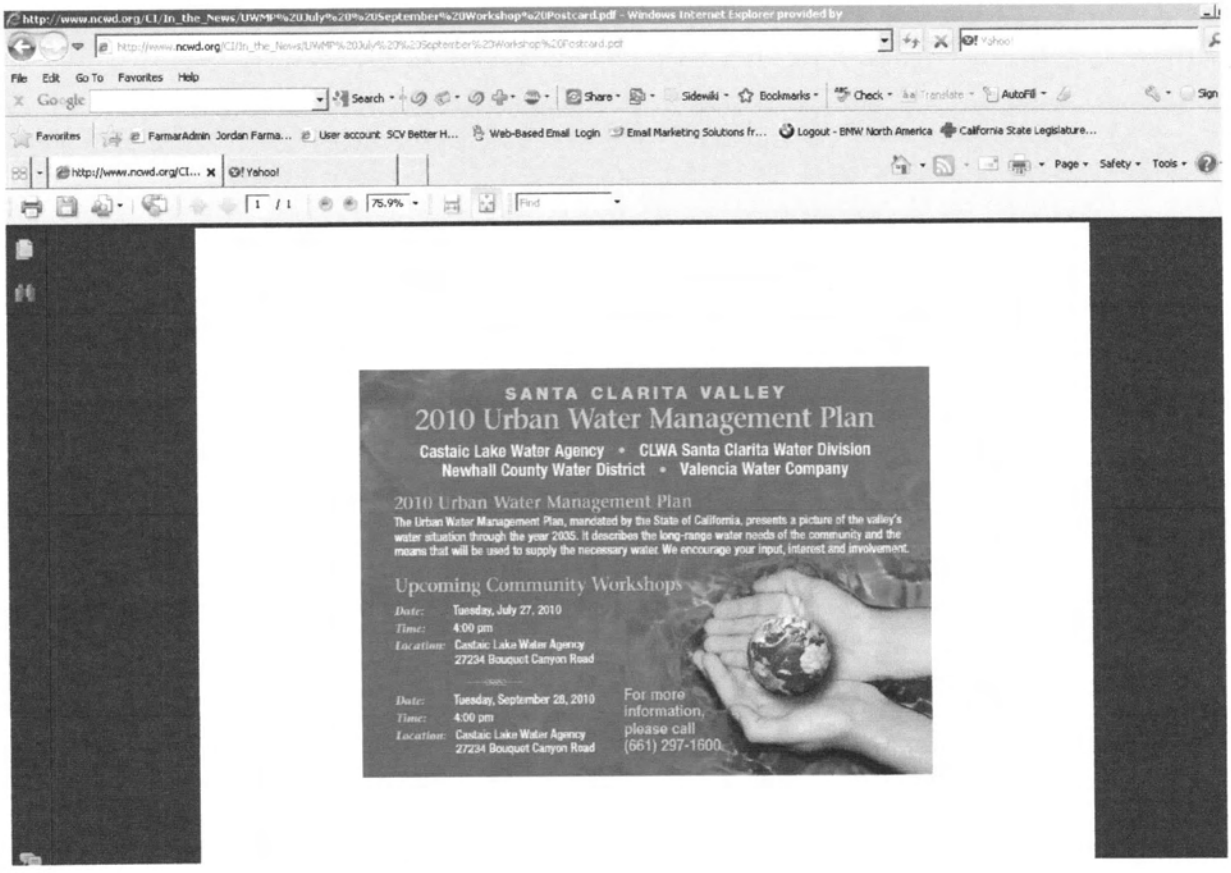


UWMP July & September 2010 Community Workshop Announcements
SCWD Website - June 28, 2010



UWMP July & September 2010 Community Workshop Announcements
NCWD Website - June 28, 2010





UWMP July & September 2010 Community Workshop Announcements
NCWD Facebook Post - June 28, 2010

UWMP Community Workshop
July 27, 2010

Enduring Relationships - Trusted Expertise - Promises Delivered

Kennedy/Jenks Consultants

Agenda

- Welcome & Introductions
- SBX7-7 Requirements
- Recycled Water
- Groundwater Supplies
- State Water Project Reliability
- Questions & Answers
- Next Workshop & Timelines

Enduring Relationships - Trusted Expertise - Promises Delivered

Kennedy/Jenks Consultants

2010 UWMP SBX7-7

- Mary Lou Cotton, Kennedy/Jenks Consultants

Enduring Relationships - Trusted Expertise - Promises Delivered

Kennedy/Jenks Consultants

2010 UWMP

- New Law: SBX7-7 ("20% x 2020"), reporting starts with 2010 UWMPs, applies to retailers
  - Base gross water use in gpcd: must be calculated using one of three methodologies
  - Target reduction from base by 2020: must be calculated using one of four methodologies
  - Supplier must hold public hearing to explain how targets will be met (can be held as part of UWMP hearing)

2010 UWMP

- Base gross water use in gpcd: methodologies
  - 10-year average
    - *ending no earlier than 2004 – no later than 2010*
  - 15-year average if 10% of 2008 demand met by recycled water
    - *get to add 5 years to calculation*
  - *And*: 5-year average
    - *ending no earlier than 2007 – no later than 2010*
    - *100 gpcd; at least 5% reduction for all agencies in CA over 100 gpcd*

2010 UWMP

- Target reduction methodology options
  1. 20% reduction from base (i.e., 80% of average gross water use in gpcd)
  2. Combination of state standards:
     - 55 gpcd indoor residential + landscape use at 70% ETo + 10% reduction in commercial/industrial/institutional use
  3. DWR 20x2020 hydrologic region target (South Coast region = 149 gpcd)
  4. Option to be developed by October 2010

2010 UWMP

- Reduction Target Option 4
  - Subject to DWR public process during 2010
  - Will identify targets to achieve cumulative statewide 20% reduction
  - Must allow flexibility for water supplier service area characteristics

2010 UWMP

- Wholesalers (such as CLWA) must describe in the UWMP "an assessment of present and proposed future measures, programs and polices to help achieve the water use reductions required" of retailers in their service areas.

2010 UWMP

- DWR Public Process Issues
  - DWR will derive methodologies for SBX7-7 calculations: population, base gross water use, compliance levels, sector water use, others
  - If DWR derives new standards, agencies will be required to use them
  - Won't be final until October 2010
  - Option 4 method won't be final until December 2010.

2010 UWMP

- DWR Public Process Issues, (cont'd.)
  - If work has already been done, it may need to be repeated;
  - If agency has already adopted UWMP, it may need to be amended
  - = Reason for UWMP deadline extension to July 1, 2011 (Note: wholesaler UWMPs still due by Dec 31, 2010; legislation in process to apply extension to them)

SBX7-7 Methodologies Status

- DWR has convened the Urban Stakeholder Committee ("USC")
  - Co-chaired by DWR and CUWCC
- Has formed an Agency Team: DWR, SWRCB, CPUC, CDPH, CBDA, USBR
- Has hired a consultant team (mainly economists and statisticians)

SBX7-7 Methodologies Status

- USC has held three meetings to date (next: tomorrow, 7/28/10)
- DWR has defined several technical methodologies efforts, based on statute
- DWR Legal has reviewed statute and provided guidance to DWR staff and consultant team
- Developed a set of Issue Papers for each methodology in statute
- Has created groupings according to task:

SBX7-7 Methodologies Status

- U3:
  - Gross water use
  - Service area population
  - Base daily per capita use
  - Compliance daily per capita use
  - Landscape area water use
  - Baseline CII use
  - Compliance year adjustment criteria
  - Indoor residential use

SBX7-7 Methodologies Status

- U4:Target Reduction Option 4
  - Proposal from ACWA
  - Two proposals from various CUWCC members (IRWD/City of San Luis Obispo/City of Long Beach; and Western Municipal Water District)
  - DWR/Consulting Team proposal
- U4 Workgroup set up, focus on how to formulate methodology

SBX7-7 Methodologies Status

- U5: Process Water
  - Use by Commercial, Industrial, Institutional customers
- U6: Regional Compliance
  - Guidance for Regional UWMPs and Conservation Target Reductions

SBX7-7 Methodologies Status

- Schedule:
  - June 22 & 23 USC and U4 Meetings at IEUA
  - July 28 USC Meeting
  - **August 5 & 6 U3 Public Workshops**
  - August 26 USC Meeting
  - September 21 USC Meeting
  - October 1 finalize U3 methodologies
  - **October 27 & 29 U4 Public Meetings**
  - November 15 USC Meeting
  - December 31 U4 method finalized

2010 UWMP- SBX7-7

- SBX7-7 Questions?

Recycled Water

- Lynn Takaichi, Kennedy/Jenks Consultants

Recycled Water

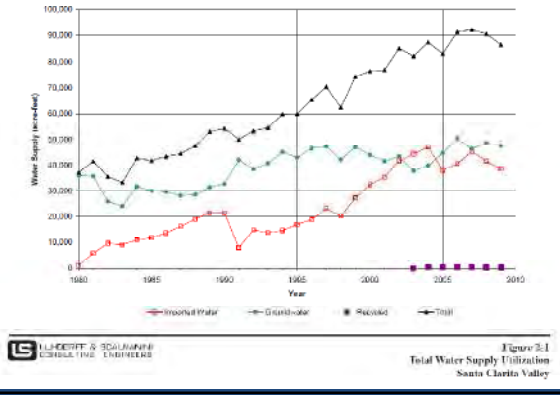
- Based on 2002 Recycled Water Master Plan and 2006 Programmatic EIR
  - Modified Phasing and Pipeline Alignments
  - Both VWRP and SWRP Utilized
  - Potential Onsite RW Production
- Current Production = 430 AFY
- Ultimate Production = 17,400 AFY, plus 5,344 AFY from Newhall Ranch WRP
- Will Help the SCV Meet 20x2020 Goals

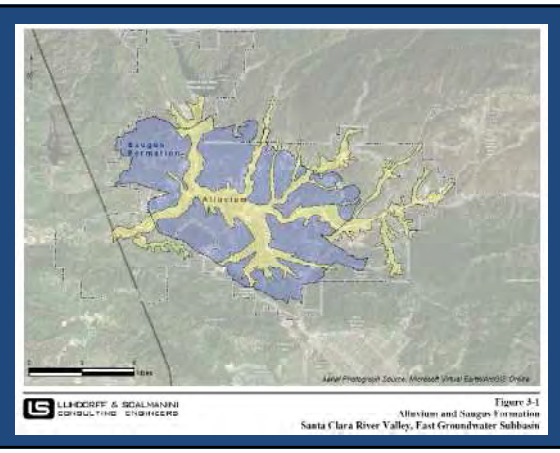
Groundwater Supplies

- Joe Scalmanini - Luhdorff and Scalmanini

Groundwater Component of Water Supplies 2010 Urban Water Management Plan

- Castaic Lake Water Agency • CLWA Santa Clarita Water Division
- Los Angeles County Waterworks District 36
- Newhall County Water District • Valencia Water Company





Groundwater Management Plan (2003)

Management Objectives (Goals) for the Basin

- development of integrated surface water, groundwater, and recycled water supply to meet existing and projected uses
- determination of operational groundwater yield to avoid overdraft = sustainability
- preservation of groundwater quality, including solution of contamination problems
- preservation of interrelated surface water resources = maintenance of surface water flows and non-degradation of quality

Groundwater Management Plan (2003)

Elements

- groundwater monitoring
- surface water monitoring
- basin yield analysis
- regular and dry year water supplies
- continued conjunctive use
- long-term salinity management
- integration of recycled water
- mitigate contamination
- local, state and federal relationships
- public education and water conservation
- recharge wellhead protection areas
- well construction and destruction policies
- provisions to add additional components

Annual Water Reports (1998-present)

Annual Water Requirements and Supplies
- actual water use
- sources of supply to meet actual use

Groundwater
- Alluvial and Saugus aquifer conditions

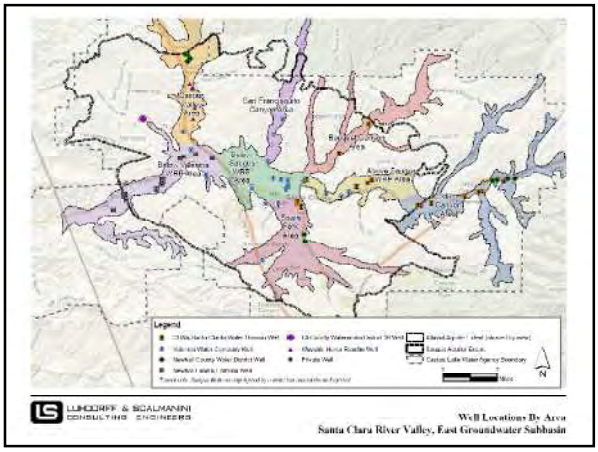
Supplemental Water Supplies
- State Water Project
- banking and other programs

Water Quality

Recycled Water

Santa Clara River
- outflows from Santa Clarita Valley

Short-Term (one year) Outlook
- water requirements adjusted from UWMP
- surface water, groundwater and recycled water supplies
- adequacy of water supplies



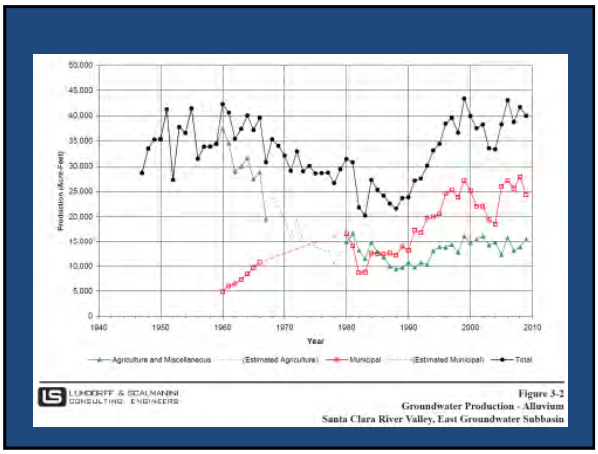


Figure 3-2
Groundwater Production - Alluvium
Santa Clara River Valley, East Groundwater Subbasin

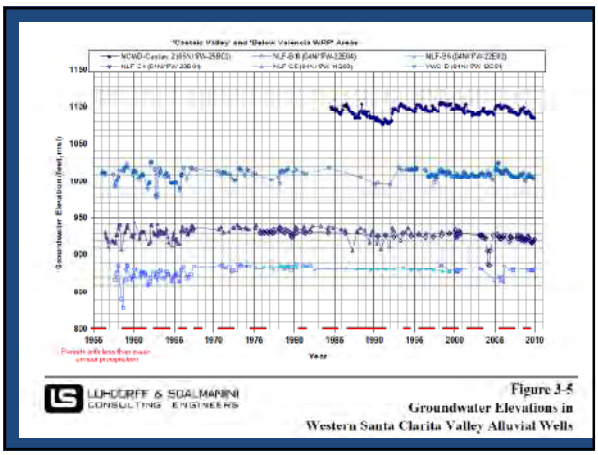


Figure 3-5
Groundwater Elevations in
Western Santa Clarita Valley Alluvial Wells

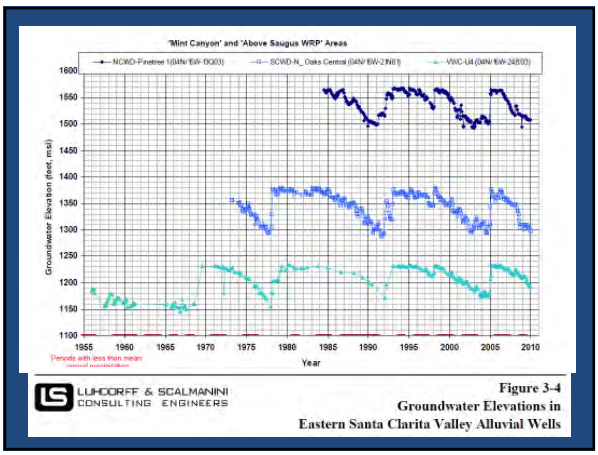
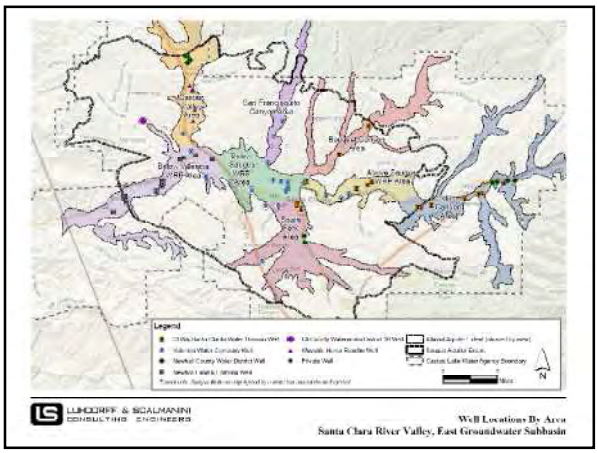
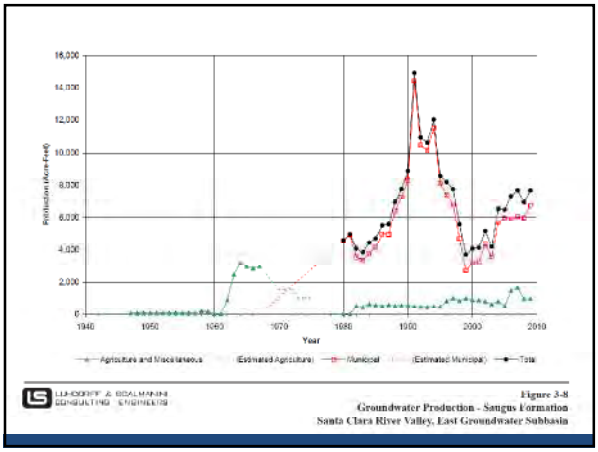
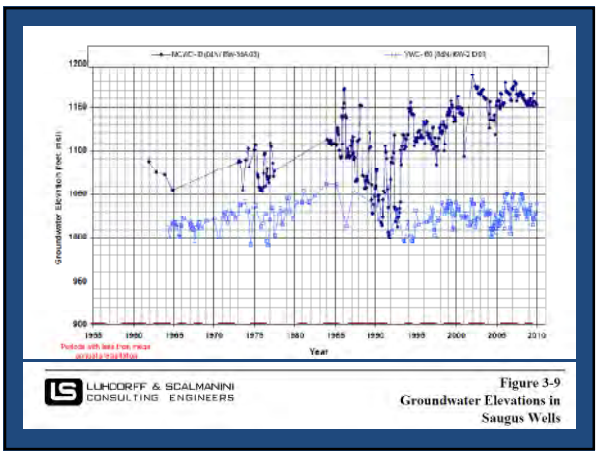


Figure 3-4
Groundwater Elevations in
Eastern Santa Clarita Valley Alluvial Wells

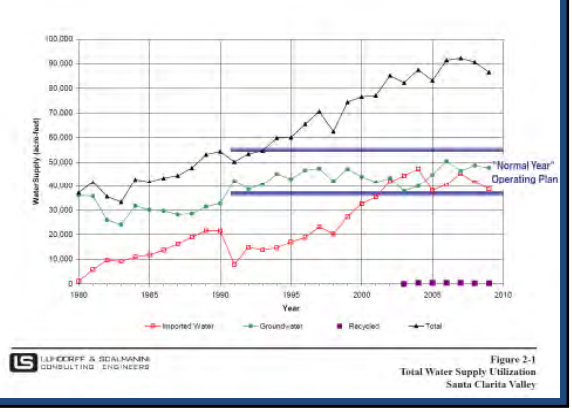

Legend
LUHDORFF & SCALMANINI CONSULTING ENGINEERS
Well Locations By Area
Santa Clara River Valley, East Groundwater Subbasin


Year
Agriculture and Miscellaneous
(Estimated Agriculture)
Municipal
(Estimated Municipal)
Total
LUHDORFF & SCALMANINI CONSULTING ENGINEERS
Figure 3-8
Groundwater Production - Saugus Formation
Santa Clara River Valley, East Groundwater Subbasin


Year
LUHDORFF & SCALMANINI CONSULTING ENGINEERS
Figure 3-9
Groundwater Elevations in
Saugus Wells

2008 Groundwater Operating Plan

Groundwater Pumping 2010 UWMP				
Aquifer	**Normal Years**	**Dry Year 1**	**Dry Year 2**	**Dry Year 3+**
Alluvium	30,000-40,000 (38,600)	30,000-35,000 (36,500)	30,000-35,000 (34,850)	30,000-35,000 (34,850)
Saugus	7,500-15,000 (12,485)	15,000-25,000 (19,125)	21,000-25,000 (25,227)	21,000-35,000 (34,977)



Sustainability and Achievability

Sustainability

"lack of chronic, or sustained, depletion of groundwater storage, as indicated by projected groundwater levels, over a reasonable range of wet, normal, and dry hydrologic conditions" (86 years: 1922-2007)

"maintenance of surface water flows in the western portion of the basin (which are partially maintained by groundwater discharge) and surface water outflow to downstream basins over the same range of hydrologic conditions"

Achievability

maintenance of groundwater levels above, or only temporarily slightly into, the intake (screened or perforated) sections of production wells

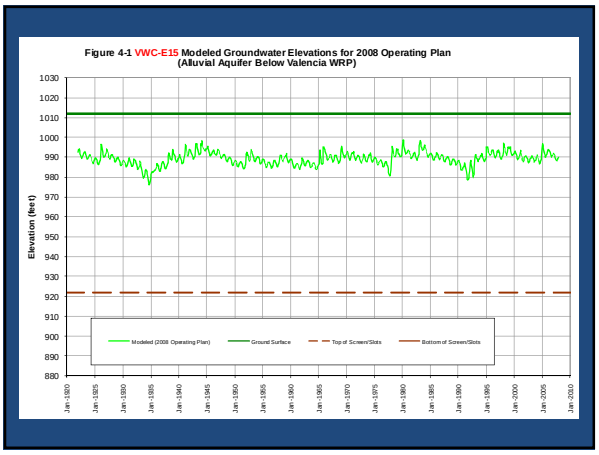


Figure 4-1 VWC-E15 Modeled Groundwater Elevations for 2008 Operating Plan
(Alluvial Aquifer Below Valencia WRP)
Elevation (feet)
Modeled (2008 Operating Plan)
Ground Surface
Top of Screen/Slots
Bottom of Screen/Slots

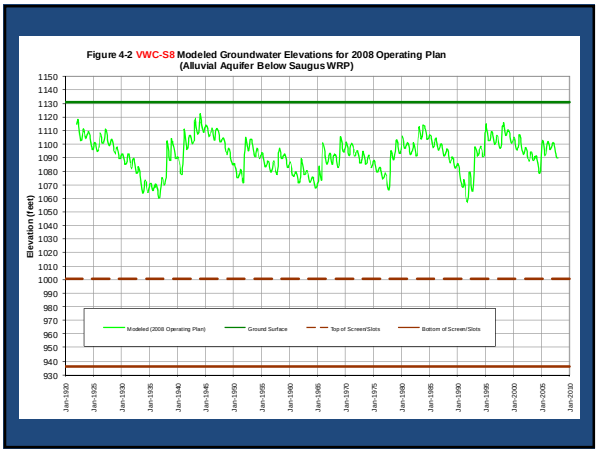


Figure 4-2 VWC-S8 Modeled Groundwater Elevations for 2008 Operating Plan
(Alluvial Aquifer Below Saugus WRP)
Elevation (feet)
Modeled (2008 Operating Plan)
Ground Surface
Top of Screen/Slots
Bottom of Screen/Slots

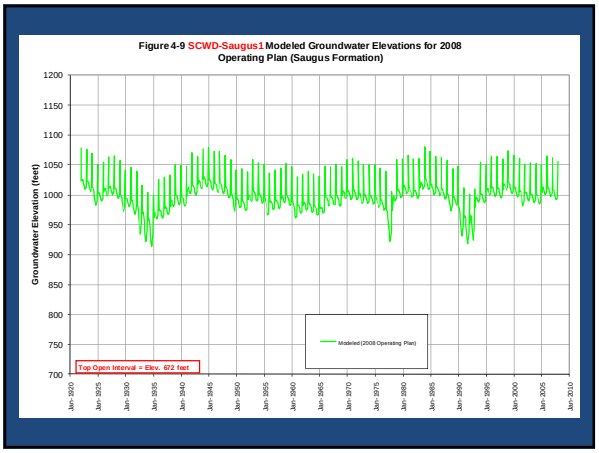
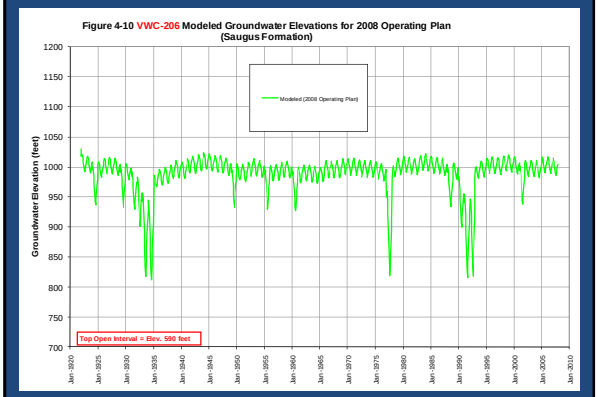


Figure 4-9 SCWD-Saugus1 Modeled Groundwater Elevations for 2008
Operating Plan (Saugus Formation)
Groundwater Elevation (feet)
Modeled (2008 Operating Plan)
Top Open Interval = Elev. 672 feet



2008 Operating Plan Conclusions

Operating Plan is fully sustainable (no chronic groundwater level declines; no depleted stream flow) and mostly achievable (limited dry-period declines in eastern part of Valley)

Achievability issues in extended dry periods can be resolved by redistribution of some pumping to the west

- with redistribution, retain dry-period Alluvial pumping near 35,000 afy
- without redistribution, dry-period Alluvial pumping closer to 30,000 afy

Climate Change Impacts

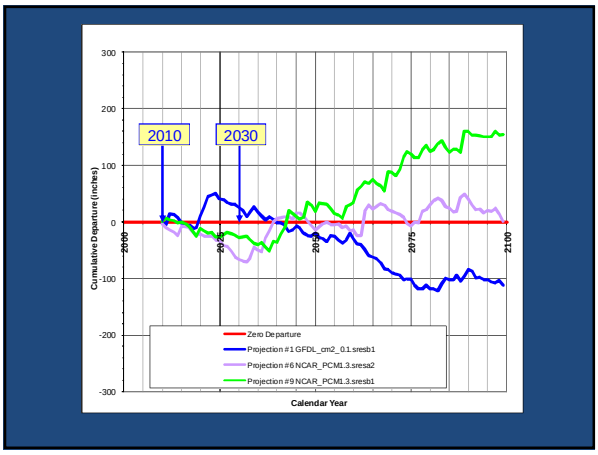
Studied 9 of 112 published climate change projections; same 9 projections as evaluated by DWR for reliability of SWP

Selected 3 projections for variety of rainfall cycles during UWMP planning horizon and beyond

- #1 = considerable fluctuation and generally wetter through UWMP, then long-term drying of climate
- #9 = less fluctuation and generally drier through UWMP, then sustained long-term wetting of climate
- #6 = less fluctuation and generally drier through UWMP, then long-term fluctuating cycles of below-normal and above-normal rainfall

Simulated customized operating plan for 86 years: 2010-2095

- simulated revised infiltration of precipitation, storm water, River inflow and Castaic Creek for three climate projections
- varied year-to-year Alluvial pumping dependant on prior year hydrology


2010
2030
Cumulative Departure (inches)
Calendar Year
Zero Departure
Projection #1 GFDL_cm2_0.1.sresb1
Projection #6 NCAR_PCM1.3.sresa2
Projection #9 NCAR_PCM1.3.sresb1

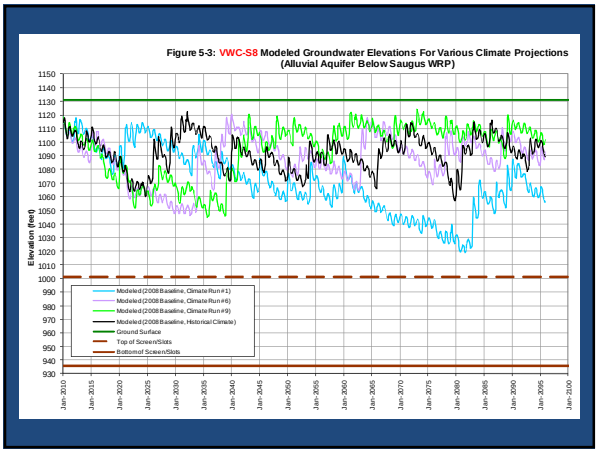
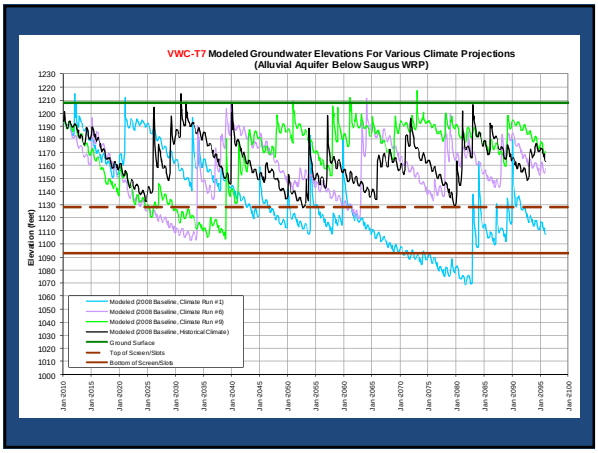


Figure 5-3: VWC-S8 Modeled Groundwater Elevations For Various Climate Projections
(Alluvial Aquifer Below Saugus WRP)
Elevation (feet)
Modeled (2008 Baseline, Climate Run #1)
Modeled (2008 Baseline, Climate Run #6)
Modeled (2008 Baseline, Climate Run #9)
Modeled (2008 Baseline, Historical Climate)
Ground Surface
Top of Screen/Slots
Bottom of Screen/Slots


VWC-T7 Modeled Groundwater Elevations For Various Climate Projections
(Alluvial Aquifer Below Saugus WRP)
Elevation (feet)
Modeled (2008 Baseline, Climate Run #1)
Modeled (2008 Baseline, Climate Run #6)
Modeled (2008 Baseline, Climate Run #9)
Modeled (2008 Baseline, Historical Climate)
Ground Surface
Top of Screen/Slots
Bottom of Screen/Slots

Climate Change "Conclusions"

No assurance of nature of potential climate change

For broad range of climate change possibilities, Operating Plan sustainable and achievable through shorter-term horizon of UWMP

Broad range of potential climate change extends from long-term dry to wet

- Operating Plan sustainable through average to wetter "changed" climate
- Operating Plan unsustainable through long-term drying climate due to decreased local recharge and resultant declining groundwater levels

Total Groundwater Supply Santa Clarita Valley

	Normal Years		
	Alluvium (afy)	Saugus Fm. (afy)	Total (afy)
Municipal Purveyors	25,850	11,485	37,335
Agriculture & Others	12,750	1,000	13,750
Total	**38,600**	**12,485**	**51,085**

	Multiple Dry Years		
	Alluvium (afy)	Saugus Fm. (afy)	Total (afy)
Municipal Purveyors	23,800-22,250	18,125-33,975	41,975-56,225
Agriculture & Others	12,700-12,600	1,000	13,700-13,600
Total	**36,500-34,850**	**19,125-34,975**	**55,675-69,825**

State Water Project Supply Reliability

Nancy Clemm, P.E.

State Water Project Supply Reliability

- Source: "Draft State Water Project Delivery Reliability Report 2009," Department of Water Resources (DWR).
- Includes estimates of current (2009) and future (2029) water delivery reliability of the State Water Project (SWP).
- Delivery estimates made using DWR's operations simulation model of SWP/Central Valley Project system.

Model Studies in 2009 SWP Reliability Report

Current (2009)

- Represents estimates of current reliability under existing conditions.
- Based on historical hydrology, existing SWP facilities, existing operating constraints, and current demands.

Future (2029)

- Represents estimates of future reliability if no change to SWP facilities or operating constraints.
- Based on hydrology adjusted to reflect effect of climate change, and increased future demands.

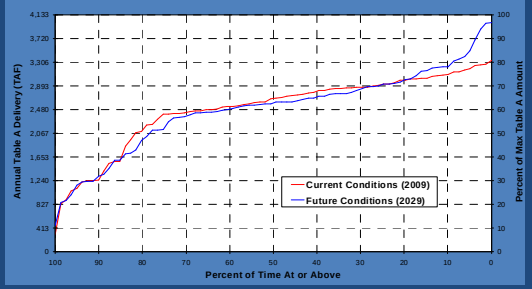
Modeling Assumptions in 2009 SWP Reliability Report

	Current (2009)	Future (2029)
Hydrology	Historical (based on 1922-2003)	Historical, adjusted for effect of climate change
SWP Facilities	Existing	Same
Operating Criteria	SWRCB D-1641 FWS Biological Opinion NMFS Biological Opinion	Same
SWP Demands		
Table A water	3.0 – 4.1 MAF	4.1 MAF (Max Table A amount)
Article 21 water	414 or 214 TAF/mo	Same

Changes Since 2005 Reliability Report: Modeling Assumptions

- Extended hydrologic period: now 1922-2003.
- Inclusion of effects of climate change in future study.
- Addition of operational constraints from FWS and NMFS Biological Opinions.
- Higher SWP demands (both Table A and Article 21 water).
- Inclusion of contractor carryover.

Results from 2009 Reliability Report: SWP Table A Delivery Probability



Results from 2009 Reliability Report: Average and Dry Period Deliveries

Total SWP Table A Delivery from Delta (in percent of max Table A amount*)						
Study	Average (1922-2003)	Single dry year (1977)	2-year drought (1976-77)	4-year drought (1931-34)	6-year drought (1987-92)	6-year drought (1929-34)
Current (2009)	60%	7%	36%	34%	35%	34%
Future (2029)	60%	11%	38%	35%	32%	36%

* Total maximum Table A amount from Delta is 4,133 TAF.

Comparison to 2005 Reliability Report: Delivery Results

- Lower average SWP deliveries.
- Higher single dry year deliveries (1977).
- Variable effect on multiple dry year deliveries.

Total SWP Table A Delivery from Delta (in percent of max Table A amounts)						
Study	Average (1922-94/2003)	Single dry year (1977)	2-year drought (1976-77)	4-year drought (1931-34)	6-year drought (1987-92)	6-year drought (1929-34)
2005 Report						
Current	68%	4%	41%	32%	42%	37%
Future	77%	5%	40%	33%	42%	38%
2009 Report						
Current	60%	7%	36%	34%	35%	34%
Future	60%	11%	38%	35%	32%	36%

Applying SWP Reliability Report Results to Castaic Lake Water Agency

- SWP Reliability Reports show total SWP deliveries.
- Prior to 2009 report, DWR directed SWP contractors to determine their share of total deliveries as the proportion of their agency's Table A amount to sum of all contractors' Table A amounts.
- In 2009 report, DWR directs using this same method for average deliveries, but recommends using contractor-specific delivery data for single year or short periods.

Applying SWP Reliability Report Results to Castaic Lake Water Agency (con't)

- In studies for 2009 report, delivery results differ by contractor due to differing contractor demands and inclusion of modeling of contractor carryover water.
- Carryover water is Table A water allocated to a contractor in one year which, if storage is available in SWP's San Luis Reservoir, can be "carried over" for delivery to that contractor the following year.
- Carryover can provide additional supply in dry years, but availability and usability differ by contractor.
- CLWA service area demands are currently low relative to its Table A amount, so carryover is likely to provide dry-year supply in near term.

Results from 2009 Reliability Report Studies: Deliveries to CLWA

Total SWP Table A Delivery to CLWA (including carryover)						
Study	Average (1922-2003)	Single dry year (1977)	2-year drought (1976-77)	4-year drought (1931-34)	6-year drought (1987-92)	6-year drought (1929-34)
Current (2009)						
Delivery (TAF)	58.3	12.8	44.0	32.8	34.4	33.4
% of Table A*	61%	13%	46%	34%	36%	35%
Future (2029)						
Delivery (TAF)	57.4	9.1	34.1	33.0	29.6	33.8
% of Table A*	60%	10%	36%	35%	31%	36%
* CLWA Table A amount is 95.2 TAF.						

Comparison to 2005 Reliability Report: Deliveries to CLWA

- Lower average SWP deliveries.
- Higher single dry year deliveries (1977).
- Variable effect on multiple dry year deliveries.

Total SWP Table A Delivery to CLWA						
Study	Average (1922-94/2003)	Single dry year (1977)	2-year drought (1976-77)	4-year drought (1931-34)	6-year drought (1987-92)	6-year drought (1929-34)
2005 Report						
Current	64.7	3.8	39.0	30.5	40.0	35.2
Future	73.3	4.8	38.1	31.4	40.0	36.2
2009 Report						
Current*	58.3	12.8	44.0	32.8	34.4	33.4
Future	57.4	9.1	34.1	33.0	29.6	33.8
* Includes deliveries of carryover water.						

State Water Project Supply Reliability

Q & A -

Urban Water Management Plan 2010

Questions and Answers

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Consultant Team

- Kennedy/Jenks Consultants
- Luhdorff and Scalmanini
- Nancy Clemm, P.E.
- Stacy Miller Public Affairs

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Kennedy/Jenks Consultants

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Future Meeting Dates and Times

- Public Workshops
  - May 25, 2010
  - July 27, 2010
  - September 28, 2010
- Hearings (Tentative)
  - October 1
  - November 30
- Adoption (Tentative)
  - CLWA December 31, 2010?
  - Purveyors June 2011?

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Kennedy/Jenks Consultants

(ORIGINAL)

Santa Clarita Valley Urban Water Management Plan
July 27, 2010 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	MARSHALL PASTER			(661) 252 6057	20701 Soledad Cyn Rd 358 Canyon Country CA 91351
2.	Stacy Mueller	SCMPA			
3.	Dirk Marks	CLWA	WRM		
4.	Mary Lou Cotton	K/J			
5.	Matt Dickens	YWC	Resource Conservation Manager	661-259-5132	MDickens@valleywater.com
6.	JANICE THOMAS	private		661 222-7450	22pupperwolf@att.net
7.	Kevin Korenthal	Self		(661) 310-0769	—
8.	Cathy Hollomon	SCWA	Assoc WR Planner	661-259-2737	chollomon@scwater.org
9.	Harold Geiger	private	Homeowner	661 254 6478	htgeiger@sbcglobal.net
10.	Kendra Geiger	"	"	" " "	"
11.	PAUL BSTRICKLAND	ASSEMBLYMAN CAMDEN SMYTH	FIELD REP	661 714 6999	LUCK4US@ca.rr.com
12.	Patrick Bryant	City of SC	Admin Analyst	661-255-4902	pbryant@santa-clarita.com
13.	mari johnson	Self		661 360 8178	marijohns7@yahoo.com
14.	Steve Cole	NCWD	GM		SCOLE@NCWD.ORG
15.	L Adams	HOA			
16.	S Moss	HOA			
17.	B Bothara	HOA			
18.	Jorge H Aguila	Aguila Landscaping	owner	661-259-5641	aguilaland@sbcglobal.net

Santa Clarita Valley Urban Water Management Plan
July 27, 2010 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	Maureen Wade	Interested Citizen		661-254-2370	mobrownies@cc.rr.c
2.	Ronald Wynn	SDS			
3.	JEFF SAUNDERS	RESIDENT			JBSAWNDERS@AOL
4.	JASON SMISKO	Santa Clarita			
5.	Rebecca Correa	Waterwise			rcorrea@waterwise-consulting.com
6.	DAN RAMLER	SANTA CLARITA			
7.	Robert DiPrimio	Valencia Water			rdiprimio@valenciawater.
8.	David Fryhm	self			engrdave@mac.com
9.	Julie Molinare	Grass Greener Landscape Designs			
10.	Jackie Bick	Sen. M. Runner			
11.	Henry Schultz	SELF		661-284 5613	HENRYSO@PACBELL.NET
12.	JESSICA BUNKER	LAC WWD		626-300-3315	jbunker@dpw.lacounty.gov
13.	RAY ARSNOW	HOMEOWNER		———	IRSTEAMERR@yhoo.com
14.					
15.					
16.					
17.					
18.					

Santa Clarita Valley Urban Water Management Plan
July 27, 2010 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	Sally Bowler	Self	4	661-313-8324	salbowler@yahoo
2.	Sandra Cattell	Sierra Club		661 2590433	sumcatt@yahoo.com
3.	Carole Lutness	SCV Fair Elections		661-755 3772	carolelutness@att.com
4.	DAN MASNADA	CLWA	G.M.	661 2971600	
5.	Nancy Andrews	Retire DWR		661-295-6771	
6.	Frank Smathers	customer		661-296-0511	thunder1road@gmail.com
7.					
8.					
9.					
10.					
11.					
12.					
13.					
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17.					
18.					

September 2010 UWMP Workshop Notification of Postponement

Public Outreach Record

2010 Santa Clarita Valley Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations

September 14, 2010

«AddressBlock»

Subject: **September 2010 UWMP Workshop Postponed**

«GreetingLine»

Thank you for your interest in the 2010 Urban Water Management Plan (UWMP) and/or your attendance at one of the recent community workshops.

This is to notify you that the originally scheduled **September 28, 2010 UWMP workshop** has been **postponed** as we are awaiting UWMP document guidelines from the State of California which will not be released until the end of October, 2010.

The next 2010 UWMP community workshop will provide the most current information on components of the 2010 planning document and will take place as follows:

Date:	Tuesday, November 16, 2010
Time:	4:00 pm
Location:	Castaic Lake Water Agency 27234 Bouquet Canyon Road

The Urban Water Management Plan presents a picture of the valley's water situation through the year 2035 and describes the long-range water needs of the community and the means to supply the necessary water.

I encourage your participation at the November community workshop and look forward to seeing you then. If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Government Affairs, Public Relations & Communication
P.O. Box 55745, Valencia, CA 91385 [818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

POSTPONED

Friday 9-24-10 Signal

The originally scheduled September 28, 2010 UWMP workshop has been postponed as we are awaiting UWMP document guidelines from the State of California which will not be released until the end of October, 2010.

The next 2010 UWMP community workshop will provide the most current information on components of the 2010 planning document and will take place as follows:

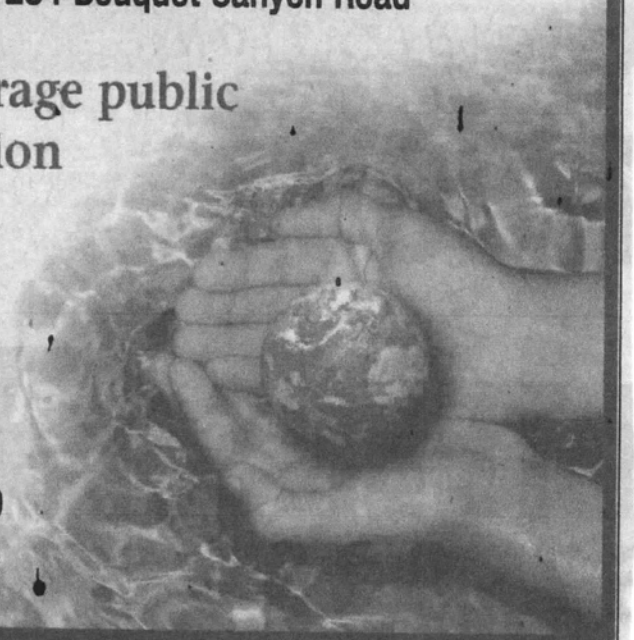
New Workshop Date is:

Date: Tuesday, November 16, 2010

Time: 4:00 pm

Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

We encourage public participation and input



For more information, please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

November IRWM Stakeholder Presentation

Public Outreach Record

2010 Santa Clarita Valley Urban Water Management Plan

To: Jeff Ford
Cc: Jeff Ford
Subject: RE: November 9 Upper Santa Clara River IRWM Stakeholders Meeting

From: Jeff Ford
Sent: Thursday, October 28, 2010 7:55 AM
To: Jeff Ford
Subject: November 9 Upper Santa Clara River IRWM Stakeholders Meeting

Dear Upper Santa Clara River IRWM Stakeholders:

Our next meeting will be one week from today at the City's Activities Center. We have had several meetings at this location now, but you can go to the City's website if you need directions, or map the address (20880 Centre Pointe Parkway, Santa Clarita, California 91350). On the agenda is an update of our grant applications, an update of the activities of the Invasive Weeds Task Force and an overview of the 2010 Urban Water Management Plan for the Santa Clarita Valley presented by the consultants working on it (an agenda is attached). We will start as usual at 2:30 p.m., but probably end a little later than normal given the items on the agenda.

Hope to see you all there.

Regards,

Jeff Ford
Principal Water Resources Planner
Castaic Lake Water Agency
(661) 513-1281

1

Urban Water Management Plan

Upper Santa Clara River Watershed
Integrated Regional Water Management Plan
Stakeholder Meeting
Tuesday, November 9, 2010

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IRWMP Stakeholder Meeting
UWMP Overview

- What is an UWMP?
- Who is required to submit an UWMP?
- Why are UWMPs developed?
- When are the UWMPs developed?
- Existing and new requirements of UWMPs
- Q&A

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What is an Urban Water Management Plan?

- An Urban Water Management Plan is a comprehensive planning process whereby urban water suppliers describe and evaluate sources of water supply, efficient uses of water, demand management measures, implementation strategy and schedule, and other relevant information and programs.

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Who is required to prepare an UWMP?

- Publicly or privately owned water suppliers (including wholesalers), providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet annually.

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Why are UWMPs Developed?

- In adherence to the 1983 Urban Water Management Planning (UWMP) Act and subsequent legislation
- To develop a framework for agencies to integrate programs and projects that enhance the quality and quantity of regional water supplies
- To identify gaps between supply and demand through time (20-year analysis required)
- To provide detailed description of all supply sources (surface, recycled, groundwater)

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Why are UWMPs Developed? (Cont'd.)

- To identify Demand Management Measures (water conservation programs)
- To address water quality issues
- To develop water shortage contingency planning
- To describe how demand will be met through time, in all hydrologic year types (normal, multiple dry, critical dry)

7

When are UWMP Plans Developed?

- Suppliers are required to update UWMP every five-years (years ending in 0 or 5).
- 2010 – current update
- July 1, 2011 for retailers (SBx7-7 extended UWMP deadline for retailers but silent on extension for wholesalers.)
  - Under current UWMP Act, wholesalers should complete UWMP by December 31, 2010. But "cleanup legislation" (AB 2776 and SB 1478) extended deadline to July 1, 2011 for wholesalers.

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Coordination and Notification Requirements

"Each urban water supplier shall coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practical."

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Coordination and Notification Requirements

Other:

- Must hold public hearing prior to adoption of UWMP
- Must give cities and counties in service area 60 days notice prior to public hearing
- Must provide cities and counties and LAFCO in service area with copies of UWMP within 30 days of adoption

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Penalties

- Ineligible for State Grant and Loan Funding (at least until plan is completed to DWR satisfaction)
- Vital to the IRWMP process!

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What, Who, Why, When, etc…

- Q&A/Discussion

12

New Requirements for 2010 UWMP

- New Law: SBX7-7 ("20% x 2020"), reporting starts with 2010 UWMPs
  - Base gross water use in gpcd: must be calculated using one of three methodologies
  - Target reduction from base by 2020: reporting requirements differ for retailers vs. wholesalers
  - Must be calculated using one of four methodologies
  - Agencies must hold public hearing to explain how targets will be met (can be held as part of UWMP hearing)

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New UWMP Requirements

- Base gross water use in gpcd: calculation

  Total volume of water (treated or not) entering the retail distribution system, divided by the total population of the service area

  (Excludes: recycled water, net volume into long-term storage, water conveyed to another retailer, agricultural water)

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New UWMP Requirements

- Base gross water use in gpcd: methodologies
  - 10-year average
    - *ending no earlier than 2004 – no later than 2010; OR*
  - 15-year average if 10% of 2008 demand met by recycled water
    - *get to add 5 years to calculation; AND*
  - 5-year average
    - *at least 5% reduction if agency is already close to 100 gpcd*
    - *ending no earlier than 2007 – no later than 2010*

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New UWMP Requirements

- Base gross water use in gallons per capita per day (gpcd)
  - Averages are determined on a rolling basis
  - Should review demands over various periods to determine hydrologic and demand year types
  - Recent economic impacts and drought response may have reduced demand!

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New UWMP Requirements

- Target reduction methodology options
  1. 20% reduction from base (i.e., 80% of average gross water use in gpcd)
  2. Combination of state standards:
     - 55 gpcd indoor residential + landscape use at 70% -80% ETo + 10% reduction in commercial/industrial/institutional use
  3. DWR 20x2020 hydrologic region target (South Coast region = 149 gpcd)
  4. Option to be developed by October 2010

17

New UWMP Requirements

- Reduction Target Option 4
  - Subject to DWR public process during 2010
  - Will identify targets to achieve cumulative statewide 20% reduction
  - Must allow flexibility for water supplier service area characteristics

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New UWMP Requirements

- Issues: DWR will derive methodologies for calculations: population, base water use, gross water use, sector water use, Option 4, others
  - As DWR derives new methodology standards, agencies may be required to use them
  - Won't be final until December 2010
  - If work has already been done, it may need to be repeated
  - = Reason for UWMP deadline extension to July 1, 2011

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New UWMP Requirements

- Other
  - SB 1087 (Florez) - requires an UWMP to include projected water use for single-family and multi-family residential housing for lower income households as identified in the housing element of any city, county, or city and county in the service area of the supplier.

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Consultant Team

- Kennedy/Jenks Consultants
- Luhdorff and Scalmanini
- Nancy Clemm, P.E.
- Stacy Miller Public Affairs

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Questions, Answers and Discussion

CASTAIC LAKE WATER AGENCY

NCWD

SCWD

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Future Meeting Dates and Times
Public Workshops
May 25, 2010
July 2, 2010
November 16, 2010
January 11, 2011 (tentative)
March 8, 2011 (tentative)
Public Hearings
January 26, 2011 (tentative)
March 23, 2011 (tentative)
April 27, 2011 (tentative)
Adoption
June 2011
Enduring Relationships - Trusted Expertise - Promises Delivered

Upper Santa Clara River Watershed
Integrated Regional Water Management Plan

Stakeholder Meeting #18
Tuesday, November 9, 2010
2:30 pm –4:30 pm
City of Santa Clarita Activities Center
20880 Centre Pointe Parkway
Santa Clarita, California 91350

Meeting Objectives:

- Updates on Grants
- Invasive Weeds Task Force Report
- 2010 Urban Water Management Plan Workshop

AGENDA

2:30 **I. Welcome and Introductions**

A. Meeting purpose and outcomes

B. Stakeholder self-introductions

Jeff Ford, CLWA

2:35 **II. Project Updates/Prioritzation**

A. Planning Grant Update

B. Planning Grant Schedule

C. Implementation Grant Update

D. Final Suite of Projects

E. Implementation Grant Schedule

Jeff Ford, CLWA

2:45 **III Santa Clara River Invasive Weeds Task Force**

A. Results of October Meeting

B. Future Activites

Heather Merenda, City of Santa Clarita

3:00 **IV. 2010 Urban Water Management Plan**

4:30 **V. Close**

UPPER SANTA CLARA RIVER
INTEGRATED REGIONAL WATER MANAGEMENT PLAN

Stakeholder Meeting #18

November 9, 2010
City of Santa Clarita, Activities Center

Meeting Summary

PURPOSE AND MEETING OVERVIEW

The purpose of this 18th stakeholder meeting was to:

- Update Stakeholders on Grants
- Report on the Invasive Weeds Task Force
- Hold a Workshop on the 2010 Urban Water Management Plan

Stakeholders representing public agencies and private, non-profit organizations attended this meeting.

UPDATE ON THE IRWM PROCESS

Jeff Ford provided a recap and explanation of the progress on grant applications for both the Planning Grant and the Implementation Grant including:

- Overview of new Plan requirements
- The submittal of a Planning Grant application in September and the schedule for DWR to award.
- Progress on preparing an Implementation Grant application and the expected schedule for DWR to accept applications and make awards.
- Review of the final project suite in the Implementation Grant application and approval of including a project not in the adopted IRWMP: the Valencia Water Company's Santa Clarita Valley Southern End Recycled Water Project.

UPDATE ON THE SANTA CLARA RIVER INVASIVE WEEDS TASK FORCE

Heather Merenda from the City of Santa Clarita discussed the Task Force's progress to date and gave an overview of the goals of the Task Force. She noted that the next meeting was scheduled for January in Filmore. More details will be sent to the stakeholders as they become available, but interested parties were encouraged to join the Task Force directly.

OVERVIEW OF THE 2010 URBAN WATER MANAGEMENT PLAN

Stacy Miller of Stacy Miller Public Affairs and Mary Lou Cotton of Kennedy/Jenks Consultants gave an overview of the requirements of the UWMP Act, the contents of the UWMP and the progress to date on the 2010 UWMP. They detailed the schedule of workshops and hearings leading the adoption of the UWMP in June of 2011.

OTHER ITEMS

Jeff Ford announced that the next Stakeholders Meeting is tentatively scheduled for January at a location TBD. Meeting notices will be emailed to stakeholders once a date is determined.

IRWMP Invitee & Attendee List - 11-9-10

Organization	Telephone Number	Fax Number	e-mail address	Initial
LA County Regional Planning	(213) 974-6476		madams@planning.lacounty.gov	
DWR, Glendale, CA	(818, 500-1645		ljurkevi@water.ca.gov	
California Native Plant Society				
LA Co Flood Control District Meherva Ariki	626-458-4314		mariki@dpw.lacounty.gov	
Atkins Environmental	(661) 266-2260	(661) 253-3555	bj@atkinsenvironmental.com	
Building Industry Association	(661) 257-5046		nayala@biaglav.org	
Acton Town Council	(661) 269-2588		Airspecial@aol.com	
UCCE Water Quality Program				
West Ranch Town Council				
Senator George Runner	(661) 286-1471		jackie.bick@sen.ca.gov	
Los Angeles Sheriffs Department			wfbennet@lasd.org	
California Dept. of Water Resources				
UCCE - Los Angeles				
California Dept. of Water Resources				
California Regional Water Quality Control Board	(213) 576-6679		sbirosik@waterboards.ca.gov	
LA County Flood Control District			HBORDAS@dpw.lacounty.gov	
CDFG	(661)259-3750			
Friends of the Santa Clara River	(805) 498-4373		bottorffm@verizon.net	
UCCE Center for Water Resources				
U.A.P. Timberland				
California Coastal Conservancy				
NRCS-Somis				
U.S. Army Corps of Engineers	(213) 452-4057		darrell.w.buxton@usace.army.mil	
VCRCD-Wildscape Restoration	(805) 644-6852	(805) 642-2127	noreen@wildscaperestoration.com	
Los Angeles County DPW	(661) 947-7173		mcaddick@dpw.lacounty.gov	
USDA Forest Service			jcapell@fs.fed.us	
California Dept of Fish and Game	(805) 640-1852		mcardenas@dfg.ca.gov	
MIG Associates			joanc@migcom.com	
Newhall County Water District	(661) 259-3610		scole@ncwd.org	
Acton Town Council	(661) 269-5675			
The Nature Conservancy				
Kennedy/Jenks Consultants	(805) 658-0607		MaryLouCotton@KennedyJenks.com	
California Dept. of Fish and Game	(661) 263-8306		bcourtney@dfg.ca.gov	
Kennedy/Jenks Consultants	(805) 658-0607		MeredithClement@kennedyjenks.com	
	(818) 365-9847		d r crane@hotmail.com	
LA County DPW	(626) 458-3524	(626) 458-3534	ascruz@dpw.lacounty.gov	
Valley Crest Tree Company	(818) 737-2697		rcrudup@vctree.com	
Acton Town Council	(661) 269-3682	(661) 269-3683	wdavis289@hughes.net	
Assemblyman Cameron Smith	(661) 286-1565		jarrod.degoria@asm.ca.gov	
LA Co DPW	(626) 458-4313		bdepoto@dpw.lacounty.gov	
Valencia Water Company	(661) 294-0828		rdiprimio@valencia.com	

Organization	Telephone Number	Fax Number	e-mail address	Initial
The Nature Conservancy			tdoherty@tnc.org	
University of California Cooperative Extension	(323) 266-3404		sldrill@ucdavis.edu	
University of California, Santa Barbara	(805) 893-2911		tdudley@msi@uscsb.edu	
	(661) 251-9729	(661) 259-1845	water@dslextreme.com	
Santa Clarita Valley Well Owners Association	(661) 298-2000		rfleck@socal.rr.com	
Castaic Lake Water Agency	(661) 513-1281		jford@clwa.org	
LA Co DPW	(626) 458-6158		afuentes@dpw.lacounty.gov	
LA Co DPW Waterworks	(626) 300-3324	(626) 300-3358	hgallardy@dpw.lacounty.gov	
			avrcd@carcd.org	
LA Co Dept. of Regional Planning	(213) 974-6417		rglaser@planning.lacounty.gov	
Acton Town Council				
			tgrant@ladpw.org	
Los Angeles County Sanitation Disrict			fguerrero@lacsd.org	
West Ranch Town Council	(661) 254-6116		grf497@aol.com	
SCWD				
Los Angeles County Sanitation Disrict	(562) 908-4288 x 2832		fguerrero@lacsd.org	
Santa Clarita Valley Environmental Coalition			mgutzeit@ca.rr.com	
LA County Public Works Department	(626) 458-5918		bhamamo@ladpw.org	
California DFG			spharris@cdfg.ca.gov	
Director Regional Planning				
L.A. County Supv'r Mike				
CLWA	(661) 513-1253		Thawes@clwa.org	
Agua Dulce Town Council	(661) 268-1731			
Agua Dulce Town Council	(661) 268-1731		BH33605@AOL.com	
	(661) 295-7300		John@gruber-systems.com	
SCWD	(661) 259-2737		chollomon@scwater.org	
County of Ventura			Susan.Hughes@Ventura.org	
U.S. Army Corps of Engineers	(213) 452-3826		james.d.hutchison@spl01.usace.army.mil	
Agua Dulce Town Council			jjennings3570@sbcglobal.net	
Evironmental Protection Agency				
Vulcan Materials Co.,				
CalTrans, District 7 - IGR/CEQA Branch	(213) 897-1346		edwin_kapmann@dot.ca.gov	
Valencia Industrial Association				
LA County DPW	(626) 458-4350		fkim@dpw.lacountry.gov	
LA County Waterworks	(626) 300-3327		tjkim@dpw.lacounty.gov	
Castaic Area Town Council				
LA County Flood Control District	(626) 458-4350		Fkuo@dpw.lacounty.gov	
City of Santa Clarita	(661) 255-4337		TLANGE@santa-clarita.com	
Lakes Town Council	(661) 724-0150		cedar91@verizon.net	
			redraggles2@earthlink.net	
NRCS	(661) 945-2604 X 110		jae.lee@causda.gov	

Organization	Telephone Number	Fax Number	e-mail address	Initial
Angeles National Forest			mlambardo@fs.fed.us	
SCOPE				
Los Angeles County Sanitation Disrict	(562) 699-7411 X 2802		blouie@lacsd.org	
Santa Clarita Valley Chamber of Commerce	(661) 702-6977		Lmankin@scvchamber.com	
Castaic Lake Water Agency				
Aqua Dulce Town Council				
Ventura Cty Watershed Protection District				
LA County Dept. of Public Works	(661) 947-7173		mcaddick@dpw.lacounty.gov	
The Nature Conservancy	(805) 642-0345 ext. 502		cmccalvin@tnc.org	
L. A. County Regional Planning				
United Water Conservation District				
City of Santa Clarita	(661) 284-1413		hmerenda@santa-clarita.com	
County of Ventura Ag. Commisioner's Office				
The Nature Conservancy	(661) 642-0345 X 502		smatsumoto@tnc.org	
United Water Conservation District				
Valencia Water Company	(661) 295-6512		gmilleman@valencia.com	
City of Santa Clarita	(661) 284-1413		hmerenda@santa-clarita.com	
Ventura County Resource Conservation District (VCRCD)	(805) 386-4685	(805) 386-4890	marty.melvin@vcred.org	
County of Ventura				
Kennedy/Jenks Consultants				
City of Santa Clarita	(661) 255-4959		cmonde@santa-clarita.com	
NRCS				
County of Los Angeles, Department of Parks and Recreation				
			TNGOV@dpw.lacounty.gov	
SCOPE	(661) 255-7112			
Ventura Cty Watershed Protection District			kirk.norman@ventura.org	
			kathy@via.org	
Stillwater Sciences	(510) 848-8098 ext. 111		bruce@stillwatersci.com	
Tataviam Band of Mission Indians				
	(661)251-6113		DOJTRUM@SOCAL.RR.COM	
South Coast Wildlands Project				
Newhall Land	(661)257-1095		cperez@newhall.com	
Association of Water Agencies of Ventura County				
Supervisor Antonovich's Office	(661) 287-3657		dperry@lacbos.org	
Los Angeles County Flood Control District	(805) 57-0497			
SCOPE				
Well Owner	(661) 297-4401			
			avconservancy@yahoo.com	
SCV Well Owners Association				
The Sierra Club, Angeles Chapter				
County of Ventura	(805) 654-2455		lynn.rodriguez@ventura.org	

Organization	Telephone Number	Fax Number	e-mail address	Initial
Ventura Cty Watershed Protection District				
County of Ventura				
Newhall County Water District	(661) 259-3610		krussell@ncwd.org	
LA County Waterworks District #36 & 37			DRYDMAN@dpw.lacounty.gov	
Rivers and Mountains Conservancy	(626) 458-4315		fsimpson@rmc.ca.gov	
Aqua Dulce/Acton Country Journal	(661) 269-5804	(661) 269-5532	countryjournal@bigplanet.com	
Friends of the Santa Clara River	(661) 644-2802		rsweet46@hotmail.com	
Santa Monica Mountains Conservancy				
Sierra Club	(661) 296-1212		kms39005@csun.edu	
US Fish and Wildlife Service	(805) 644-1766 X 339		Steurer_denise@fws.gov	
Wetlands Recovery Project				
Rivers and Mountains Conservancy	(626) 815-1019 x110		ltorres@rmc.ca.gov	
Foothill Associates	(661) 284-3018		jeff.trow@foothill.com	
Mountains Recreation and Conservation Authority				
Ventura Cty Watershed Protection District				
Friends of the Santa Clara River				
Supervisor Antonovich's Office	(661) 287-3657		rwayman@lacbos.org	
	(661) 251-7790			
Councilmember, City Of Santa Clarita				
West Ranch Town Council	(661) 799-8089		rg@rgwinter.com	
United Water Conservation District				
LA County-DPW	(626) 458-6159		alwong@dpw.lacounty.gov	
State of California, Dept of Water Resources	(916) 651-9283		bwycoff@water.ca.gov	
Santa Clarita Valley Sanitation District	(562) 699-7411 X 2820		mzauner@lacsd.org	
LA County-Dept. Water Resources	(626) 456-6188		kzimmer@ladpw.gov	

SMPA - Stacy Meller 818402-5806 Stacy@StacyMellerPA.com

Mata Dickens - Valencia water 661-510-9733 mDickens@Valleywater.com

K Russell NCWD 661-2593610

D. Marks CLWA

Roger A. Harris CCA 805-641-3781 rah@agriculturesucss.com

November 2010 UWMP Workshop
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations

November 3, 2010

*** Orgs shaded above will receive letter return receipt requested See Attached

Subject: 2010 Urban Water Management Plan November Workshop

Dear Sir or Madam,

The Santa Clarita Valley's water agencies, Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company are currently preparing the 2010 Urban Water Management Plan (UWMP).

In an effort to ensure all interested parties are fully informed and involved in this process, the water agencies have scheduled their third community workshop on November 16, 2010 and welcome your participation. This workshop will provide the most current information on components of the 2010 UWMP.

Date:	Tuesday, November 16, 2010
Time:	4:00 pm
Location:	Castaic Lake Water Agency 27234 Bouquet Canyon Road

The Urban Water Management Plan presents a picture of the valley's water situation through the year 2035, describes the long-range water needs of the community and the means to supply the necessary water.

I encourage your participation and look forward to seeing you then. If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Government Affairs, Public Relations & Communication
P.O. Box 55745, Valencia, CA 91385 [818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

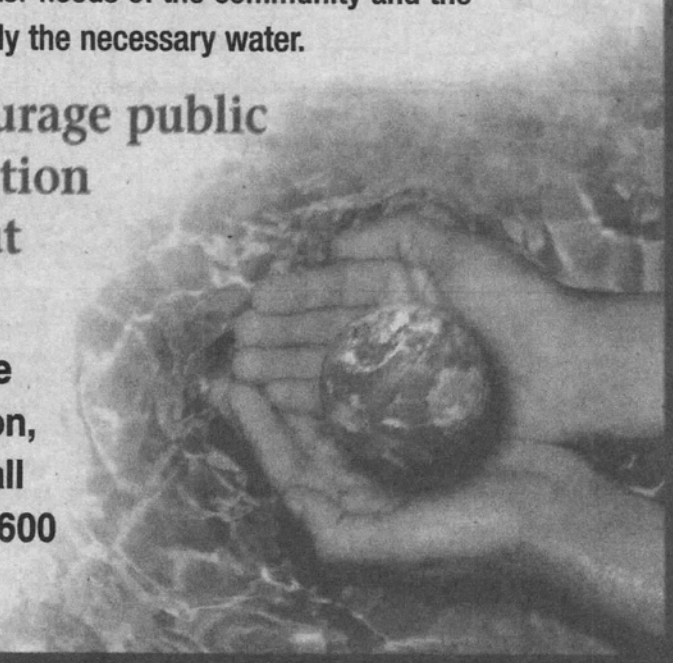
The Signal
11-9-10

Date: Tuesday, November 16, 2010
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

This workshop will provide the most current information on components of the 2010 UWMP. Our team will provide an overview of the opportunities for public comment and will also be available for questions.

The Urban Water Management Plan, mandated by the State of California, presents a picture of the valley's water situation through the year 2035. It describes the long-range water needs of the community and the means to supply the necessary water.

We encourage public participation and input



For more information, please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

The Signal
11-14-10

Date: Tuesday, November 16, 2010
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

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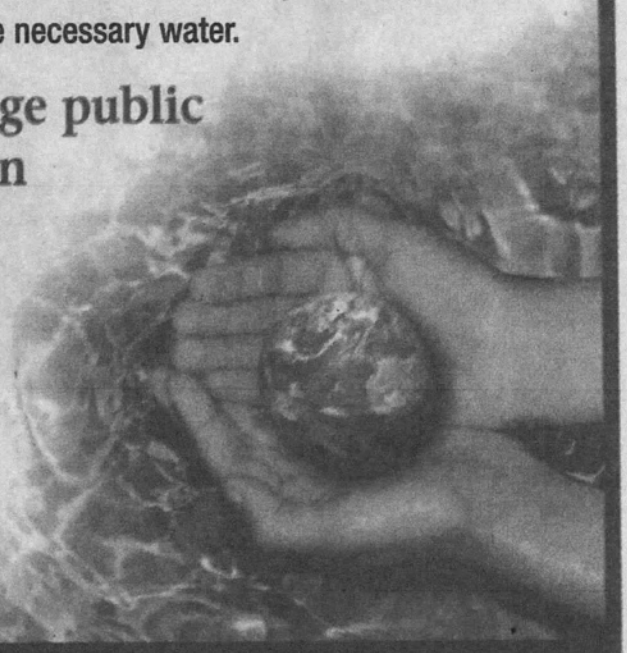


For more information, please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

URBAN WATER MANAGEMENT PLAN UPDATE

2010 UWMP offers creative solutions to SCV water issues

The California Urban Water Planning Act requires water utilities to update and submit an Urban Water Management Plan (UWMP) every five years. CLWA and the local water retailers are preparing a draft of the Santa Clarita Valley 2010 Urban Water Management Plan for review this winter and spring of 2011. All California urban water suppliers having more than 3,000 service connections or selling more than 3,000 acre-feet of water annually are required by the California Water Code to prepare a UWMP every five years.

CLWA is one of approximately 450 water suppliers in California preparing such a plan. CLWA, Santa Clarita Water Division, Newhall County Water District (NCWD) and Valencia Water Company are working together to prepare a draft of the 2010 plan for the valley. The Los Angeles County Waterworks District No. 36 is participating on an ad hoc basis, as the Los Angeles County Department of Public Works must prepare its own UWMP.

Every Drop Counts

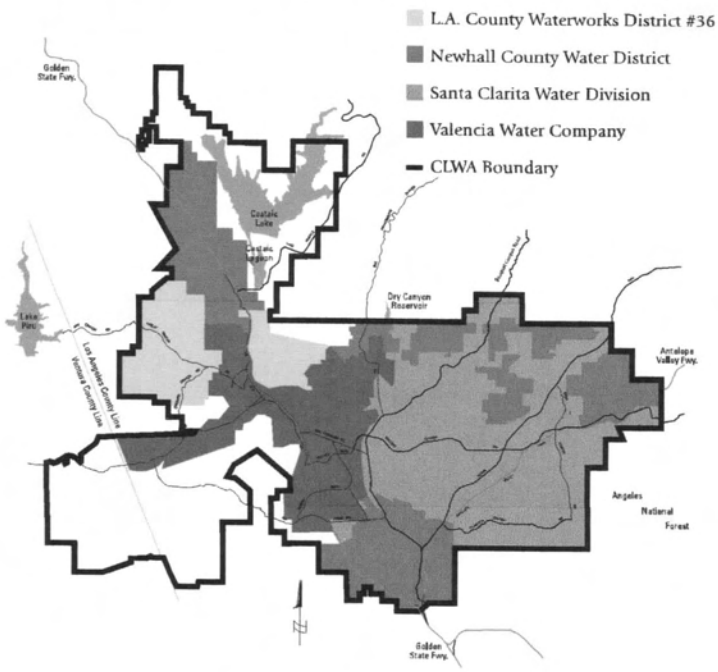
A UWMP must consider projected demands and supplies for a minimum 20-year period, in five-year increments. It must also assess water supply and demand scenarios for average/normal water years (i.e, periods of normal precipitation), a single dry year, and multiple dry years.

The draft 2010 UWMP for the valley will identify current local and imported water supply sources, as well as potential future sources. Current sources include the State Water Project, other sources of imported water, local groundwater and recycled water. Future potential sources include all of these plus water transfers and additional recycled water. The 2010 UWMP will also address the required levels of water conservation both to meet state law and ensure adequate supplies.

The plan will identify future demand based on growth projections. By assessing projected demand along with projected supply, the 2010 UWMP will show how the valley will meet its water needs through at least 2035.

There have been public workshops held to explain the UWMP and the process, and there will be several more along with a least two public hearings in 2011 by the CLWA and NCWD Boards of Directors. Public participation at all of these events is encouraged. The UWMP must be adopted no later than June 30, 2011.

Castaic Lake Water Agency Service Area



YOUR QUESTIONS AND COMMENTS ARE IMPORTANT TO US
PLEASE CALL (661) 297-1600 OR EMAIL US AT MAIL@CLWA.ORG

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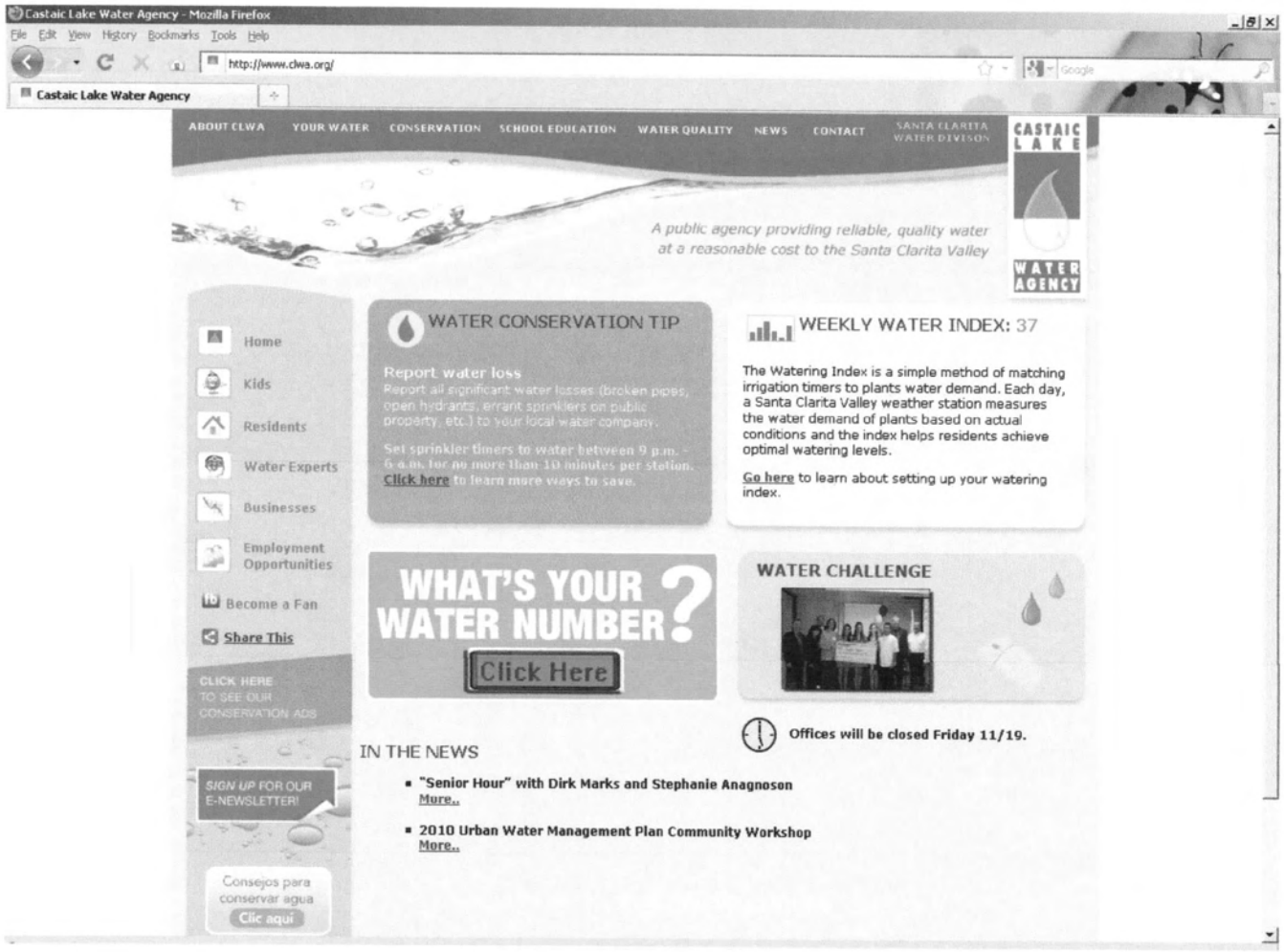
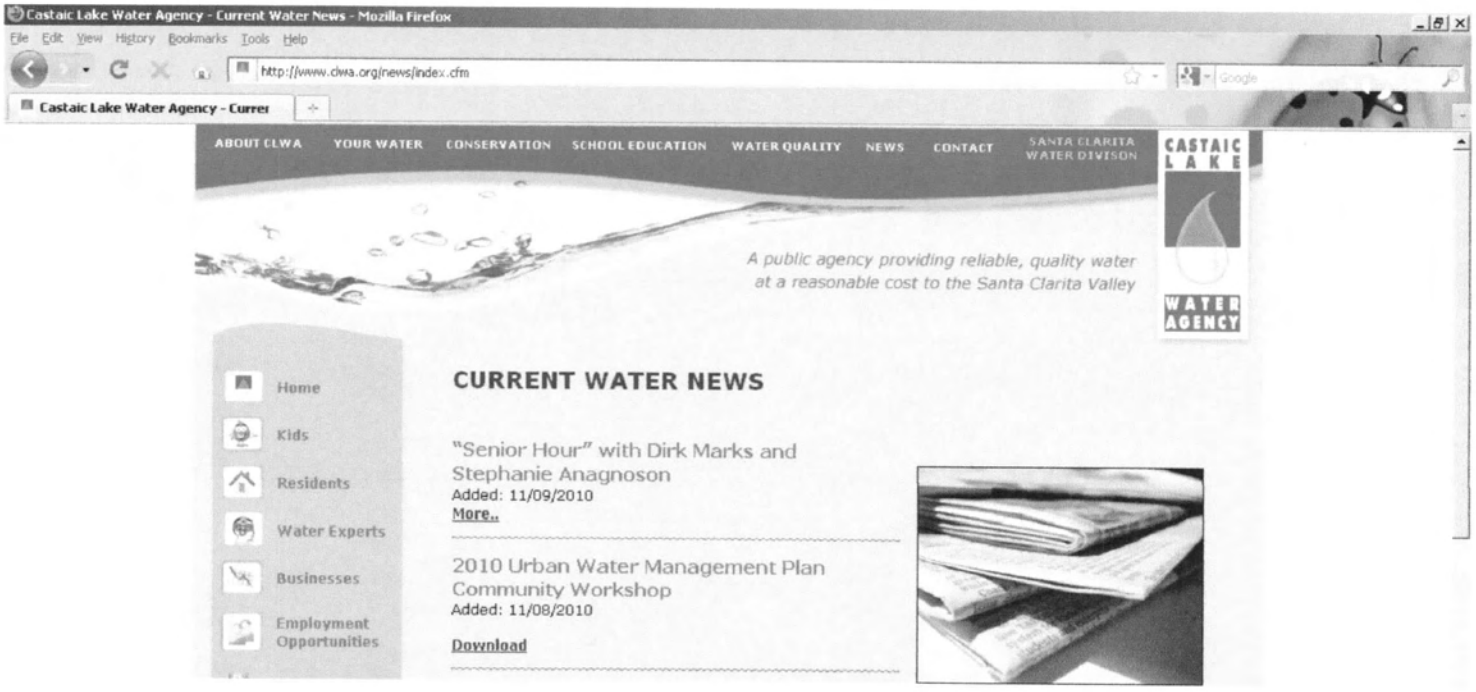
CASTAIC LAKE WATER AGENCY
27234 BOUQUET CANYON ROAD
SANTA CLARITA, CALIFORNIA
91350
(661) 297-1600
WWW.CLWA.ORG

Water Currents Newsletter
Fall 2010

PRINTED ON RECYCLED PAPER. EACH TON OF RECYCLED PAPER SAVES 7,000 GALLONS OF WATER.

Castaic Lake Water Agency
Webpage & Facebook Posting – November 2010 UWMP Workshop
Monday, November 08, 2010





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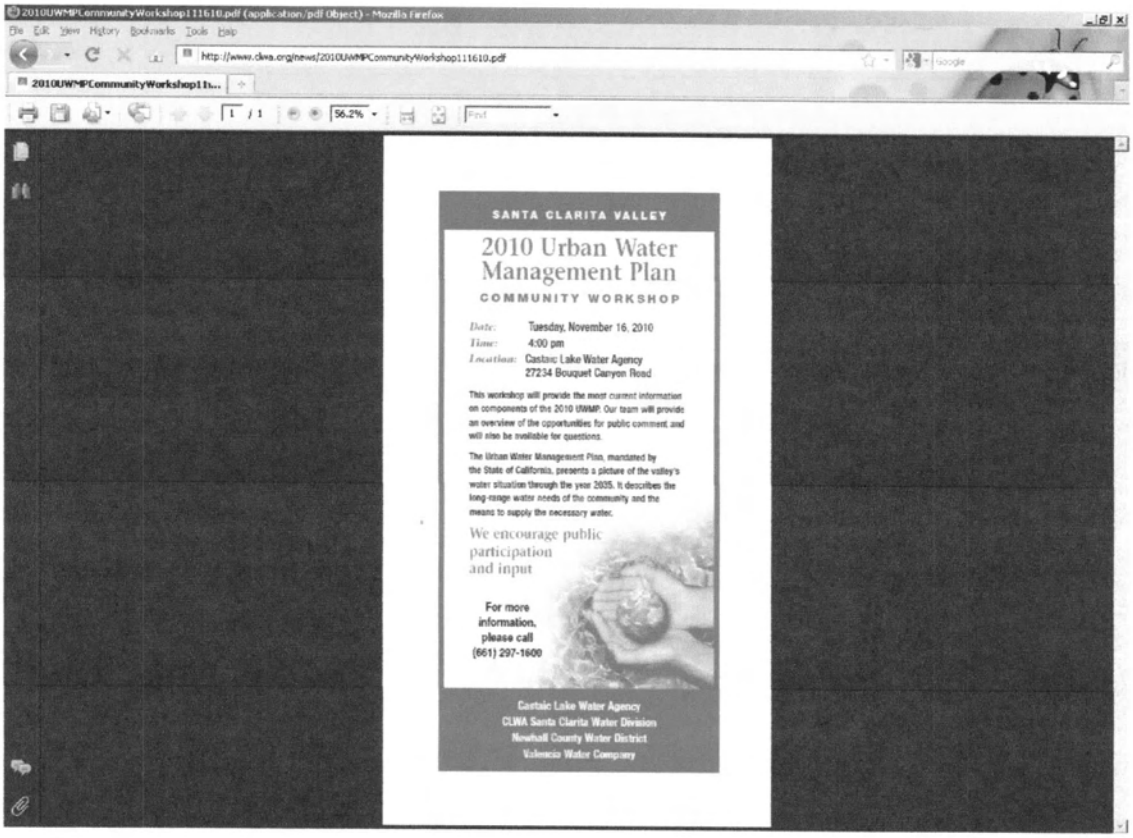
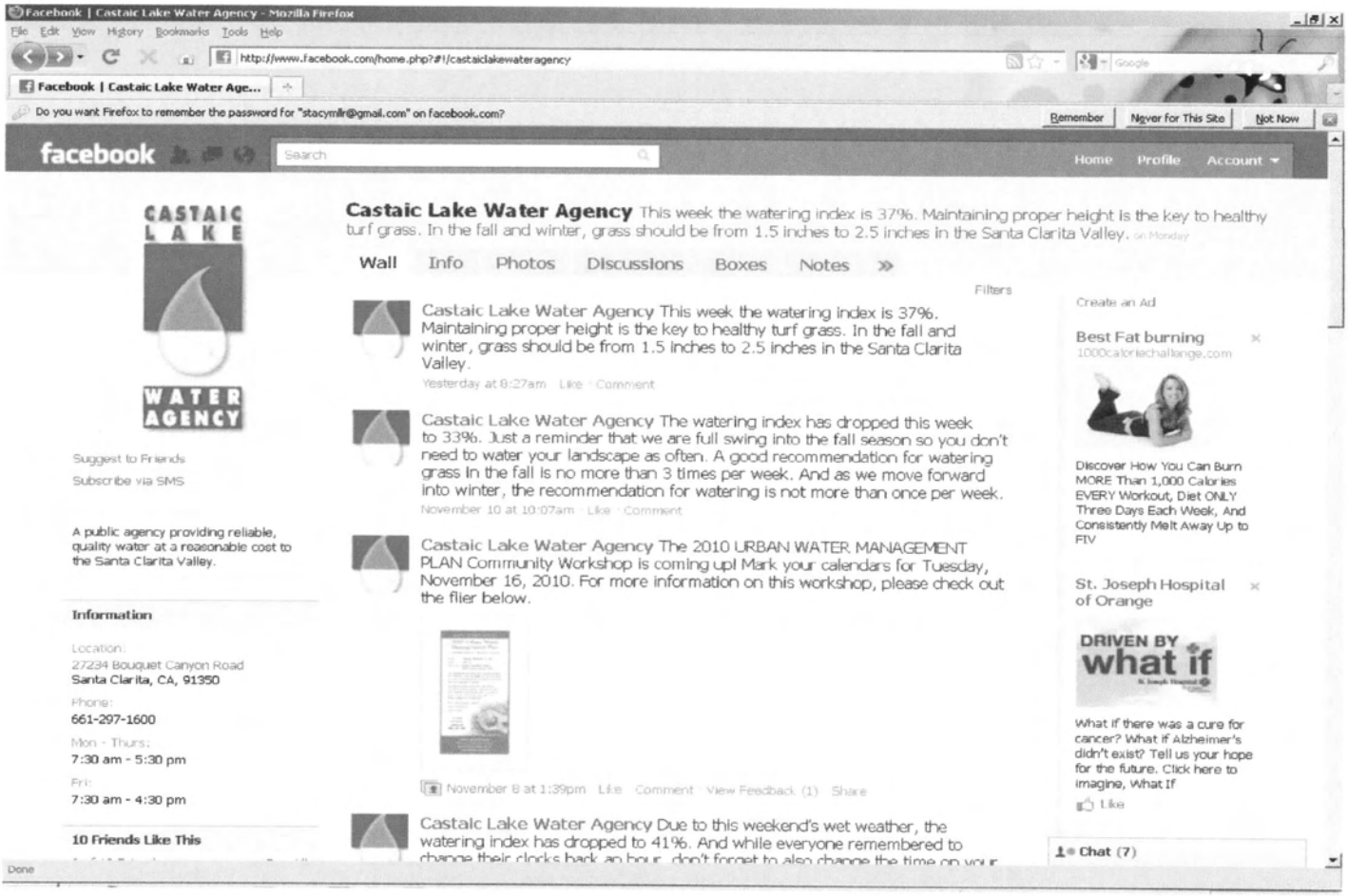
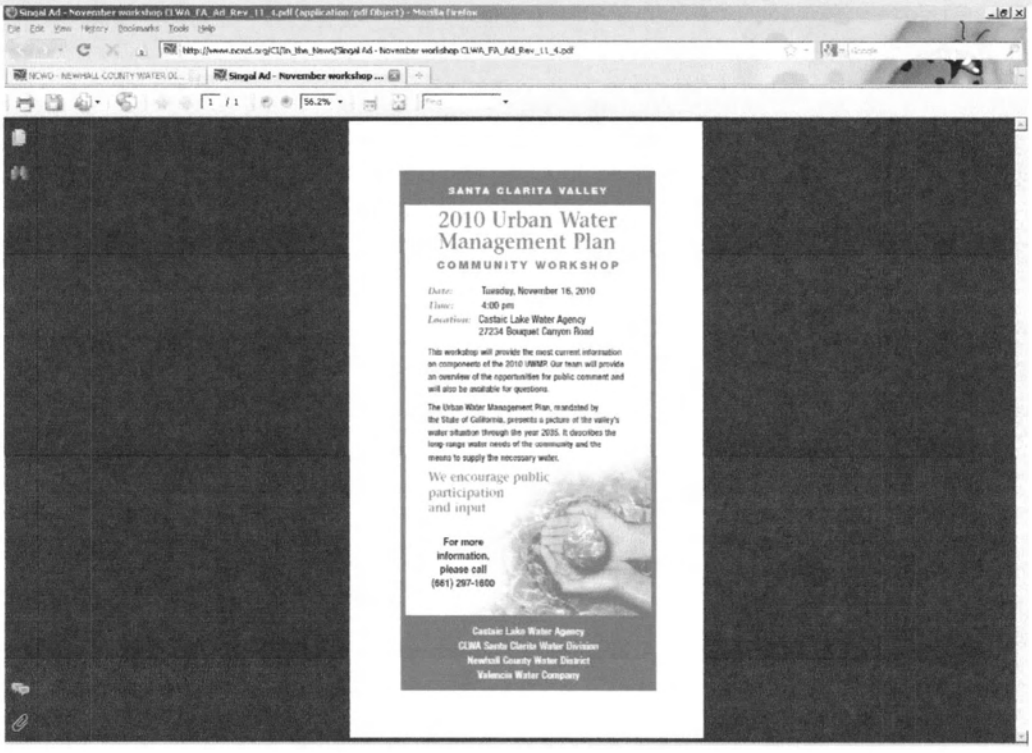
Monday, November 08, 2010





Newhall County Water District
Webpage & Facebook posting – November 2010 UWMP Workshop
Monday, November 08, 2010



Facebook | Newhall County Water District - Mozilla Firefox

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NCWD

NEWHALL COUNTY WATER DISTRICT

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Our water is a precious resource... Use water efficiently, Every Drop Counts!

Information

Location:
23780 N Pine Street
Newhall, CA, 91321

Phone:
661-259-3610

Mon - Fri:
8:00 am - 5:00 pm

Newhall County Water District

Wall | Info | Photos | Discussions | Notes | Video

Write something...

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Newhall County Water District + Others | Just Newhall County Water District | Just Others

Newhall County Water District Reg Board Mtg Wed Nov 17, 10 @ 6:30 pm

http://www.ncwd.org/OB/Agendas/regular-meeting-Nov17-2010.pdf
www.ncwd.org

November 10 at 10:29am · Like · Comment · Share

Newhall County Water District 2010 Urban Water Management Plan Community Workshop Nov 16, 10

http://www.ncwd.org/CI/In_the_News/Singal%20Ad%20-%20November%20workshop%20CLWA_FA_Ad_Rev_11_4.pdf
www.ncwd.org

November 8 at 11:03am · Like · Comment · Share

Newhall County Water District Notice of Holiday Closure

http://www.ncwd.org/CI/In_the_News/Holiday%20Closure.pdf
www.ncwd.org

November 4 at 10:09am · Like · Comment · Share

Newhall County Water District SCV Water Committee Mtg on Tue Nov 2, 10 @ 2pm @ City Hall of Santa Clarita

http://www.ncwd.org/OB/Agendas/SCV%20Comm%20Agenda%20Nov%202%2010.pdf

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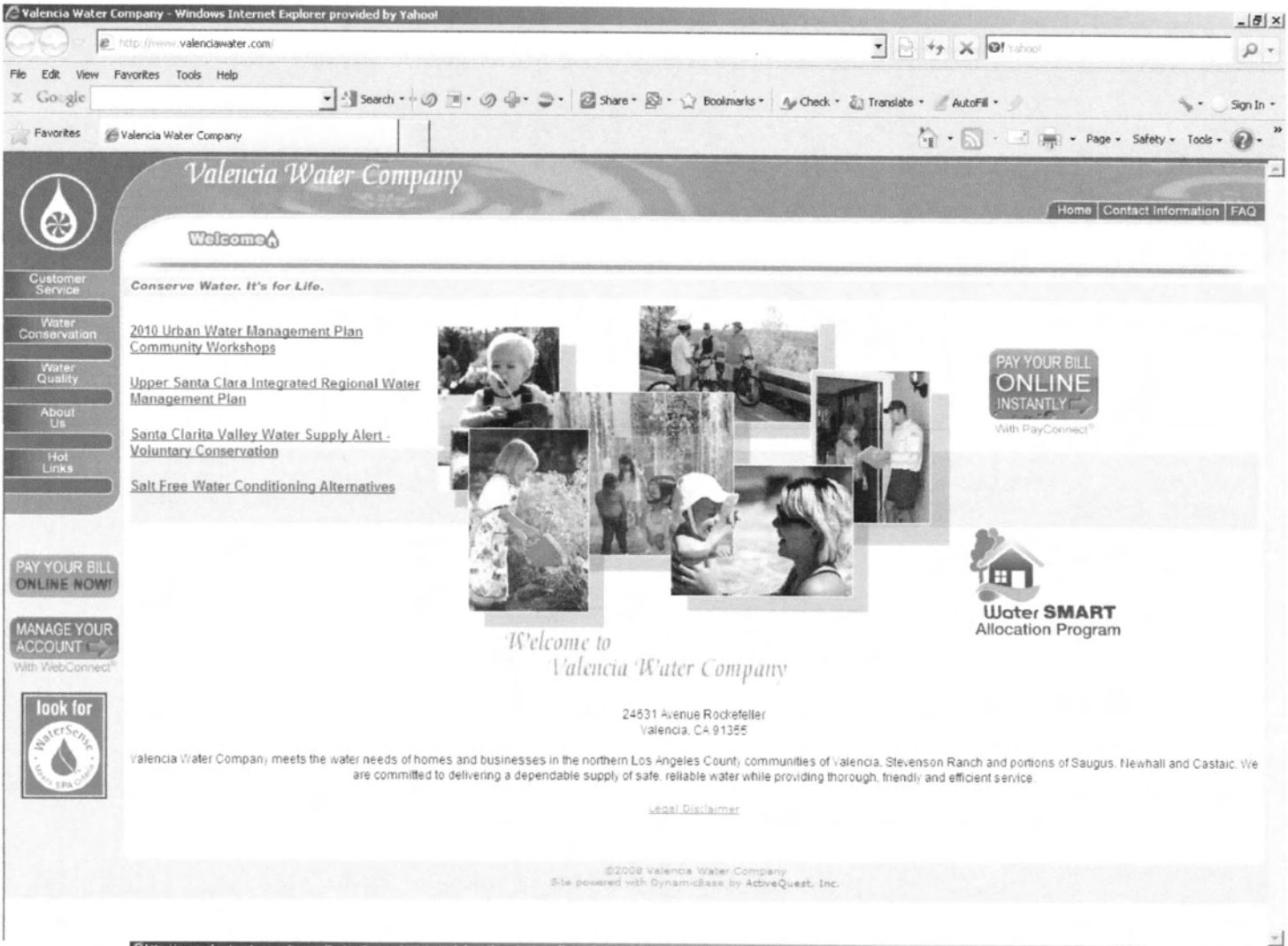
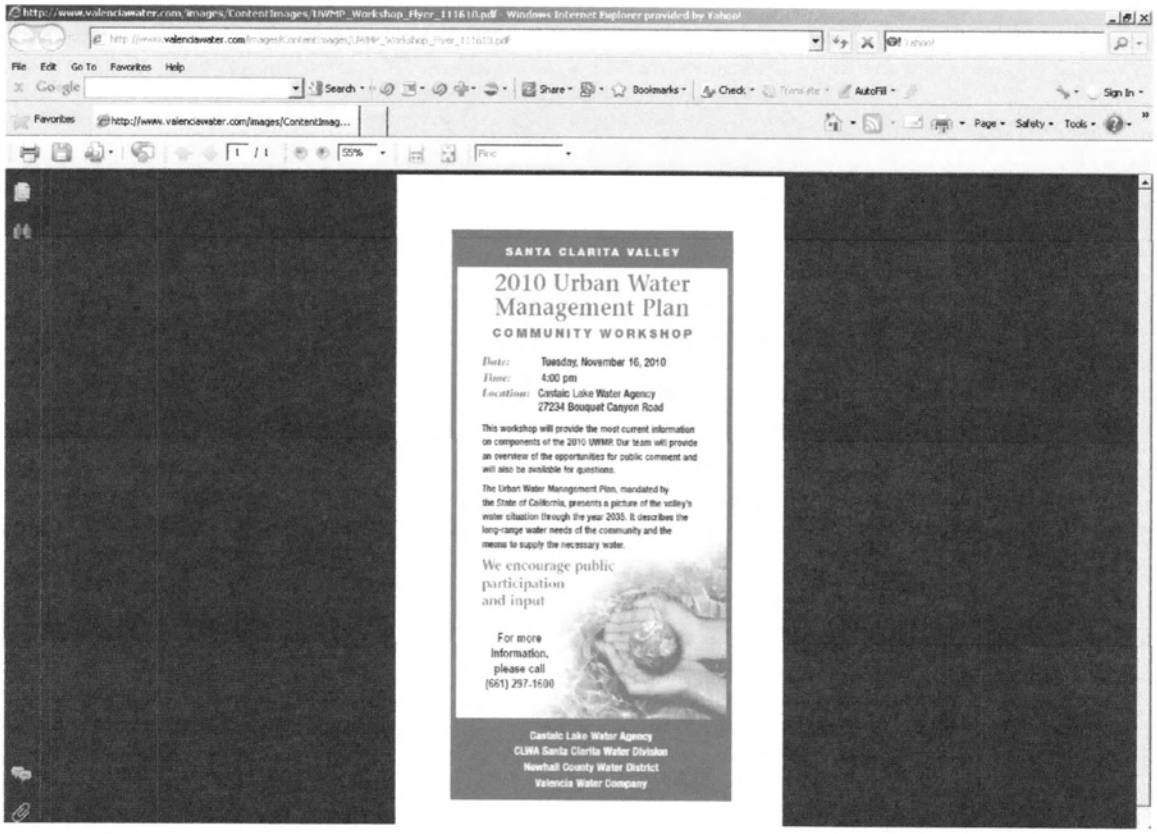
Valencia Water Company
Webpage posting – November 2010 UWMP Workshop
Friday, November 05, 2010





Santa Clarita Valley Urban Water Management Plan

Community Workshop

November 16, 2010
4:00 pm
Castaic Lake Water Agency

Agenda

- Introductions
- Review/status of UWMP process
- SBX7-7 GPCD population assumptions and calculations, and targets by retailer
- Questions and Answers

New Law: SBX7-7 ("20% x 2020")

- 20% demand reduction statewide by 2020
- Sets mandatory demand reduction goal for each retail water supplier
- Reporting starts with 2010 UWMPs
  - Base gross water use in gallons per capita per day (GPCD): must be calculated using one of three methodologies
  - Target reduction from base by 2020: must be calculated using one of four methodologies
  - Supplier must hold public hearing to explain how targets will be met (can be held as part of UWMP hearing)

Process for Determining SBX7-7 Base Gross Water Use (in GPCD)

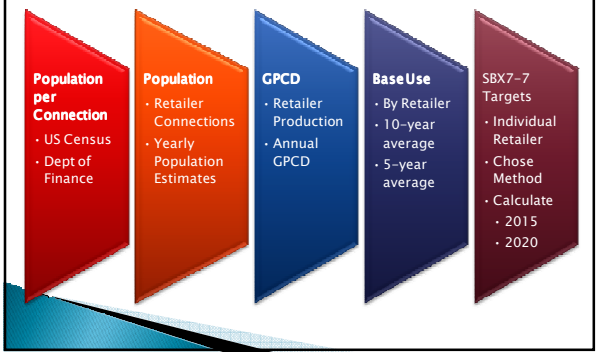
Base Gross Water Use Method

- Base water use in GPCD: methodologies
  - 10-year average
    - ending no earlier than Dec 31, 2004 – no later than Dec 31, 2010 *OR*:
  - 15-year average if 10% of 2008 demand met by recycled water
    - get to add 5 years to calculation (SCV retailers do not qualify)
  - And: 5-year average
    - ending no earlier than Dec 31, 2007 – no later than Dec 31, 2010
    - 100 gpcd; at least 5% reduction for all agencies in CA over 100 gpcd

Example: Newhall County Water District Draft GPCD Calculation

Year	Single Family	Multi-Family	People per Unit	Population	Production (AF)	GPCD	10-year Average
1995	5,680	4,552	3.020	30898	7,755	224	240
1996	5,723	4,589	3.038	31323	7,887	225	241
1997	6,035	4,612	3.056	32533	8,801	242	242
1998	6,037	4,622	3.074	32764	8,087	220	243
1999	6,202	4,651	3.092	33561	9,348	249	244
2000	6,255	4,713	3.111	34121	9,718	254	
2001	6,428	4,768	3.130	35041	9,525	243	
2002	6,777	4,823	3.149	36526	10,362	253	
2003	7,199	4,852	3.168	38178	10,351	242	
2004	7,873	4,870	3.187	40618	11,217	247	
2005	8,163	4,875	3.207	41814	10,756	230	
2006	8,292	4,875	3.227	42490	11,470	241	
2007	8,431	4,875	3.247	43206	11,975	247	
2008	8,450	4,875	3.267	43539	11,340	233	
2009	8,492	4,875	3.288	43951	10,559	214	
2010	8,529	4,875	3.288	43951	10,559	214	

Process for Determining SBx7-7 Base Use and GPCD Reduction Targets



Draft Base Gross Water Use Results

Agency	5-year GPCD	10-year GPCD
CLWA Santa Clarita Water Division	230	235
Newhall County Water District	241	244
Valencia Water Company	258	278

Target Demand Reduction Methodology Options

- 1.) 20% reduction from base (i.e., 80% of average gross water use in GPCD)
- 2.) Combination of state standards:
  - 55 gpcd indoor residential + landscape use at 70% ETo + 10% reduction in commercial/ industrial/institutional use
- 3.) DWR 20x2020 hydrologic region target (South Coast region = 149 GPCD)
- 4.) Option to be developed by DWR Public Process

Draft GPCD Target Demand Reductions Option 1 : 80% of base use

Agency	2015 Objective	2020 Objective	2009 GPCD (current)
VWC	250	222	240
NCWD	219	195	214
SCWD	211	188	201
Regional	219	195	219

Method normalizes for:

- Low economic activity
- High vacancy rates
- Year to year weather variances

Note: Note: 2009 is 3rd year of drought

Future development has more CII demands

Consultant Team

- Kennedy/Jenks Consultants
- Luhdorff and Scalmanini
- Nancy Clemm, P.E.
- Stacy Miller Public Affairs

Questions and Answers

Public Workshops and Hearings

- **Public Workshops**
  - May 25, 2010
  - July 2, 2010
  - November 9, 2010 (IRWMP Stakeholders)
  - November 16, 2010
  - January 11, 2011 (tentative)
  - March 8, 2011 (tentative)
- **Public Hearings**
  - January 26, 2011 (tentative)
  - March 23, 2011 (tentative)
  - April 27, 2011 (tentative)
- **Adoption**
  - June 2011

Santa Clarita Valley Urban Water Management Plan
November 16, 2010 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	JOSE ZEGARRA	COC		(661) 287 4403	JOSEZEGARRAS@HOTMAIL
2.	Genaro Vallejo	COC		323-243-2638	genarovallejo@att.net
3.	Patrick Bryant	City of SC	Admin Analyst	661-255-4902	pbryant@santa-clarita.com
4.	Cathy Holloman	SCWD	Assoc Water Res Planner	661-259-2737	cholloman@scwater.org
5.	KEITH ABERCROMBIE	VWC	GM	661-295-6501	KABercrombie@ValleyWater
6.	GENE MUTH	COC		661 250-8414	GMUTH@BEVERLYHILLS.ORG
7.	BILL DEPOTO	LACFCD		626.458.4313	BDEPOTO@LADPW.ORG
8.	JIM WEIHERER	CLWA	PURCHASING TECH	661-297-1600	jweiherer@clwa.org
9.	ALBERT PETERSEN	GWP	APPRENTICE	818/468-7880	MARIVETTEPTRSN@AOL.COM
10.	Sharon Sorensen	City of Santa Clarita	Sr. Planner	661/267-5234	SSorensen@santaclarita.com
11.	JESSICA BUNKER	LACWWD NO. 36	Assoc. CE	626/300-3315	jbunker@ladpw.org
12.	Tom Worthington	Impact Sciences	President	805 443-5170	tomworthington@impactsciences.com
13.	KEVIN AGUILAR	COC		(661) 250-0737	KAguilar@SUCAL.COM
14.	Jeff Ford	CLWA	WR Planner	(661) 513-1281	Jford@clwa.org
15.	Dirk Marks	"	WR Manager	661 513 1257	dmarks@clwa.org
16.	BRIJESH MISRA	LA City	Inspector	(818) 830-0420	Brijeshcmisra@gmail.com
17.	BJ Atkins	Atkins Env. HELP	Owner	661 510 3663	bj@atkinsenvironmental.com
18.	STEVE MCLEAN	—	—	661-259-4767	MCLEAN.STEPHEN@CH.RR.COM

Santa Clarita Valley Urban Water Management Plan
November 16, 2010 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	Francisco Guerrero	LACSD	Senior Engineer	562 903 4209 x 2032	FGuerrero@lacsd.org
2.	Stacey Miller	SMPA	Consult	818 403-5800	Smiller@SMP
3.	LUIS MARGHERITIS	CLWA	TECH.	(661) 510-4448	LMARGHERITIS@CLWA.ORG
4.	COLETTE HILLARD				
5.	GRANTES, ERIC			661-406-3219	ERICERIC@YAHOO.COM
6.	Linda Purpus	UWCD	Env. Scientist	805-525-4431	lindap@unitedwater.org
7.	Dusty Osmonson		Public	661-644-6546	littlehorsley@yahoo.com
8.	ERNI N		public	661-296 2775	nie.mani@yahoo.com
9.	Renee Sabol	Castaic Town Council	Council person	661-803 7123	ReneeSabol@AOL.com
10.	Sharren Naulls			661 862-9221	snaulls@avc.edu
11.	Betty Cameron			661 297-8116	
12.	Greg Kring	Burbank Water & Power	Pipefitter Apprentice	(626) 475-0413	Hailgeebus@Yahoo.com
13.	Chad Brightwell	BWP	"	(818) 621-5726	highryder98@yahoo.com
14.	FRANCK ROSENTHAL	C o C	STUDENT	818-261-2036	FRANCK-IE@YAHOO.COM
15.	Bonnie Deagon	———	Pubic	661-373-8341	Bjdhugs@aol.com
16.					
17.					
18.					

Santa Clarita Valley Urban Water Management Plan
November 16, 2010 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	K. C. Valvo	BWP	App	818) 238-3500	
2.	JAMES ROWLANDS	BWP	APP	(818) 926-0978	
3.	Bonnie Deagon			661. 373-8341	
4.	Leah Schulman			661-645-6344	leah.schulman@gmail.com
5.					
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January 2011 UWMP Workshop
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations

January 10, 2011

*** Orgs shaded above will receive letter return receipt requested (See attached)

Subject: January 2011 Workshop - 2010 Urban Water Management Plan

Dear Sir or Madam,

The Santa Clarita Valley water suppliers, Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company, are currently preparing the 2010 Urban Water Management Plan (UWMP).

In an effort to ensure all interested parties are fully informed and involved in this process, the water agencies have scheduled their fourth community workshop on January 25, 2011 and welcome your participation. This workshop will provide the most current information on components of the UWMP.

Date:	Tuesday, January 25, 2011
Time:	4:00 pm
Location:	Castaic Lake Water Agency 27234 Bouquet Canyon Road

The Urban Water Management Plan presents a picture of the valley's future water situation, describes the long-range water needs of the community and the means to supply the necessary water.

I encourage your participation and look forward to seeing you then. If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Government Affairs, Public Relations & Communication
P.O. Box 55745, Valencia, CA 91385 [818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

or four years down the road? — but our government has *sarily those of The Signal.*

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

The Signal 1-18-11

Date: Tuesday, January 25, 2011
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

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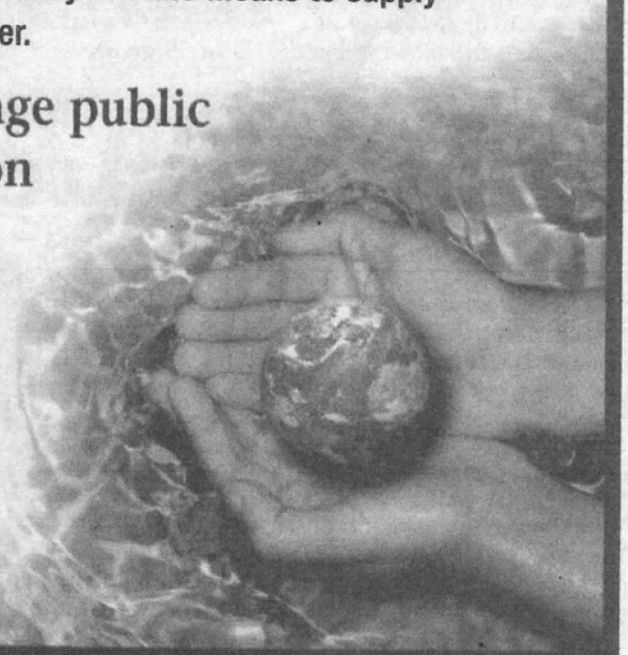

For more information, please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

The Signal 1-23-11

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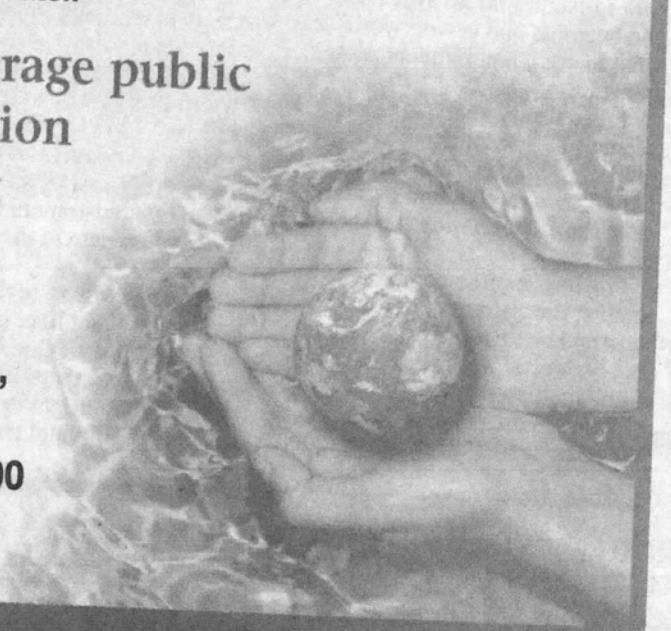
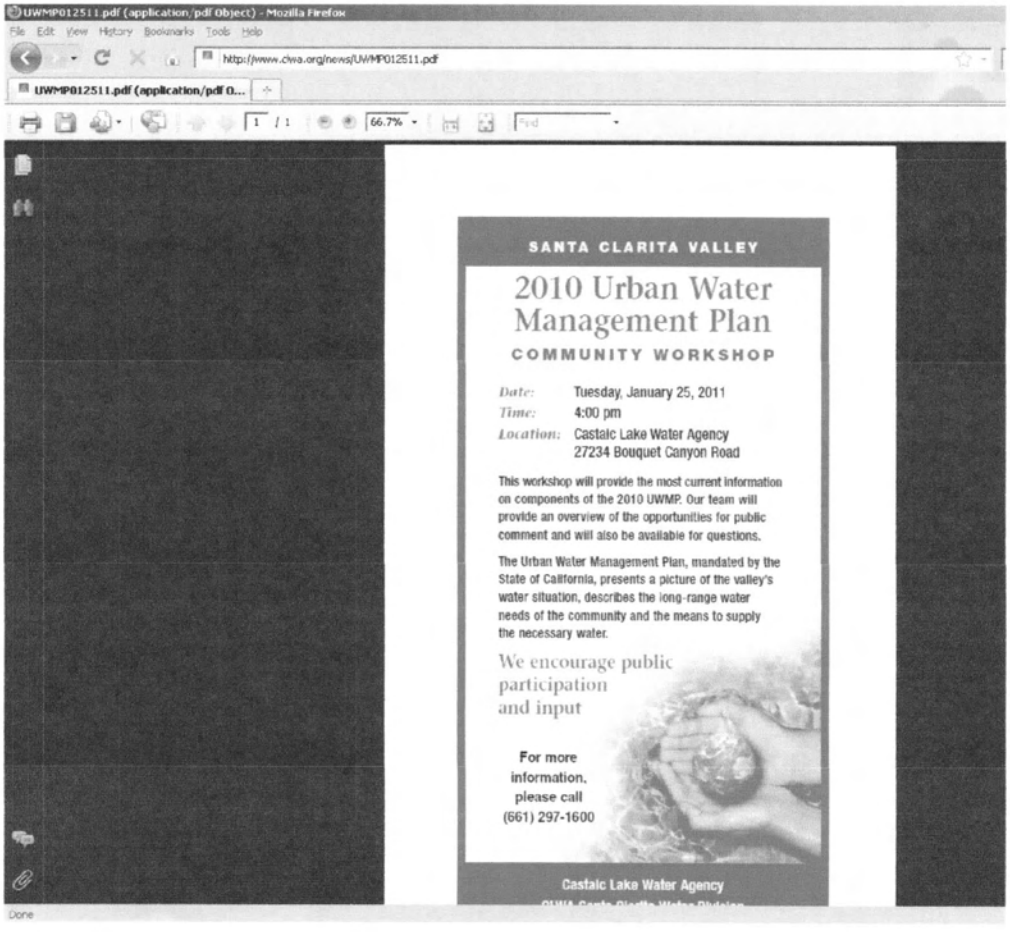


For more information, please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

Castaic Lake Water Agency
Webpage & Facebook Posting – January 2011 UWMP Workshop



Castaic Lake Water Agency
Webpage & Facebook Posting – January 2011 UWMP Workshop

Newhall County Water District
Webpage & Facebook posting – January 2011 UWMP Workshop

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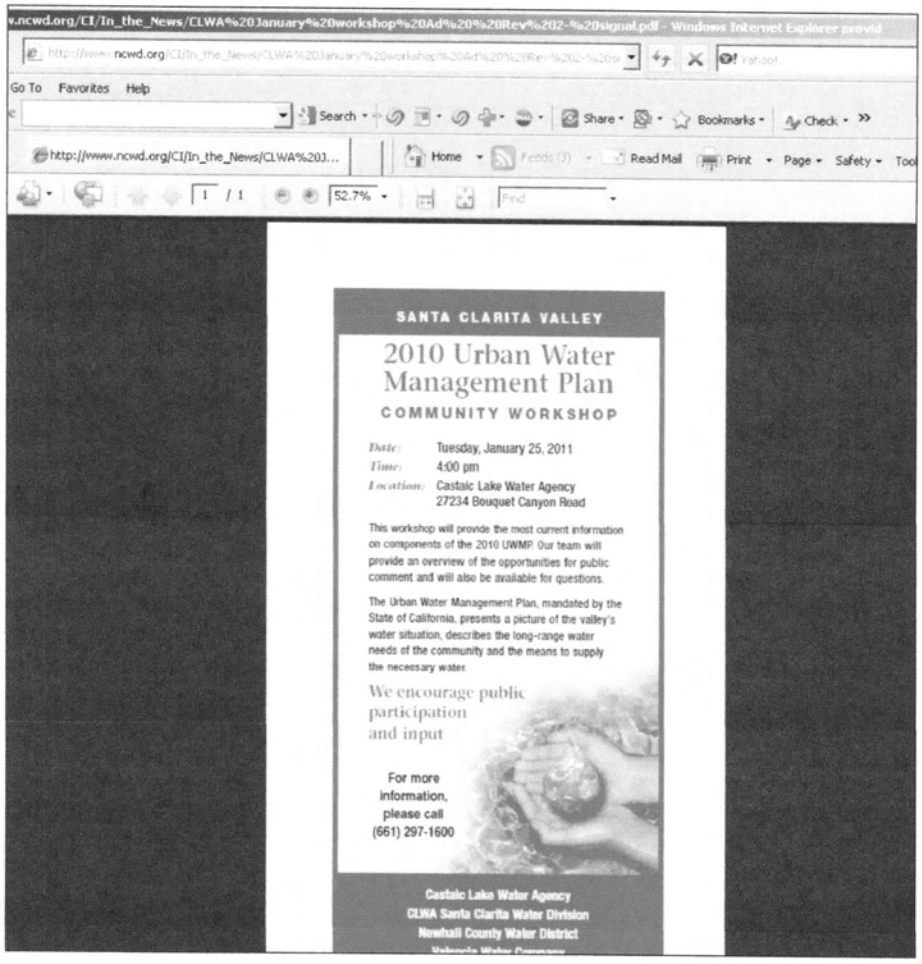
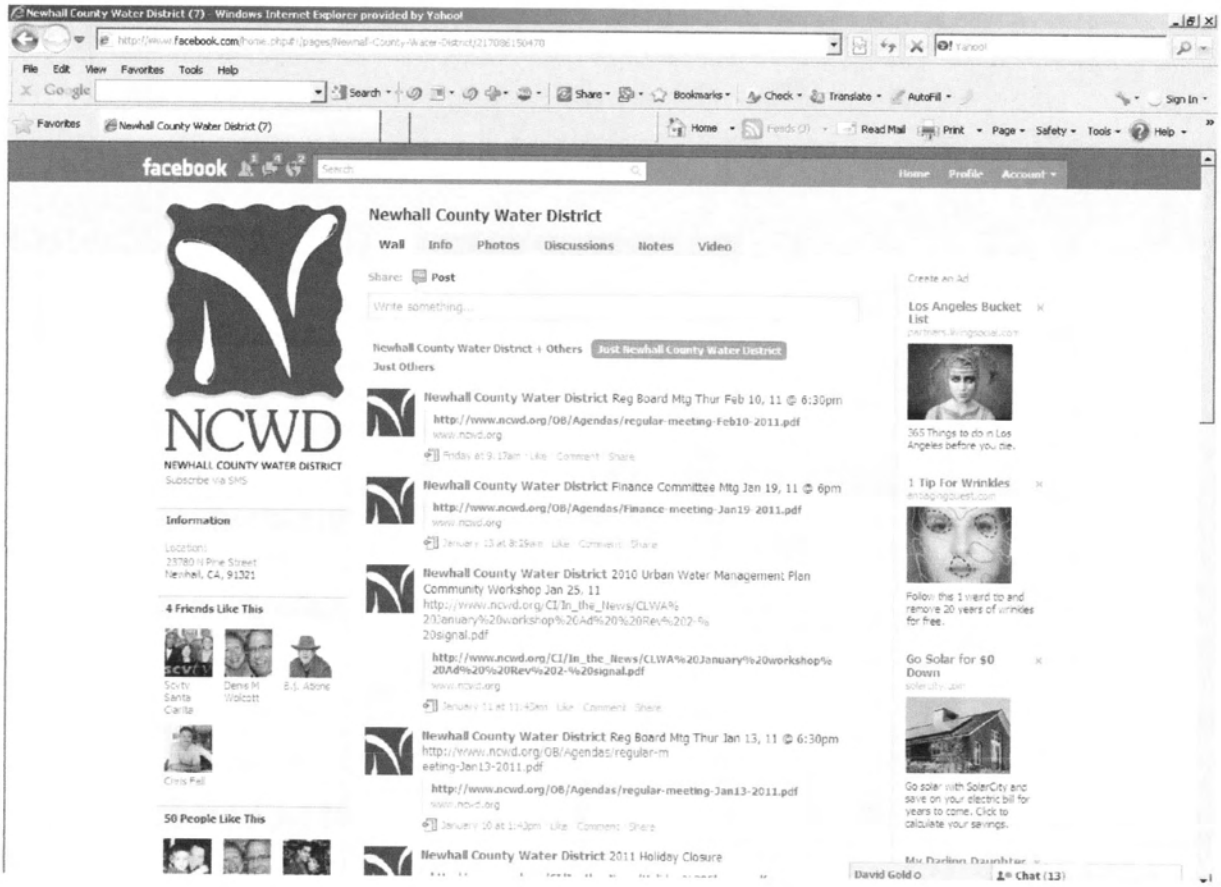
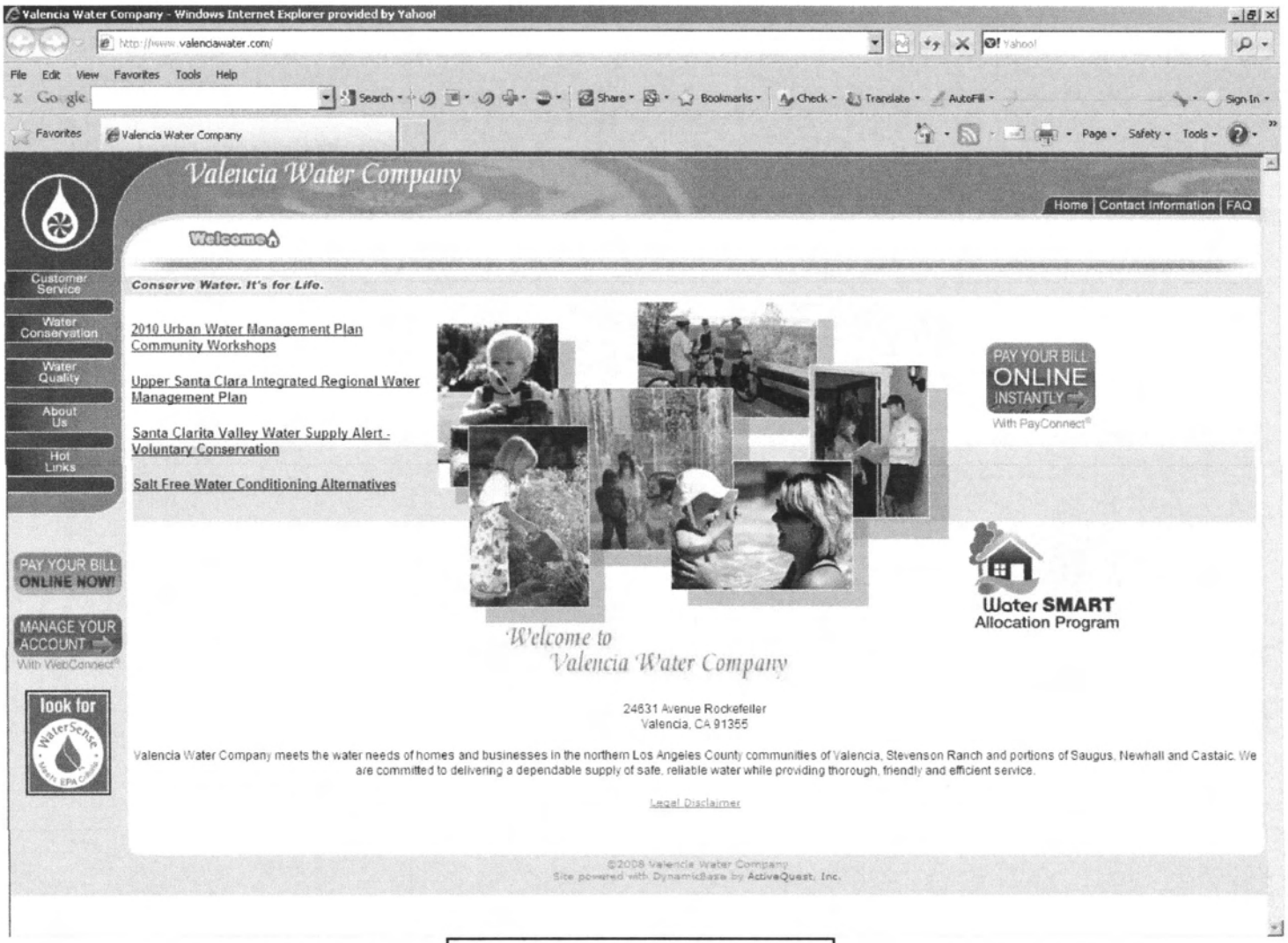
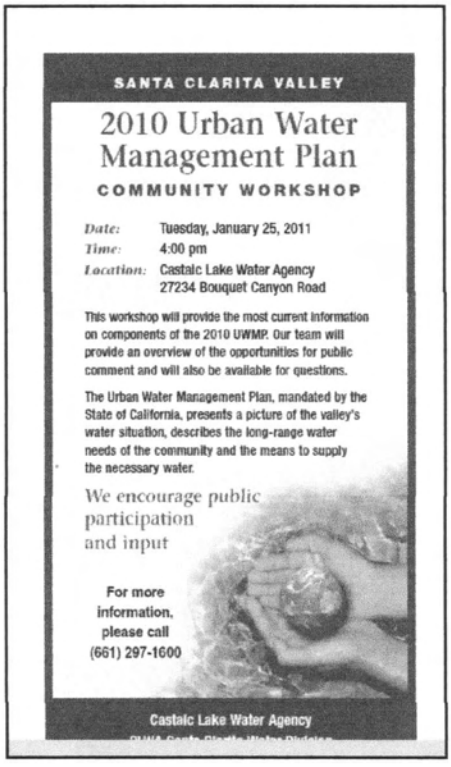
Newhall County Water District
Webpage & Facebook posting – January 2011 UWMP Workshop





Valencia Water Co
Website Posting – January 2011 UWMP Workshop





Santa Clarita Valley Urban Water Management Plan

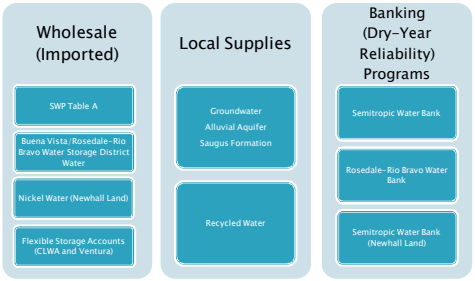
Community Workshop

January 25, 2011
4:00 pm
Castaic Lake Water Agency

Agenda

- Introductions
- Overview of water supplies
- SWP reliability update
- CLWA reliability planning update
- SBX7-7 ("20x2020") calculations and targets
- Overview of water supplies and demands
- Schedule
- Questions and Answers

Santa Clarita Valley Water Supplies



SWP Reliability Update

- DWR finalized the 2009 State Water Project Delivery Reliability Report
- Captures impacts on the SWP from recent regulatory and judicial decisions related to endangered species in the Delta
  - Average year long-term SWP deliveries = 60%
  - Single-dry year deliveries = 7%
  - Multiple-dry year deliveries = 34-36%

CLWA Reliability Planning Update

- Basis of the Plan:
  - Water Demand Projections by Purveyors
  - 2009 DWR SWP Delivery Reliability Report
  - Updated GW Operating Plan
  - Recycled Water Master Plan (as modified)

Preliminary Results
Water Supply Reliability Plan Update

- At 95% confidence level:
  - 6-year pumpback = no storage needed with current practices
  - 1-year pumpback (most severe drought) = 20,000 AF
- Results consider the following variables:
  - Conservation
  - Levee failure in the Delta

Preliminary Results
Storage and Pumpback Requirements

1. No levee failure and no conservation

Percentile (%)	1-Year Pumpback (AFY)	6-Year Storage (AF)
90	34,000	83,000
95	38,000	100,000
99	51,000	164,000

2. Levee failure and no conservation

Percentile (%)	1-Year Pumpback (AFY)	6-Year Storage (AF)
90	60,000	136,000
95	61,000	153,000
99	62,000	219,000

Preliminary Results
Storage and Pumpback Requirements

3. Conservation and no levee failure

Percentile (%)	1-Year Pumpback (AFY)	6-Year Storage (AF)
90	9,000	0
95	13,000	0
100	24,000	17,000

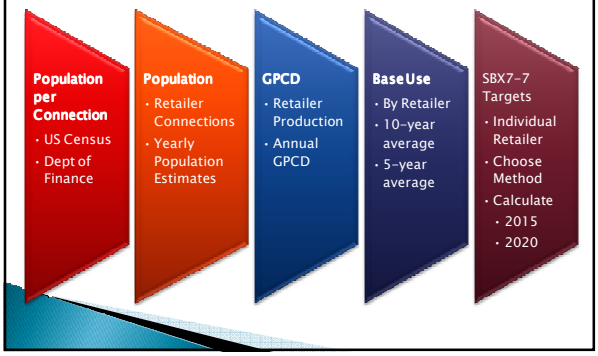
4. Conservation and levee failure

Percentile (%)	1-Year Pumpback (AFY)	6-Year Storage (AF)
90	20,000	0
95	20,000	0
100	21,000	28,000

Update on SBX7-7 ("20% x 2020") Calculations and Targets

- 20% demand reduction statewide by 2020
- Sets mandatory demand reduction goal for each retail water supplier
- Reporting starts with 2010 UWMPs
  - Base gross water use in gallons per capita per day (GPCD): must be calculated using one of three methodologies
  - Target reduction from base by 2020: must be calculated using one of four methodologies
  - Supplier must hold public hearing to explain how targets will be met (can be held as part of UWMP hearing)

Process for Determining SBx7-7 Base Use and GPCD Reduction Targets



GPCD Target Demand Reduction Options

1. 20% reduction from base (i.e., 80% of average gross water use in gpcd)
2. Combination of state standards:
   - 55 gpcd indoor residential + landscape use at 70% ETo + 10% reduction in commercial/industrial/institutional use
   - *Requires specific data not available in SCV*
3. DWR 20x2020 hydrologic region target (South Coast region = 149 gpcd)
4. *Option to be developed by October 2010: not completed by DWR and Urban Stakeholder Committee*

Updated (January 2011) GPCD Target Demand Reduction Calculations

Agency	Base Daily Per Capita Water Use (GPCD)	Compliance Year	Selected Urban Water Use Target Method
			Method 1 – 80% of Base Daily Per Capita Water Use
VWC	278	2015	250
		2020	222
NWCD	244	2015	219
		2020	195
SCWD	235	2015	211
		2020	188

Santa Clarita Valley Existing Water Supplies– Avg / Normal Year (acre-feet)

EXISTING SUPPLIES	2015	2020	2030	2040	2050
Groundwater (Basin Yield)	*51,100*	*51,100*	*51,100*	*51,100*	*51,100*
Alluvial Aquifer	38,600	38,600	38,600	38,600	38,600
Saugus Formation	12,500	12,500	12,500	12,500	12,500
Projected Groundwater to Non-Purveyors	*15,400*	*14,400*	*11,000*	*9,000*	*7,500*
Newhall Land and Farming	10,500	9,500	7,500	5,500	4,000
Honor Ranch	3,400	3,400	2,000	2,000	2,000
Other Non-Purveyors	1,500	1,500	1,500	1,500	1,500
Projected Groundwater to Purveyors	**34,600**	**36,600**	**39,600**	**41,600**	**43,600**
Alluvial Aquifer	24,000	25,000	28,000	30,000	32,000
Saugus Formation	10,600	11,600	11,600	11,600	11,600
Projected Groundwater to Purveyors and Non-Purveyors	50,000	51,000	50,600	50,600	51,100
Recycled Water	**1,300**	**1,700**	**1,700**	**1,700**	**1,700**
Imported Water	**69,727**	**69,727**	**69,727**	**69,727**	**69,727**
SWP Table A Supply	57,120	57,120	57,120	57,120	57,120
Buena Vista-Rosedale	11,000	11,000	11,000	11,000	11,000
Nickel Water – Newhall Land	1,607	1,607	1,607	1,607	1,607
Total Supplies Available to Purveyors	**105,627**	**108,027**	**111,027**	**113,027**	**115,027**

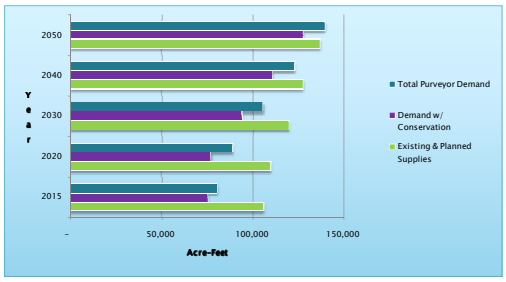
Santa Clarita Valley Existing and Planned Water Supplies Avg / Normal Year (acre-feet)

PLANNED SUPPLIES	2015	2020	2030	2040	2050
Recycled Water	***0***	***1,350***	***7,900***	***13,900***	***21,100***
Recycled Water to Non-Purveyor (Honor Ranch)	0	0	1,500	1,500	1,500
Recycled Water to Purveyors	0	1,350	6,400	12,400	19,600
Total Planned Supplies	**0**	**1,350**	**7,900**	**13,900**	**21,100**
Total Supplies Available to Purveyors	**105,627**	**108,027**	**111,027**	**113,027**	**115,027**
Total Existing and Planned Supplies Available to Purveyors	**105,627**	**109,377**	**118,927**	**126,927**	**136,127**

Santa Clarita Valley Projected Water Demands Avg / Normal Year (acre-feet)

SB7x7 DEMAND REDUCTION	2015	2020	2030	2040	2050
Total Purveyor Demand	80,070	88,484	105,312	122,140	138,968
Sum of Purveyor Demand Reductions	6,691	14,937	18,949	21,161	24,274
Reduction from Recycled Water	*1,300*	*3,050*	*9,600*	*15,600*	*22,800*
Reduction from Water Conservation	*5,391*	*11,887*	*11,887*	*11,887*	*11,887*
Total Action to Meet SB7x7	**6,691**	**14,937**	**21,487**	**27,487**	**34,687**
Demand w/ Conservation	**74,679**	**76,597**	**93,425**	**110,253**	**127,081**

Santa Clarita Valley Water Supplies and Demands – Avg / Normal Year



Schedule

- **Public Workshops and Hearings**
  - **Workshops**
    - May 25, 2010
    - July 27, 2010
    - November 9, 2010 (IRWMP Stakeholders)
    - November 16, 2010
    - January 25, 2011
    - March 8, 2011
  - **Hearings**
    - March 23, 2011 (tentative)
    - April 27, 2011 (tentative)
- **Adoption**
  - June 2011 (due to DWR within 30 days after adoption)

Questions and Answers

Santa Clarita Valley Urban Water Management Plan
January 25, 2011 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	Stacy Meeler	SMPA	Pres	818 402-5806	Stacy@StacyMeerPA.com
2.	Lauren Everett	KJ	planner	805-913-5706	laureneverett@kennedyjenks.
3.	Ed Colley	CLWA	Director	—	—
4.	Bonnie Deagon	—	—		
5.	Dirk Marks	CLWA	Water Resource Manager		
6.	Rosalind Wayman	SDS			
7.	Jarrod DeGonia	Asm. Smyth	District Director	(661) 286-1565	jarrod.degonia@asm.ca.gov
8.	Jeff Ford	CLWA	WR Planner	(661) 513-1281	jford@clwa.org
9.	DAN MASNADA	CLWA	C.M.	(661) 297 1600	dmasnada@clwa.org
10.	ERNIE VILLEGAS	ASM. GORELL	DIST. DIRECTOR	(805) 230-9167	ernie.villegas@asm.ca.gov
11.					
12.					
13.					
14.					
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16.					
17.					
18.					

Santa Clarita Valley Urban Water Management Plan
January 25, 2011 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	Marilyn Cotton ✓	RJ			
2.	Steve Cole ✓	NCWD	G.M.		SCOLE@NCWD.ORG
3.	CHARLES GILL ✓	IPSG		6612949355	CGILL@IPSGINC.COM
4.	Keith Abercrombie ✓	VWC	GM		
5.	Cathy Hollomon ✓	SCWA	Assoc WR Planner	661-259-2737	chollomon@scwater.org
6.	Sandy Sandy	BVA	G.A.D.	310-995-4456	ssandy@bivlav.org
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March 2011 UWMP Workshop
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations

February 17, 2011

«AddressBlock» ***(see attached mailing list)***

Subject: March 2011 Urban Water Management Plan Workshop

«GreetingLine»

The Santa Clarita Valley water suppliers, Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company, are currently preparing the 2010 Urban Water Management Plan (UWMP).

In an effort to ensure all interested parties are fully informed and involved in this process, the water agencies have scheduled their final community workshop on March 8, 2011 and welcome your participation. This workshop will provide the most current information on components of the UWMP.

Date:	Tuesday, March 8, 2011
Time:	4:00 pm
Location:	Castaic Lake Water Agency 27234 Bouquet Canyon Road

The Urban Water Management Plan presents a picture of the valley's future water situation, describes the long-range water needs of the community and the means to supply the necessary water.

I encourage your participation and look forward to seeing you then. If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Government Affairs, Public Relations & Communication
P.O. Box 55745, Valencia, CA 91385 [818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

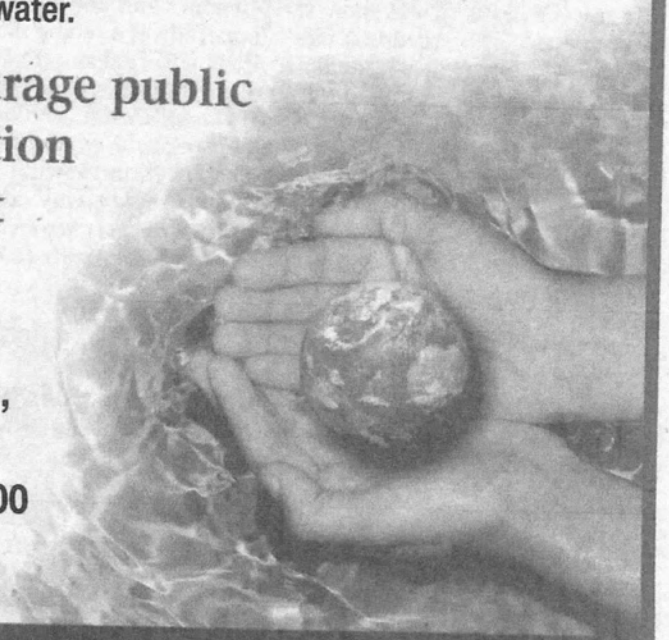
The Signal 3/1/11

Date: Tuesday, March 8, 2011
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

This workshop will provide the most current information on components of the 2010 UWMP. Our team will provide an overview of the opportunities for public comment and will also be available for questions.

The Urban Water Management Plan, mandated by the State of California, presents a picture of the valley's water situation, describes the long-range water needs of the community and the means to supply the necessary water.

We encourage public participation and input



For more information, please call (661) 297-1600

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

SANTA CLARITA VALLEY

2010 Urban Water Management Plan

COMMUNITY WORKSHOP

The Signal
3-6-11

Date: Tuesday, March 8, 2011
Time: 4:00 pm
Location: Castaic Lake Water Agency
27234 Bouquet Canyon Road

This workshop will provide the most current information on components of the 2010 UWMP. Our team will provide an overview of the opportunities for public comment and will also be available for questions.

The Urban Water Management Plan, mandated by the State of California, presents a picture of the valley's water situation, describes the long-range water needs of the community and the means to supply the necessary water.

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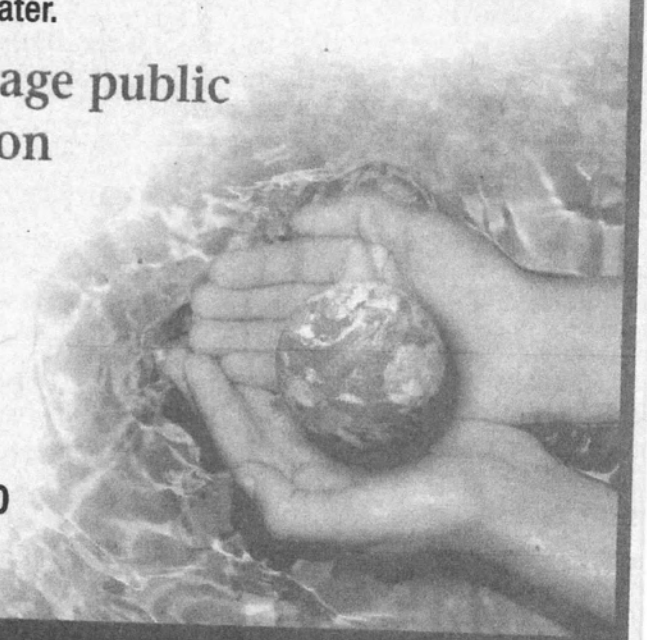

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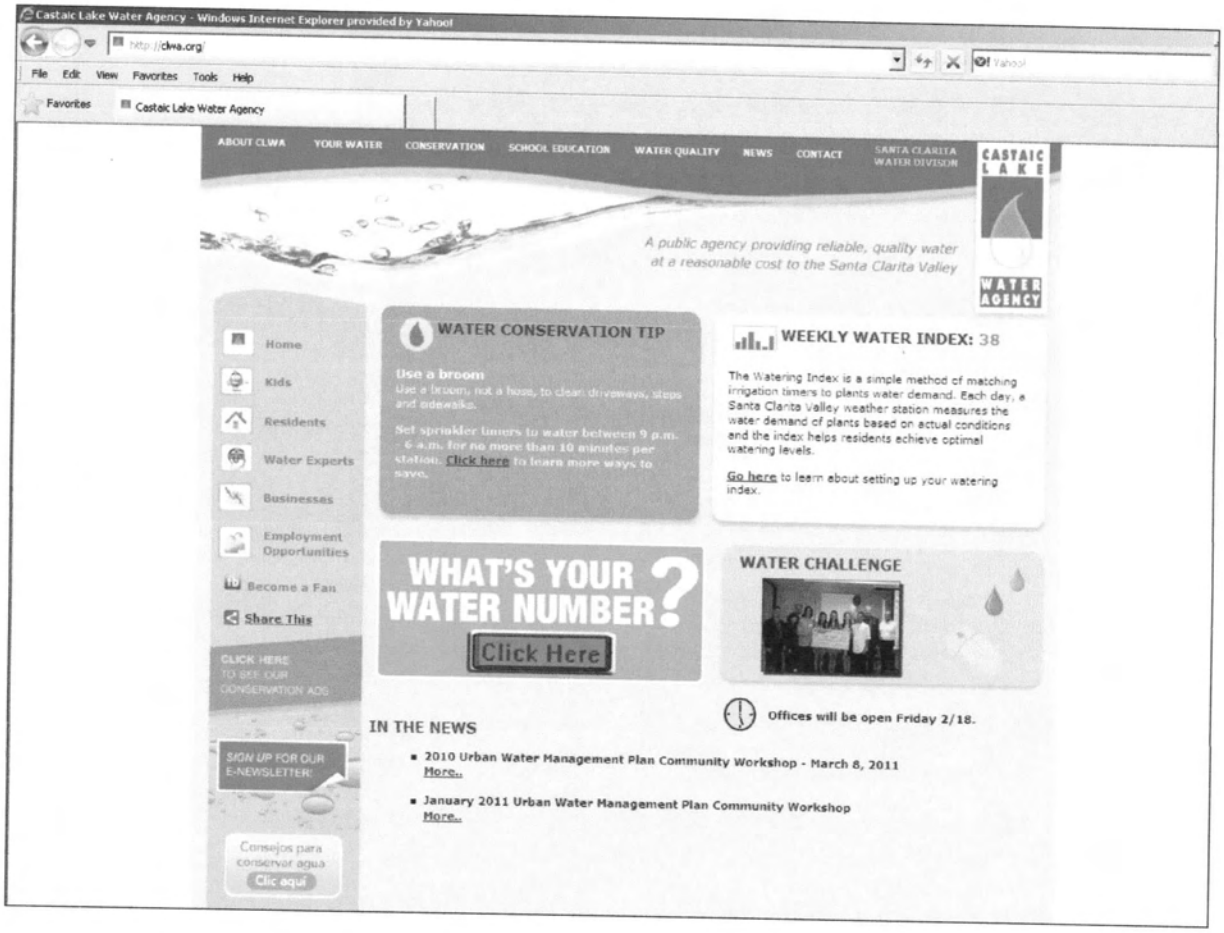
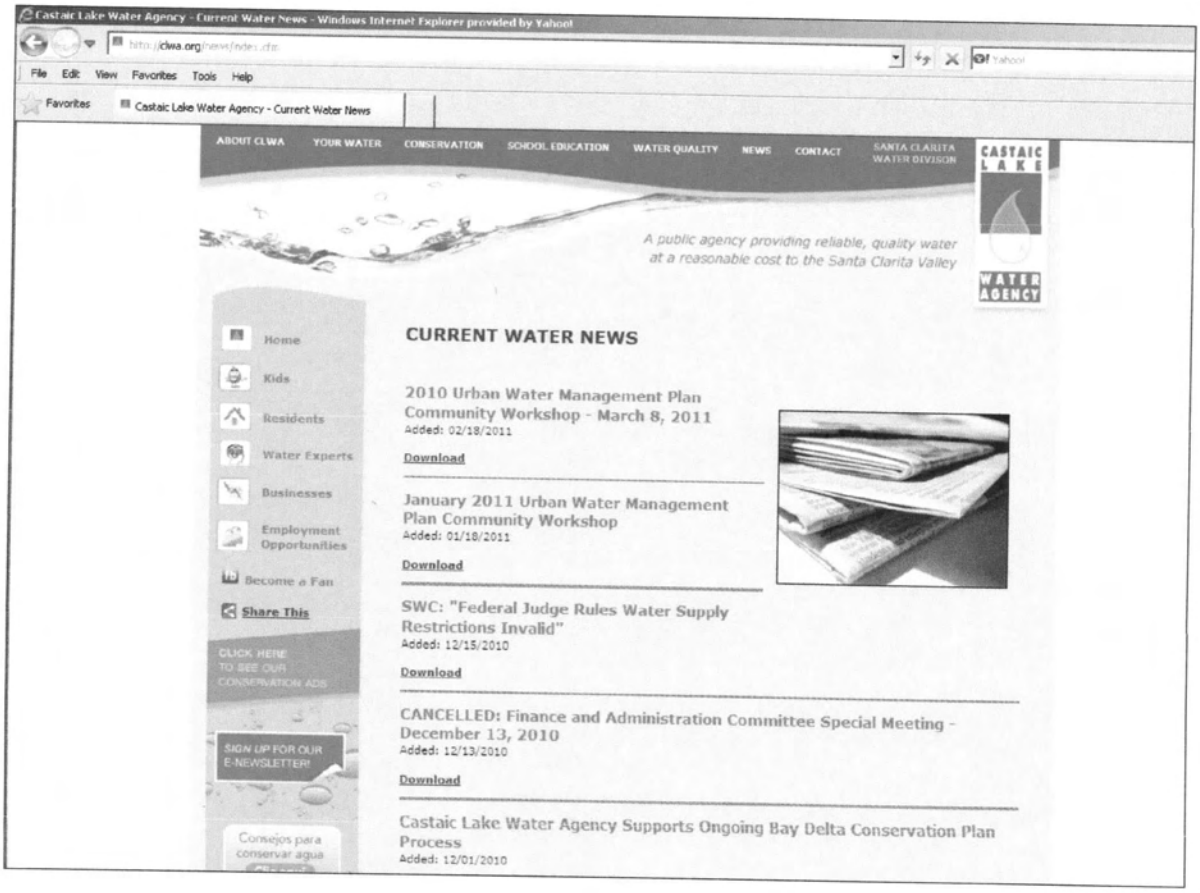
Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

Castaic Lake Water Agency
Webpage & Facebook Posting – March 2011 UWMP Workshop





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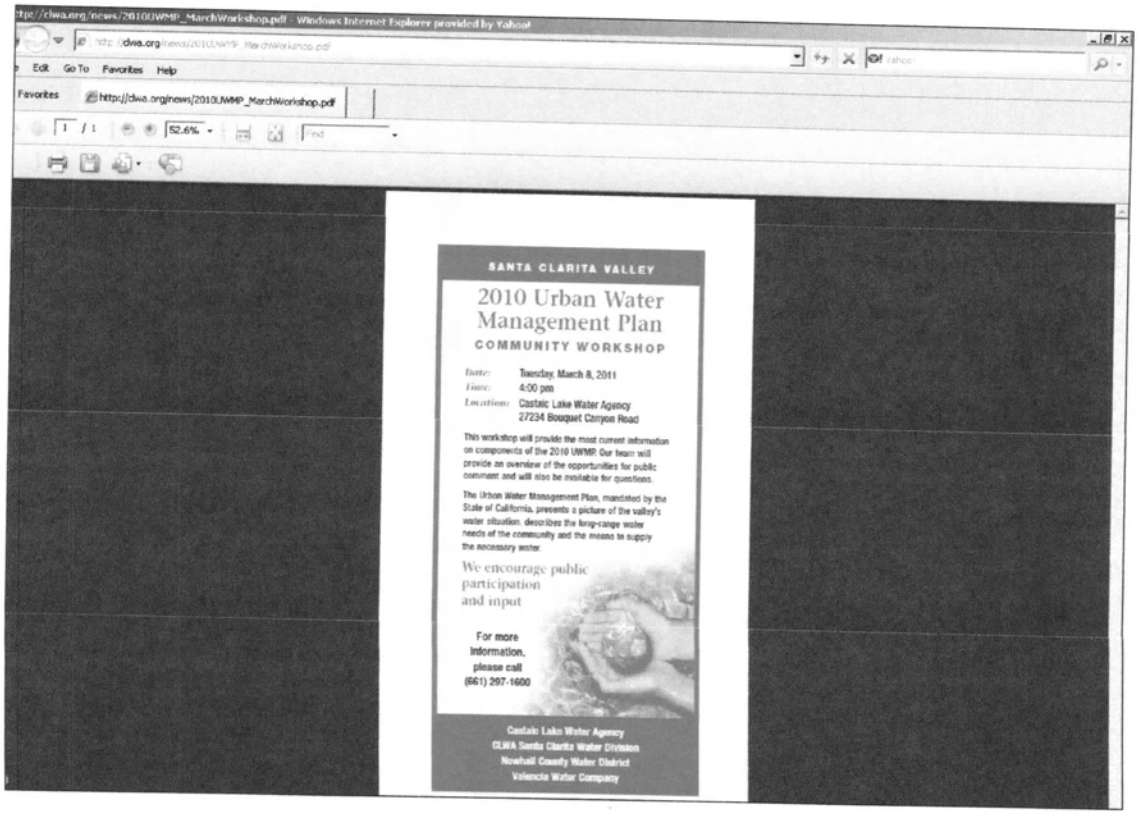
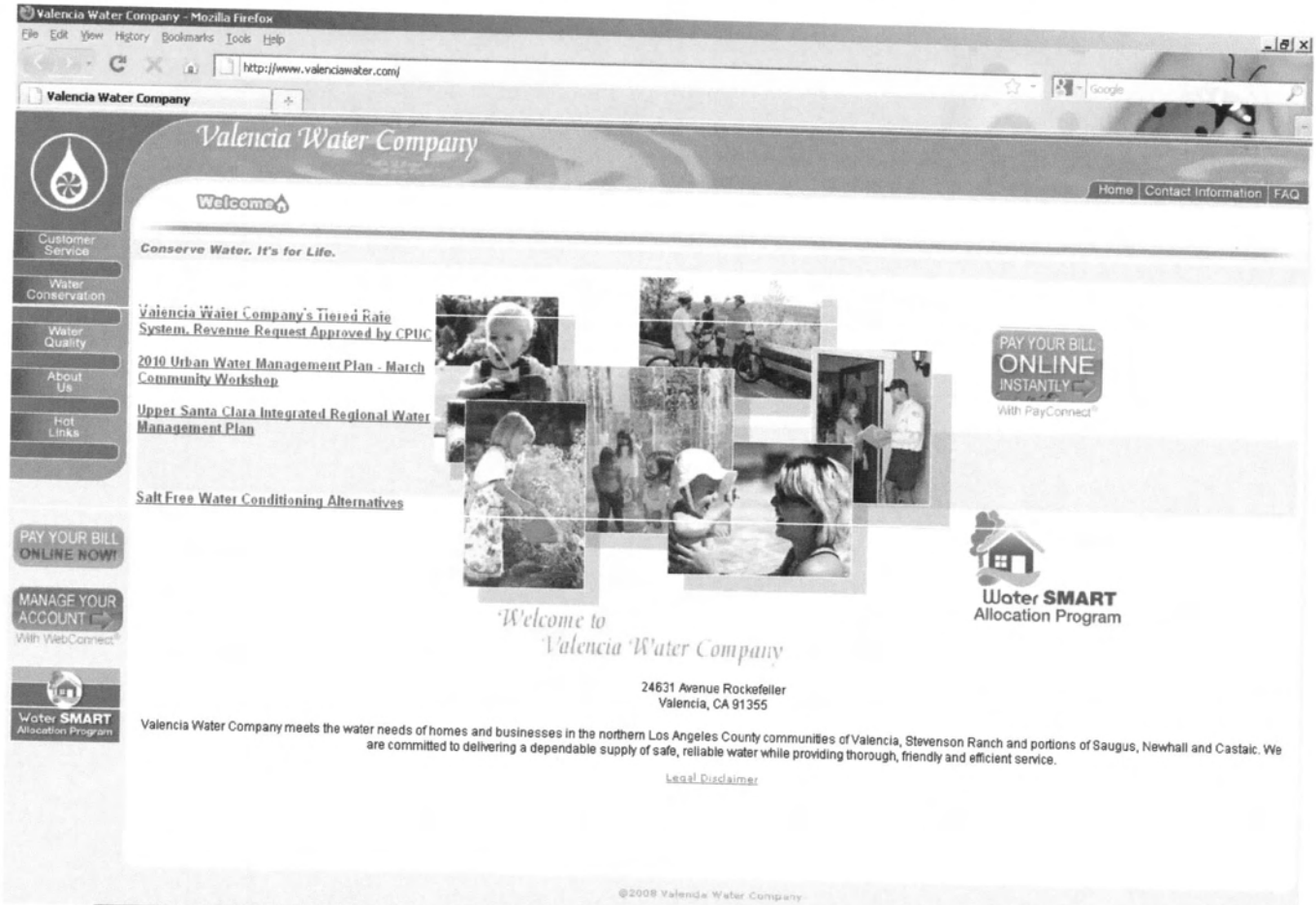
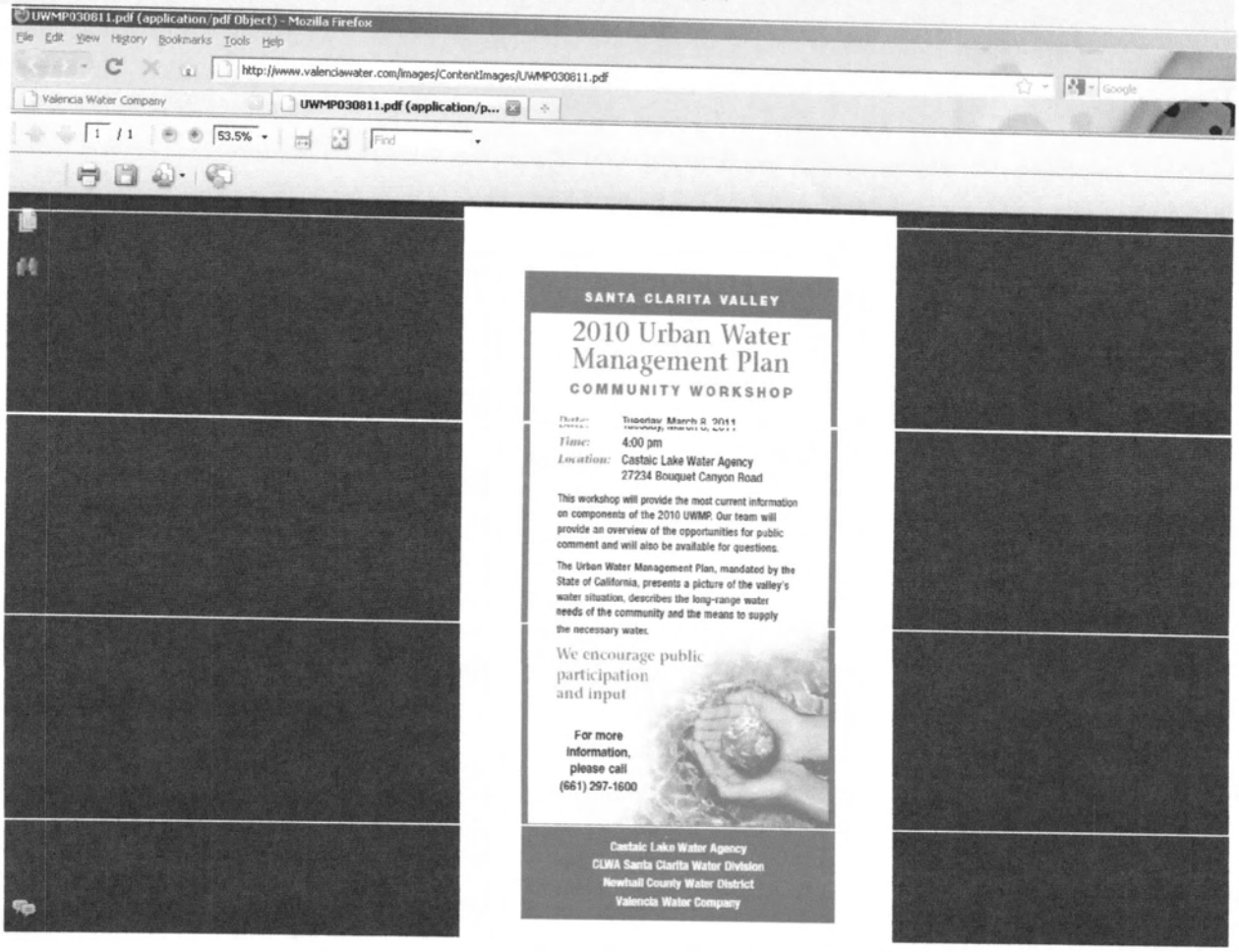
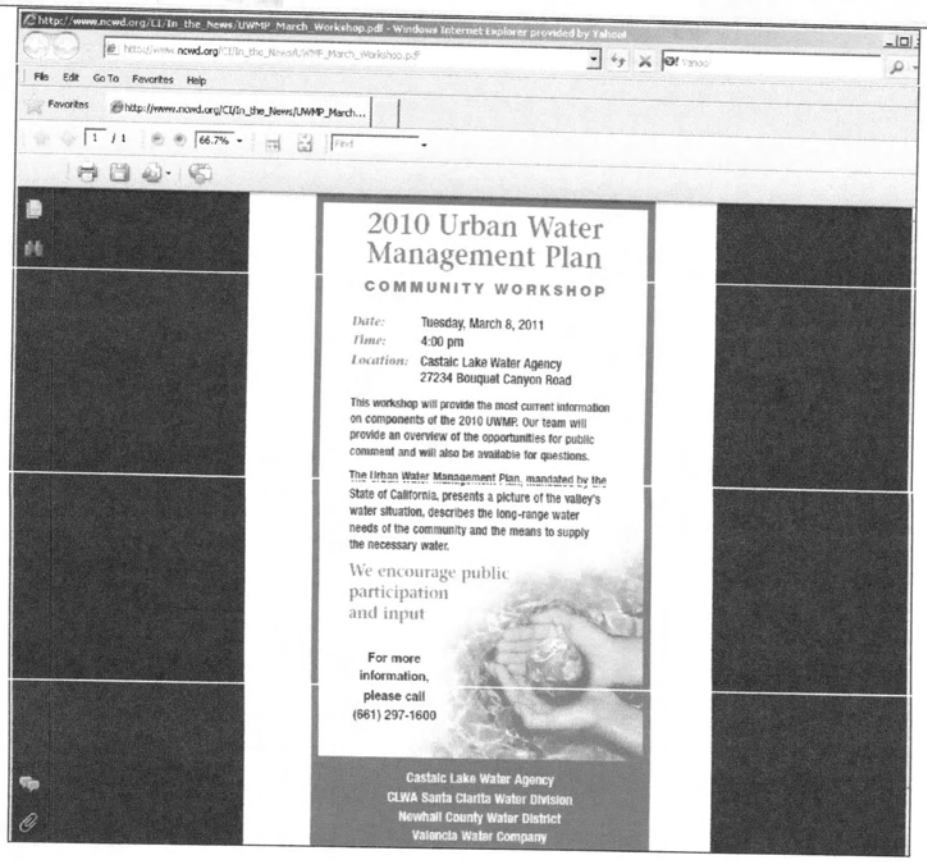


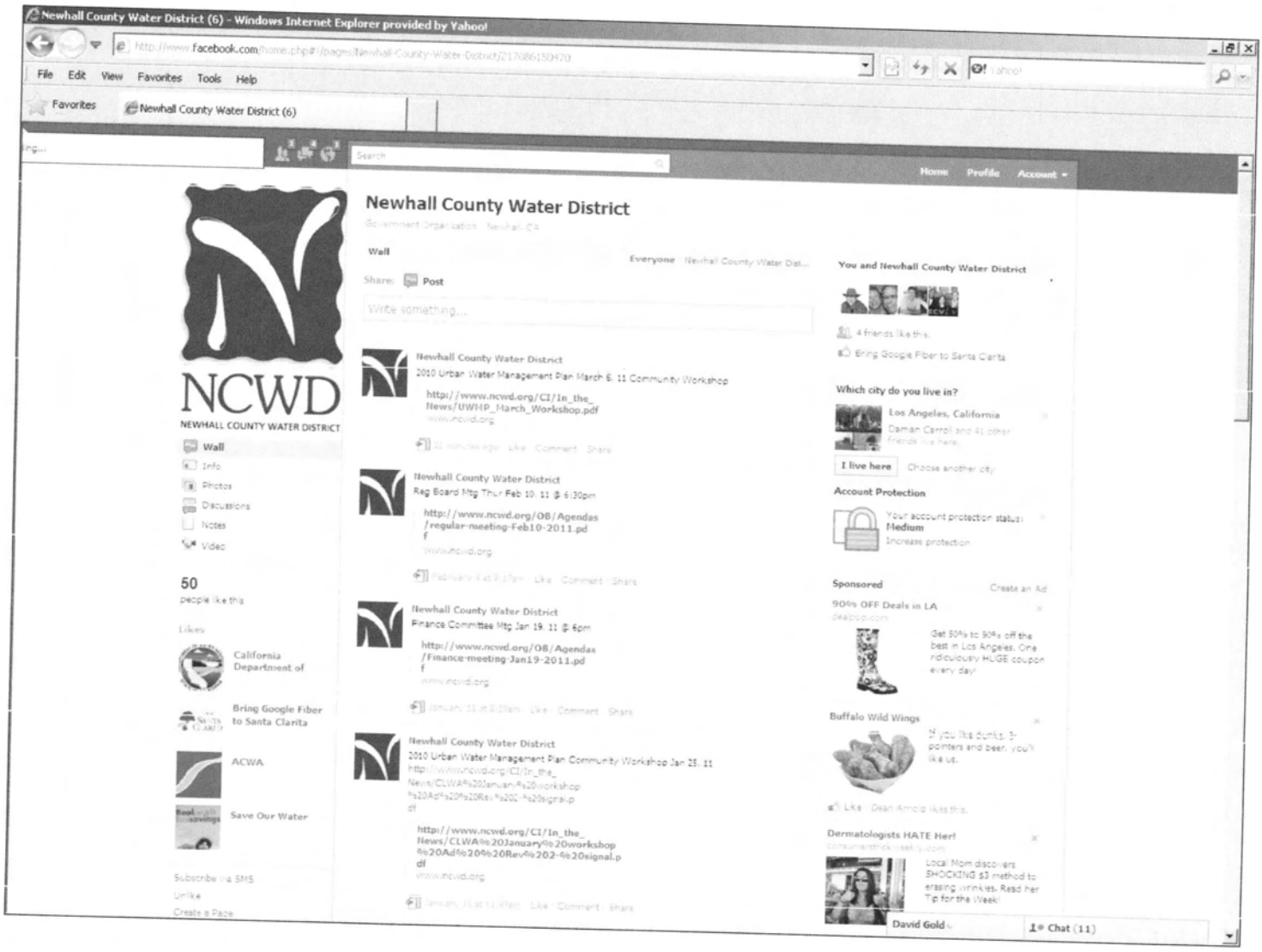
Valencia Water Company
Webpage posting – March 2011 UWMP Workshop





Newhall County Water District
Webpage & Facebook posting – March 2011 UWMP Workshop




Newhall County Water District (6) - Windows Internet Explorer provided by Yahoo!
File Edit View Favorites Tools Help
Favorites
Newhall County Water District (6)
Home Profile Account
Newhall County Water District
NCWD
NEWHALL COUNTY WATER DISTRICT
Wall
Info
Photos
Discussions
Notes
Video
50
people like this
Likes
California Department of
Bring Google Fiber to Santa Clarita
ACWA
Save Our Water
Subscribe via SMS
Unlike
Create a Page
Wall
Everyone
Share: Post
Write something...
Newhall County Water District
2010 Urban Water Management Plan March 8, 11 Community Workshop
http://www.ncwd.org/CI/In_the_News/UWMP_March_Workshop.pdf
Newhall County Water District
Reg Board Mtg Thur Feb 10, 11 @ 6:30pm
http://www.ncwd.org/OB/Agendas/regular-meeting-Feb10-2011.pdf
Newhall County Water District
Finance Committee Mtg Jan 19, 11 @ 6pm
http://www.ncwd.org/OB/Agendas/Finance-meeting-Jan19-2011.pdf
Newhall County Water District
2010 Urban Water Management Plan Community Workshop Jan 25, 11
http://www.ncwd.org/CI/In_the_News/CLWA%20January%20workshop%20Ad%20%20Rev%202-4%20signal.pdf
You and Newhall County Water District
4 friends like this.
Bring Google Fiber to Santa Clarita
Which city do you live in?
Los Angeles, California
I live here
Choose another city
Account Protection
Your account protection status:
Medium
Increase protection
Sponsored
Create an Ad
90% OFF Deals in LA
Buffalo Wild Wings
Dermatologists HATE Her!
David Gold
Chat (11)

Santa Clarita Valley Urban Water Management Plan

Community Workshop

March 8, 2011
4:00 pm
Castaic Lake Water Agency

1

Agenda

- Introductions
- Review of Past Workshops
- UWMP Overview
- Water Supply and Demands
- Public Hearing Process and Schedule
- Questions and Answers

2

Past Workshops

- **May 2010**
- UWMP purposed and process – What, Who, Why and When
- Existing and new requirements of UWMPs

- **July 2010**
- SBX7-7 Requirements
- Recycled Water
- Groundwater Supplies
- State Water Project Reliability

- **November 2010** (with the IRWMP Stakeholders)
- UWMP purposed and process – What, Who, Why and When
- Required under SBX7-7
- Importance of UWMP to IRWMP process and vice versa

3

Past Workshops

- **November 2010**
- GPCD population assumptions and calculations
- SBX7-7
- Targets by retailer

- **January 2011**
- Overview of water supplies
- SWP reliability update
- CLWA reliability planning update
- SBX7-7 ("20x2020") calculations and targets
- Overview of water supplies and demand

4

UWMP Act Overview

- The Basics
  - UWMP Act applies to all CA water suppliers with 3,000 or more service connections or selling at least 3,000 AFY (retail or wholesale)
  - Main focus: to identify gaps between supply and demand through time (20-year analysis required)
  - Must describe how demand will be met through time, in all hydrologic year types (normal, multiple dry years, single dry year)
  - If there will be shortages, describe how they will be addressed

5

UWMP Act Overview

- The Basics (cont'd.)
  - Requires detailed description of all supply sources (surface, recycled, groundwater)
  - Water quality problems that may impact supply
  - Demand Management Measures (water conservation programs)
  - Water shortage contingency planning
  - Must update every five years, in years ending in 5 and 0 (such as 2010)

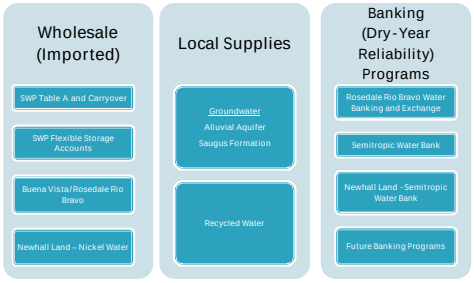
6

UWMP Act Overview

- DWR reviews UWMPs for "completeness"
  - If data not evident or items not in compliance, DWR will find UWMP "incomplete"
  - DWR will send letter to water supplier requesting additional data to bring UWMP up to code
  - May impact supplier's ability to obtain grant/loan funding
  - May impact supplier's ability to provide SB 610 Water Supply Assessments and SB 221 Water Supply Verifications

7

Santa Clarita Valley Water Supplies



8

Water Supplies and Demand

Normal/Single Dry/Multiple Dry Years

- Existing Supplies
- Planned Supplies
- Demands with and without Conservation
- Demands and Supply Comparison

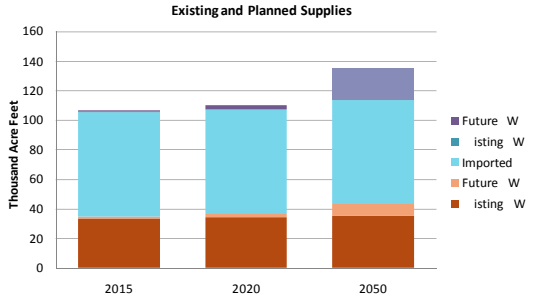
9

Normal Year – Regional Summary

Regional Summary	Supply (AF) 2015	2020	2050
Existing Groundwater			
Alluvial Aquifer	24,385	24,000	25,000
Saugus Formation	6,725	10,225	10,225
Recycled Water	325	325	325
Imported Water			
State Water Project Table A and Carryover	58,300	57,900	57,400
Flexible Storage Accounts	-	-	-
Buena Vista-Rosedale	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607
Banking Programs			
Rosedale Rio-Bravo	-	-	-
Semitropic Water Storage District	-	-	-
Semitropic - Newhall Land and Farming	-	-	-
Total Existing Supplies	**102,342**	**105,057**	**105,557**
Planned Supplies			
Future Groundwater			
Alluvial Aquifer	-	1,000	7,000
Saugus Formation	-	1,375	1,375
Recycled Water	-	2,725	20,975
Future Banking Programs	-	-	-
Total Planned Supplies	**-**	**5,100**	**29,350**
Total Existing and Planned Supplies	**102,342**	**110,157**	**134,907**
Demand without Conservation	**80,070**	**88,484**	**138,968**
Conservation Requirements			
Conservation Objective	6,691	14,937	24,274
Reduction from Recycled Water	1,300	3,050	21,300
Net Anticipated Water Conservation	5,391	11,887	12,403
Demand w/ Conservation	**74,679**	**76,597**	**126,565**

10

Normal Year Supplies



11

Normal Year – Existing Water Supplies

Water Supply Sources	Supply (AF) 2015	2020	2050
Existing Groundwater			
Alluvial Aquifer			
LACWD 36	-	-	-
NCWD	1,825	1,825	1,825
SCWD	10,500	10,500	11,500
VWC	11,675	11,675	11,675
Saugus Formation			
LACWD 36			
NCWD	3,525	3,525	3,525
SCWD	2,850	3,350	3,350
VWC	2,850	3,350	3,350
Recycled Water			
LACWD 36	-	-	-
NCWD	-	-	-
SCWD			
VWC	325	325	325
Imported Water			
SWP Table A and Carryover			
LACWD 36	1,656	1,943	3,269
NCWD	8,084	8,918	11,469
SCWD	23,918	24,263	25,787
VWC	24,442	22,776	16,875
SWP Flexible Storage Accounts			
Buena Vista-Rosedale			
LACWD 36	325	375	650
NCWD	1,600	1,750	2,250
SCWD	4,675	4,775	5,050
VWC	4,400	4,100	3,050
Nickel Water - Newhall Land			
VWC	1,607	1,607	1,607
Totals Existing Supplies			
LACWD 36	**1,981**	**2,318**	**3,919**
NCWD	**15,034**	**16,018**	**19,069**
SCWD	**41,943**	**42,888**	**45,687**
VWC	**45,299**	**43,833**	**36,882**

12

Normal Year – Planned Water Supplies

Planned Supplies	Supplies (AF) 2015	2020	2050
Future Groundwater			
Alluvial Aquifer			
LACWD 36	-	-	-
NCWD	-	-	-
SCWD	-		
VWC	-	1,000	7,000
Saugus Formation			
LACWD 36	500	500	500
NCWD	875	875	875
SCWD	-	-	-
VWC	-	-	-
Recycled Water			
LACWD 36	-	50	50
NCWD	200	500	3,275
SCWD	100	500	5,775
VWC*	675	1,675	11,875
Future Banking Programs	-	-	-
Total Planned Supplies			
LACWD 36	**500**	**550**	**550**
NCWD	**1,075**	**1,375**	**4,150**
SCWD*	**100**	**500**	**5,775**
VWC	**675**	**2,675**	**18,875**
Total Existing and Planned Supplies			
LACWD 36	2,481	2,868	4,469
NCWD	16,109	17,393	23,219
SCWD	42,043	43,388	51,462
VWC	45,974	46,508	55,757

* This information was inadvertently omitted from the presentation and handout materials provided at the March 8, 2011 workshop. The corrected versions have been uploaded to the Agency website.

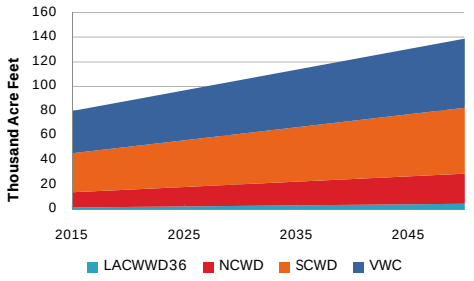
13

Normal Year – Demands with and Without Conservation

	Supplies/Demands (AF) 2015	2020	2050
LACWD 36			
Demand	1,759	2,189	4,768
Anticipated Conservation Objective	176	438	954
Reduction from Recycled Water	-	50	50
Net Anticipated Water Conservation	176	388	904
Demand w/ Conservation	1,583	1,801	3,864
Existing and Planned Supplies	2,481	2,868	4,469
SBX7-7 Compliance Calculations			
NCWD			
Demand	12,571	14,246	24,300
20x2020 Reduction	949	2,152	3,670
Reduction from Recycled Water	*200*	*500*	*3,275*
Reduction from Water Conservation	*749*	*1,652*	*1,652*
Demand w/ Conservation	11,821	12,595	22,648
Existing and Planned Supplies	16,109	17,393	23,219
SCWD			
Demand	31,633	34,814	53,900
20x2020 Reduction	2,453	5,400	8,361
Reduction from Recycled Water	*100*	*500*	*5,775*
Reduction from Water Conservation	*2,353*	*4,900*	*4,900*
Demand w/ Conservation	29,280	29,914	49,000
Existing and Planned Supplies	42,043	43,388	51,462
VWC			
Demand	34,107	37,235	56,000
20x2020 Reduction	3,112	6,948	11,289
Reduction from Recycled Water	*1,000*	*2,000*	*12,200*
Reduction from Water Conservation	*2,112*	*4,948*	*4,948*
Demand w/ Conservation	31,995	32,287	51,052
Existing and Planned Supplies	45,974	46,508	55,757

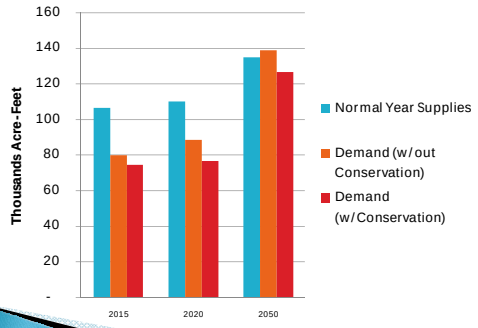
14

Normal Year Purveyor Demands



15

Normal Year – Regional Summary
Existing and Projected Supplies and Demands



16

Single Dry Year
Water Supply and Demand

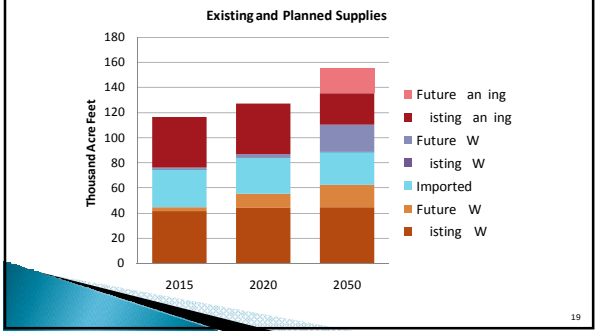
17

Single Dry Year
Existing and Planned Supplies and Demands

Water Supply Sources	Supplies (AF) 2015	2020	2050
Existing Supplies			
Existing Groundwater			
Alluvial Aquifer	20,300	20,250	20,650
Saugus Formation	21,225	24,175	24,150
Recycled Water	325	325	325
Imported Water			
SWP Table A and Carryover	11,900	11,000	9,100
SWP Flexible Storage Accounts	6,060	4,680	4,680
Buena Vista-Rosedale	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607
Banking Programs			
Rosedale Rio-Bravo	20,000	20,000	20,000
Semitropic Water Bank	15,000	15,000	
Semitropic - NLF	4,950	4,950	4,950
Total Existing Supplies	**112,367**	**112,987**	**96,462**
Planned Supplies			
Future Groundwater			
Alluvial Aquifer	200	1,250	7,750
Saugus Formation	2,875	9,925	9,950
Recycled Water	975	2,725	20,975
Banking Programs			20,000
Total Planned Supplies	**4,050**	**13,900**	**58,675**
Total Existing and Planned Supplies	**116,417**	**126,887**	**155,137**
Demand w/o Conservation	**88,077**	**97,332**	**152,865**
Conservation Requirement			
Conservation Objective	6,681	14,937	24,274
Reduction from Recycled Water	1,300	3,050	21,300
Net Anticipated Conservation	5,381	11,887	12,401
Demand w/ Conservation	**82,696**	**85,445**	**140,462**

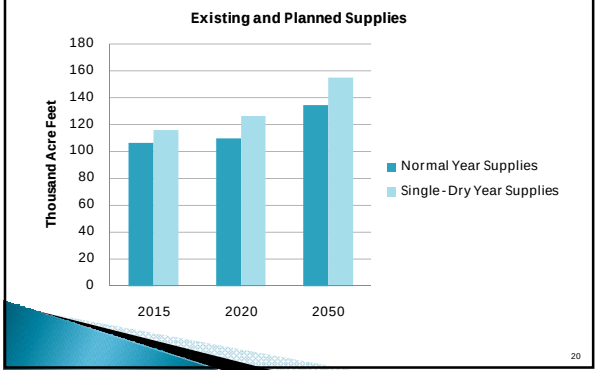
18

Single Dry Year



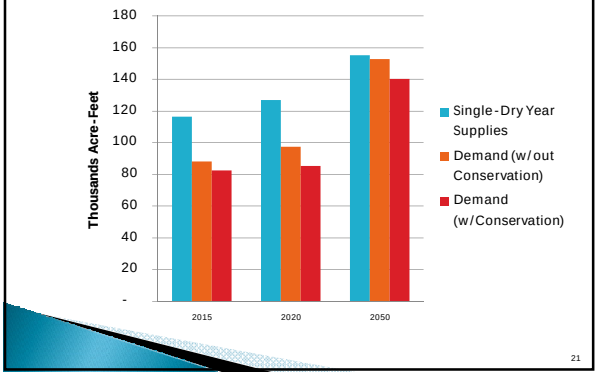
19

Normal vs. Single Dry Year



20

Single-Dry Year
Existing and Planned Supplies and Demands



21

Multiple Dry Year
Water Supply and Demand

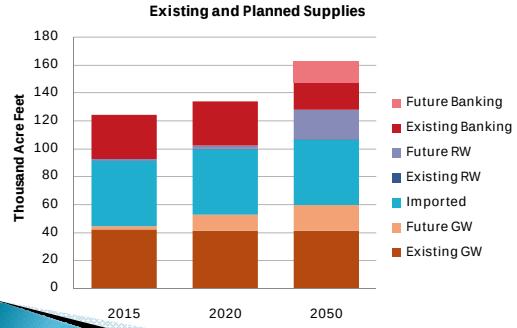
22

Multiple Dry Year
Existing and Planned Supplies and Demands

Water Supply Sources	Supplies (AF)		
	2015	2020	2050
Existing Supplies			
Existing Groundwater			
Alluvial Aquifer	20,425	20,425	21,325
Saugus Formation	22,075	21,325	20,575
Recycled Water	325	325	325
Imported Water			
SWP Table A and Carryover	32,900	32,900	33,000
Flexible Storage Accounts	1,510	1,170	1,170
Buena Vista-Rosedale	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607
Banking Programs			
Rosedale Rio-Bravo	15,000	15,000	15,000
Semitropic Water Bank	11,500	11,500	-
Semitropic - NLF	4,950	4,950	4,950
Total Existing Supplies	121,292	120,202	108,952
Planned Supplies			
Future Groundwater			
Alluvial Aquifer	-	1,000	7,000
Saugus Formation	2,250	10,325	11,075
Recycled Water	975	2,725	20,975
Banking Programs	-	-	15,000
Total Planned Supplies	3,225	14,050	54,050
Total Existing and Planned Supplies	124,517	134,252	163,002
Demand w/o Conservation	88,068	97,325	152,865
Conservation Requirement			
Conservation Objective	6,691	14,937	24,274
Reduction from Recycled Water	1,300	3,050	21,300
Net Anticipated Conservation	5,391	11,887	12,403
Demand w/ Conservation	82,678	85,438	140,462

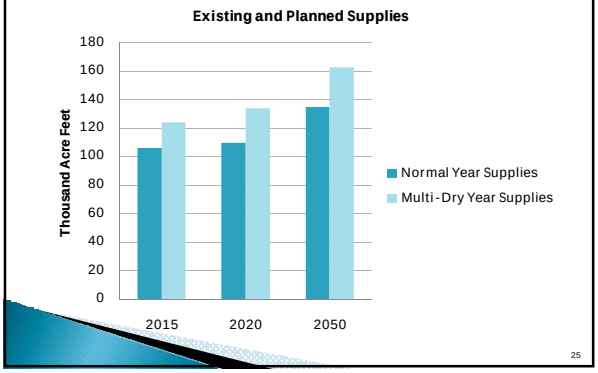
23

Multiple Dry Year Supplies



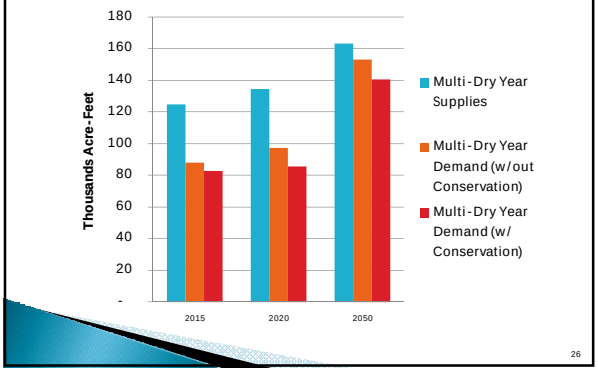
24

Normal Year vs. Multiple Dry Year



25

Multiple Dry Year
Existing and Planned Supplies and Demands



26

Public Hearings

- **Hearings (CLWA and NCWD)**
  - March 23, 2011, 6:15 pm at CLWA
  - May 4, 2011, 6:15 pm at CLWA
- **Adoption**
  - May or June 2011 (due to DWR within 30 days after adoption)

27

Questions and Answers

28

Santa Clarita Valley Urban Water Management Plan
March 8, 2011 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	ALBERT PETERSON	CITY OF GLENDALE WATER	APPRENTICE	818/548-2011	N/A
2.	GRAVES, E	cc	observe	661.406.3219	—
3.	Keith Abercrombie	VWC			
4.	Jackie Biale	Sen Sharon Runner			
5.	Jessica Bunker	WWD No. 36	ASSOCIATE CIVIL ENG.	626-300-3315	jbunker@ladpw.org
6.	Jeff Ford	CLWA	Water Res Planner	(661) 297-1600	jford@clwa.org
7.	Rose Talamantis				
8.	Clint Brightwell	BWP	Apprentice	(818) 621-5726	
9.	James Rowland	" "	" "	(818) 926-0978	
10.	KC VALVO	" "	" "	" "	
11.	MIKE WILDERMUTH	" "	" "	" "	
12.	ROBERT MUZARDJA	" "	WATER METER MECHANIC	818 238 3500	
13.	Sean Allen	" "	Apprentice	818 618 0331	
14.					
15.					
16.	Pam Noteboer (Sparwicks)				
17.	Lynn Plambeck				
18.					

Santa Clarita Valley Urban Water Management Plan
March 8, 2011 - Community Workshop Sign In Sheet

	PRINT NAME	ORGANIZATION	TITLE	PHONE	EMAIL
1.	MARK YOCHUM	MA YOCHUM	PRES	661 252 4806	MYOCHUM@SOCAL.RR.COM
2.	Tom Reynolds	NA	NA	661 252 4374	—
3.	Lauren Everett	KJ		805 973 6705	
4.	Charles Romero	GWP	Water System Mechanic	818-548-2011	cromero.ci.glendale.ca.gov
5.	JON WALLACE	COC	STUDENT	(661) 313-8095	JCWALLACE@yahoo.com
6.	Francisco Guerrero	LACSD	Engineer	562 908 4288 x2732	FGuerrero@lacsd.org
7.	Sharan Sorensen	City of S.C.	Sr. Planner	(661) 255-4330	SSorensen@santaclarita.com
8.	Casey Bingham	City of SC	Analyst	661-255-4902	cbingham@santa-clarita.com
9.	Mic Guerrero	CoC	Student	661 210 5717	
10.	Kimberly Clayton	COC	NA	661 713-2312	shychic_@yahoo.com
11.	STEVE MCLEAN	COC	—	661-312-5463	MCLEAN.STEPHEN@CH.RR.COM
12.	Stephanie Anagnoson	CLWA		6615131231	
13.	Cathy Hollcomon	SCWA	Assoc WR Planner	661-259-2737	chollcomon@scwater.org
14.	MIKE REYES	C.O.C	STUDENT	———	
15.	LUIS MARGHERITIS	COC	ELECT./ELECTRO	661 510 4448	LMARGHERITIS@CLWA.ORG
16.	Greg Millen	VWC	VP Admin	661 295-6517	
17.	Derrick Jacobson	COC	N/A	(661) 310-6145	drock18@ymail.com
18.	Tristan Moreno	N/A	N/A	↓	↓

Email notification of revised March workshop powerpoint
Sent to all on master list

Stacy Miller

To: Stacy Miller
Cc: Stacy Miller
Subject: FW: Urban Water Management Plan (UWMP)

Dear March 8th Urban Water Management Plan (UWMP) community workshop attendee:

Below, please find a link to an updated version of the PowerPoint presentation from the March 8, 2011 UWMP Community Workshop. Please note that there was a small amount of information on the "Normal Year - Planned Water Supply" slide that was inadvertently omitted from the presentation and handout materials.

We appreciate your attendance, participation and feedback in this important process. Should you have any questions, please feel free to contact us.

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

- Link to March 8, 2011 UWMP Community Workshop Presentation - http://www.clwa.org/about/pdfs/March%202011%20UWMP%20Workshop%20draft%203811.pdf

Stacy Miller
PUBLIC AFFAIRS
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P.O. Box 55745, Valencia, CA 91385
(818) 402-5806 (661) 222-9733 Fax stacy@StacyMillerPA.com
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First Public Hearing
March 23, 2011
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

March 3, 2011

Mike Murphy
Intergovernmental Relations Officer
City of Santa Clarita
23920 Valencia Blvd., Suite 300
Santa Clarita, CA 91355

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Murphy:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

CLWA is providing you with this notice on its behalf, as well as on behalf of SCWD, LA-36, NCWD and VWC, pursuant to Water Code, section 10621, subdivision (b) of the Act, which requires an urban water supplier to notify any city or county within which it provides water that it is reviewing its plan and considering changes to the plan. Additionally, when a draft UWMP is available for public review, a copy will be sent to you.

While the Act only requires that an urban water supplier hold one public hearing before adopting a plan, in order to ensure sufficient opportunity for public feedback, input and suggestions concerning the 2010 UWMP, two public hearings are scheduled. Additional hearings may be scheduled if needed.

The first public hearing will be held at 6:15 p.m., on Wednesday, March 23, 2011. The second public hearing will held at 6:15 p.m., on Wednesday, May 4, 2011. Both public hearings will take place at the CLWA Boardroom, located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

If you have any questions please contact me at (661) 297-1600.

Sincerely,

Dirk Marks
Water Resources Manager

CASTAIC LAKE WATER AGENCY

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CASTAIC LAKE WATER AGENCY

March 3, 2011

Jeff W. Hogan, AICP
Interim Planning Manager
City of Santa Clarita Planning Division
23920 Valencia Blvd., Suite 300
Santa Clarita, CA 91355

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Hogan:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

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Sincerely,

Dirk Marks
Water Resources Manager

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March 3, 2011

Jason Smisko
Senior Planner
City of Santa Clarita Planning Division
23920 Valencia Blvd., Suite 300
Santa Clarita, CA 91355

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Smisko:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

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If you have any questions please contact me at (661) 297-1600.

Sincerely,

Dirk Marks
Water Resources Manager

CASTAIC LAKE WATER AGENCY

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CASTAIC LAKE WATER AGENCY

March 3, 2011

Chris Stevens, Director
Resource Management Agency
County of Ventura
800 South Victoria Avenue
Ventura, CA 93009-1740

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Stevens:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

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If you have any questions please contact me at (661) 297-1600.

Sincerely,

Dirk Marks
Water Resources Manager

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GENERAL COUNSEL
McCORMICK, KIDMAN & BEHRENS, LLP
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March 3, 2011

Richard J. Bruckner, Director
Los Angeles County
Department of Regional Planning
1390 Hall of Records
320 West Temple Street
Los Angeles 90012

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Bruckner:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

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The first public hearing will be held at 6:15 p.m., on Wednesday, March 23, 2011. The second public hearing will held at 6:15 p.m., on Wednesday, May 4, 2011. Both public hearings will take place at the CLWA Boardroom, located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

If you have any questions please contact me at (661) 297-1600.

Sincerely,

Dirk Marks

Dirk Marks
Water Resources Manager

CASTAIC LAKE WATER AGENCY

BOARD OF DIRECTOR
PRESIDENT
THOMAS P. CAMPBELL
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SECRETARY
APRIL JACOBS

March 3, 2011

Mark Pestrella
Department of Public Works
Los Angeles County
P.O. Box 1460
Alhambra 91802-1460

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Pestrella:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

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Water Resources Manager

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CASTAIC LAKE WATER AGENCY

March 3, 2011

Jessica Bunker, P.E.
Waterworks Division
P.O. Box 1460
Alhambra, CA 91802-1460

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Ms. Bunker:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

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Sincerely,

Dirk Marks
Water Resources Manager

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March 3, 2011

Rosalind Wayman, Field Deputy
Los Angeles County
Fifth Supervisorial District
23920 Valencia Blvd., Suite 265
Santa Clarita, CA 91355

Subject: Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Ms. Waymans:

As you know, Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC) have joined to prepare a regional Urban Water Management Plan (UWMP) for the Santa Clarita Valley, as they did in 2000 and 2005. Los Angeles County Waterworks District No. 36 (LA 36) is participating on an ad hoc basis. Adoption of the 2010 UWMP is required under the Urban Water Management Planning Act (Act) by July 1, 2011.

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If you have any questions please contact me at (661) 297-1600.

Sincerely,

Dirk Marks

Dirk Marks
Water Resources Manager

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THE SIGNAL NEWSPAPER
24000 Creekside Rd
Valencia, Ca 91355

Proof of Publication
(2015.5 C.C.P.)

STATE OF CALIFORNIA,
COUNTY OF LOS ANGELES

I am a citizen of the United States,and a resident of the county aforesaid; I am over the age of eighteen years; and I am not a party to or interestedin the notice published. I am the chief legal advertising clerk of the publisher of the

SIGNAL NEWSPAPER

a newspaper of general circulation, printed and published **Daily** in the city of Santa Clarita County of Los Angeles, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Los Angeles State of California, under the date of **March 25, 1988**
Case number **NVC15880**, that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to-wit: 2/25 3/4, 3/11, 3/18

All in the year 20 11

I certify (or declare) under penalty of perjury' that the foregoing is true and correct

Dated at Valencia, California, this 18 day of March, 20 11

Signature

NOTICE OF PUBLIC HEARINGS 2010 URBAN WATER MANAGEMENT PLAN

Castaic Lake Water Agency ("CLWA"), CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company have directed the preparation of a joint regional 2010 Urban Water Management Plan ("UWMP") for the Santa Clarita Valley, as encouraged by the Urban Water Management Planning Act ("Act"). Los Angeles County Waterworks District No. 36 is participating in the process on an ad hoc basis. Adoption of the 2010 UWMP is required under the Act by July 1, 2011.

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For additional information regarding the public hearings, please contact Dirk Marks, CLWA Water Resources Manager, at (661) 297-1600.

The Signal 2/25, 3/4, 3/11 & 3/18 2011

Paste Clipping of Notice SECURELY In This Space

Santa Clarita Valley Urban Water Management Plan

Community Workshop
March 8, 2011
4:00 pm
Castaic Lake Water Agency

1

Agenda

- Introductions
- Review of Past Workshops
- UWMP Overview
- Water Supply and Demands
- Public Hearing Process and Schedule
- Questions and Answers

2

Past Workshops

- **May 2010**
- UWMP purposed and process - What, Who, Why and When
- Existing and new requirements of UWMPs

- **July 2010**
- SBX7-7 Requirements
- Recycled Water
- Groundwater Supplies
- State Water Project Reliability

- **November 2010** (with the IRWMP Stakeholders)
- UWMP purposed and process - What, Who, Why and When
- Required under SBX7-7
- Importance of UWMP to IRWMP process and vice versa

3

Past Workshops

- **November 2010**
- GPCD population assumptions and calculations
- SBX7-7
- Targets by retailer

- **January 2011**
- Overview of water supplies
- SWP reliability update
- CLWA reliability planning update
- SBX7-7 ("20x2020") calculations and targets
- Overview of water supplies and demand

4

UWMP Act Overview

- **The Basics**
  - UWMP Act applies to all CA water suppliers with 3,000 or more service connections or selling at least 3,000 AFY (retail or wholesale)
  - Main focus: to identify gaps between supply and demand through time (20-year analysis required)
  - Must describe how demand will be met through time, in all hydrologic year types (normal, multiple dry years, single dry year)
  - If there will be shortages, describe how they will be addressed

5

UWMP Act Overview

- **The Basics (cont'd.)**
  - Requires detailed description of all supply sources (surface, recycled, groundwater)
  - Water quality problems that may impact supply
  - Demand Management Measures (water conservation programs)
  - Water shortage contingency planning
  - Must update every five years, in years ending in 5 and 0 (such as 2010)

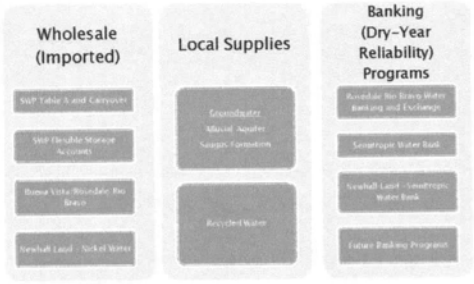
6

UWMP Act Overview

- DWR reviews UWMPs for "completeness"
  - If data not evident or items not in compliance, DWR will find UWMP "incomplete"
  - DWR will send letter to water supplier requesting additional data to bring UWMP up to code
  - May impact supplier's ability to obtain grant/loan funding
  - May impact supplier's ability to provide SB 610 Water Supply Assessments and SB 221 Water Supply Verifications

7

Santa Clarita Valley Water Supplies



8

Water Supplies and Demand

Normal/Single Dry/Multiple Dry Years

- Existing Supplies
- Planned Supplies
- Demands with and without Conservation
- Demands and Supply Comparison

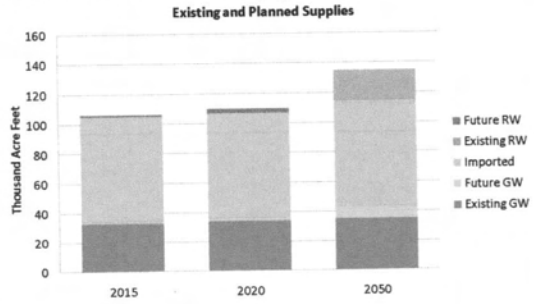
9

Normal Year – Regional Summary

Regional Summary	Supply (AF) 2015	2020	2050
Existing Groundwater			
Alluvial Aquifer	24,366	24,000	35,000
Saugus Formation	8,725	19,225	10,725
Recycled Water	325	325	325
Imported Water			
State Water Project Table A and Carryover	58,300	57,900	57,400
Flexible Storage Accounts	-	-	-
Buena Vista-Rosedale	11,000	11,000	11,000
Nickel Water - Newhall Land	1,807	1,907	1,807
Banking Programs			
Rosedale Rio-Bravo	-	-	-
Semitropic Water Storage District	-	-	-
Semitropic - Newhall Land and Farming	-	-	-
Total Existing Supplies	**102,342**	**105,057**	**105,557**
Planned Supplies			
Future Groundwater			
Alluvial Aquifer	-	1,900	7,000
Saugus Formation	-	1,375	1,375
Recycled Water	-	2,725	20,975
Future Banking Programs	-	-	-
Total Planned Supplies	**-**	**5,100**	**29,350**
Total Existing and Planned Supplies	**102,342**	**110,157**	**134,907**
Demand without Conservation	**90,070**	**88,484**	**126,966**
Conservation Requirements			
Conservation Objective	6,681	14,937	24,274
Reduction from Recycled Water	1,300	3,050	21,300
Net Anticipated Water Conservation	5,381	11,887	12,403
Demand w/ Conservation	**74,879**	**79,597**	**126,566**

10

Normal Year Supplies



11

Normal Year – Existing Water Supplies

Water Supply Sources	Supply (AF) 2015	2020	2050
Existing Groundwater			
Alluvial Aquifer			
LACWD 36	-	-	-
NCWD	1,805	1,805	1,805
SCWD	10,500	10,500	11,500
VWC	11,875	11,875	11,875
Saugus Formation			
LACWD 36	-	-	-
NCWD	3,625	3,625	3,625
SCWD	2,850	3,350	3,350
VWC	2,850	3,350	3,350
Recycled Water			
LACWD 36	-	-	-
NCWD	-	-	-
SCWD	-	-	-
VWC	325	325	325
Imported Water			
SWP Table A and Carryover			
LACWD 36	1,658	1,843	3,289
NCWD	9,084	9,918	11,469
SCWD	22,818	24,763	25,787
VWC	24,442	22,778	16,875
SWP Flexible Storage Accounts	-	-	-
Buena Vista-Rosedale			
LACWD 36	326	375	650
NCWD	1,600	1,750	2,450
SCWD	4,675	4,775	5,050
VWC	4,400	4,100	3,850
Nickel Water - Newhall Land			
VWC	1,807	1,807	1,807
Totals Existing Supplies			
LACWD 36	**1,981**	**2,218**	**3,918**
NCWD	**15,034**	**16,018**	**19,050**
SCWD	**41,843**	**43,888**	**45,687**
VWC	**45,299**	**43,835**	**36,982**

12

Normal Year – Planned Water Supplies

Planned Supplies	Supplies (AF) 2015	2020	2060
Future Groundwater			
Alluvial Aquifer			
LACWD 36	-	-	-
NCWD	-	-	-
SCWD	-	-	-
VWC	-	1,000	7,000
Saugus Formation			
LACWD 36	500	500	500
NCWD	975	975	975
SCWD	-	-	-
VWC	-	-	-
Recycled Water			
LACWD 36	-	50	50
NCWD	200	500	3,275
SCWD	100	500	5,775
VWC*	675	1,675	11,975
Future Banking Programs	-	-	-
Total Planned Supplies			
LACWD 36	**500**	**550**	**550**
NCWD	**1,075**	**1,375**	**4,150**
SCWD*	100	500	5,775
VWC	**675**	**2,675**	**18,875**
Total Existing and Planned Supplies			
LACWD 36	2,461	2,899	4,469
NCWD	16,109	17,393	23,219
SCWD	42,043	43,388	51,482
VWC	45,974	46,508	55,757

* This information was inadvertently omitted from the presentation and handout materials provided at the March 8, 2011 workshop. The corrected versions have been uploaded to the Agency website.

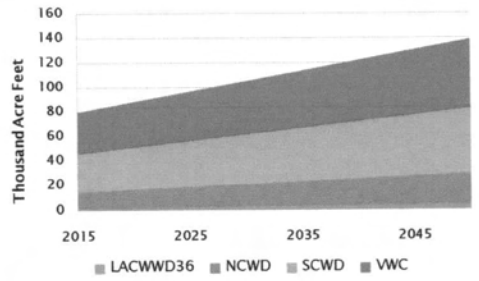
13

Normal Year – Demands with and Without Conservation

	Supplies/Demands (AF) 2015	2020	2060
LACWD 36			
Demand	1,769	2,189	4,758
Anticipated Conservation Objective	178	438	954
Reduction from Recycled Water		50	50
Net Anticipated Water Conservation	178	388	904
Demand w/ Conservation	1,591	1,801	3,854
Existing and Planned Supplies	2,461	2,899	4,469
SBX7-7 Compliance Calculations			
NCWD			
Demand	12,571	14,246	24,300
20x2020 Reduction	948	2,152	3,870
Reduction from Recycled Water	200	500	3,275
Reduction from Water Conservation	749	1,652	1,652
Demand w/ Conservation	11,871	12,595	22,648
Existing and Planned Supplies	16,109	17,393	23,219
SCWD			
Demand	31,833	34,814	53,900
20x2020 Reduction	2,453	5,400	8,361
Reduction from Recycled Water	100	500	5,775
Reduction from Water Conservation	2,353	4,900	4,900
Demand w/ Conservation	29,380	29,914	49,000
Existing and Planned Supplies	42,043	43,388	51,482
VWC			
Demand	94,107	37,335	68,000
20x2020 Reduction	3,112	6,948	11,269
Reduction from Recycled Water	1,000	2,000	12,200
Reduction from Water Conservation	2,112	4,948	4,948
Demand w/ Conservation	91,995	32,387	51,852
Existing and Planned Supplies	45,974	46,508	55,757

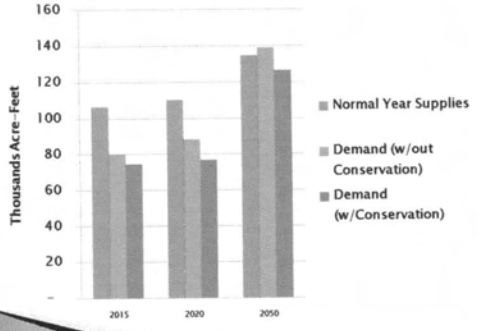
14

Normal Year Purveyor Demands



15

Normal Year – Regional Summary
Existing and Projected Supplies and Demands



16

Single Dry Year
Water Supply and Demand

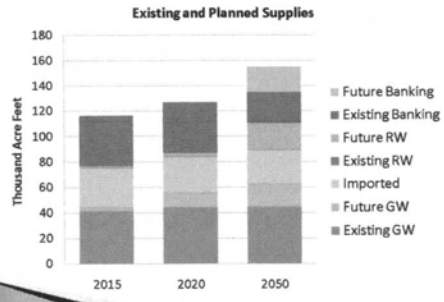
17

Single Dry Year
Existing and Planned Supplies and Demands

Water Supply Sources	Supplies (AF) 2015	2020	2050
Existing Supplies			
Existing Groundwater			
Alluvial Aquifer	20,300	20,250	20,650
Sauquis Formation	21,225	24,175	24,150
Recycled Water	375	725	725
Imported Water			
SWP Table A and Carryover	11,800	11,000	9,100
SWP Flexible Storage Account	8,882	4,880	4,880
Bueno Vista-Rosedale	11,000	11,000	11,000
Nickel Water - Newhall Land	1,881	1,881	1,881
Banking Programs			
Rosedale Rio Bravo	20,000	20,000	20,000
Semitropic Water Bank	15,000	15,000	-
Semitropic - NLF	4,950	4,950	4,950
Total Existing Supplies	**112,363**	**112,861**	**96,462**
Planned Supplies			
Future Groundwater			
Alluvial Aquifer	200	1,250	7,750
Sauquis Formation	2,875	9,825	9,850
Recycled Water	975	2,725	20,975
Banking Programs			20,000
Total Planned Supplies	**4,050**	**13,800**	**58,575**
Total Existing and Planned Supplies	**116,413**	**126,661**	**155,137**
Demand w/o Conservation	**80,077**	**97,332**	**152,066**
Conservation Requirement			
Conservation Objective	8,881	14,931	24,274
Reduction from Recycled Water	1,300	3,050	21,300
Net Anticipated Conservation	-5,381	11,881	12,403
Demand w/ Conservation	**80,696**	**86,446**	**140,462**

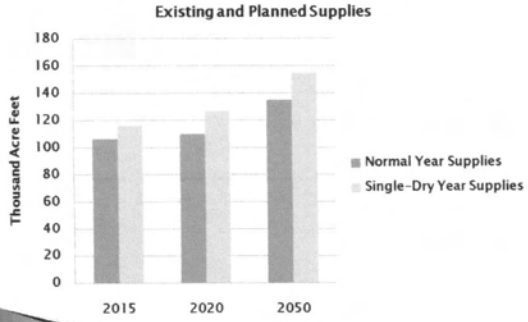
18

Single Dry Year



19

Normal vs. Single Dry Year



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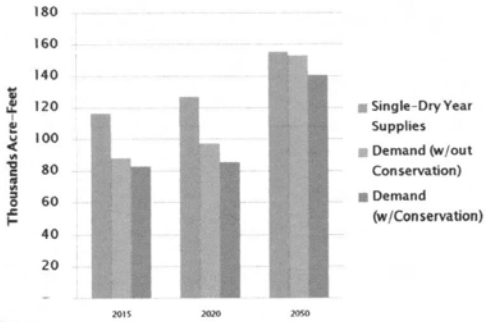
Single-Dry Year
Existing and Planned Supplies and Demands



21

Multiple Dry Year
Water Supply and Demand

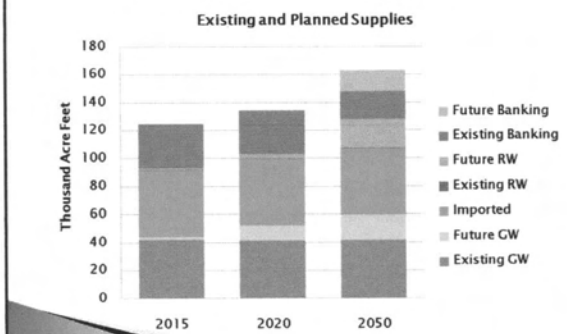
22

Multiple Dry Year
Existing and Planned Supplies and Demands

Water Supply Sources	Supplies (AF) 2015	2020	2050
Existing Supplies			
Existing Groundwater			
Alluvial Aquifer	20,425	20,425	21,325
Saugus Formation	22,075	21,325	20,575
Recycled Water	325	325	325
Imported Water			
SWP Table A and Carryover	32,900	32,900	33,000
Flexible Storage Accounts	1,510	1,170	1,170
Buena Vista-Rosedale	11,000	11,000	11,000
Nickel Water - Newhall Land	1,607	1,607	1,607
Banking Programs			
Rosedale Rio-Bravo	15,000	15,000	15,000
Semitropic Water Bank	11,500	11,500	-
Semitropic - NLF	4,950	4,950	4,950
Total Existing Supplies	121,292	120,202	108,952
Planned Supplies			
Future Groundwater			
Alluvial Aquifer	-	1,200	7,000
Saugus Formation	2,250	10,225	11,075
Recycled Water	975	2,725	20,975
Banking Programs	-	-	15,000
Total Planned Supplies	**3,225**	**14,050**	**54,050**
Total Existing and Planned Supplies	**124,517**	**134,252**	**163,002**
Demand w/o Conservation	**80,090**	**97,328**	**102,866**
Conservation Requirement			
Conservation Objective	6,681	14,937	24,774
Reduction from Recycled Water	1,300	3,060	21,300
Net Anticipated Conservation	5,381	11,887	12,403
Demand w/ Conservation	**82,870**	**85,438**	**140,462**

23

Multiple Dry Year Supplies



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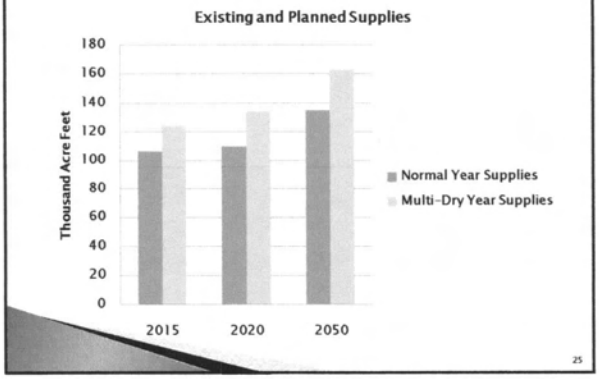
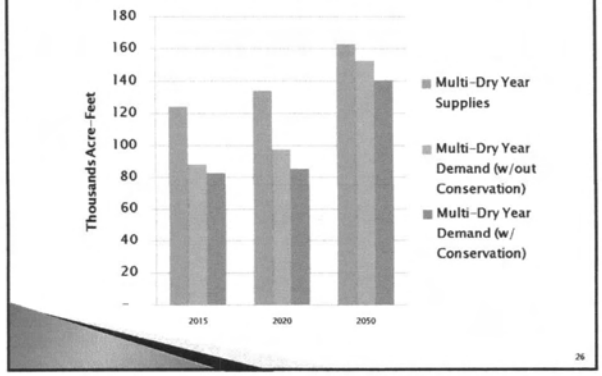
Normal Year vs. Multiple Dry Year



25

Multiple Dry Year
Existing and Planned Supplies and Demands



26

Public Hearings

- Hearings (CLWA and NCWD)
  - March 23, 2011, 6:15 pm at CLWA
  - May 4, 2011, 6:15 pm at CLWA
- Adoption
  - May or June 2011 (due to DWR within 30 days after adoption)

27

Questions and Answers

28

Notification of UWMP Draft Document Availability

Public Outreach Record

2010 Santa Clarita Valley Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations

April 11, 2010

<Address Block> - ***See Attached For Distribution List***

Subject: 2010 Urban Water Management Plan Draft Document Availability-April 15, 2011

Dear <Saluatation>,

The Santa Clarita Valley water suppliers, Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company, have spent the last 10 months working with the community to prepare the 2010 Urban Water Management Plan (UWMP). In addition to six community workshops, the water suppliers have cooperated with the City of Santa Clarita, Counties of Los Angeles and Ventura and other interested parties on the planning document.

The draft 2010 Urban Water Management Plan will be available to the public for review beginning Friday, April 15, 2011. The UWMP document can be accessed via the water suppliers' websites, by contacting your water supplier directly (contact information below), or at one of the local Santa Clarita Valley libraries. The deadline for the public to submit comments on the UWMP draft document is 5:00 p.m. on May 20, 2011. Comments can be submitted either by hand delivery, U.S. mail, email or fax to any of the water suppliers listed below.

Castaic Lake Water Agency www.clwa.org 27234 Bouquet Canyon Road Santa Clarita, CA 91350 Phone 661-297-1600 / Fax: 661-297-1611 Email: mail@clwa.org	**CLWA Santa Clarita Water Division** www.scwater.org 26521 Summit Circle Santa Clarita, CA 91350-3049 Phone: 661-259-2737 / Fax: 661-286-4333 Email: mail@clwa.org
Newhall County Water District www.ncwd.org 23780 North Pine ST Newhall, CA 91321 Phone: 661-259-3610 / Fax: 661-259-3574 Email: mail@ncwd.org	**Valencia Water Company** www.valenciawater.com 24631 Avenue Rockefeller Valencia, CA 91355 Phone: 661-294-0828 / Fax: 661-294-3806 Email: vwcuwmp@valenciawater.com

If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Email notification to IRWM Stakeholders
Availability of Draft Document

From: Jeff Ford [mailto:jford@clwa.org]
Sent: Monday, April 18, 2011 9:47 AM
To: Jeff Ford
Subject: Availability of the Public Review Draft of the 2010 Urban Water Management Plan for the Santa Clarita Valley

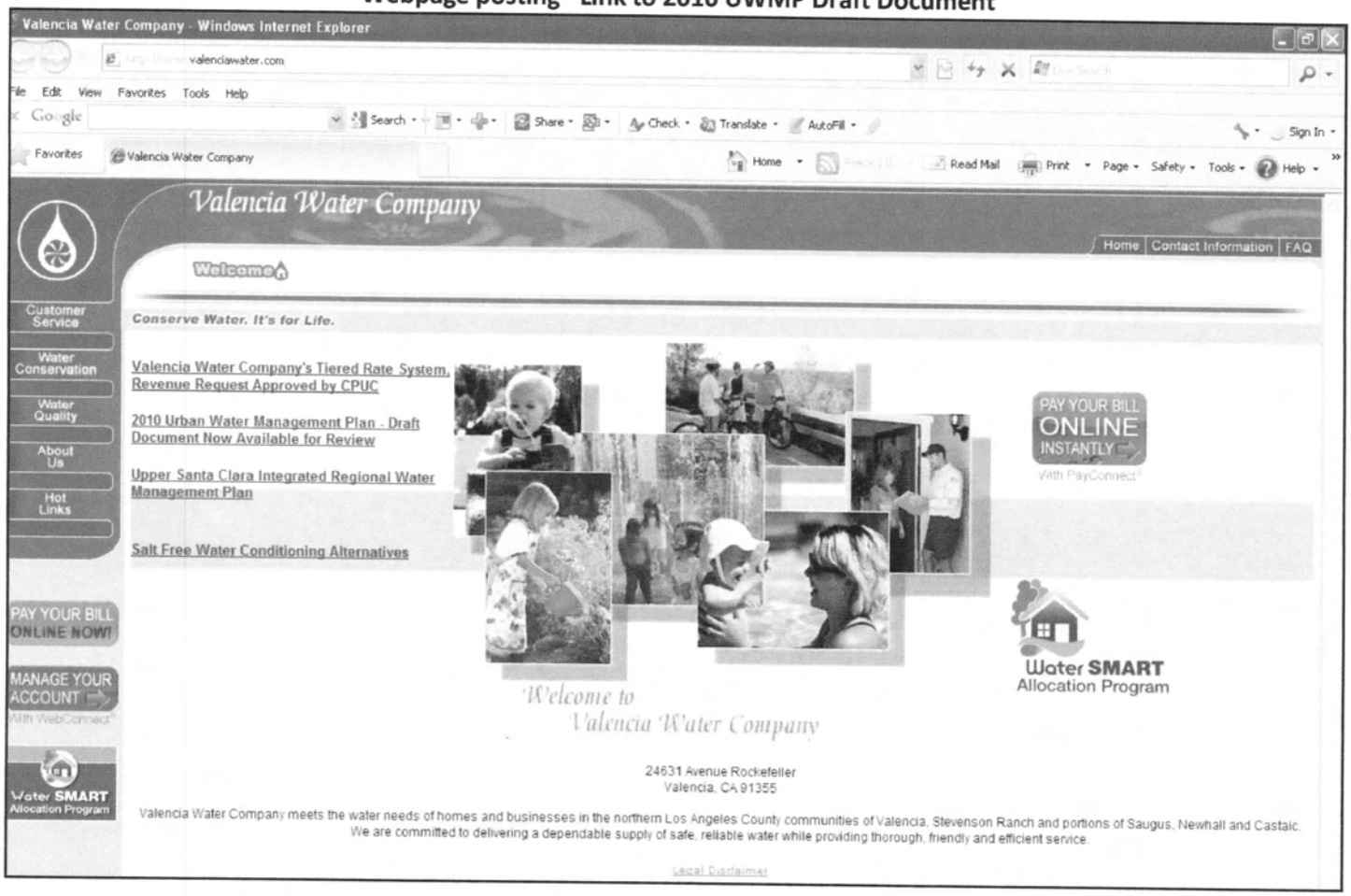
Upper SCR IRWM Stakeholders:

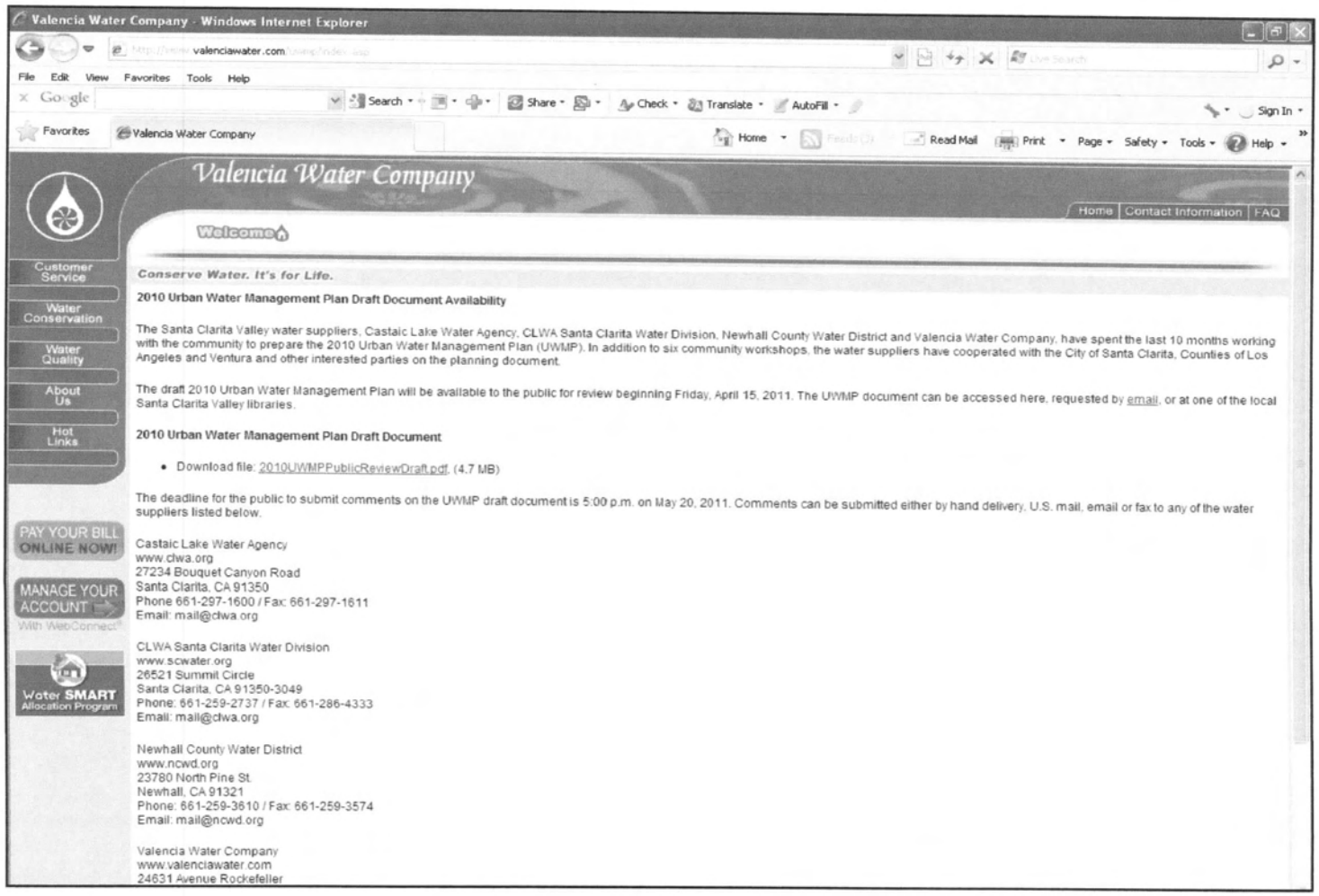
The Public Review Draft of the 2010 Urban Water Management Plan for the Santa Clarita Valley is available for review. The document can be found on the Castaic Lake Water Agency (CLWA) website at: http://www.clwa.org/about/pdfs/CLWA_2010UWMP_PublicReviewDraft.pdf. There will be a joint public hearing by the CLWA Board of Directors and the Newhall County Water District Board of Directors for the document on May 18, 2011 at 6:15 p.m. at CLWA, 27234 Bouquet Canyon Road, Santa Clarita, CA 91350.

Regards,

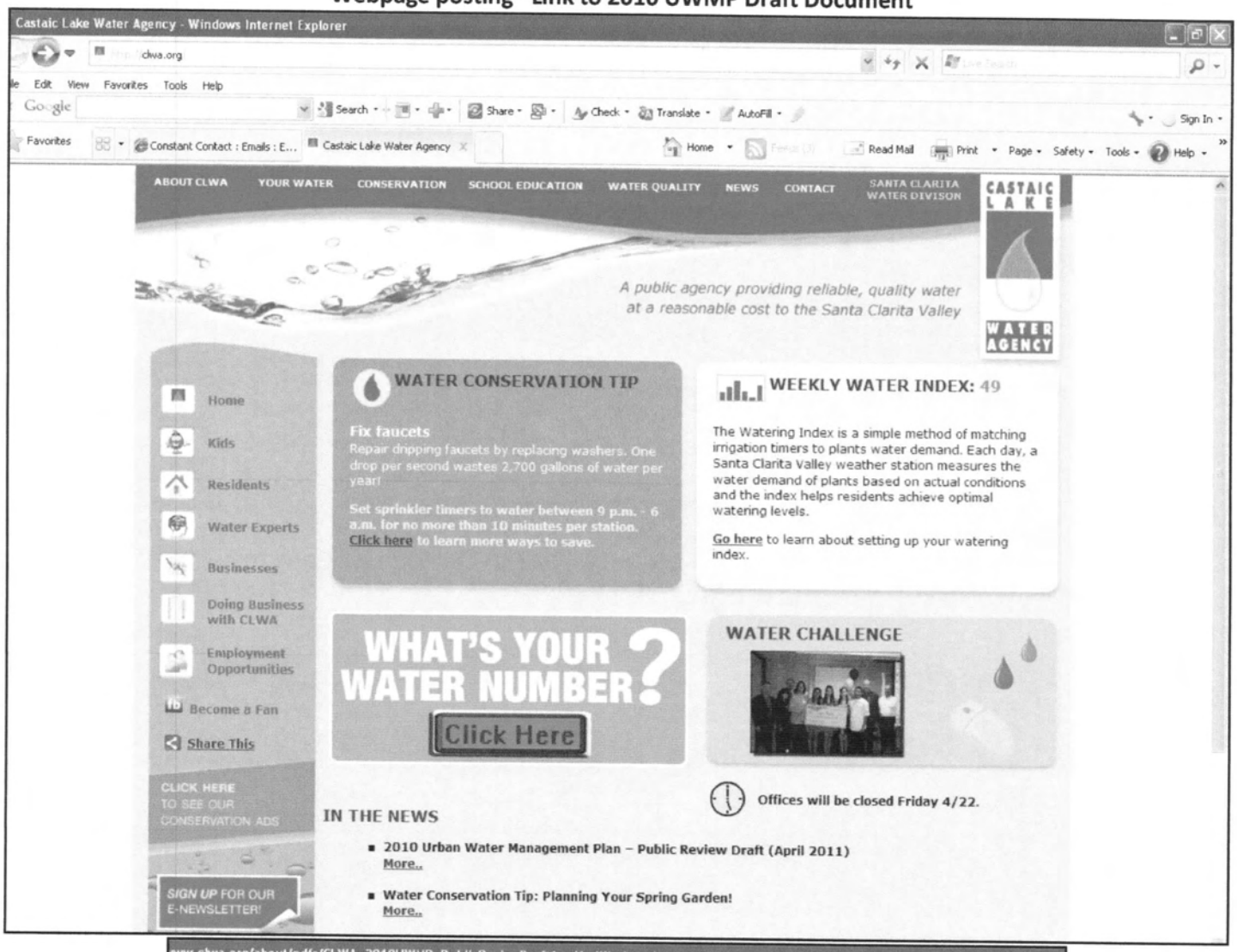
Jeff Ford
Principal Water Resources Planner
Castaic Lake Water Agency
(661) 513-1281

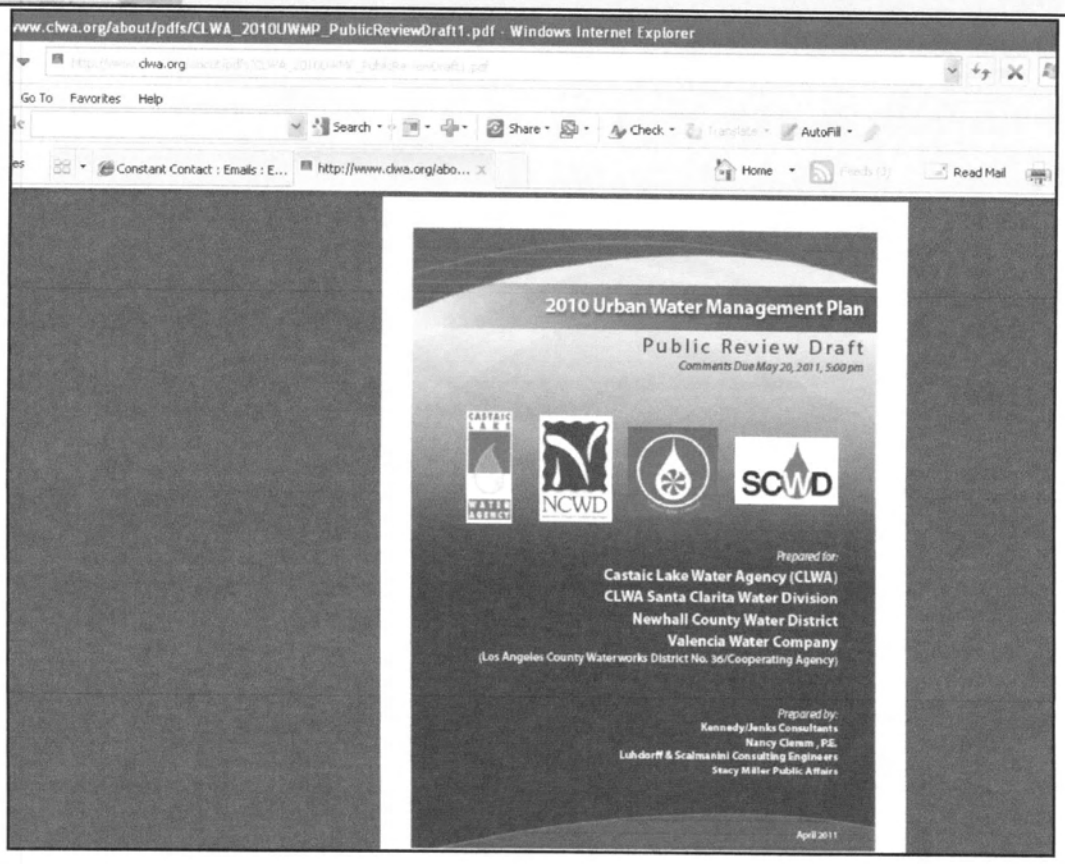
Valencia Water Company
Webpage posting –Link to 2010 UWMP Draft Document



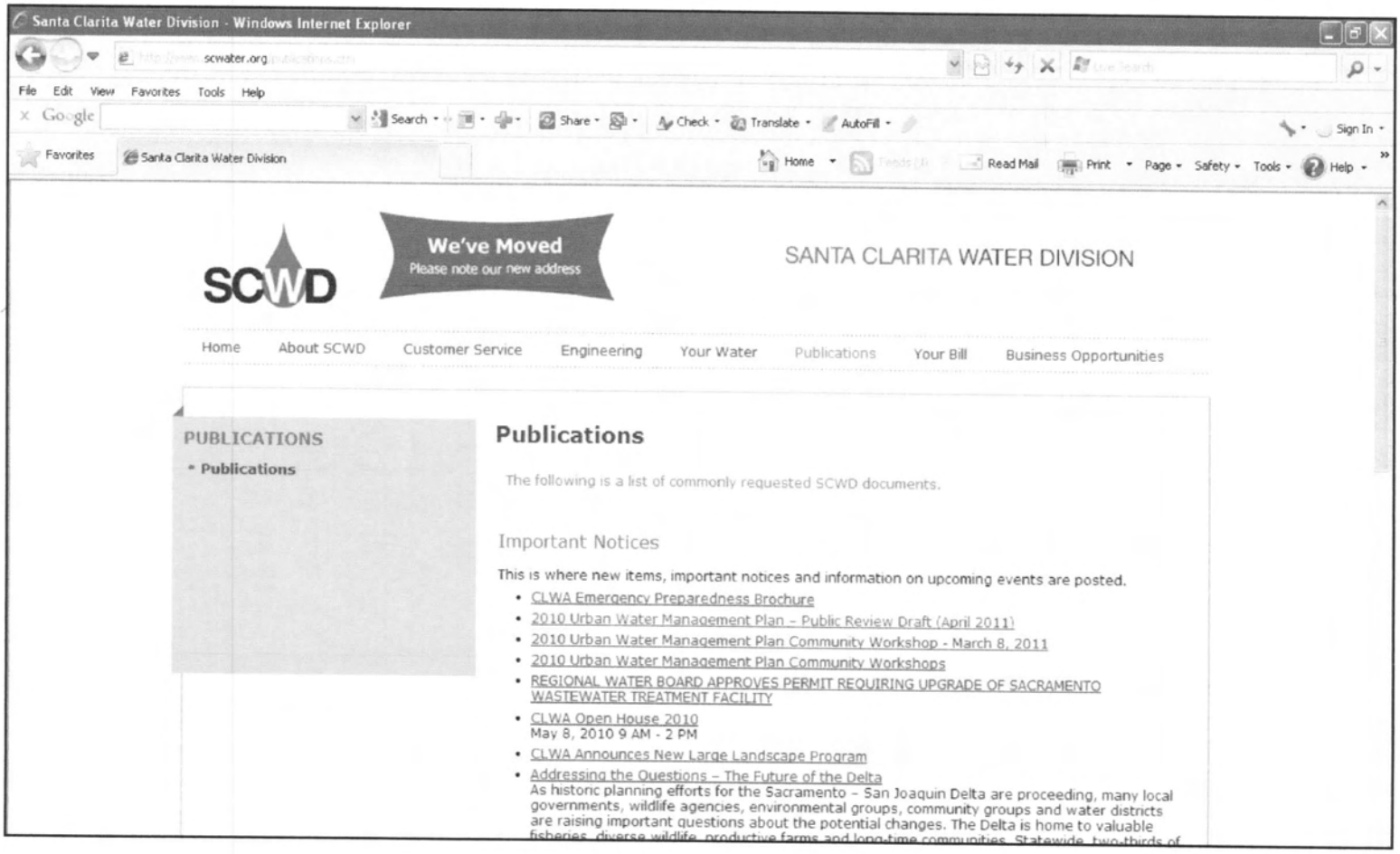


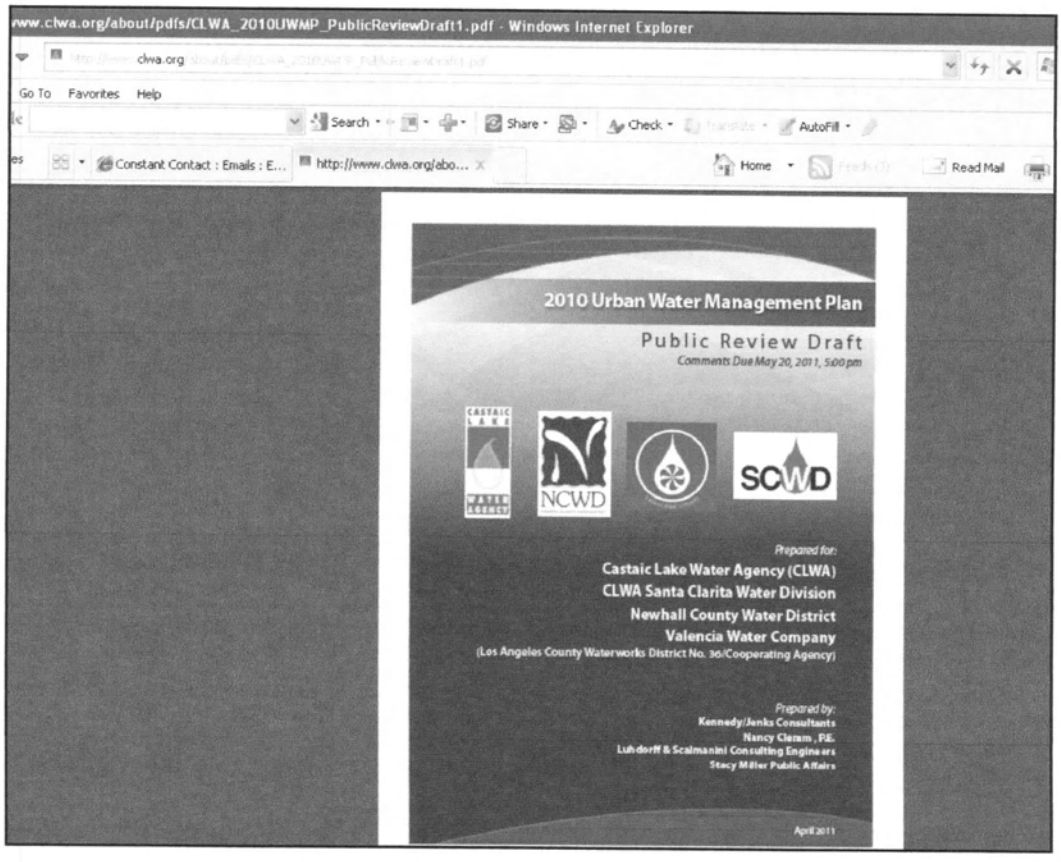
Castaic Lake Water Agency
Webpage posting –Link to 2010 UWMP Draft Document



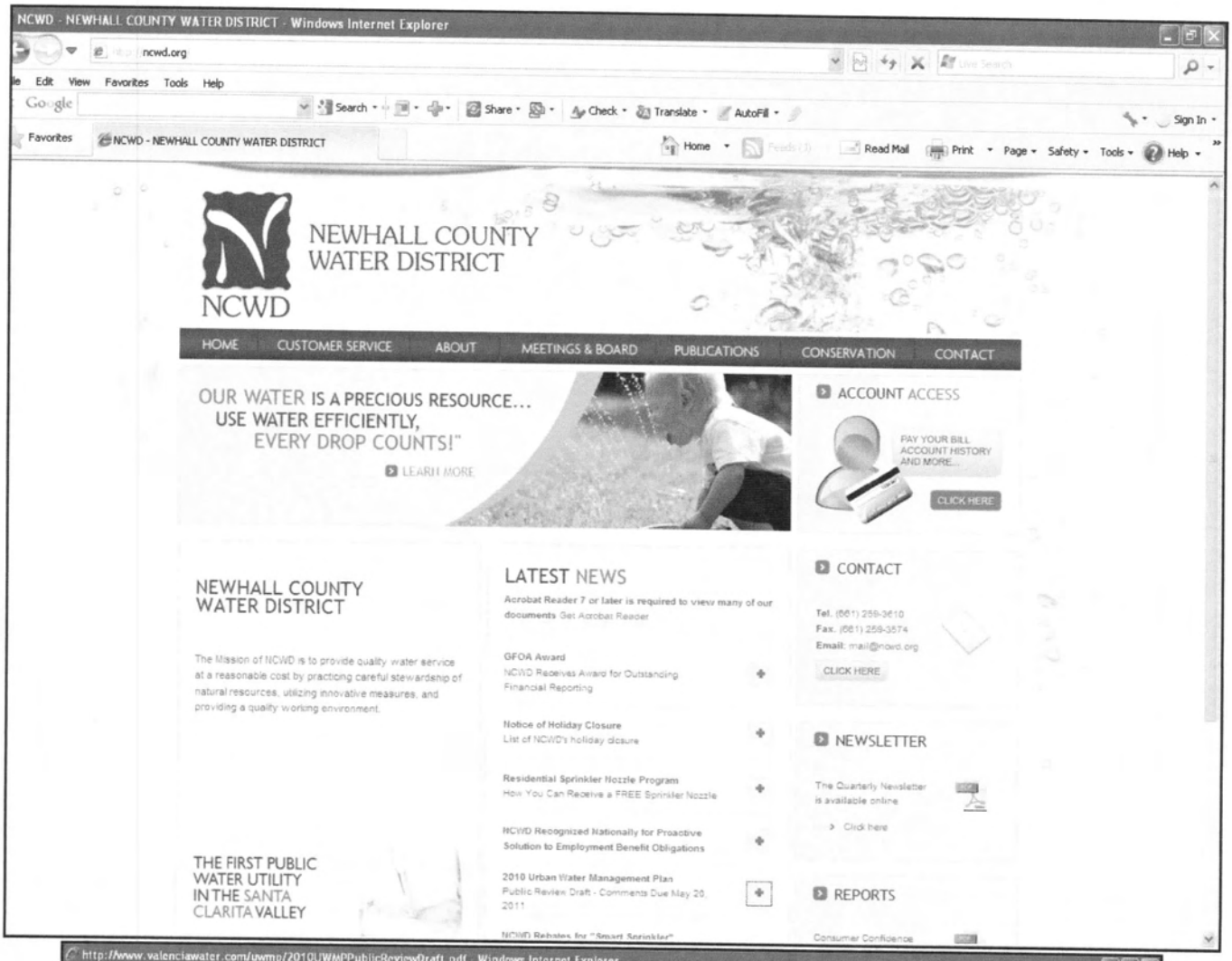


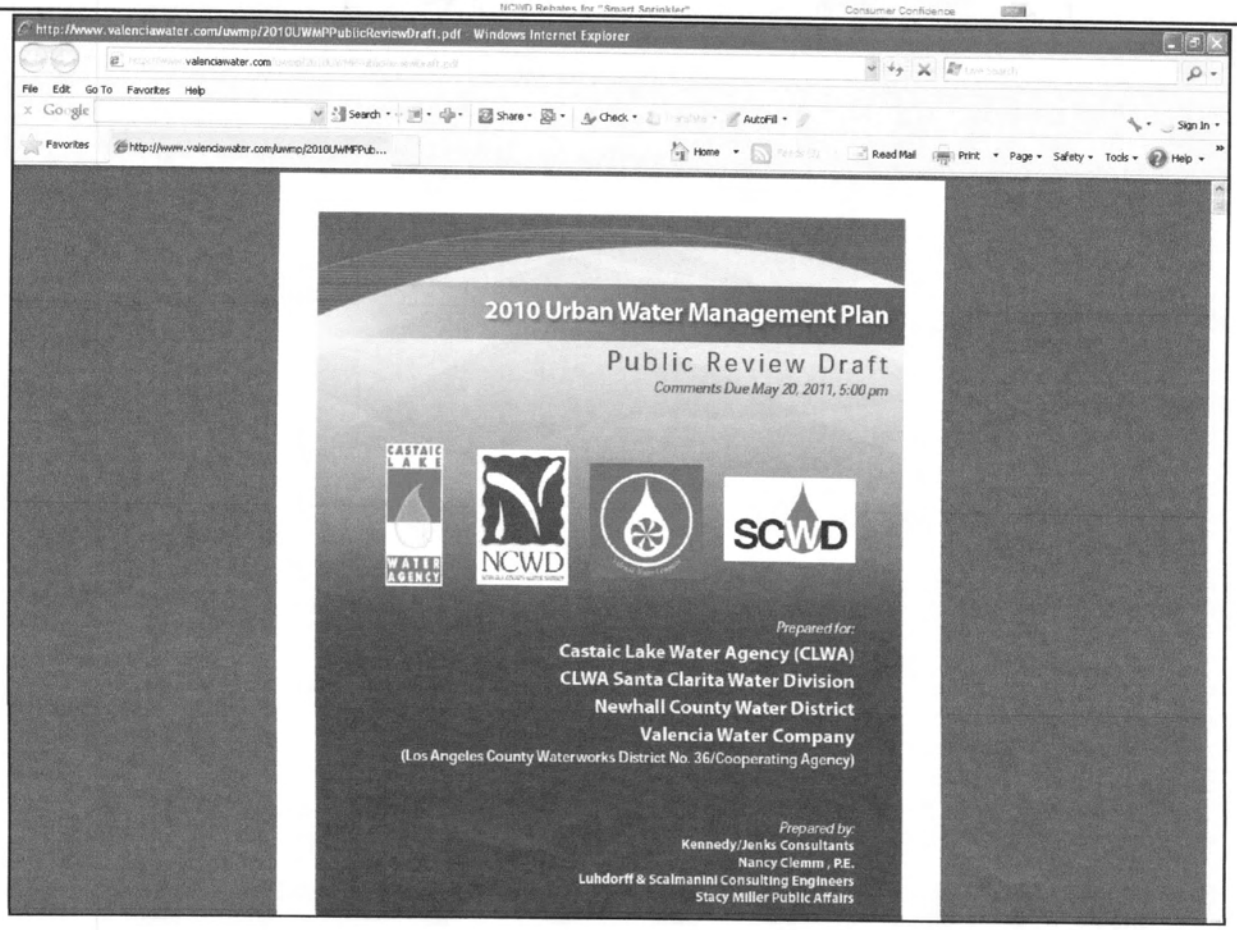
Santa Clarita Water Division
Webpage posting –Link to 2010 UWMP Draft Document





Newhall County Water District
Webpage posting –Link to 2010 UWMP Draft Document





Meetings Requested & Held Regarding Draft Document
Public Outreach Record

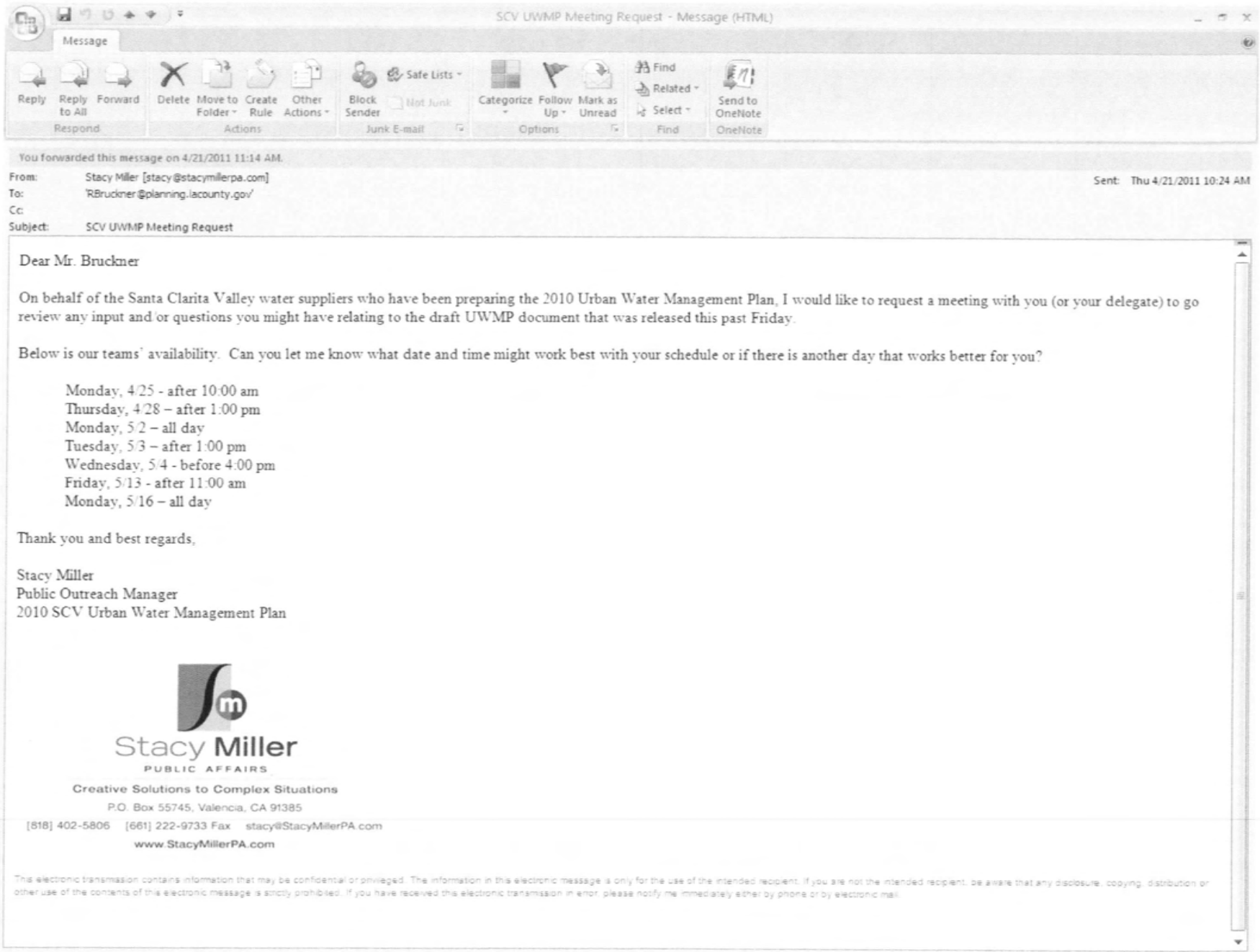
2010 Santa Clarita Valley Urban Water Management Plan

Meetings Requested and Held Regarding Input on UWMP Draft Document

Name	Affiliation	Date Meeting Held
Mike Solomon	United Water Conservation District	May 11, 2011
Mitch Glaser	LA County Planning	May 16, 2011
Jeff Hogan	City of Santa Clarita Planning	May 16, 2011
Rosalind Wayman	LA County Supervisor Michael Antonovich	May 16, 2011
Sandy Stevens	Building Industry Association	May 13, 2011
Chris Stephens	County of Ventura Resource Management Agency	Declined to meet due to busy schedule

Emails Requesting Meetings for 2010 UWMP Draft Document Input

Sent to Richard Bruckner, Regional Planning LA County



SCV UWMP Meeting Request - Message (HTML)

Message

Reply | Reply to All | Forward | Delete | Move to Folder | Create Rule | Other Actions | Block Sender | Safe Lists | Not Junk | Categorize | Follow Up | Mark as Unread | Find | Related | Select | Send to OneNote

Respond | Actions | Junk E-mail | Options | Find | OneNote

You forwarded this message on 4/21/2011 11:14 AM.

From: Stacy Miller [stacy@stacymillerpa.com]
To: 'RBruckner@planning.lacounty.gov'
Cc:
Subject: SCV UWMP Meeting Request

Sent: Thu 4/21/2011 10:24 AM

Dear Mr. Bruckner

On behalf of the Santa Clarita Valley water suppliers who have been preparing the 2010 Urban Water Management Plan, I would like to request a meeting with you (or your delegate) to go review any input and/or questions you might have relating to the draft UWMP document that was released this past Friday.

Below is our teams' availability. Can you let me know what date and time might work best with your schedule or if there is another day that works better for you?

Monday, 4/25 - after 10:00 am
Thursday, 4/28 – after 1:00 pm
Monday, 5/2 – all day
Tuesday, 5/3 – after 1:00 pm
Wednesday, 5/4 - before 4:00 pm
Friday, 5/13 - after 11:00 am
Monday, 5/16 – all day

Thank you and best regards,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations
P.O. Box 55745, Valencia, CA 91385
[818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

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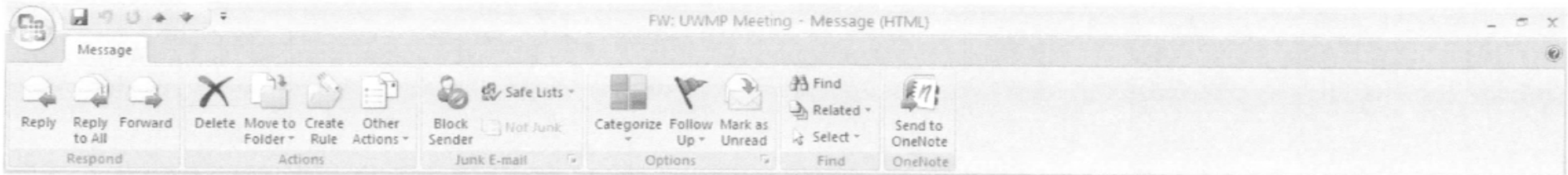
Sent to: Jeff Hogan, City of Santa Clarita



From: Stacy Miller [stacy@stacymillerpa.com]
To: 'jhogan@santa-clarita.com'
Cc: 'lpowell@santa-clarita.com'
Subject: FW: UWMP Meeting
Sent: Wed 4/20/2011 4:32 PM

Hi Jeff –

I wanted to set up a meeting with you (or your delegate), me and two of the Urban Water Management Plan (UWMP) team leads (Dirk Marks and Mary Lou Cotton) to go over any questions you might have relating to the draft UWMP document that was released this past Friday. Below is the teams availability, can you let know what date/time might work best with your schedule?

Monday, 4/25 - after 10:00 am
Thursday, 4/28 – after 1:00 pm
Monday, 5/2 – all day
Tuesday, 5/3 – after 1:00 pm
Wednesday, 5/4 - before 4:00 pm
Friday, 5/13 - after 11:00 am
Monday, 5/16 – all day

Thanks much.

Stacy

Stacy Miller
PUBLIC AFFAIRS
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P.O. Box 55745, Valencia, CA 91385
[818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
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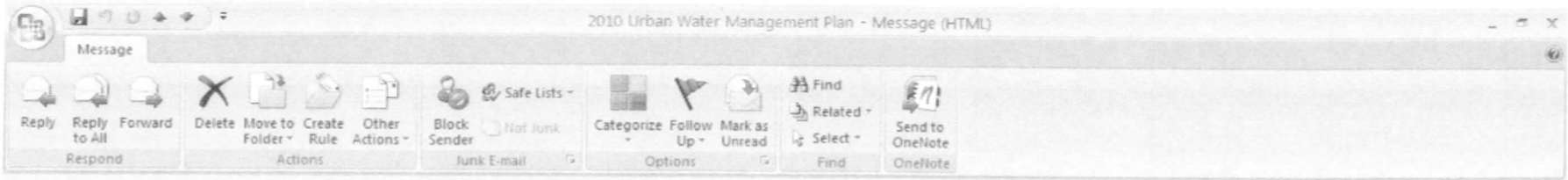
Sent to: E. Michael Solomon, United Water Conservation District



From: Stacy Miller [stacy@stacymillerpa.com]
To: 'msolomon@unitedwater.org'
Cc: 'michelle@unitedwater.org'
Subject: 2010 Urban Water Management Plan
Sent: Fri 4/22/2011 1:38 PM

Dear Mr. Solomon:

On behalf of the Santa Clarita Valley water suppliers who have been preparing the 2010 Urban Water Management Plan, I would like to request a meeting with you (or your delegate) to go over any questions you might have relating to the draft UWMP document that was released last week.

Below is our teams' availability. Can you let me know what date and time might work best with your schedule?

Thursday, 4/28 – after 1:00 pm
Monday, 5/2 – all day
Tuesday, 5/3 – after 1:00 pm
Wednesday, 5/4 - before 4:00 pm
Friday, 5/13 - after 11:00 am
Monday, 5/16 –9:00 am- noon

Thank you.

Stacy Miller
Public Outreach Manager
2010 UWMP

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations
P.O. Box 55745, Valencia, CA 91385
[818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

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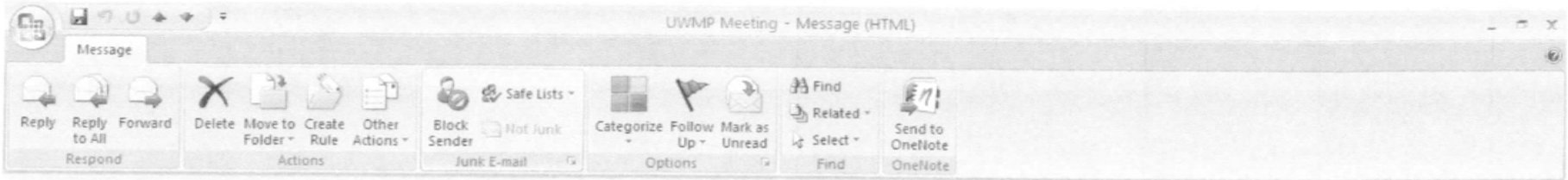
Sent to: Rosalind Wayman, Supervisor Antonovich Office



You replied on 4/22/2011 11:37 AM.

From: Stacy Miller [stacy@stacymillerpa.com]
To: 'Rosalind Wayman'
Cc:
Subject: UWMP Meeting

Sent: Wed 4/20/2011 4:19 PM

Hi Rosalind –

I wanted to set up a meeting with you, me and two of the Urban Water Management Plan (UWMP) team leads (Dirk Marks and Mary Lou Cotton) to go over any questions you might have relating to the draft UWMP document that was released this past Friday. Below is the teams availability, can you let know what date/time might work best with your schedule?

Monday, 4/25 - after 10:00 am
Thursday, 4/28 – after 1:00 pm
Monday, 5/2 – all day
Tuesday, 5/3 – after 1:00 pm
Wednesday, 5/4 - before 4:00 pm
Friday, 5/13 - after 11:00 am
Monday, 5/16 – all day

Thanks much.

Stacy

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations
P.O. Box 55745, Valencia, CA 91385
[818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
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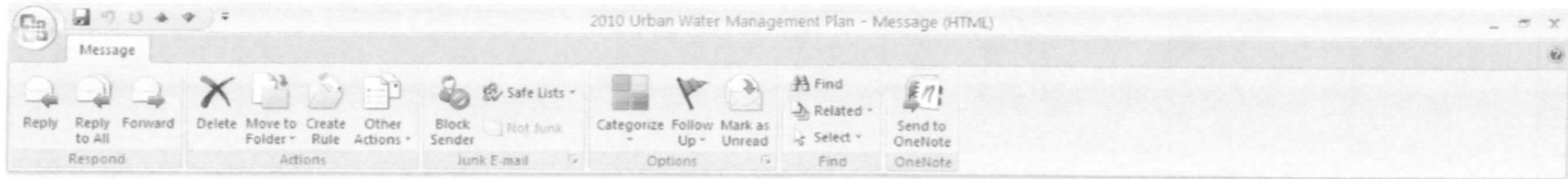
Sent to: Chris Stevens, Ventura County



From: Stacy Miller [stacy@stacymillerpa.com]
To: 'Chris.Stephens@ventura.org'
Cc:
Subject: 2010 Urban Water Management Plan

Sent: Fri 4/22/2011 1:26 PM

Dear Chris:

On behalf of the Santa Clarita Valley water suppliers who have been preparing the 2010 Urban Water Management Plan, I would like to request a meeting with you (or your delegate) to go over any questions you might have relating to the draft UWMP document that was released last week.

Below is our teams' availability. Can you please let me know what date and time might work best with your schedule?

Thursday, 4/28 – after 1:00 pm
Monday, 5/2 – all day
Tuesday, 5/3 – after 1:00 pm
Wednesday, 5/4 - before 4:00 pm
Friday, 5/13 - after 11:00 am
Monday, 5/16 –9:00 am- noon

Thank you

Stacy Miller
Public Outreach Manager
2010 UWMP

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Creative Solutions to Complex Situations
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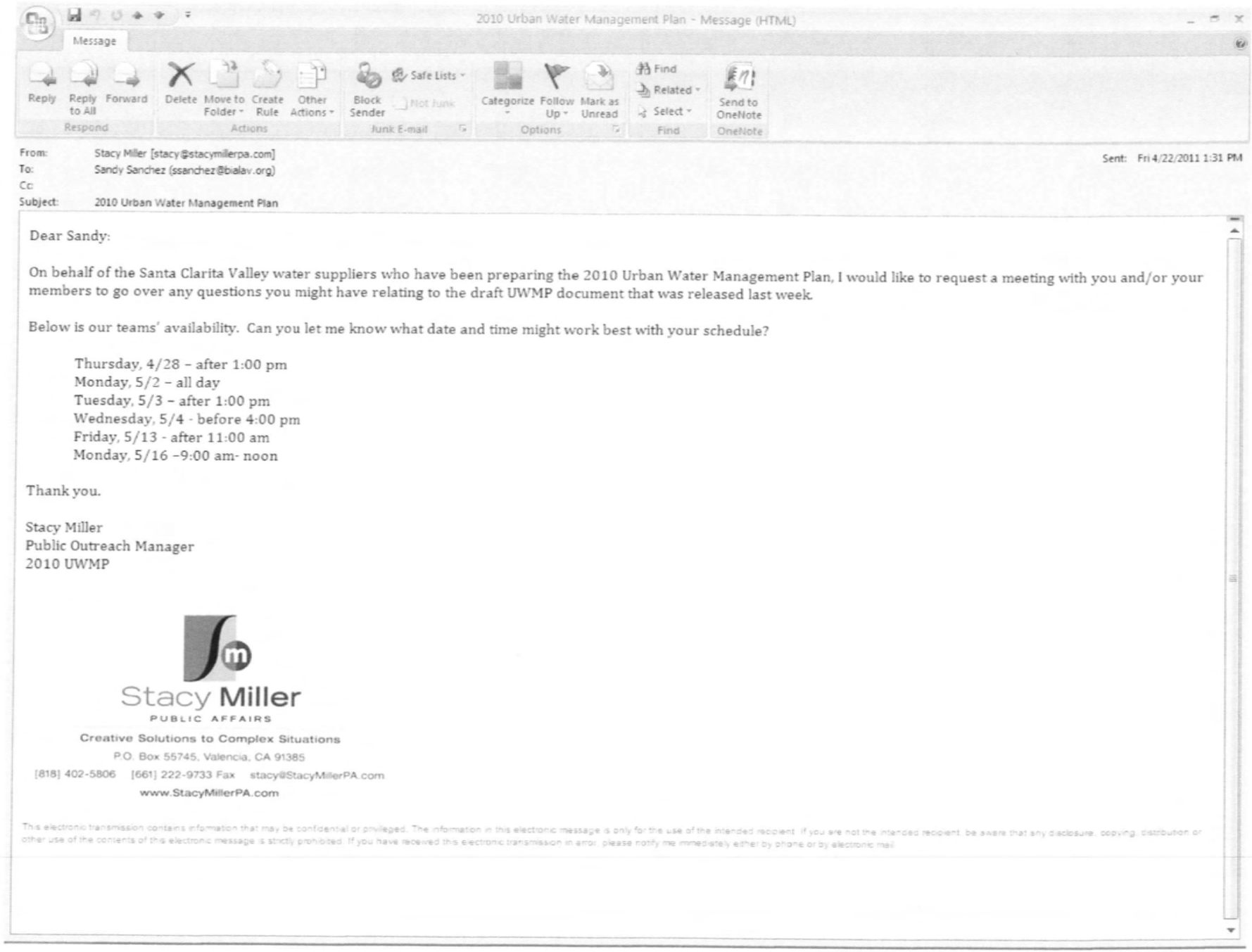
Sent to: Sandy Sanchez - Building Industry Association



2010 Urban Water Management Plan - Message (HTML)

Message

Reply | Reply to All | Forward | Delete | Move to Folder | Create Rule | Other Actions | Block Sender | Safe Lists | Not Junk | Categorize | Follow Up | Mark as Unread | Find | Related | Select | Send to OneNote

Respond | Actions | Junk E-mail | Options | Find | OneNote

From: Stacy Miller [stacy@stacymillerpa.com]
To: Sandy Sanchez (ssanchez@bialav.org)
Cc:
Subject: 2010 Urban Water Management Plan

Sent: Fri 4/22/2011 1:31 PM

Dear Sandy:

On behalf of the Santa Clarita Valley water suppliers who have been preparing the 2010 Urban Water Management Plan, I would like to request a meeting with you and/or your members to go over any questions you might have relating to the draft UWMP document that was released last week.

Below is our teams' availability. Can you let me know what date and time might work best with your schedule?

Thursday, 4/28 – after 1:00 pm
Monday, 5/2 – all day
Tuesday, 5/3 – after 1:00 pm
Wednesday, 5/4 - before 4:00 pm
Friday, 5/13 - after 11:00 am
Monday, 5/16 –9:00 am- noon

Thank you.

Stacy Miller
Public Outreach Manager
2010 UWMP

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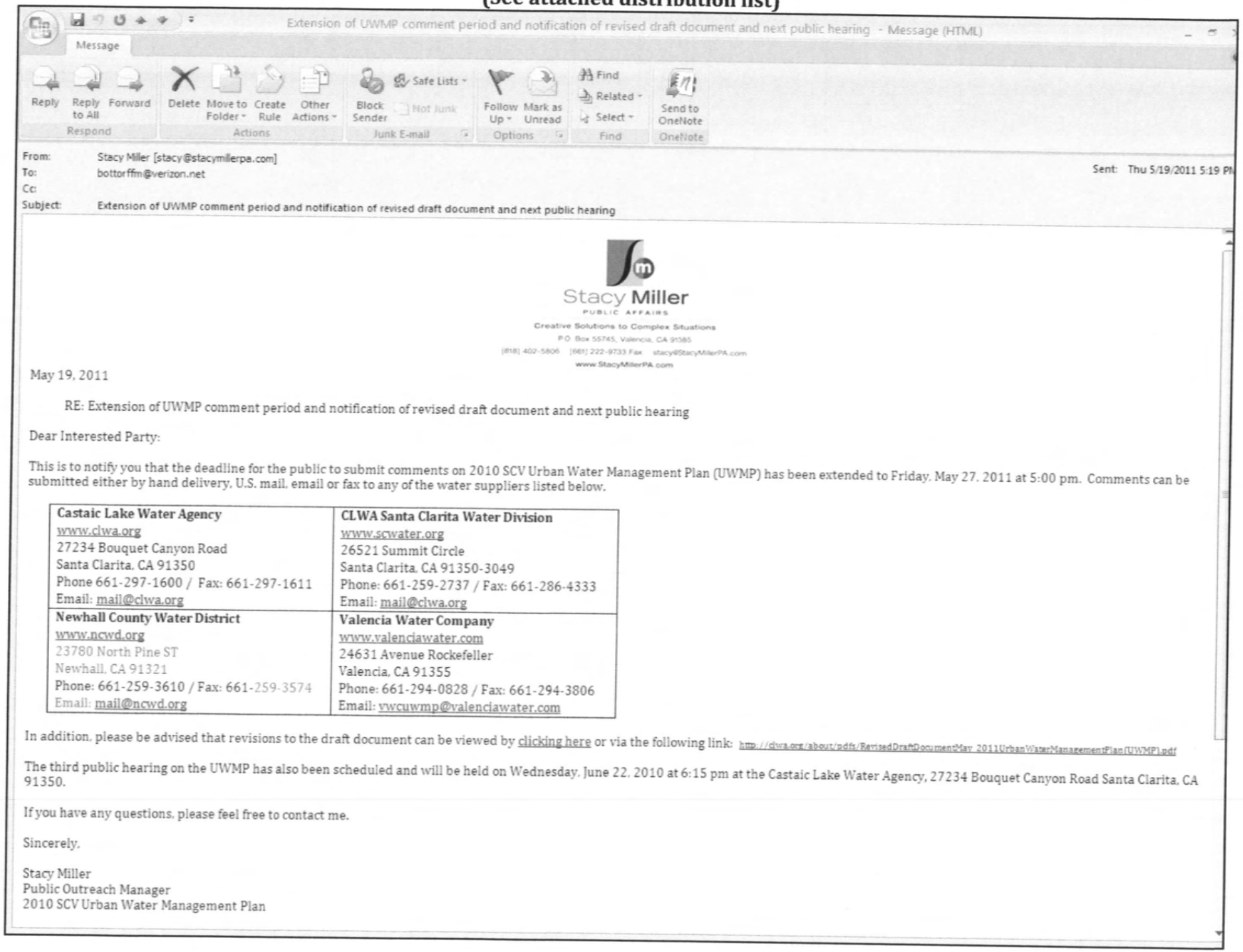
Extension of Comment Period Notification to Interested Parties
Public Outreach Record

2010 Santa Clarita Valley Urban Water Management Plan

Emails sent regarding
Extension of UWMP comment period and notification of revised draft document and next public hearing
(See attached distribution list)



Extension of UWMP comment period and notification of revised draft document and next public hearing - Message (HTML)

Message

Reply | Reply to All | Forward | Delete | Move to Folder | Create Rule | Other Actions | Block Sender | Safe Lists | Not Junk | Follow Up | Mark as Unread | Find | Related | Select | Send to OneNote

Respond | Actions | Junk E-mail | Options | Find | OneNote

From: Stacy Miller [stacy@stacymillerpa.com]
To: bottorffm@verizon.net
Cc:
Subject: Extension of UWMP comment period and notification of revised draft document and next public hearing
Sent: Thu 5/19/2011 5:19 PM

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations
P.O. Box 55745, Valencia, CA 91385
(818) 402-5806 (661) 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

May 19, 2011

RE: Extension of UWMP comment period and notification of revised draft document and next public hearing

Dear Interested Party:

This is to notify you that the deadline for the public to submit comments on 2010 SCV Urban Water Management Plan (UWMP) has been extended to Friday, May 27, 2011 at 5:00 pm. Comments can be submitted either by hand delivery, U.S. mail, email or fax to any of the water suppliers listed below.

Castaic Lake Water Agency www.clwa.org 27234 Bouquet Canyon Road Santa Clarita, CA 91350 Phone 661-297-1600 / Fax: 661-297-1611 Email: mail@clwa.org	**CLWA Santa Clarita Water Division** www.scwater.org 26521 Summit Circle Santa Clarita, CA 91350-3049 Phone: 661-259-2737 / Fax: 661-286-4333 Email: mail@clwa.org
Newhall County Water District www.ncwd.org 23780 North Pine ST Newhall, CA 91321 Phone: 661-259-3610 / Fax: 661-259-3574 Email: mail@ncwd.org	**Valencia Water Company** www.valenciawater.com 24631 Avenue Rockefeller Valencia, CA 91355 Phone: 661-294-0828 / Fax: 661-294-3806 Email: vwcuwmp@valenciawater.com

In addition, please be advised that revisions to the draft document can be viewed by clicking here or via the following link: http://clwa.org/about/pdfs/RevisedDraftDocumentMay_2011UrbanWaterManagementPlan(UWMP).pdf

The third public hearing on the UWMP has also been scheduled and will be held on Wednesday, June 22, 2010 at 6:15 pm at the Castaic Lake Water Agency, 27234 Bouquet Canyon Road Santa Clarita, CA 91350.

If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Email to IRWM Stakeholder Group re: Notice of the Extension of the Written Comment Period for the 2010 SCV UWMP
May 20, 2011

Notice of the Extension of the Written Comment Period for the 2010 SCV UWMP and Call for Proposals for the 2012 Smart Growth Conference - Message (HTML)

Message

Reply | Reply to All | Forward | Delete | Move to Folder | Create Rule | Other Actions | Block Sender | Safe Lists | Not Junk | Follow Up | Mark as Unread | Find | Related | Select | Send to OneNote

Respond | Actions | Junk E-mail | Options | Find | OneNote

From: Jeff Ford [jford@clwa.org]
To: Jeff Ford
Cc:
Subject: Notice of the Extension of the Written Comment Period for the 2010 SCV UWMP and Call for Proposals for the 2012 Smart Growth Conference

Sent: Fri 5/20/2011 9:24 AM

Upper SCR IRWM Stakeholder:

May 19, 2011

RE: Extension of UWMP comment period and notification of revised draft document and next public hearing

Dear Interested Party:

This is to notify you that the deadline for the public to submit comments on 2010 SCV Urban Water Management Plan (UWMP) has been extended to Friday, May 27, 2011 at 5:00 pm. Comments can be submitted either by hand delivery, U.S. mail, email or fax to any of the water suppliers listed below.

Castaic Lake Water Agency www.clwa.org 27234 Bouquet Canyon Road Santa Clarita, CA 91350 Phone 661-297-1600 / Fax: 661-297-1611 Email: mail@clwa.org	**CLWA Santa Clarita Water Division** www.scwater.org 26521 Summit Circle Santa Clarita, CA 91350-3049 Phone: 661-259-2737 / Fax: 661-286-4333 Email: mail@clwa.org
Newhall County Water District www.ncwd.org 23780 North Pine ST Newhall, CA 91321 Phone: 661-259-3610 / Fax: 661-259-3574 Email: mail@ncwd.org	**Valencia Water Company** www.valenciawater.com 24631 Avenue Rockefeller Valencia, CA 91355 Phone: 661-294-0828 / Fax: 661-294-3806 Email: vwcuwmp@valenciawater.com

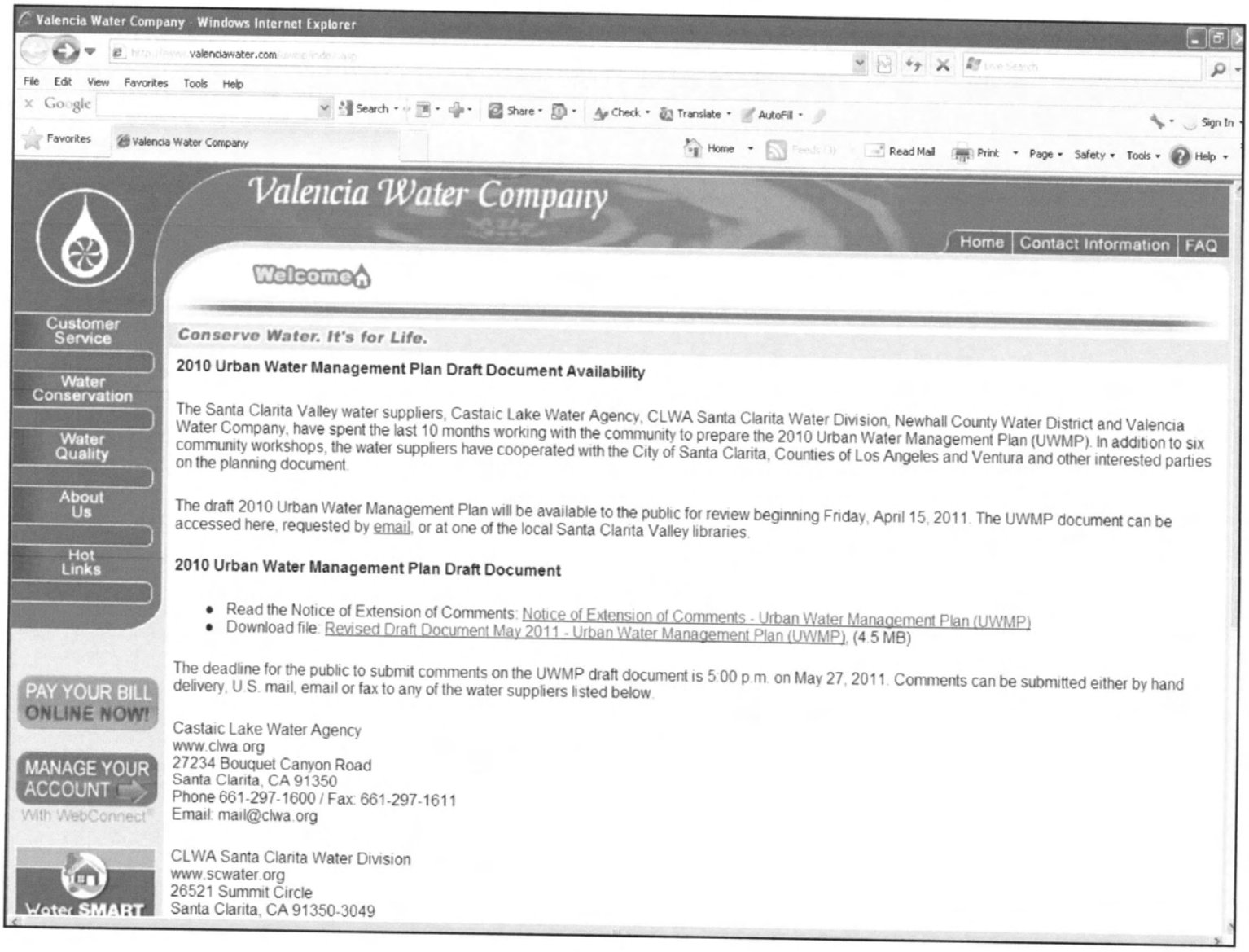
In addition, please be advised that revisions to the draft document can be viewed by clicking here or via the following link: http://clwa.org/about/pdfs/RevisedDraftDocumentMay_2011UrbanWaterManagementPlan(UWMP).pdf

The third public hearing on the UWMP has also been scheduled and will be held on Wednesday, June 22, 2010 at 6:15 pm at the Castaic Lake Water Agency, 27234 Bouquet Canyon Road Santa Clarita, CA 91350.

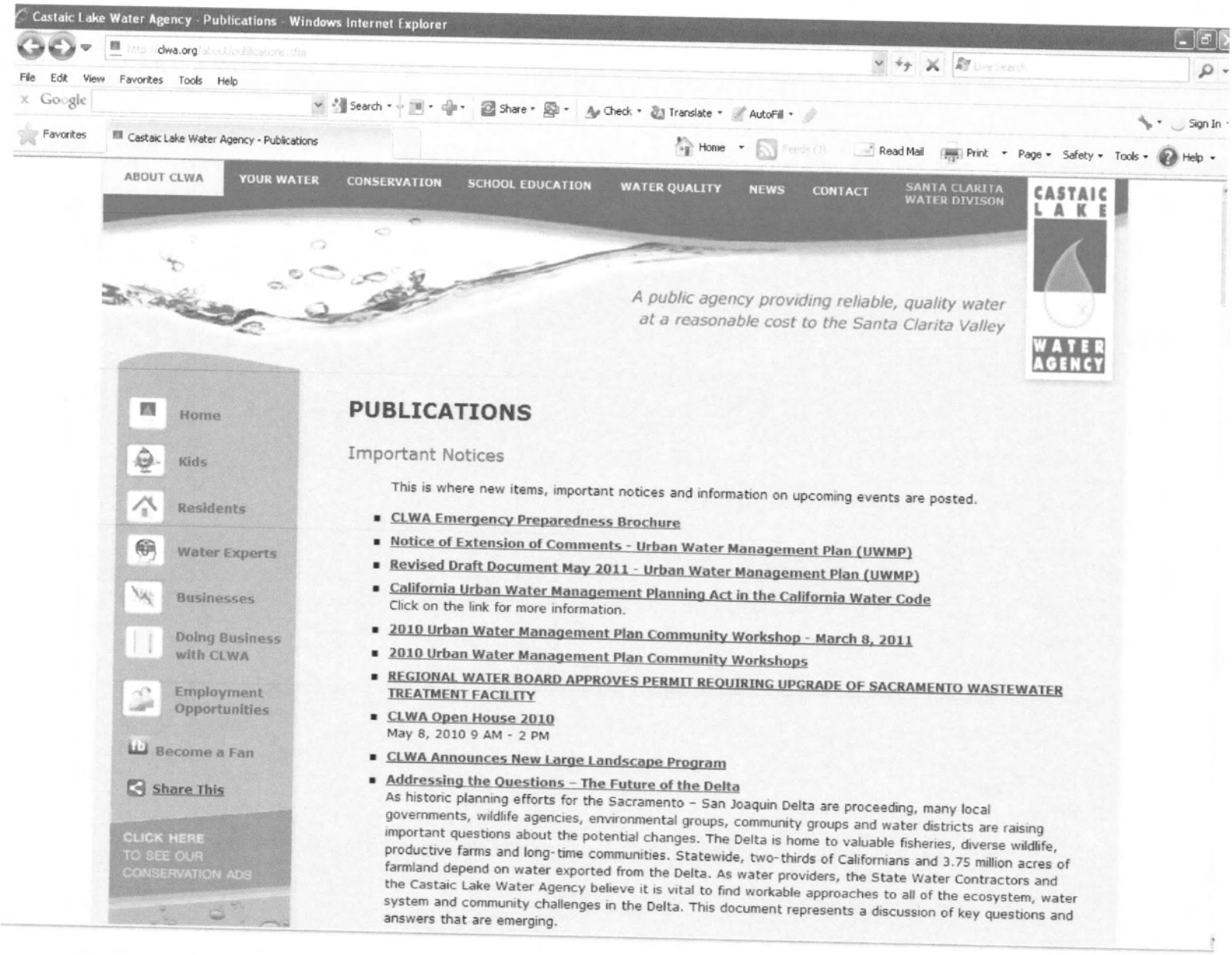
Master Email List
Extension of UWMP comment period and notification of revised draft document and next public hearing
Sent May 19, 2011

Jarrod Degonia Assemblymember Cameron Smyth Jarrod.DeGonia@asm.ca.gov	Ernie Villegas Assemblymember Jeff Gorell Ernie.Villegas@asm.ca.gov	Kevin Korenthal Associated Builders & Contractors of CA; ABC-CCC kkorenthal@abc-ccc.org
Holly Schroeder BIA - Los Angeles/Ventura Chapter hschroeder@bialav.org	Sandy Sanchez BIA - Los Angeles/Ventura Chapter ssanchez@bialav.org	David Inouye CA Department of Water Resources davidi@water.ca.gov
Robert Kelly Castaic Area Town Council RobertKelly@CastaicAreaTownCouncil.org	Mike Murphy City of Santa Clarita mmurphy@santa-clarita.com	Jason Smisko City of Santa Clarita JSmisko@santa-clarita.com
Bruce Fortine College of the Canyons fortine@earthlink.net	Bob Haueter Congressman Howard McKeon Bob.Haueter@mail.house.gov	Chris Stephens County of Ventura Resource Management Agency Chris.Stephens@ventura.org
Ron Bottorff Friends of the Santa Clara River bottorffm@verizon.net	Mark Pestrella LA County Department of Public Works mpestrel@dpw.lacounty.gov	Richard Bruckner LA County Department of Regional Planning RBruckner@planning.lacounty.gov
Jessica Bunker LA County WWD jbunker@ladpw.org	Lynn Plambeck Santa Clarita Organization for Planning the Environment - SCOPE lynne.plambeck@scope.org	Robert Fleck Santa Clarita Valley Well Owners Association rfleck@socal.rr.com
Terry Kingery SCV Chamber of Commerce tkingery@scvchamber.com	Sierra Club Angeles Chapter Contact.us@angeles.sierraclub.org	Mark Butala Southern CA Association of Governments butala@scag.ca.gov
Jackie Bick State Senator Sharon Runner Jackie.Bick@sen.ca.gov	Scott Wilk Jr. State Senator Tony Strickland scott.wilk@sen.ca.gov	David Perry Supervisor Michael Antonovich, 5th District dperry@lacbos.org
Rosalind Wayman Supervisor Michael Antonovich, 5th District rwayman@lacbos.org	E. Michael Solomon United Water Conservation District msolomon@unitedwater.org	Kathy Norris Valley Industrical Association of Santa Clarita (VIA) kathy@via.org
Ron Mechsner West Ranch Town Council Rmechsner@WestRanchTownCouncil.com	Carol Lutness SCV Fair Elections Committee santaclarita-info@caclean.org	Katherine Squires Sierra Club Angeles Chapter katherine.m.squires@csun.edu
Dunn Residents water@dslextreme.com	Mitch Glaser LA Co Department of Regional Planning mglaser@planning.lacounty.gov	Also sent via US Mail to • Mr. & Mrs. Dunn • Cam Nolltemeyer • Michael A. Naoum

UWMP – Draft Document & Extended Comment Period
Valencia Water Company
May 19, 2011

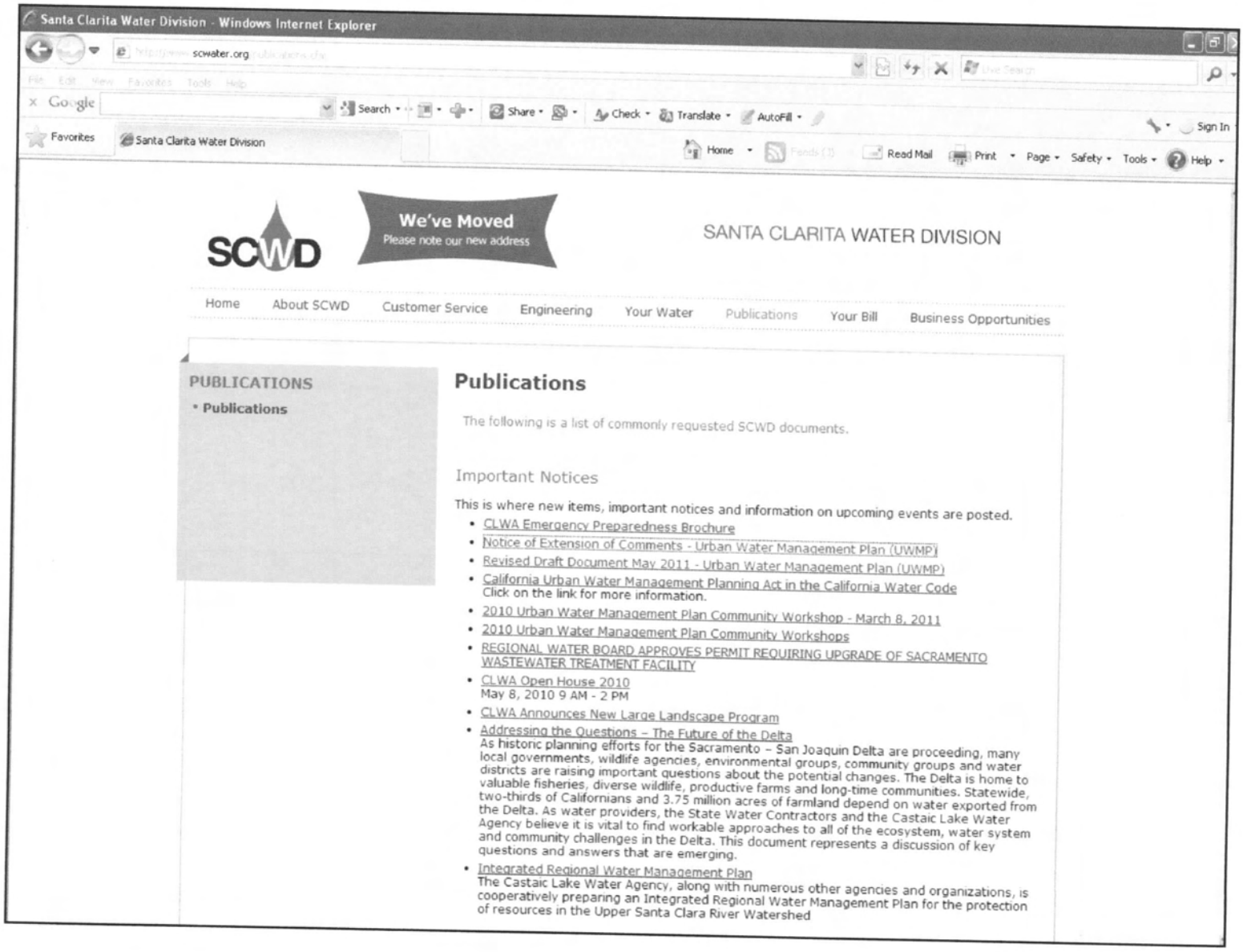


UWMP – Draft Document & Extended Comment Period
CLWA Website
May 19, 2011



UWMP – Draft Document & Extended Comment Period
Newhall County Water District
May 19, 2011

UWMP – Draft Document & Extended Comment Period
Santa Clarita Water Division
May 19, 2011



Second Public Hearing
May 18, 2011
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

CASTAIC LAKE WATER AGENCY

April 11, 2011

Richard J. Bruckner, Director
Los Angeles County
Department of Regional Planning
1390 Hall of Records
320 West Temple Street
Los Angeles, CA 90012

See attached for mailing list

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Bruckner:

In a March 3, 2011, letter (attached) we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 pm has been rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The public hearing on May 18, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

For additional information regarding the public hearings, please contact me at (661) 297-1600.

Sincerely,

Dirk Marks

Dirk Marks,
Water Resources Manager

Attachment

BOARD OF DIRECTORS
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Mailing List for May 18, 2011 Hearing Notification

Rosalind Wayman, Field Deputy Los Angeles County Fifth Supervisorial District 23920 Valencia Blvd., Suite 265 Santa Clarita, CA 91355	Jessica Bunker, P.E. Waterworks Division P.O. Box 1460 Alhambra, CA 91802-1460
Jeff W. Hogan, AICP Interim Planning Manager City of Santa Clarita Planning Division 23920 Valencia Blvd., Suite 300 Santa Clarita, CA 91355	Mike Murphy Intergovernmental Relations Officer City of Santa Clarita 23920 Valencia Blvd., Suite 300 Santa Clarita, CA 91355
Chris Stevens, Director Resource Management Agency County of Ventura 800 South Victoria Avenue Ventura, CA 93009-1740	Richard J. Bruckner, Director LA County Dept. Regional Planning Los Angeles County 1390 Hall of Records 320 West Temple Street Los Angeles 90012
Mark Pestrella LA County Dept. Public Works Los Angeles County P.O. Box 1460 Alhambra 91802-1460	

THE SIGNAL NEWSPAPER
24000 Creekside Rd
Valencia, Ca 91355

Proof of Publication
(2015.5 C.C.P.)

STATE OF CALIFORNIA,
COUNTY OF LOS ANGELES

I am a citizen of the United States,and a resident of the county aforesaid; I am over the age of eighteen years; and I am not a party to or interestedin the notice published. I am the chief legal advertising clerk of the publisher of the

SIGNAL NEWSPAPER

a newspaper of general circulation, printed and published **Daily** in the city of Santa Clarita County of Los Angeles, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Los Angeles State of California, under the date of **March 25, 1988**
Case number **NVC15880**, that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to-wit:

4/14, 4/21, 4/28, 5/5, 5/12

All in the year 20 11

I certify (or declare) under penalty of perjury' that the foregoing is true and correct

Dated at Valencia, California, this 12th day of May, 20 11

Signature

NOTICE OF PUBLIC HEARING 2010 URBAN WATER MANAGEMENT PLAN

Castaic Lake Water Agency ("CLWA"), CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company have directed the preparation of a joint regional 2010 Urban Water Management Plan ("UWMP") for the Santa Clarita Valley, as encouraged by the Urban Water Management Planning Act ("Act"). Los Angeles County Waterworks District No. 36 is participating in the process on an ad hoc basis. Adoption of the 2010 UWMP is required under the Act by July 1, 2011.

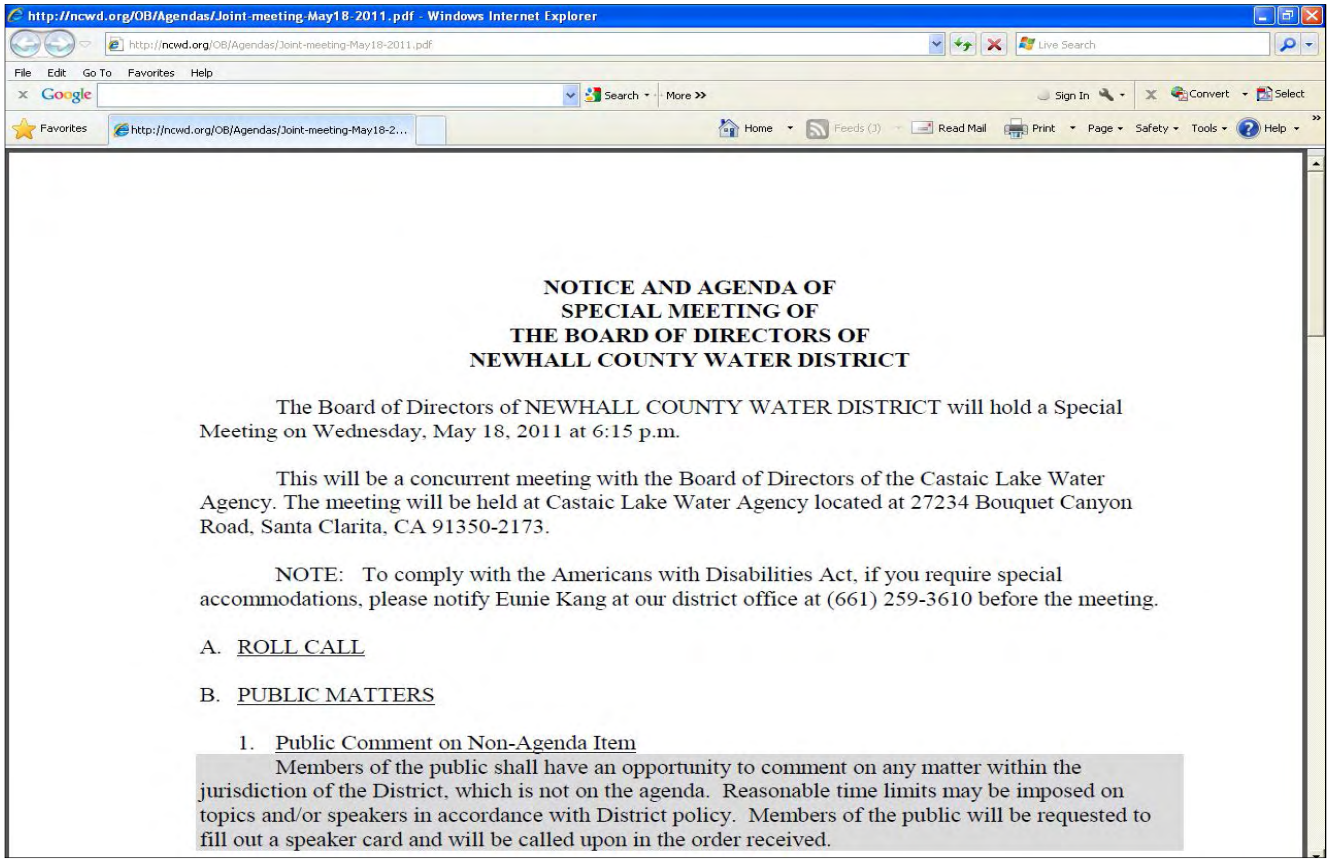
While the Act only requires that an urban water supplier hold one public hearing before adopting a plan, in order to ensure sufficient opportunity for public feedback, input and suggestions concerning the 2010 UWMP, two public hearings were scheduled. Additional hearings may be scheduled if needed.

The first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 pm has been rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The public hearing on May 18, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

For additional information regarding the public hearings, please contact Dirk Marks, CLWA Water Resources Manager, at (661) 297-1600.

The Signal 4/14, 4/21, 4/28, 5/5 & 5/12 2011

UWMP –May Hearing Notice
NCWD Website



Santa Clarita Valley Urban Water Management Plan

Public Hearing
May 18, 2011
Castaic Lake Water Agency

Agenda

- **Open public hearing**
- **Review of public input process and public comment period**
- **Public comment**
- **Board questions and answers**
- **Description of UWMP document finalization process**
- **Next steps**

Past Workshops

- **May 2010**
- UWMP purposed and process - What, Who, Why and When
- Existing and new requirements of UWMPs

- **July 2010**
- SBX7-7 Requirements
- Recycled Water
- Groundwater Supplies
- State Water Project Reliability

- **November 2010** (with the IRWMP Stakeholders)
- UWMP purposed and process - What, Who, Why and When
- Required under SBX7-7
- Importance of UWMP to IRWMP process and vice versa

Past Workshops (continued)

- **November 2010**
- GPCD population assumptions and calculations
- SBX7-7
- Targets by retailer

- **January 2011**
- Overview of water supplies
- SWP reliability update
- CLWA reliability planning update
- SBX7-7 ("20x2020") calculations and targets
- Overview of water supplies and demand

- **March 2011**
- Water Supply and Demands

Public Hearing and Draft Document

- 1st public hearing March 23, 2011
- Draft document made available April 15, 2011
- Comment period through May 20, 2011

Comment Letters Received

- Friends of the Santa Clara River
- Santa Clarita resident and Valencia Water ratepayer
- Santa Clarita Valley Fair Elections Committee
- Sierra Club
- Mr. and Mrs. Dunn
- Mr. Naoum

Broad Categories of Comments Received

- Groundwater overdraft
- Water banking programs
- State Water Project reliability
- Water conservation accounting
- Chlorides (TMDL/AWRM)
- Perchlorate
- Organic compounds

Santa Clarita Valley Urban Water Management Plan

Public Comment Period

Santa Clarita Valley Urban Water Management Plan

Directors' Question and Answer Period

a) Overall/general UWMP comments
b) Demands, Supplies (SWP and GW), Reliability
c) Recycled water (Lynn Takaichi)
d) Water quality (Lynn Takaichi)
e) Water conservation
f) Contingency planning

Water Quality and Recycled Water

- Lynn Takaichi – Kennedy/Jenks Consultants

Water Quality

- Imported Water Quality
  - Chloride TMDL
  - Alternative Water Resources Management Program (AWRM)
  - SWP Water Quality Modeling
- Groundwater Quality
  - Perchlorate treatment and restoration

Water Quality (continued)

- Imported Water Quality
  - Chloride TMDL (2005) – 100 mg/L from Saugus/Valencia WRPs
- Alternative Water Resources Management Program (AWRM) (2008)
  - Established conditional site specific objectives for chloride;
  - Provides water quality and water supply benefits, and protects biological resources;
  - SWP Water Quality Modeling

Water Quality Perchlorate

Year Perchlorate Detected	Purveyor Well	Groundwater Aquifer	Status
1997	SCWD Saugus 1	Saugus	DPH approved well return to service in January 2011; well in active service utilizing approved perchlorate treatment
1997	SCWD Saugus 2	Saugus	DPH approved well return to service in January 2011; well in active service utilizing approved perchlorate treatment
1997	VWC's Well 157	Saugus	Sealed and capacity replaced by new well.
1997	NCWD Well 11	Saugus	Out of service
2002	SCWD's Stadium Well	Alluvium	Sealed and capacity replaced by new well.
2005	VWC's Well Q2	Alluvium	DPH approved perchlorate treatment removal in 2007; treatment was installed in 2005 and relocated for potential future use; well remains in service
2006	NCWD's Well NC-13	Saugus	DPH approved annual monitoring, results have always been below the detection limit for reporting; well remains in service

* *Rapid Response Fund* provides $10M in reimbursement funds to CLWA as fail-safe

Water Quality

- SCV water supplies meet all EPA and State water quality requirements
- Water quality does not currently affect the reliability of supplies

Recycled Water

- Based on 2002 Recycled Water Master Plan and 2006 Programmatic EIR
  - Modified Phasing and Pipeline Alignments
  - Both Valencia WRP and Saugus WRP Utilized
  - Potential Onsite RW Production
- Current production = 400± AFY
- Ultimate production = 17,400 AFY, plus 5,400 AFY from Newhall Ranch WRP
- Will help the SCV meet 20x2020 goals

Recycled Water (continued)

Recycled Water Master Plan

2010 Demand (325± AFY)

- Phase 1 - 1,700 AFY (already built)
- Phase 2A - 500 AFY ~ $28 million
- Phase 2C - 900 AFY ~ $11million

2020 Demand (3,000 AFY)

Santa Clarita Valley Urban Water Management Plan

Directors' Question and Answer Period

a) Overall/general UWMP comments
b) Demands, Supplies (SWP and GW), Reliability
c) Recycled water
d) Water quality
e) Water conservation
f) Contingency planning

Santa Clarita Valley Urban Water Management Plan

Next Steps

Third & Final Public Hearing
June 22, 2011
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

June 8, 2011

Richard J. Bruckner, Director
LA County Dept. Regional Planning
Los Angeles County
1390 Hall of Records
320 West Temple Street
Los Angeles 90012

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Bruckner,

In a March 3, 2011, letter we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 p.m. was rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The third public hearing has been scheduled on June 22, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

For additional information regarding the public hearings, please contact me at (661) 297-1600.

Sincerely,

Dirk Marks,
Water Resources Manager

CASTAIC LAKE WATER AGENCY

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June 8, 2011

Mark Pestrella
LA County Dept. Public Works
Los Angeles County
P.O. Box 1460
Alhambra 91802-1460

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Pestrella,

In a March 3, 2011, letter we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 p.m. was rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The third public hearing has been scheduled on June 22, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

For additional information regarding the public hearings, please contact me at (661) 297-1600.

Sincerely,

Dirk Marks,
Water Resources Manager

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June 8, 2011

Chris Stevens, Director
Resource Management Agency
County of Ventura
800 South Victoria Avenue
Ventura, CA 93009-1740

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Stevens,

In a March 3, 2011, letter we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 p.m. was rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The third public hearing has been scheduled on June 22, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

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Sincerely,

Dirk Marks,
Water Resources Manager

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June 8, 2011

Jason Smisko
Senior Planner
City of Santa Clarita Planning Division
23920 Valencia Blvd., Suite 300
Santa Clarita, CA 91355

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Smisko,

In a March 3, 2011, letter we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 p.m. was rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The third public hearing has been scheduled on June 22, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

For additional information regarding the public hearings, please contact me at (661) 297-1600.

Sincerely,

Dirk Marks

Dirk Marks,
Water Resources Manager

CASTAIC LAKE WATER AGENCY

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APRIL JACOBS

June 8, 2011

Mike Murphy
Intergovernmental Relations Officer
City of Santa Clarita
23920 Valencia Blvd., Suite 300
Santa Clarita, CA 91355

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Murphy,

In a March 3, 2011, letter we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 p.m. was rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The third public hearing has been scheduled on June 22, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

For additional information regarding the public hearings, please contact me at (661) 297-1600.

Sincerely,

Dirk Marks,
Water Resources Manager

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GENERAL COUNSEL
McCORMICK, KIDMAN & BEHRENS, LLP

SECRETARY
APRIL JACOBS

June 8, 2011

Jeff W. Hogan, AICP
Interim Planning Manager
City of Santa Clarita Planning Division
23920 Valencia Blvd., Suite 300
Santa Clarita, CA 91355

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Mr. Hogan,

In a March 3, 2011, letter we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 p.m. was rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The third public hearing has been scheduled on June 22, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

For additional information regarding the public hearings, please contact me at (661) 297-1600.

Sincerely,

Dirk Marks,
Water Resources Manager

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GENERAL COUNSEL
McCORMICK, KIDMAN & BEHRENS, LLP
SECRETARY
APRIL JACOBS

June 8, 2011

Jessica Bunker, P.E.
Waterworks Division
P.O. Box 1460
Alhambra, CA 91802-1460

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Ms. Bunker,

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For additional information regarding the public hearings, please contact me at (661) 297-1600.

Sincerely,

Dirk Marks

Dirk Marks,
Water Resources Manager

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APRIL JACOBS

June 8, 2011

Rosalind Wayman, Field Deputy
Los Angeles County
Fifth Supervisorial District
23920 Valencia Blvd., Suite 265
Santa Clarita, CA 91355

Subject: Revised Notification of Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan

Dear Ms. Wayman,

In a March 3, 2011, letter we notified you of the upcoming Public Hearings for the 2010 Santa Clarita Valley Urban Water Management Plan. As noted in the letter, the first public hearing was held on Wednesday, March 23, 2011. The second public hearing originally scheduled for Wednesday, May 4, 2011 at 6:15 p.m. was rescheduled to Wednesday, May 18, 2011 at 6:15 PM. The third public hearing has been scheduled on June 22, 2011 will take place at the CLWA Boardroom located on the 1st floor of the Administration Building at the Rio Vista Water Treatment Plant, 27234 Bouquet Canyon Road, Santa Clarita, California 91350.

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Sincerely,

Dirk Marks

Dirk Marks,
Water Resources Manager

CASTAIC LAKE WATER AGENCY

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THE SIGNAL NEWSPAPER
24000 Creekside Rd
Valencia, Ca 91355

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(2015.5 C.C.P.)

STATE OF CALIFORNIA,
COUNTY OF LOS ANGELES

I am a citizen of the United States,and a resident of the county aforesaid; I am over the age of eighteen years; and I am not a party to or interestedin the notice published. I am the chief legal advertising clerk of the publisher of the

SIGNAL NEWSPAPER

a newspaper of general circulation, printed and published **Daily** in the city of Santa Clarita County of Los Angeles, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Los Angeles State of California, under the date of **March 25, 1988**
Case number **NVC15880**, that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to-wit:

5/26, 6/2, 6/9, 6/16

All in the year 20 11

I certify (or declare) under penalty of perjury' that the foregoing is true and correct

Dated at Valencia, California, this
16th day of June, 20 11

Signature

NOTICE OF THIRD PUBLIC HEARING 2010 URBAN WATER MANAGEMENT PLAN

Castaic Lake Water Agency ("CLWA"), CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company have directed the preparation of a joint regional 2010 Urban Water Management Plan ("UWMP") for the Santa Clarita Valley, as encouraged by the Urban Water Management Planning Act ("Act"). Los Angeles County Waterworks District No. 36 is participating in the process on an ad hoc basis. Adoption of the 2010 UWMP is required under the Act by July 1, 2011.
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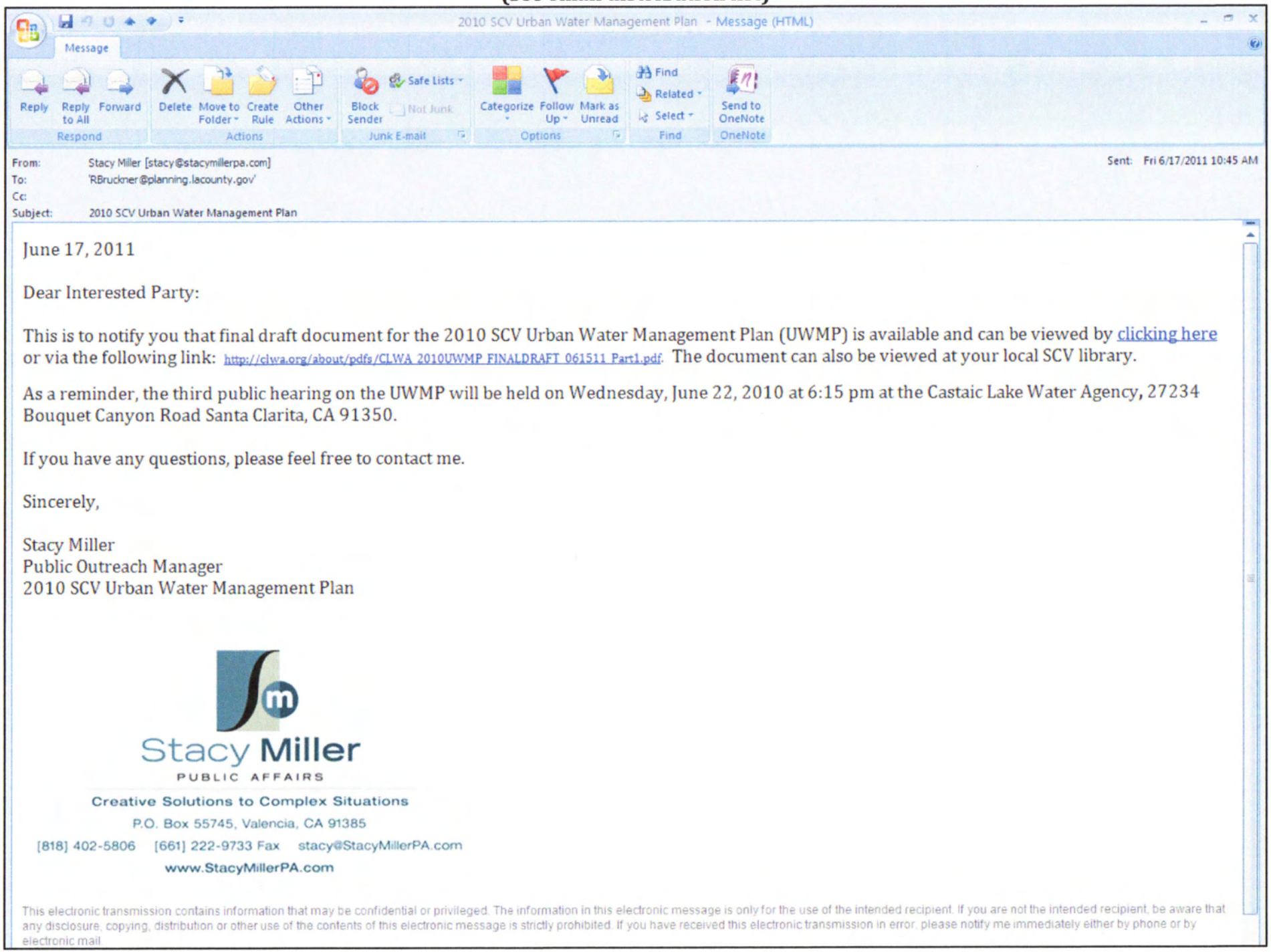
For additional information regarding the public hearings, please contact Dirk Marks, CLWA Water Resources Manager, at (661) 297-1600.
The Signal 5/26, 6/2 & 6/9 & 6/16 2011

Emails sent regarding
Final Draft Document Availability & 3rd Public Hearing Reminder
(See email distribution list)



2010 SCV Urban Water Management Plan - Message (HTML)

Message

Reply | Reply to All | Forward | Delete | Move to Folder | Create Rule | Other Actions | Block Sender | Safe Lists | Not Junk | Categorize | Follow Up | Mark as Unread | Find | Related | Select | Send to OneNote

Respond | Actions | Junk E-mail | Options | Find | OneNote

From: Stacy Miller [stacy@stacymillerpa.com]
To: 'RBruckner@planning.lacounty.gov'
Cc:
Subject: 2010 SCV Urban Water Management Plan
Sent: Fri 6/17/2011 10:45 AM

June 17, 2011

Dear Interested Party:

This is to notify you that final draft document for the 2010 SCV Urban Water Management Plan (UWMP) is available and can be viewed by clicking here or via the following link: http://clwa.org/about/pdfs/CLWA_2010UWMP_FINALDRAFT_061511_Part1.pdf. The document can also be viewed at your local SCV library.

As a reminder, the third public hearing on the UWMP will be held on Wednesday, June 22, 2010 at 6:15 pm at the Castaic Lake Water Agency, 27234 Bouquet Canyon Road Santa Clarita, CA 91350.

If you have any questions, please feel free to contact me.

Sincerely,

Stacy Miller
Public Outreach Manager
2010 SCV Urban Water Management Plan

Stacy Miller
PUBLIC AFFAIRS
Creative Solutions to Complex Situations
P.O. Box 55745, Valencia, CA 91385
[818] 402-5806 [661] 222-9733 Fax stacy@StacyMillerPA.com
www.StacyMillerPA.com

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Master Email List
Extension of UWMP comment period and notification of revised draft document and next public hearing
Sent June 17, 2011

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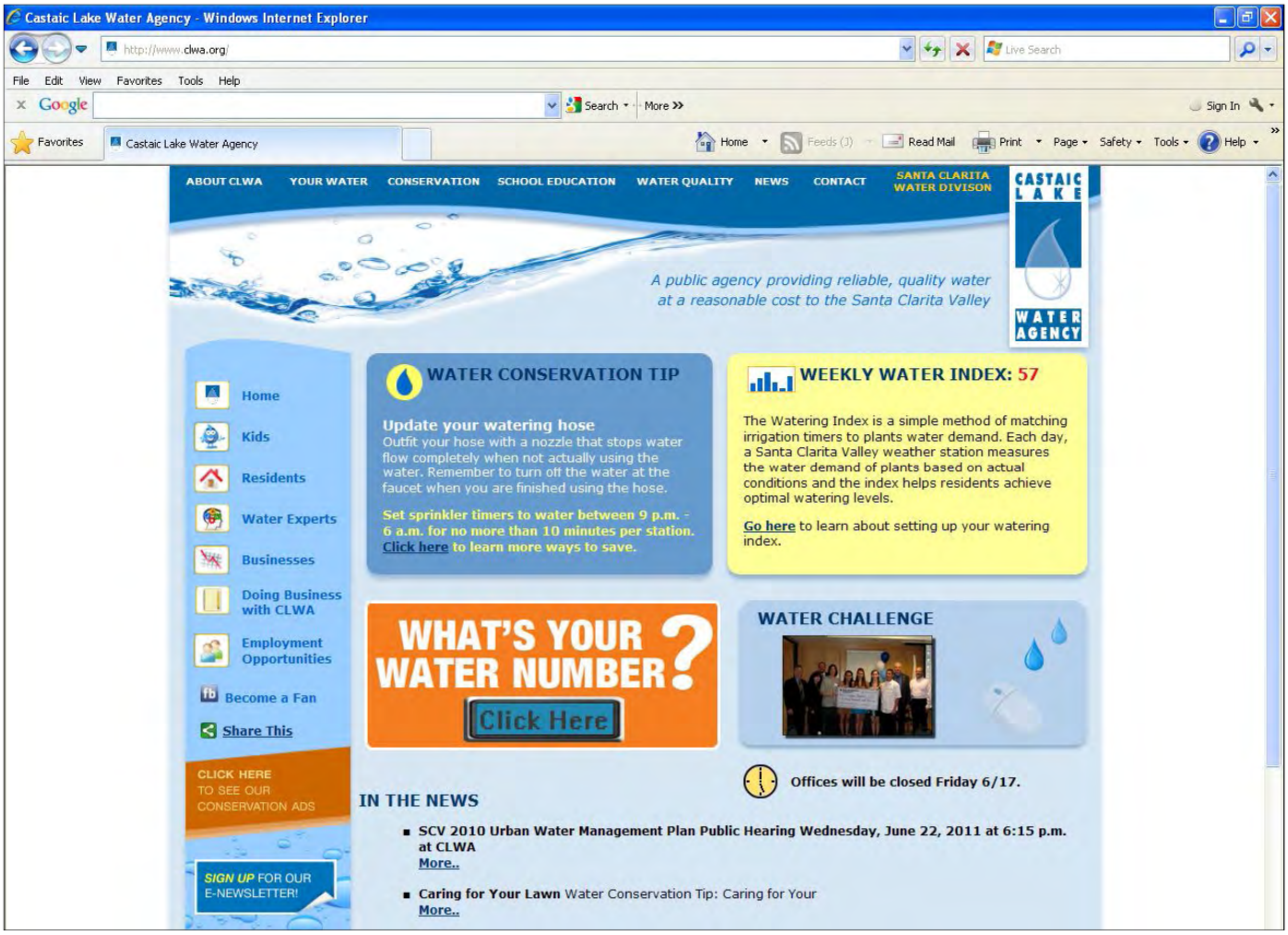
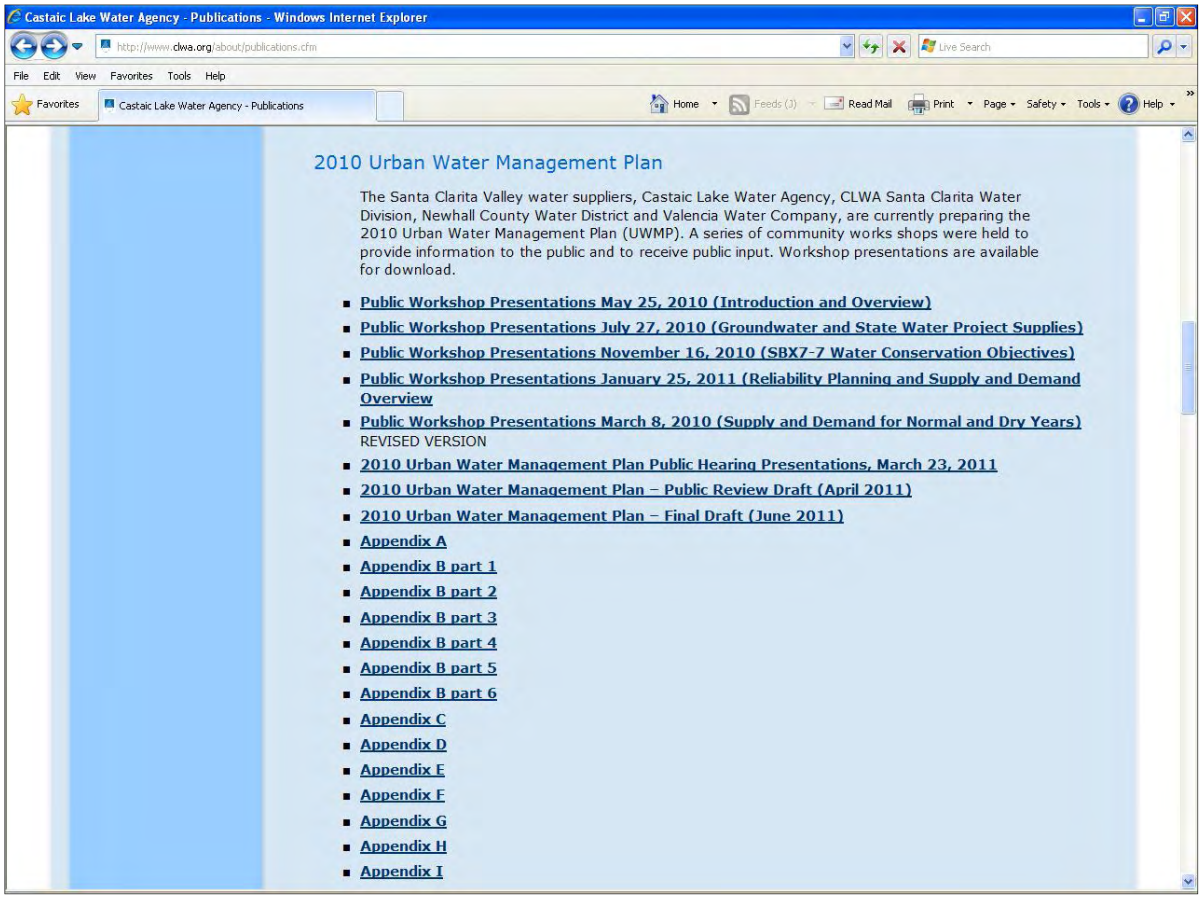
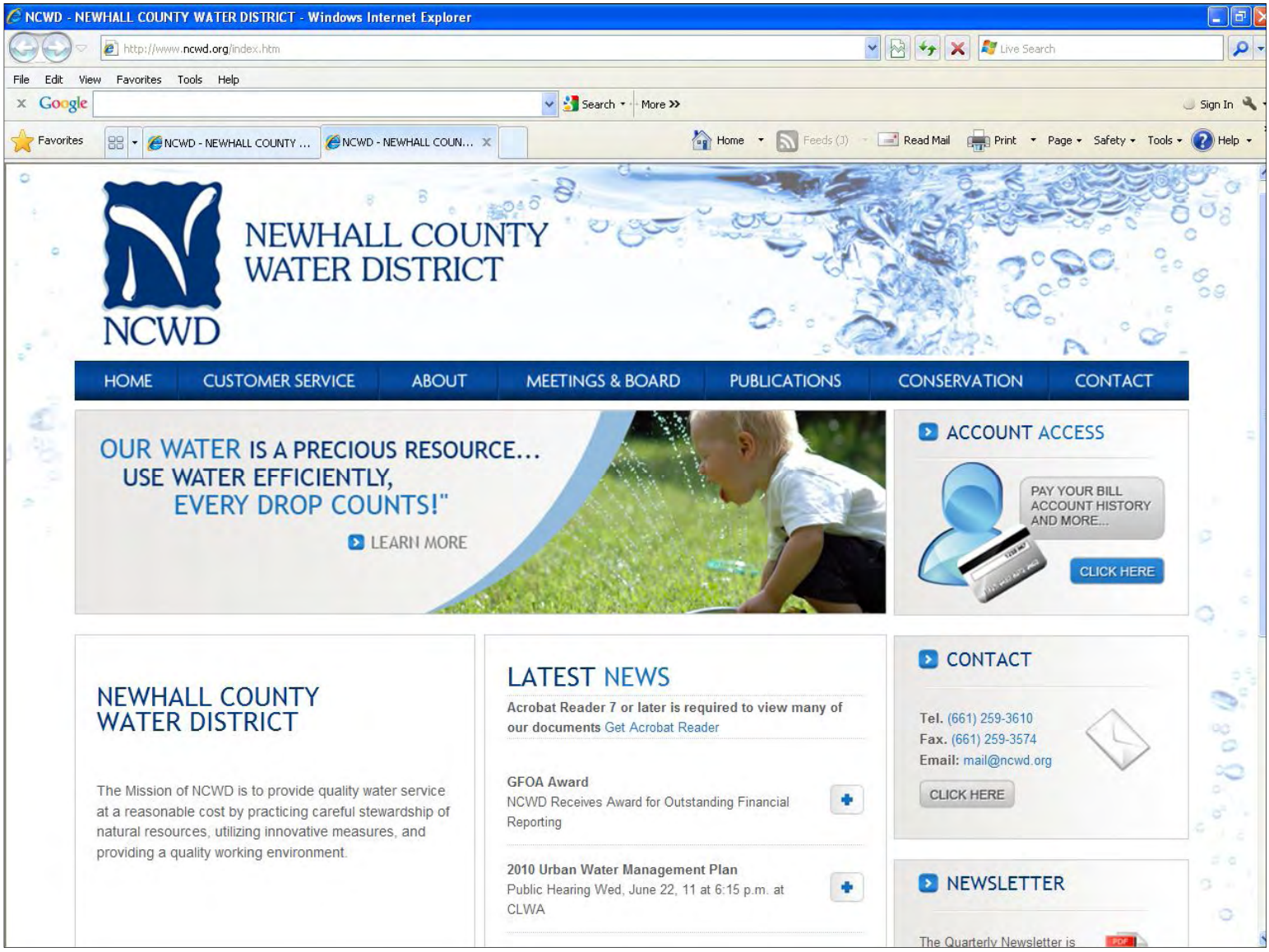
UWMP –June Hearing & Final Draft Document Notice
CLWA Website

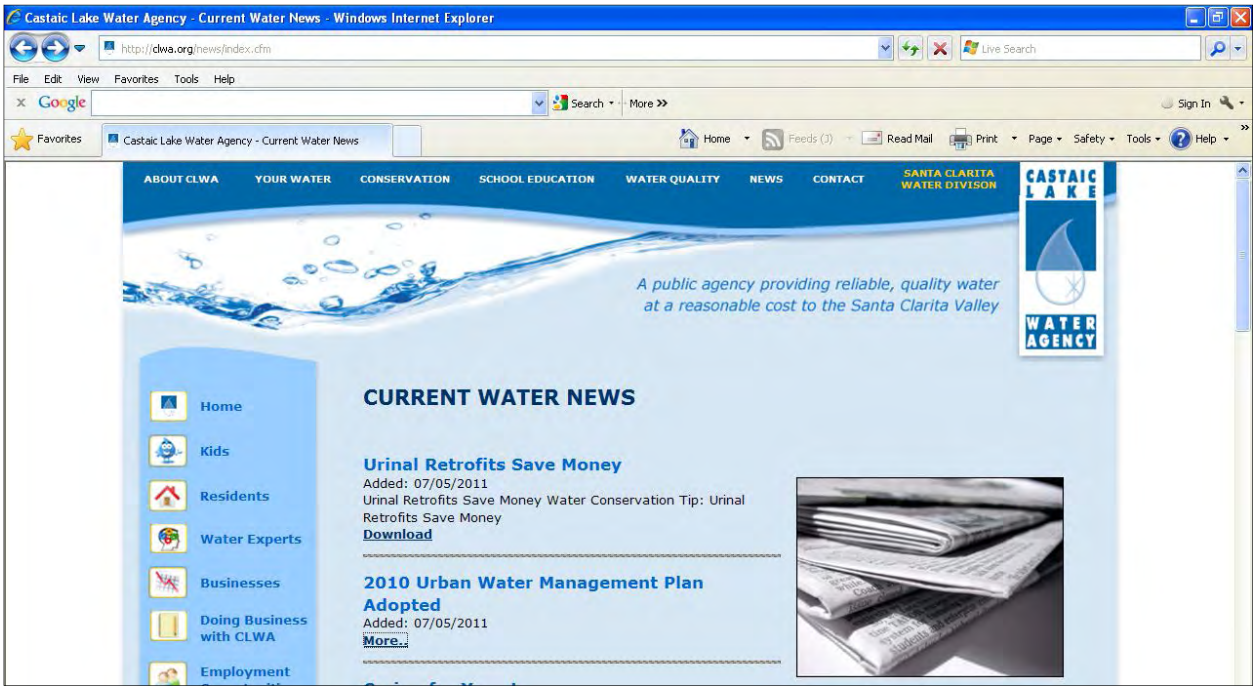


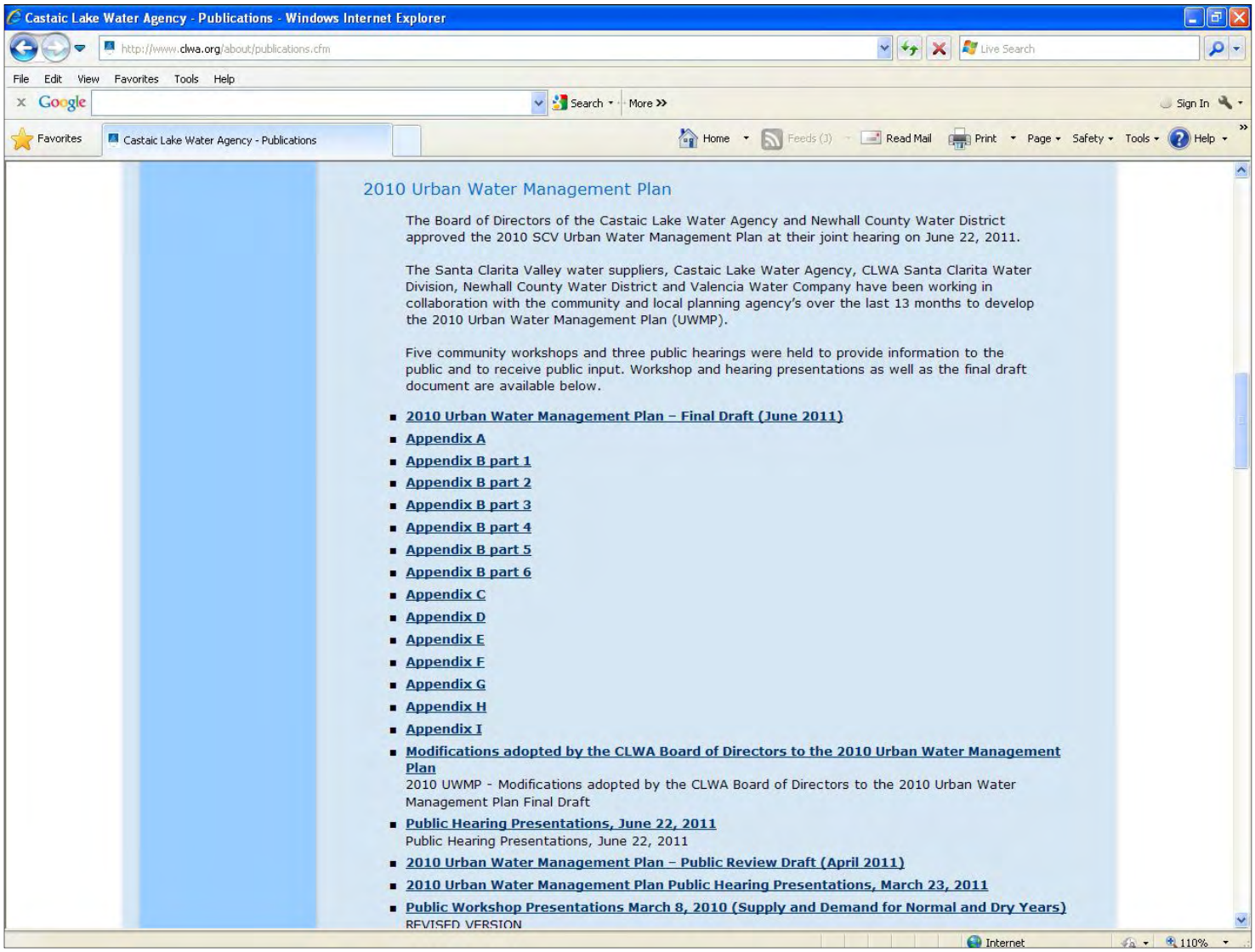


UWMP –June Hearing & Final Draft Document Notice
NCWD Website

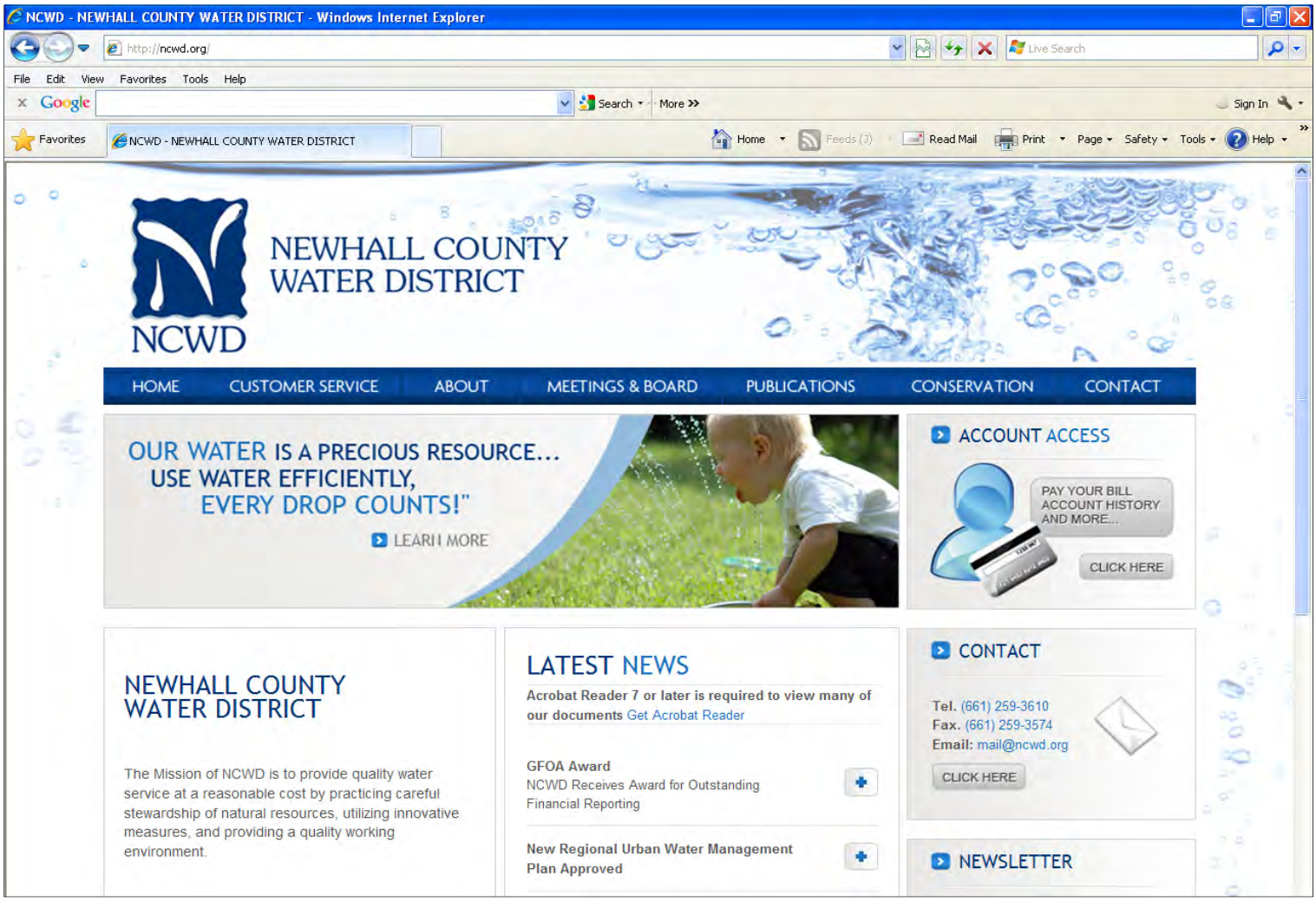


UWMP Adoption Notice
CLWA Website June 2011

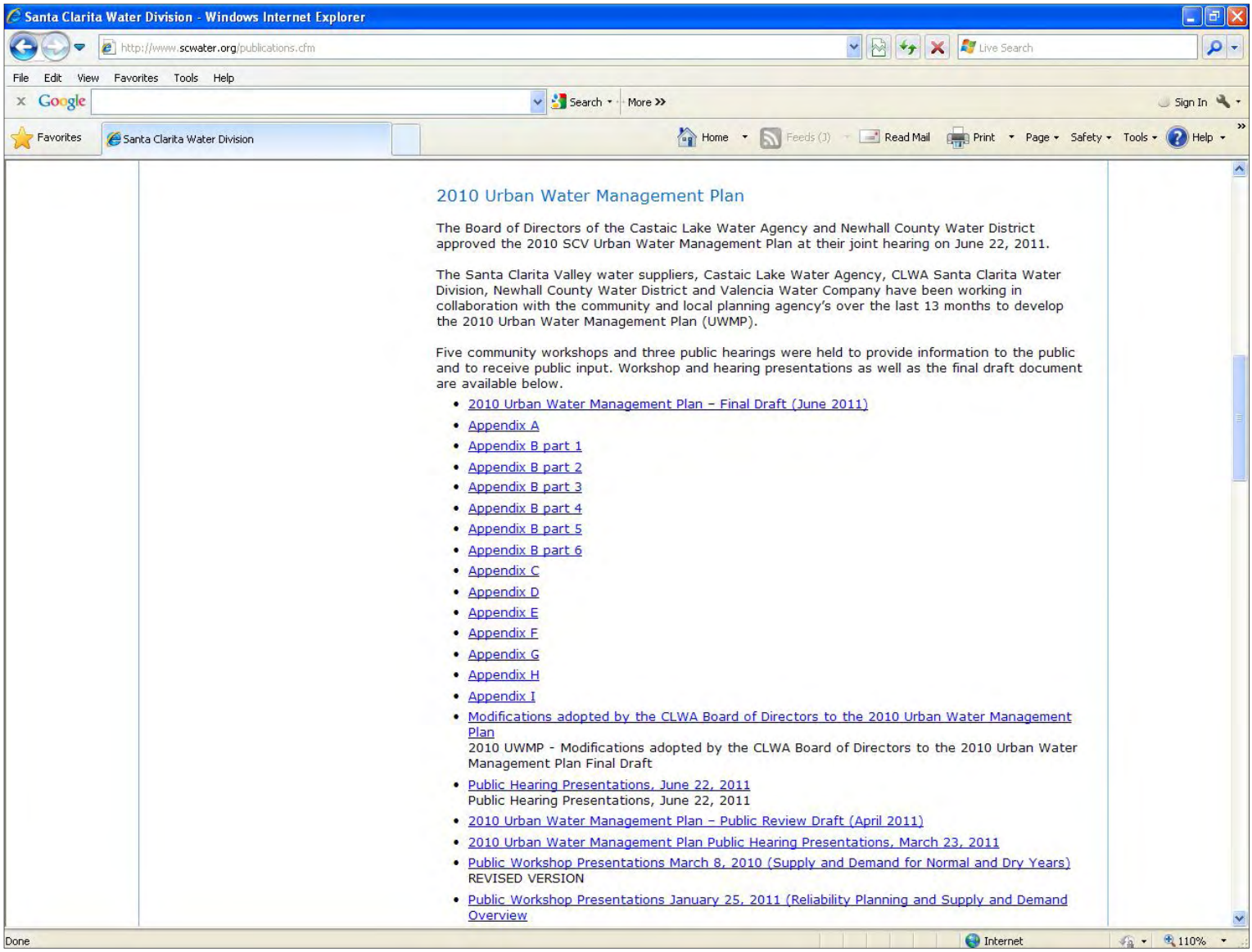




2010 UWMP Adoption Notice
NCWD Website
June 2011



2010 UWMP Adoption Notice
SCWD Website
June 2011



NEWHALL COUNTY WATER DISTRICT

NCWD

New Regional Urban Water Management Plan Approved

Santa Clarita Valley Family of Water Suppliers Approve Critical Planning Tool

Santa Clarita, CA –The Boards of Directors of the Newhall County Water District and Castaic Lake Water Agency unanimously approved the 2010 Santa Clarita Valley Urban Water Management Plan at a joint public hearing on June 22, 2010.

"The approval by the two Boards is a testament to the quality of this document and the team that has worked so hard on its preparation," stated Daniel Mortensen, NCWD Board President.

The creation of the Santa Clarita Valley Urban Water Management Plan began in May 2010 and included opportunities for input from our community, water partners, environmental groups, elected officials, business groups and other community stakeholders during the five community workshops and three public hearings that were held on the plan.

"We have gone far beyond the public participation requirements cited in the Urban Water Management Plan regulations to ensure that all residents and interested parties had ample opportunity to participate, comment and weigh in on this important process," stated Tom Campbell, CLWA Board President.

The Urban Water Management Plan presents a picture of the valley's future water situation and describes the long-range water needs of our community and the means to supply the necessary water to the year 2050. Every five years, the water suppliers who deliver in excess of 3,000 acre feet of water or serve over 3,000 connections per year are required by law to prepare an Urban Water Management Plan.

The SCV Family of Water Suppliers partnered in this planning effort to ensure a collaborative planning approach. This plan is not a project-specific document, nor does it take the place of individual project requirements; rather it is a tool that helps guide the local water suppliers' actions and offers a broad perspective on a wide variety of water issues. The plan concludes that the combination of existing and

planned programs to increase supply and conservation will meet the Valley's water needs through 2050.

"I am proud of the tremendous amount of time and work that has been put into the development of this plan by the community, our staff, consultants and my fellow Board members," stated Bill Cooper, CLWA Board Vice President . "Our Urban Water Management Plan serves as the 'gold standard' of planning documents throughout the state and is followed closely for its content and thoroughness."

The final SCV Urban Water Management Plan will be delivered to the State Department of Water Resources before the end of July 2011. The final draft and additional amendments that were made at the recent board meetings are currently available for review online at www.ncwd.org.

Santa Clarita Valley Urban Water Management Plan

Public Hearing
June 22, 2011
Castaic Lake Water Agency

Agenda

- Open public hearing
- Review of public input process and public comment letters
- Public comment period
- Presentation on Groundwater Basin
- Presentations on Perchlorate Restoration, VWC Well 201
- Presentations on Water Banking, SWP reliability, Water Conservation, Chlorides/AWRM
- Board questions and answers
- Description of UWMP document finalization process
- Close hearing and next steps

UWMP Act Process

ACT REQUIREMENTS

- Coordinate preparation of UWMP with other appropriate agencies in the area.
- 60 days notice to city and counties, and may consult with, and obtain comments from, city and counties receiving notice.
- Encourage active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan.

ACT REQUIREMENTS EXCEEDED

- Draft Final UWMP, §§1.3.1 & 1.3.3, Table 1-1, pgs 1-3 to 1-8.
- Draft Final UWMP, §1.3.3, Table 1-1, pgs 1-3 to 1-8, Appendix B.
- Five Public Workshops between May 2010 and March 2011; three CLWA/NCWD joint public hearings; written public comment period; written public comment deadline extended; Draft Final UWMP, §§1.3.1 &1.3.3, Table 1-2, pgs 1-3 to 1-8.

UWMP Act Process

ACT REQUIREMENTS	ACT REQUIREMENTS EXCEEDED
Prior to adopting a plan, the urban water supplier shall make the plan available for public inspection.	Draft UWMP has been available since April 15, 2011; Final Draft UWMP, §§1.3.1 & 1.3.3, Table 1-2, pgs 1-3 to 1-8, Appendix B.
One Public hearing.	Three CLWA/NCWD joint public hearings.
Notice of hearing in compliance with Gov. Code § 6066.	Final Draft UWMP, §§1.3.1 & 1.3.3, Table 1- 2, pgs 1-3 to 1-8, Appendix B.

UWMP Act Process

ACT REQUIREMENTS	ACT REQUIREMENTS EXCEEDED
Notice of hearing to any city or county within which the supplier provides water supplies.	Final Draft UWMP, §§1.3.1 & 1.3.3, Table 1-2, pgs 1-3 to 1-8, Appendix B.
After the hearing, the plan shall be adopted as prepared or as modified after the hearing.	June 22, 2011 Joint Meeting and 3rd Joint Public Hearing

Past Workshops

May 2010
- UWMP purposed and process – What, Who, Why and When
- Existing and new requirements of UWMPs

July 2010
- SBX7-7 ("20x2020") Requirements
- Recycled Water
- Groundwater Supplies
- State Water Project Reliability

November 2010 –
- Presentation to IRWMP Stakeholders

Past Workshops (continued)

November 2010
- GPCD population assumptions and calculations
- SBX7-7 Targets by retailer

January 2011
- Overview of water supplies
- SWP reliability update
- CLWA reliability planning update
- SBX7-7 calculations and targets
- Overview of water supplies and demand

March 2011
- Water Supply and Demands

Public Hearings and Draft Document

1st public hearing March 23, 2011
- Public Draft document made available April 15, 2011
- Comment period through May 20, 2011

2nd public hearing May 18, 2011
- Comment period extended through May 27, 2011
- Final Draft document made available June 15, 2011

3rd public hearing June 22, 2011

Comment Letters Received

- Friends of the Santa Clara River
- Santa Clarita resident and Valencia Water ratepayer
- Sierra Club
- Mr. and Mrs. Dunn
- Mr. Naoum
- Mr. Dunn
- Sierra Club
- SCOPE
- Whittaker-Bermite Citizens Advisory Group
- Babak Naficy
- Santa Clarita Valley Fair Elections Committee

Broad Categories of Comments Received

- Groundwater overdraft claims
- Perchlorate and VWC Well 201
- Organic compounds
- Water banking program issues; State Water Project reliability and contingency planning
- Water conservation accounting
- Chloride water quality issues (TMDL/AWRM)

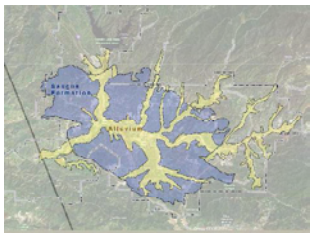
Santa Clarita Valley Urban Water Management Plan

Public Comment Period

Groundwater Supplies and Related Issues, e.g. "Overdraft"

- Joe Scalmanini –
  Luhdorff and Scalmanini, Consulting Engineers

Groundwater Component of Water Supplies
2010 Urban Water Management Plan



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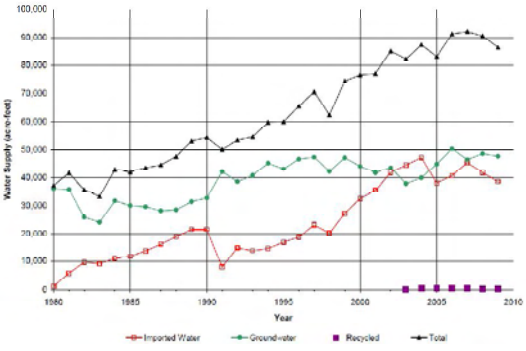
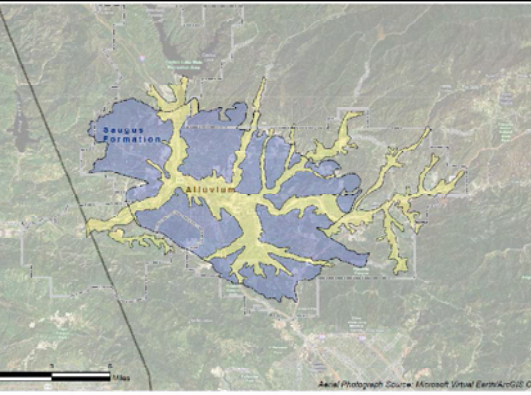


LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 2-1
Total Water Supply Utilization
Santa Clarita Valley



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 3-1
Alluvium and Saugus Formation

Groundwater Management Plan (2003)

Management Objectives (Goals) for the Basin

- evelopment o integrated sur a e ater ground ater and re led ater suppl to meet e isting and pro e ted uses
- etermination o operational ground ater ield to avoid overdra t sustaina ilit
- reservation o ground ater ualit in luding solution o ontamination pro lems
- reservation o interrelated sur a e ater resour es maintenan e o sur a e ater lo s and non degradation o ualit

Groundwater Management Plan (2003)

Elements

- round ater monitoring
- Sur a e ater monitoring
- asin ield anal sis
- egular and dr ear ater supplies
- ontinued on un tive use
- ong term salinit management
- Integration o re led ater
- itigate ontamination
- o al state and ederal relations ips
- u li edu ation and ater onservation
- e arge ell ead prote tion areas
- Well onstru tion and destru tion poli ies
- rovisions to add additional omponents

Annual Water Reports (1998-present)

Annual Water Requirements and Supplies

- A tual ater use
- Sour es o suppl to meet a tual use

Groundwater

- Alluvial and Saugus a ui er onditions

Supplemental Water Supplies

- State Water ro e t
- an ing and ot er programs

Water Quality

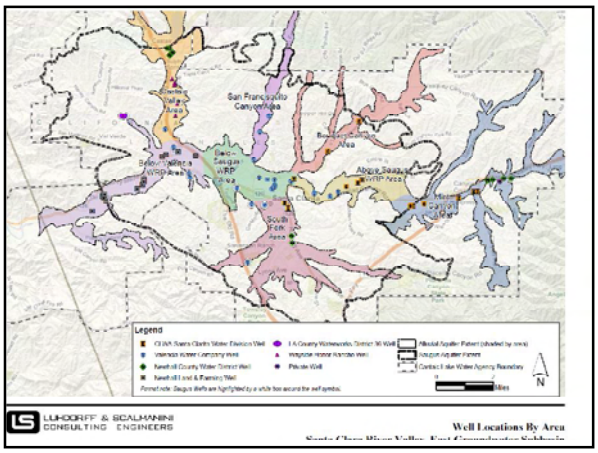
Recycled Water

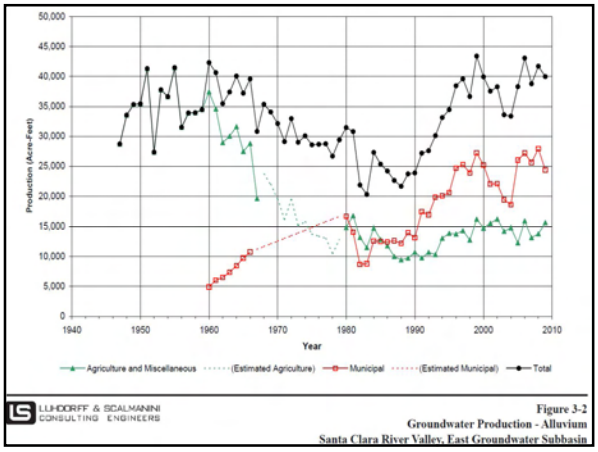
Santa Clara River

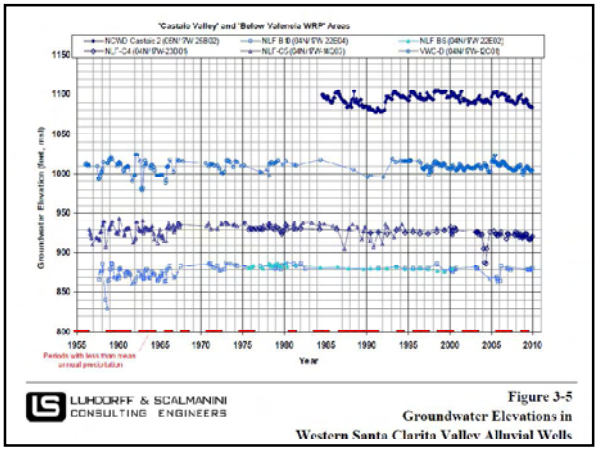
- ut lo s rom Santa larita alle

Short-Term (one year) Outlook

- Water re uirements ad usted rom W
- Sur a e ater ground ater and re led ater supplies
- Ade ua o ater supplies


San Francisquito Canyon Area
Castaic Valley Area
Below Valencia WRP Area
Above Saugus WRP Area
Saugus Area
South Fork Area
Legend
Well Locations By Area
LUHDORFF & SCALMANINI CONSULTING ENGINEERS


Production (Acre-Feet)
Year
Agriculture and Miscellaneous
(Estimated Agriculture)
Municipal
(Estimated Municipal)
Total
LUHDORFF & SCALMANINI CONSULTING ENGINEERS
Figure 3-2
Groundwater Production - Alluvium
Santa Clara River Valley, East Groundwater Subbasin


'Castaic Valley' and 'Below Valencia WRP' Areas
Groundwater Elevation (feet, msl)
Year
LUHDORFF & SCALMANINI CONSULTING ENGINEERS
Figure 3-5
Groundwater Elevations in
Western Santa Clarita Valley Alluvial Wells

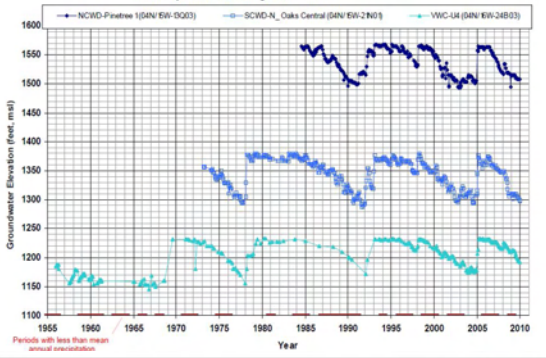


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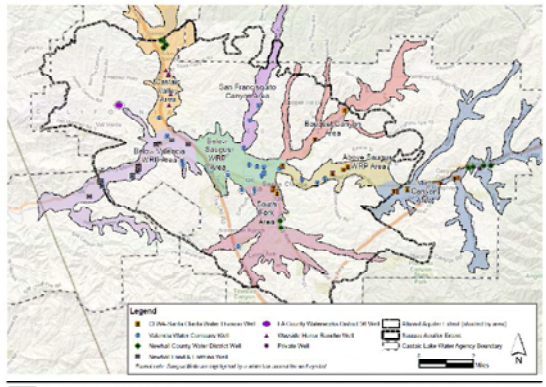
Figure 3-4
Groundwater Elevations in Eastern Santa Clarita Valley Alluvial Wells



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Well Locations By Area
Santa Clara River Valley, East Groundwater Subbasin

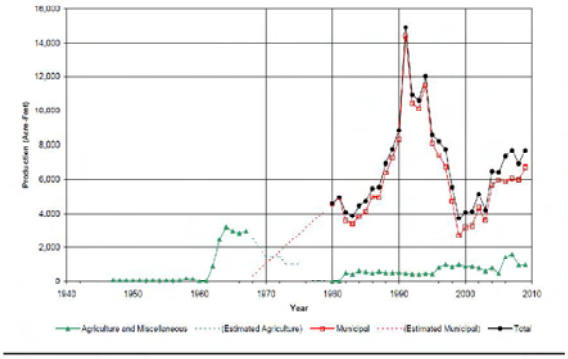

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Figure 3-8
Groundwater Production - Saugus Formation
Santa Clara River Valley, East Groundwater Subbasin

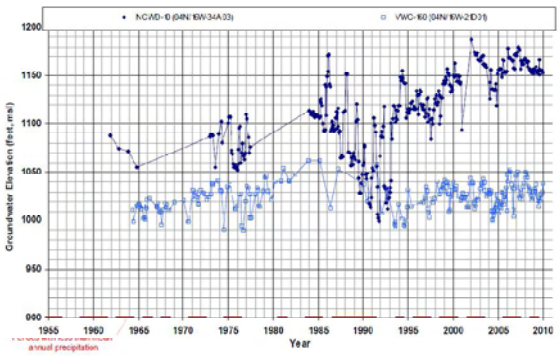

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Figure 3-9
Groundwater Elevations in Saugus Wells

Total Groundwater Supply Santa Clarita Valley

	Normal Years		
	Alluvium (afy)	Saugus Fm. (afy)	Total (afy)
Municipal Purveyors	25,850	11,485	37,335
Agriculture & Others	12,750	1,000	13,750
Total	**38,600**	**12,485**	**51,085**

	Multiple Dry Years		
	Alluvium (afy)	Saugus Fm. (afy)	Total (afy)
Municipal Purveyors	23,800-22,250	18,125-33,975	41,975-56,225
Agriculture & Others	12,700-12,600	1,000	13,700-13,600
Total	**36,500-34,850**	**19,125-34,975**	**55,675-69,825**

2008 Groundwater Operating Plan

Groundwater Pumping 2010 UWMP				
Aquifer	**Normal Years**	**Dry Year 1**	**Dry Year 2**	**Dry Year 3+**
Alluvium	30,000-40,000 (38,600)	30,000-35,000 (36,500)	30,000-35,000 (34,850)	30,000-35,000 (34,850)
Saugus	7,500-15,000 (12,485)	15,000-25,000 (19,125)	21,000-25,000 (25,227)	21,000-35,000 (34,977)

from 2009 Basin Yield Update (LSCE & GSI), following 2001 Groundwater Update Report (Slade) & 2005 Basin Yield Analysis (CH2M Hill & LSCE)

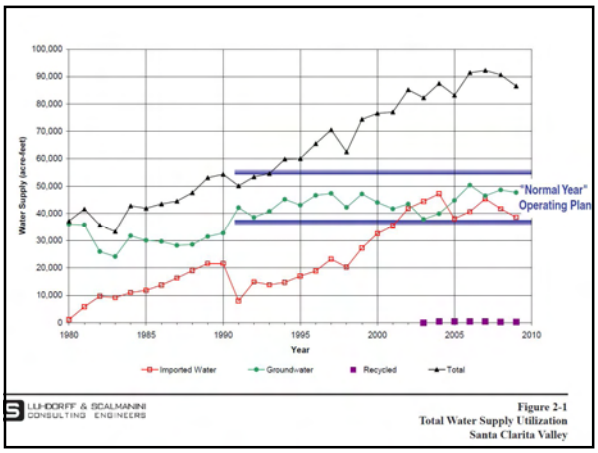


Figure 2-1
Total Water Supply Utilization
Santa Clarita Valley

Sustainability and Achievability

Sustainability

la o roni or sustained depletion o ground ater storage as indi ated pro e ted ground ater levels over a reasona le range o et normal and dr drologi onditions 86 ears 1922 2007

maintenan e o sur a e ater lo s in t e estern portion o t e asin i are partiall maintained ground ater dis arge and sur a e ater out lo to do nstream asins over t e same range o drologi onditions

Achievability

maintenan e o ground ater levels a ove or onl temporaril slig tl into t e inta e s reened or per orated se tions o produ tion ells

from 2009 Basin Yield Update (LSCE & GSI)

2008 Operating Plan Conclusions

Operating Plan is fully sustainable (no chronic groundwater level declines; no depleted stream flow), i.e. not overdraft, and mostly achievable (limited dry-period declines in eastern part of Valley)

Lack of any projected overdraft is consistent with actual historical basin response to the same range of groundwater pumping

Achievability issues in extended dry periods can be resolved by redistribution of some pumping to the west

it redistri ution retain dr period Alluvial pumping near 35 000 a

it out redistri ution dr period Alluvial pumping loser to 30 000 a

Subsidence

In alluvial aquifers, results from "aquitard drainage" and resulting consolidation of the "aquitard"

- re uires e tensive t i a uitard ine grained sediments i e la ed
- re uires roni all depressed ground ater levels to allo la to drain

Santa Clarita Valley Alluvium

- up to 240 t t i ut la ing an e tensive t i a uitard geolog not ondu ive to su siden e regardless o ground ater levels
- some near onstant and some lu tuating ground ater levels ut no roni all depressed ground ater levels an ere drolog not ondu ive to su siden e

No physical evidence of subsidence, e.g. lowering of land surface.

Small Private Pumping

imited su mittal o pumping related data appro 5 6 ears ago or t o tri utar an ons uanti ied less t an 200 a

o in ormation su mitted a out ell ompletions e g et er in Alluvium or edro pump apa ities ater level re ords

o in ormation a out ell ailures e g going dr

trapolated limited pumping data to onservativel estimate 500 a o asin ide small private pumping in luded in Annual Water eport

eported and ontinue to e pe t all private Alluvial ells to e perien e t e same ground ater level lu tuations as monitored and reported in Annual Water eport

Monitoring

CA Health and Safety Code, Title 22

- omesti Water ualit and onitoring
- Water or s Standards

CA Dept of Public Health

- omesti Water Suppl ermits
- Appli ation o ealt Sa et ode and oli ies

Santa Clarita Valley Purveyors

- ermitted and regulated as a ove
- In omplian e it a ove or uantit and ualit o ater supplies

Perchlorate Treatment

- Groundwater Quality
  - Perchlorate treatment and restoration

Perchlorate

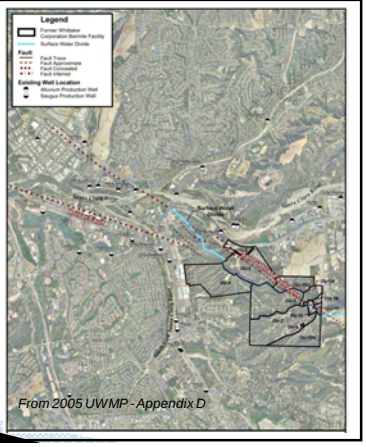
Year Perchlorate Detected	Purveyor Well	Groundwater Aquifer	Status
1997	SCWD Saugus 1	Saugus	DPH approved well return to service in January 2011; well in active service utilizing approved perchlorate treatment.
1997	SCWD Saugus 2	Saugus	DPH approved wells return to service in January 2011; well in active service utilizing approved perchlorate treatment.
1997	VWC Well 157	Saugus	Sealed and capacity replaced by new well.
1997	NCWD Well 11	Saugus	Out of service
2002	SCWD Stadium Well	Alluvium	Sealed and capacity replaced by new well.
2005	VWC Well Q2	Alluvium	DPH approved perchlorate treatment removal in 2007; treatment was installed in 2005 and relocated for potential future use; well remains in service.
2005	DTSC approved Interim Remedial Action Plan		
2006	NCWD Well NC-13	Saugus	DPH approved annual monitoring, results have always been below the detection limit for reporting; well remains in service.
2007	Settlement Agreement		
2010	VWC Well 201	Saugus	Out of service pending additional monitoring and evaluation of remediation alternatives.

Rapid Response Fund provides $10M in reimbursement funds to CLWA as fail-safe.

Perchlorate Impact

Valencia Water Company
Well 201

Site Location -- Former Whittaker Bermite Facility



From 2005 UWMP - Appendix D

Perchlorate Concentrations

Initial Detection (August, 2010) 5.0 ug/l
- well removed from water supply service

Quarterly/Monthly Confirmation Sampling (November, 2010 – April, 2011) fluctuations between 5.7 and 12 ug/l

Logical Occurrence or Completely Unexpected?

Initial Perchlorate Contamination in Saugus Wells - 1997
- Saugus 1 & 2; V 157; NCWD 11

Groundwater Flow
- westerly gradient and flow direction – pre-1997 to 2010

Gradient Control = "Containment" via Restoration of Saugus 1 & 2
- modeled – 2004
- permitting, litigation, Settlement Agreement – 2007
- design, construction – 2010
- DPH water supply permit – 2010
- start-up operations – 2010
- full-time operation – January 2011

Valencia 201
- first down-gradient Saugus well from original impacts
- 13-year elapsed time from initial impacts to V 201 impact
- listed as "threatened" well in Settlement Agreement
- while not a foregone conclusion, detection is a logical occurrence, and not completely unexpected

Water Supply Impact

Recent Operations
- capture zone analysis – 2004
- reduced pumping to avg. 180 afy – 2004-2010
- replaced pumping with other Saugus well capacity

Saugus Formation
- 7,500 – 15,000 afy – normal year – water supply
- 15,000 – 35,000 afy – dry year – water supply

V 201
- key well in dry years
- 3,777 afy of total – dry year – water supply
- capacity needs to be restored before next potential dry year, i.e., within two years

V 201 Response

Removed from Water Supply Service at Initial Detection (August, 2010)

Quarterly-Monthly Confirmation Sampling

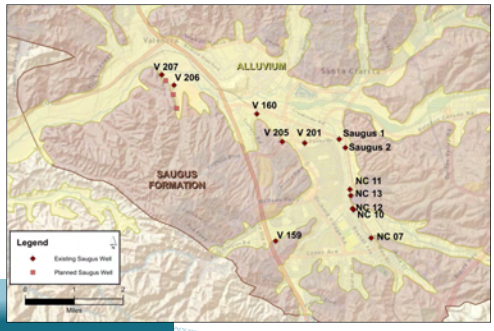
Alternatives
- restoration with – wellhead – treatment
- well replacement

Groundwater Modeling
- perchlorate migration
- need for secondary – containment –
- updated assessment of – threatened – wells

Dept. of Public Health Permitting

Design and Construction

Existing and Planned Saugus Well Locations



Organic Compounds

- Volatile and Synthetic Organic Compounds
  - Trichloroethylene (TCE) and Tetrachloroethylene (PCE)
    - Cleaning solvents, legacy contamination, urban stormwater runoff, septic systems
- CLWA annually monitors for these compounds;
  - TCE was found below the MCL in trace levels in groundwater in the Valley.
  - Not currently affecting production or needing treatment.

Water Banking Program Terms

Water Banking Programs

Banking Program	Extraction Capacity (AFY)	Contract Term
Rosedale Rio-Bravo	20,000	Through term of SWP contract
Semitropic interim programs	15,000	Through 2012/13 originally; through 2022/23 with Amendment
Semitropic – Newhall Land	4,950	Through 2035 with renewal by mutual agreement

State Water Project Reliability Comment Areas

- Supply Reliability
- Facility Reliability
- SWP and West Branch Conveyance
- Catastrophic Supply Interruption

SWP Supply Reliability

- Supply data from DWR's 2009 SWP Delivery Reliability Report.
- Based on model studies using 82 years of historical hydrology (1922 – 2003).
- Historical period includes several significant drought periods.
- Estimate for future (2029) includes adjustments to hydrology to reflect climate change.

SWP Facility Reliability

- Past SWP outages have been short-term (typically weeks in duration).
- Longest West Branch outage was planned three-month winter outage (Dec 1998 – Feb 1999).
- CLWA ideally located immediately downstream of two large SWP reservoirs – Pyramid and Castaic Lakes.
- Location allows deliveries to continue to CLWA and other West Branch Contractors even with outage in aqueduct upstream.
- No past SWP outages have impacted deliveries to CLWA.
- Potential supply impacts of future outage evaluated in UWMP Section 8.

SWP Conveyance

- SWP facilities are owned by State and operated by DWR.
- West Branch facilities, including aqueduct and Pyramid and Castaic Reservoirs, are part of SWP.
- CLWA and 28 other SWP Contractors each have a Water Supply Contract with DWR for water supply and delivery, with similar terms.
- Water Supply Contract:
  - Dictates terms for water delivery.
  - Provides for delivery of SWP water, supplies to and from out-of-service area banking programs, and non-SWP water.

SWP Conveyance (cont.)

- Each SWP Contractor has same priority for delivery within proportion of aqueduct capacity they pay for.
- Deliveries in excess of that capacity may be made through unused capacity of other Contractors.
- DWR requires separate delivery agreements for Contractor programs needing delivery through SWP facilities.
- CLWA has agreements with DWR for deliveries to and from its San Joaquin Valley banking programs and for delivery of its Buena Vista-Rosedale supply.

West Branch Conveyance

- DWR controls deliveries to each of three West Branch Contractors (CLWA, MWD, Ventura Co WPD).
- In dry years when SWP supplies are low, capacity normally used to convey SWP water is available to deliver other supplies.
- CLWA withdrawals from banking programs are planned only for dry years, when capacity would be available to convey it.

Catastrophic Supply Interruption

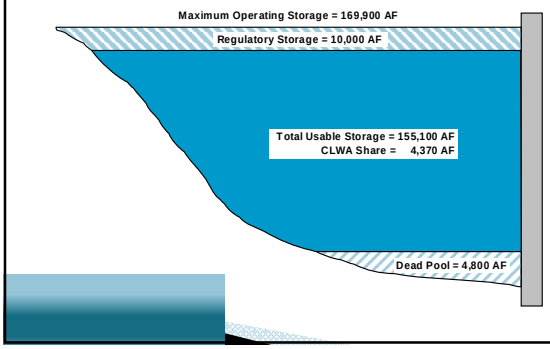
- Three SWP emergency outage scenarios considered:
  - Levee breach in Delta
  - California Aqueduct in San Joaquin Valley
  - West Branch Aqueduct
- Worst-case outage: West Branch Aqueduct
  - No SWP or other supplies through aqueduct
  - No supplies from groundwater banking in San Joaquin Valley

Catastrophic Supply Interruption

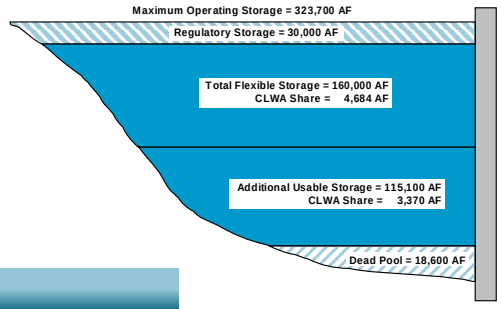
Outage assumptions:

- Six-month outage
- Occurs in normal/average year
- Supplies limited to:
  - Local Supplies
    - Groundwater
    - Recycled water
  - CLWA share of storage in West Branch reservoirs
    - Flexible storage
    - Emergency storage

Pyramid Lake Storage



Castaic Lake Storage



Six-Month West Branch Aqueduct Outage: Water Supplies and Demand (AF)

Water Supply Sources	2015	2020	2035	2050
Local Supplies				
Existing Supplies				
Groundwater	22,200	22,200	22,700	22,700
Recycled Water	120	120	120	120
Planned Supplies				
Future Groundwater	1,900	7,350	8,850	10,350
Recycled Water	370	1,020	3,850	7,870
Total Local Supplies	**24,590**	**30,690**	**35,520**	**41,040**
SWP West Branch Storage Available				
SWP Flexible Storage Accounts	6,060	4,680	4,680	4,680
Emergency Storage				
Pyramid Lake	4,370	4,370	4,370	4,370
Castaic Lake	3,370	3,370	3,370	3,370
Total West Branch Storage	**13,800**	**12,420**	**12,420**	**12,420**
Total Local Supplies and West Branch Storage	**38,390**	**43,110**	**47,940**	**53,460**
Demands				
Total Demand w/o Conservation	40,035	44,242	56,863	69,484
Total Demand w/ Conservation	**36,172**	**35,954**	**48,447**	**60,939**
Additional Supply and/or Conservation Required	**-**	**-**	**507**	**7,479**
As Percent of Demand	0%	0%	1%	11%

SBX7-7 Calculations and Water Conservation Accounting

SBX7-7 Calculations

- All values reported in UWMP by purveyors are required in statute passed in late 2009
- Methodologies developed through a DWR public committee process also required in statute; Kennedy/Jenks is a committee member
- Demand reduction targets calculated for each retail purveyor
- Purveyors may reach targets by combination of water conservation and recycled water programs

Water Conservation Accounting

- Estimates of future savings made by reviewing a wide variety of water conservation measures and programs, and then applying industry-accepted savings factors to them
- Saving factors are determined by in-depth technical studies, mainly done by the California Urban Water Conservation Council (CUWCC) and the American Waterworks Association
- CUWCC reports all savings calculations for its signatory agencies to SWRCB annually
- Detailed SCV Water Use Efficiency Strategic Plan is implementation plan for demand reductions

SBX7-7 Calculations and Water Conservation Accounting

- Document website links
  - SBX7-7 Methodologies: http://www.water.ca.gov/wateruseefficiency/sb7/committees/urban/u3/
  - CUWCC SWRCB Report: http://www.cuwcc.org/about/annual-reports
  - SCV Water Use Efficiency Strategic Plan: http://www.scvh2o.org/ http://www.clwa.org/about/publications.cfm

Chlorides/AWRM

- Imported Water Quality
  - Chloride TMDL
  - Alternative Water Resources Management Program (AWRM)
  - SWP Water Quality Modeling

Chlorides (continued)

- Imported Water Quality
  - Chloride TMDL (2005) – 100 mg/L from Saugus/Valencia WRPs
- Alternative Water Resources Management Program (AWRM) (2008)
  - Established conditional site specific objectives for chloride;
  - Provides water quality and water supply benefits, and protects biological resources;
  - SWP Water Quality Modeling

Santa Clarita Valley Urban Water Management Plan

Directors' Question and Answer Period

Santa Clarita Valley
Urban Water Management Plan

Next Steps

Consultant Team Resumes
Public Outreach Record

2010 Santa Clarita Valley
Urban Water Management Plan

Lynn M. Takaichi, P.E.

Chairman

Education

MS in Civil Engineering (Sanitary), University of California, Berkeley, 1972
BS in Civil Engineering, University of California, Berkeley, 1971
Special Study in Environmental Impact Assessment, University of California
Study in City and Regional Planning, University of California
Study in Water Resources Planning Civil Defense Preparedness Agency, Certificate of Achievement in Multi-Protection Design, University of Hawaii

Registration

Civil Engineer in California

Professional Summary

Mr. Takaichi is responsible for major planning and design projects, particularly assignments involving complex institutional and financial arrangements. He has directed a wide range of water projects including water resource studies, water system master plans, water treatment investigations, water facilities design and utility management plans. In addition, he has managed the preparation of numerous environmental impact assessments.

Mr. Takaichi has particular expertise in complex institutional arrangements and he works closely with specialized legal counsel, financial consultants, and water managers. His experience includes water agency formation, drafting of enabling legislation, negotiation of water supply and water service agreements, development of annexation policies and agreements, and management of a wide variety of water programs. He also has expertise in water system appraisals and has assisted numerous public agencies with the acquisition of investor-owned utilities.

Water Demand Models

- Comprehensive water system plan update for the Lakehaven Utility District.
- Modeling of water and reclaimed water systems for the Cambria Community Services District.
- Comprehensive water system master plan update for the City of Oxnard.
- Comprehensive water plan and capital improvement program ($380 million) for the Castaic Lake Water Agency.
- Water master plan for the City of Chino.
- Water Supply Reliability Plan Update and Optimization Model for the Castaic Lake Water Agency.
- Integrated Regional Water Management Plan for the Antelope Valley for the County of Los Angeles.
- Water Demand Model for the Mojave Water Agency.

Water Resource Studies

- Water Supply Reliability Evaluation for the San Gorgonio Pass Water Agency.
- Strategic planning consultant for local water resources development for the Los Angeles Department of Water & Power.

- Expert witness for water rights valuation for Squaw Creek Resort.
- Integrated Regional Water Management Plan for the Antelope Valley for the County of Los Angeles.
- Water Supply Reliability Plan Update and Optimization Model for the Castaic Lake Water Agency.
- Alternative Water Management Plan for the Santa Clara River for the Los Angeles County Sanitation Districts.
- Negotiation of numerous water transfer and exchange agreements for public and private clients.
- Evaluation of potential water marketing concepts at Lake Elizabeth for Ridgetop Ranch Properties.
- Peer review of SB 610/221 Water Supply Assessment for the Centennial Development (27,000 homes).
- Numerous groundwater evaluations and groundwater management plans.
- Preparation of numerous urban water management plans. Among these are plans for the Antelope Valley, Castaic Lake Water Agency, Hi-Desert Water District, City of Oxnard, City of Santa Paula, and Twentynine Palms Water District.
- Feasibility Evaluation of Alternative Spreading Facilities at the Cucamonga Spreading Grounds for the San Antonio Water Company.
- Evaluation of water banking requirements (Water Supply Reliability Plan) for the Castaic Lake Water Agency.
- Strategy Development for the Santa Ana River Recharge Facilities for the San Bernardino Valley Water Conservation District.
- Water resource evaluation of the Antelope Valley.
- West Ventura County water supply reliability study for the cities of Ventura and Oxnard.
- Water Resources Plan for the Cambria Community Services District.
- Concept Plan for the restoration of the Santa Rosa Basin for the Camrosa Water District.
- McGrath Lake preliminary watershed study for the McGrath State Beach Area Trustee Council.
- Water production alternatives study for the City of Camarillo.
- Evaluation of supplemental water supplies for the Nipomo Community Services District.
- Baseline water supply study for the Cambria Community Services District.
- Preliminary evaluation of the potential use of freeway dewatering water as a water supply for the City of Downey.
- Water resources study for the City of Santa Paula.
- Water Resources Element (LA County) of the Santa Clara River Enhancement and Management Plan for the Castaic Lake Water Agency.
- Optimization study of state water importation into Ventura County.
- Evaluation of potential water resources for the Hidden Valley Municipal Water District.
- Water resources evaluation and environmental assessment of 200,000 acres in Hawaii for the Soil Conservation Service.

Affiliations

American Society of Civil Engineers
American Water Works Association
National Society of Professional Engineers
Society of American Military Engineers
Water Environment Federation

National Association of Corrosion Engineers

Publications

Levi Brekke, Milton D. Larsen, Mary Ausburn, and Lynn Takaichi. 2002. *Suburban Water Demand Modeling Using Stepwise Regression.* Journal – American Water Work Association, October 2002.

Mary Lou Cotton, C.C.P.

Technical/Policy Advisor and QA/QC

Education

MS, Geological Sciences, University of Southern California
BS, Biological Sciences, University of Southern California

Registrations

Certified Water Conservation Practitioner, AWWA-CA/NV

Affiliations

California Urban Water Conservation Council
American Water Works Association, Water Conservation Certification Committee
Association of California Water Agencies, Water Use Efficiency and Communications Committees

Professional Summary

Mary Lou Cotton is a water resources planning and water conservation expert, with over 17 years of management experience with water agencies statewide, specifically in conducting water resource planning and management programs including surface water and groundwater investigations; water transfer, banking and exchange transactions and agreements; water conservation planning and management; master planning and design studies; water quality and hazardous waste investigations; and supporting the preparation of CEQA Compliance documents and obtaining project permits. Ms. Cotton is working in an advisory capacity for several clients on a wide variety of water banking (supply reliability) programs, as well as water transfers or exchanges for short-term and long-term water supplies. In addition, Ms. Cotton assists the State Water Contractors in an advisory capacity on Bay-Delta matters and is also serving as the General Manager of the State Water Project Contractors Authority.

Ms. Cotton has served on the California Urban Water Conservation Council for over a dozen years, as representative for Council members Kern County water Agency, Castaic Lake Water Agency and now Kennedy/Jenks Consultants. She has served on the Council Steering Committee for eight years, and is currently Secretary/Treasurer of the organization; this experience has made her extremely familiar with the requirements of the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU). Ms. Cotton is also a member of the Association of California Water Agencies Water Use Efficiency and Communications Committees. She is an AWWA registered Level 1 Water Conservation Practitioner and currently serves on the AWWA Water Conservation Certification Committee.

This wide experience has made Ms. Cotton an expert on all aspects of California water management policy and practice. She has participated in numerous high-level efforts regarding water conservation in California, including the CALFED Bay-Delta Program Water Use Efficiency advisory committee and the Department of Water Resources Urban Water Management Plan guidebook advisory committee, and has worked on various pieces of conservation-related legislation. In addition, she has served on numerous CUWCC project advisory committees and participated in the 1997 and 2008 revisions of the MOU.

Project Experience

2010 Urban Water Management Plan Update, Castaic Lake Water Agency, Santa Clarita, CA. Project Manager for preparation of the 2010 regional Urban Water Management Plan (UWMP), which is being completed on behalf of CLWA and its four retail purveyors. The water supply analysis includes the SWP, local groundwater, reliability programs, other imported supplies and recycled water. The UWMP also includes an evaluation of the various alternative water management strategies and supplies available to the Valley and based on the evaluation, will recommend water supply strategies.

2010 Urban Water Management Plan Update, Mojave Water Agency, Apple Valley, CA. QA/QC. Kennedy/Jenks is currently providing planning services to product Mojave Water Agency's (MWA) 2010 UWMP with particular focus on Best Management Practices (BMPs) and new regulations. A State Water Project contractor, MWA's plan is to be completed in cooperation with numerous retailers from within their service area. This update will also include analysis of the various agencies' water conservation programs status for the purposes of evaluating compliance with AB 1420 and SBX7, in coordination with the local Alliance for Water Awareness and Conservation.

2010 Urban Water Management Plan Update, Western Municipal Water District, Riverside County, CA. QA/QC for preparation of the District's 2010 UWMP update, including water supplies, demands, and conservation measures.

2010 Urban Water Management Plan Update for Improvement District 4, Kern County Water Agency, Bakersfield, CA. Project Manager for preparation of the 2010 regional UWMP, for the Kern County Water Agency's (KCWA) Improvement District No. 4 (ID4), which represents the urban portion of KCWA's State Water Project wholesale service area. The water supply analysis includes the SWP, local groundwater, reliability programs, other imported supplies and recycled water. In addition to the water supply analyses required by the UWMP Act, this UWMP update will also include analysis of local water conservation program status for the purposes of evaluating compliance with AB 1420 and SBX7.

2010 Urban Water Management Plan Update, Port Hueneme Water Agency, Port Hueneme, CA. QA/QC for preparation of the Agency's 2010 UWMP update, which will include 25 years of water supply/demand analysis, new legislative requirements, water supply demand forecasting, Demand Management Measures review and analysis, and contingency planning.

2010 Urban Water Management Plan Update, City of Port Hueneme, CA. QA/QC for update of the City's 2010 UWMP. Project included review of the City's existing and future water supplies and demands, water supply reliability, summary of current conservation measures, an evaluation of recommended conservation measures, and an implementation plan.

2010 Urban Water Management Plan Update, San Bernardino Valley Municipal Water District, San Bernardino, CA. QA/QC for update of the District's 2010 UWMP with particular focus on Best Management Practices (BMP's) and new regulations. The work will also include coordination with California Department of Water Resources reviews and approvals.

2010 Urban Water Management Plan, Lake Arrowhead Community Services District, Lake Arrowhead, CA. Project Manager for production of this retail water purveyor's 2010 UWMP update.

2010 Urban Water Management Plan, North of the River Municipal Water District and Oildale Mutual Water Company, Kern County, CA. QA/QC for preparation of the 2010 UWMP update for Kern County Water Agency Improvement District No. 4's (ID4) participating retail purveyors, North of the River

Municipal Water District and Oildale Mutual Water Company. The UWMP update will provide information on ID4's wholesale service area and operations and will include data and information about the ID4 retail purveyor service areas and operations. The UWMP update will also include information on ID4 retail purveyor service areas that recover groundwater within ID4.

2010 Urban Water Management Plan, City of Ventura, CA. Project Manager for production of the City's 2010 UWMP update. The water supply analysis includes local groundwater, reliability programs, other imported supplies and recycled water. In addition to the water supply analyses required by the UWMP Act, this UWMP update will also include analysis of local water conservation program status for the purposes of evaluating compliance with AB 1420 and SBX7.

2010 Urban Water Management Plan, Central Coast Water Authority, Ventura County, CA. Currently providing QA/QC and third-party technical review for the CCWA's 2010 UWMP update.

2010 Urban Water Management Plan Update, Western Municipal Water District, Riverside County, CA. QA/QC for preparation of the District's 2010 UWMP update, including water supplies, demands, and conservation measures.

Water Use Efficiency Master Plan, Western Municipal Water District, Riverside County, CA: Project Manager. In concert with the growing emphasis on water use efficiency programs, WMWD commissioned the preparation of a Water Use Efficiency Master Plan to comprehensively address the long term use of water resources within their service area by adopting objectives, policies and programs designed to promote innovative emerging technologies and practices, as well as proven and cost-effective conservation measures. Ms. Cotton managed and authored several sections of the Plan, conducted an evaluation of water conservation measures through development of a weighted scoring matrix, and reviewed and assisted in the production of the Master Plan.

Water Conservation Master Plan, City of Riverside, Riverside County, CA: Technical Advisor & QA/QC. Recently selected for the preparation of a Water Conservation Master Plan to comprehensively address the long term use of water resources within the City's service area by adopting objectives, policies and programs designed to promote innovative emerging technologies and practices, as well as proven and cost-effective conservation measures.

Integrated Water Resources Management Plan (IWRMP), Western Municipal Water District, Riverside, CA: Project Team Member. Preparation of an integrated water resources plan for the Western Municipal Water District and retail agencies within the District (Riverside County). Project involved assistance to, and coordination of, a six member management group and approximately 20 stakeholders. Developed materials for stakeholder education, assisted with identification of water management objectives, and evaluation of projects put forth by stakeholders for consistency with objectives, financial feasibility, and compliance with State mandated requirements.

Upper Santa Clara Integrated Water Resources Management Plan, County of Los Angeles, CA: Project manager for the preparation of an integrated water resources plan for the Upper Santa Clara River Region (Los Angeles County). Project involves assistance to, and coordination of, an eight member management group and approximately 30 stakeholders. Develop materials for stakeholder education,

assist with identification of water management objectives, and evaluate projects put forth by stakeholders for consistency with objectives, financial feasibility, and compliance with State mandated requirements.

Hollister Area 2008 Urban Water Management Plan, Sunnyslope County Water District, City of Hollister, San Benito County Water District, CA. Provided QA/QC for a collaborative Urban Water Management Plan (UWMP) Update by the Sunnyslope County Water District (Sunnyslope), City of Hollister (City), and the San Benito County Water District (District). The latest amendment to the Plan incorporates a water shortage contingency plan, alternative water conservation measures and water reclamation programs.

Experience Prior to Kennedy/Jenks

Castaic Lake Water Agency, Water Resources Manager, Santa Clarita, CA. At the direction of the General Manager, work consisted of managing all aspects of the Agency's water resources projects, specifically dealing with water supply issues at the state and local levels. Prepared, facilitated, reviewed and submitted all water sale/transfer contracts, various agreements, and attendant resolutions to the Agency's Board of Directors and the Department of Water Resources. Prepared all documentation and conducted negotiations for three separate groundwater banking projects. Prepared in-house technical reports and other materials, including overseeing the production of the Agency's Urban Water Management Plan. Served in scientific advising capacity in reviewing all environmental regulatory documentation, particularly in regard to CEQA requirements, including consultant reports and other scientific documents. Served as the Agency's Water Conservation Coordinator; responsible for implementation of water conservation Best Management Practices as contained in the Memorandum of Understanding of the California Urban Water Conservation Council. Responsible for the Agency's public information program and oversee all its aspects. Represented the Agency on various committees, including several State Water Contractors standing committees, the California Urban Water Conservation Council Steering Committee, and the Association of California Water Agencies Communications and Program Committees.

Castaic Lake Water Agency, Assistant to the General Manager, Santa Clarita, CA. Worked at the direction of the General Manager, specifically dealing with water supply issues at the state and local levels. Prepared, facilitated, reviewed and submitted water sale/transfer contracts, various agreements, and attendant resolutions to the Agency's Board of Directors. Served in scientific advising capacity in reviewing environmental regulatory documentation, particularly in regard to the CALFED Bay-Delta Program; environmental impact reports; consultant reports and other scientific documents. Served as the Agency's Water Conservation Coordinator; responsible for implementation of water conservation Best Management Practices as contained in the Memorandum of Understanding of the California Urban Water Conservation Council. Responsible for the Agency's public information program. Prepared, compiled, wrote, and edited the Agency's quarterly newsletter and other Agency public information materials. Prepared in-house technical reports and other materials, including the Agency's Urban Water Management Plan. Represented the Agency on various committees, including several State Water

Contractors standing committees and the Association of California Water Agencies Communications and Program Committees.

Kern County Water Agency, Water Resources Planner, Bakersfield, CA. Attached to the Agency's Water Resources Department, specifically dealing with water supply issues, at both the state and local levels. Prepared, facilitated, reviewed and submitted water sale/transfer contracts, various agreements, and attendant resolutions to the Agency's Board of Directors. Served in scientific advising capacity in reviewing environmental regulatory documentation, particularly in regard to the CALFED Bay-Delta Program; environmental impact reports; consultant reports and other scientific documents. Served as the Agency's Water Conservation Coordinator; assist the Agency's Urban Bakersfield Advisory Committee. Responsible for implementation of water conservation Best Management Practices as contained in the Memorandum of Understanding of the California Urban Water Conservation Council. Also assisted with the Agency's participation in the AB3616 Agricultural Water Management Council. Responsible for majority of the Agency's public information program. Prepared, compiled, wrote, and edited the Agency's monthly newsletter. Prepared and wrote Agency public information materials. Prepared in-house technical reports and other materials including the Agency's Urban Water Management Plan. . Represented the Agency on various committees, including several State Water Contractors standing committees and budget review committee, the California Water Clearinghouse (for CALFED and Bay-Delta issues), the Association of California Water Agencies Communications (vice-chair) and Program Committees, and the Executive Committee of the Water Association of Kern County.

RESUME

Joseph C. Scalmanini

Specialization:

Forty-three years of practice in groundwater development and management, and oil and gas production. Assessments of groundwater resources and implementation of groundwater basin management in various areas throughout California; groundwater development and management encompassing well design, construction, operation, and maintenance; groundwater monitoring as part of basin management and as part of groundwater contamination investigations; artificial groundwater recharge facilities and practices; injection of industrial waste water; development of brackish and saline groundwater for municipal (desalination) and industrial water supply; water supply master planning.

Professional Registration:

Registered Civil Engineer, California, CE 28233

Academic Degrees:

M.E. Civil Engineering, University of California, Davis, CA	1984
B.S. Mechanical Engineering, University of Santa Clara, Santa Clara, CA	1967

Professional Experience:

Luhdorff and Scalmanini, Consulting Engineers, Woodland, CA	
President	2004 - Present
Principal Partner	1989 - 2004
Partner	1980 - 1989
University of California, Davis, Davis, CA	1973 - 1979
Associate Development Engineer	
Shell Oil Company	1967 - 1973
Mechanical and Facilities Engineer	

Representative Professional Assignments:

Consultant to water districts and utilities, municipalities, corporate and individual farming interests, corporate and private industry, and other engineering firms on groundwater development, utilization and management, including preparation and implementation of AB 3030 and other groundwater management plans, and plans for supplemental water supply and conjunctive use management. Consultation with public agencies, corporate and private concerns regarding groundwater contamination, its identification, monitoring, and management. Consultation with legal profession on technical aspects of groundwater development and utilization, including all aspects of groundwater basin yield and management, well design and construction, and application of pumping equipment.

Representative Professional Assignments continued:

Mr. Scalmanini directed and conducted a ground-water basin assessment in the Santa Maria Valley, including developing plans for conjunctive use of imported SWP water, recaptured return flows and increased artificial recharge of natural stream flow. After the adjudication of the Santa Maria Valley Groundwater Basin, he was appointed Basin Engineer, responsible for monitoring basin conditions and annually reporting to the court on the state of the basin.

Mr. Scalmanini directed the development of an alternative basin management plan for diversion of stream flow to replace coastal groundwater pumping and halt historical seawater intrusion in the Salinas Valley. He has developed several ground-water substitution programs for both public and private farming interests in Sacramento, Yolo and Sutter Counties, and authored Ground-Water Management Plans for these respective areas.

Mr. Scalmanini served as the court-appointed technical advisor to the Special Referee in the Chino Basin for development and implementation of an Optimum Basin Management Program to preserve and potentially increase the safe yield of the aquifer system, incorporate conjunctive use within storage limits in the aquifer, and make beneficial use of degraded water quality in the lower end of the basin by desalting ground water for future domestic water supply.

Mr. Scalmanini is directing ongoing engineering and hydrogeological analyses of local groundwater and imported State Water Project water supplies in the Upper Santa Clara River Area (Santa Clarita Valley) in Los Angeles County, including the preparation of annual Water Reports over the last eleven years. As part of that work, Mr. Scalmanini developed a cooperative technical program to integrate water resource analysis with the adjacent downstream basins, and has coordinated technical analysis of sustainable yield of the groundwater basin for ongoing agricultural, municipal, and other local water requirements since 2001. Mr. Scalmanini is the primary author of the AB3030 Groundwater Management Plan that has been adopted for the basin. He also prepared the Amendment to the 2000 Urban Water Management Plan for the State Water Contractor and all the water purveyors in the Valley to specifically address the adequacy of groundwater supplies in the wake of perchlorate contamination and the plan to contain contaminant migration while restoring contaminated wells to water supply service through the installation of wellhead treatment. He subsequently co-prepared an analysis of groundwater basin sustainable yield and a subsequent analysis of the adequacy of groundwater supply after another Alluvial well was impacted by perchlorate. He prepared the groundwater components of the 2005 Urban Water Management Plan, which was based on all the preceding analyses. Most recently, Mr. Scalmanini co-prepared an updated analysis of sustainable groundwater basin yield, including consideration of potential climate change impacts, for use in ongoing basin management and in the 2010 Urban Water Management Plan.

Mr. Scalmanini also currently serves as Chairman of the Ground-Water Committee that is developing and analyzing the potential for development of additional ground water throughout the Sacramento Valley as part of the Sacramento Valley Water Management Agreement reached in Phase 8 of the SWRCB Bay-Delta Water Rights Hearings.

Professional Affiliations:

National Ground Water Association
- Association of Ground Water Scientists and Engineers

American Water Works Association
California Groundwater Association
Groundwater Resources Association of California

Public Service:

- **Yolo County Aggregate Resources Committee (1975-79)**, Alternate delegate, hydrologist - analysis of impacts and development of management plans for extraction of aggregate from Cache Creek basin.
- **California Tenth Biennial Conference on Ground Water (1975)**, Member, Planning Committee
- **Chancellor's Campus (Univ. of Calif., Davis) Water Committee (1976-78)**, Staff Engineer - analysis of water supplies and uses, projection of requirements, development of conservation and management plans.
- **City of Davis Water Planning and Conservation Committee (1977-79)**, Chairman - analysis of water supplies and uses, projection of requirements, consideration of alternative supplies, development of conservation and management plans.
- **Yolo County Water Resources Task Force (1979)**, Member - development of county-wide master water plan.
- **Pacific Gas and Electric Co. ACT^2 Irrigation Pumping Demonstration Project (1992)**, Technical Advisor
- **Association of California Water Agencies (1994-1996)**, Member - Groundwater Committee
- **Cache Creek Conservancy**, **(2000-2002)**, Director

Teaching Activities:

Course Coordinator and Instructor University Extension Courses, University of California, Davis:

Concepts of Ground Water Management (1974, 1976, 1978, 1981)
Legal and Policy Considerations in Ground Water Management (1975, 1976, 1980)
Water Supply Wells and Pumps (1977, 1978,1981, 1983, 1985, 1986)
Groundwater Law, Hydrology and Management (2001-2010)

Instructor, University of California, Davis, Water Science 198, Introductory Hydraulics (1977, 1978, 1979)

Lecturer, University of California, Davis, Water Science 2, 140, 160; Ecology 230; Civil Engineering / Geology 175 (1975 - 1979)

Lecturer on Aquifer Characteristics, Well Hydraulics, and Groundwater Development, in Technical Training Classes at the U.S. Army Corps of Engineers' Hydraulic Engineering Center, Davis, CA.

Publications and Presentations:

Scott, V.H. and J.C. Scalmanini, **Water Wells and Pumps: Their Design, Construction, Operation, and Maintenance**, University of California Division of Agricultural Sciences Bulletin No. 1889, 1977.

Helweg, O.J., Scott, V.H., and J.C. Scalmanini, **Improving Well and Pump Efficiency**, American Water Works Association, 1983.

Publications and Presentations continued:

Scalmanini, J.C., and Scott V.H., **Design and Operational Criteria for Artificial Groundwater Recharge Facilities**, Water Science and Engineering Paper No. 2009, University of California, Davis, 1979.

Scalmanini, J.C., Scott, V.H., and O.J. Helweg, **Energy and Efficiency in Wells and Pumps**, presented at Twelfth Biennial Ground Water Conference, 1979.

Scalmanini, J.C., Johnson Jr., R.M., and E.E. Luhdorff Jr., **Development of a Groundwater Monitoring Program as a Basis for Coastal Groundwater Basin Management**, presented at the Fall Conference, American Water Works Association, CA-NV Section, 1983.

Scalmanini, J.C., **3030 Hindsight and 2020 Foresight, Actual Groundwater Management Experience Over the Last 15 Years, Soquel Creek Water District**, presented at the Association of California Water Agencies' Groundwater Management Conference, March 1994.

Scalmanini, J.C., **Legal and Technical Issues Related to Surface Water and Groundwater Interaction**, presented at the Groundwater Resources Association's California Ground Water & Efficient Usage for the Year 2000 and Beyond, October 1998.

Scalmanini, J.C., A. Schneider, and V. Cahill (panel presentation), **Groundwater Classification: Is the State Water Resources Control Board's Jurisdiction Over Ground Water Changing?**, presented at the Water Education Foundation's 2000 Update on Water Law and Policy, July 2000.

Scalmanini, J.C., **What the Heck's a Sub-Basin? Defining Basins and Sub-Basins**, presented at the Association of California Water Agencies' Groundwater Management: Will CalFed Help or Hinder Workshop, November 2000.

Scalmanini, J.C., **"Groundwater Law, Policy and Science: What can Be Done About The Disconnect",** presented at the Water Education Foundation's 2005 Water Law and Policy Briefing, San Diego, July 2005.

Nancy Clemm, P.E.

WORK SUMMARY

Nancy Clemm is a civil engineer with 30 years water resources planning experience, including 20 years working primarily on State Water Project (SWP) and Bay/Delta issues. Ms. Clemm is very familiar with SWP system operations, including reservoir, Delta, and conveyance facility operations, as well as with the Department of Water Resources (DWR) planning model used to estimate SWP delivery reliability. She has assisted in the preparation of numerous water supply planning documents, focused primarily on SWP supplies and facilities, including the 2005 and 2010 Urban Water Management Plans (UWMP) for Castaic Lake Water Agency (CLWA), the 1995 Regional Urban Water Management Plan and 1996 Integrated Water Resources Plan for the Metropolitan Water District of Southern California (MWD), and several environmental impact reports (EIR) dealing with SWP supplies and/or use of SWP conveyance facilities.

EXPERIENCE

WATER RESOURCES CONSULTANT, Los Angeles, California, 1999 - Present.
(Self-employed)

2005 and 2010 UWMPs: For CLWA, participated in preparation of 2005 and 2010 UWMPs, primarily focused on determining availability of SWP water supplies and assessing overall supply reliability.

Monterey Plus EIR: For MWD, provided technical support to SWP contractor representatives on advisory committee to DWR regarding water supply analyses and SWP contract issues, for preparation of new environmental document for Monterey Amendment to SWP water supply contract.

Water Program EIRs: For CLWA, assisted in preparation of EIRs for water programs involving use of SWP conveyance facilities, for CLWA's Rosedale Rio Bravo Water Storage District Water Banking Program, and its water acquisition from Buena Vista Water Storage District/Rosedale Rio Bravo Water Storage District.

SWP Table A Transfer EIR: For CLWA EIR for permanent transfer of SWP Table A amount, conducted SWP water supply reliability and water allocation analyses using data from DWR model studies, performed SWP aqueduct capacity rights and availability analysis, and prepared overall CLWA supply reliability assessment.

SWP Water Operations and Water Transfers: For State Water Contractors (SWC), participating in SWC Water Operations Committee, addressing SWP annual water supply and operational issues; and in SWC Water Transfers Committee, reviewing and providing recommendations regarding approval of proposed SWP contractor transfers and exchanges.

Reservoir Reoperation Report: For CALFED, drafted report on potential water supply and environmental benefits of reoperation of hydroelectric facilities in northern and central California.

Hydrologic Model: For Salt River Project, assisted with enhancements to runoff forecasting model, including making programming revisions, assisting with addition of user-interface, and writing user's manual and program documentation.

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, Los Angeles, California, 1991 - 98. (Senior Engineer, SWP Branch, 1993 - 98; Engineer, Bay Delta Branch, 1992; Engineer, SWP Branch, 1991)

SWP Water Supply Analyses: Assisted in preparation of several planning documents, including 1995 Regional Urban Water Management Plan and 1996 Integrated Water Resources Plan. Conducted numerous additional analyses to estimate future availability of SWP supplies, and to evaluate proposed SWP operational constraints, future water supply options, and SWP contract provisions.

SWP Supply Operations: Participated in SWC committee monitoring DWR's reservoir and Delta operations, addressing operational issues and various contractor issues such as equity and current supply versus risk of future shortage.

Water Contracts: Provided significant support in development of Monterey Amendment to SWP contract, including providing technical support for urban contractor negotiating team; assisting in amendment drafting and completion of environmental documentation; and resolution of implementation issues. Participated in drafting numerous agreements between MWD, DWR, and other agencies related to establishment of and water delivery to groundwater banking and exchange programs.

SWP Supply Planning: Participated in SWC committee monitoring DWR planning efforts to enhance SWP supplies, including review of proposed projects' feasibility, supply yield, water quality, environmental effects and mitigation, and costs.

SALT RIVER PROJECT, Phoenix, Arizona, 1981 - 90. (Senior Water Resources Analyst, 1985 - 90; Engineer III, 1983 - 84; Rotational Engineer, 1981 - 82)

Water Supply Analyses: Worked extensively with reservoir operations simulation model of Salt River Project system to conduct supply studies, to estimate future supplies and evaluate supply impacts given proposed physical and operational changes. Made major programming modifications and wrote program documentation.

Other Computer Modeling: Developed runoff forecasting model to estimate real-time runoff to reservoir system, including all model design, programming, and documentation. Assisted in development of water demand forecasting model based on land use, including model design, development, and implementation.

Water Contracts / Accounting: Developed detailed knowledge of existing water delivery and reservoir storage contracts. Participated in several negotiations for new water contracts, primarily concerning water delivery, accounting, and measurement.

EDUCATION

Bachelor of Science in Civil Engineering, Arizona State University, 1981.
Graduate courses in water resources modeling, Arizona State University.

REGISTRATION

Civil Engineer, California and Arizona

J. Lauren Everett

Water Resources Specialist

Education

B.S., Environmental Studies, University of California, Santa Barbara, 1999
M.S., Donald Bren School of Environmental Science and Management University of California, Santa Barbara, 2001

Professional Summary

Ms. Everett is a Water Resources Specialist, with over 8 years of experience in environmental and regulatory compliance providing technical planning support for a diverse range of water resource projects. Ms. Everett is currently involved with implementing DWR's Proposition 84 Integrated Regional Water Management Grant Program, urban water management planning, and supply and demand forecasting. Lauren has served as the liaison between planning, and engineering teams, and appreciates the teamwork and communication skills needed to successfully integrate planning and design concepts to meet regulatory requirements. She has also served as the project manager and project specialist for numerous water resource studies in Southern California.

Professional Experience

- *Castaic Lake Water Agency (CLWA), 2010 Urban Water Management Plan Update, Santa Clarita, CA:* Preparation of the 2010 regional Urban Water Management Plan (UWMP) is being completed on behalf of CLWA and its four retail purveyors. The water supply analysis includes the SWP, local groundwater, reliability programs, other imported supplies and recycled water. Ms. Everett is the technical lead on the UWMP development.

- *2010 Urban Water Management Plan Update for Improvement District 4, Kern County Water Agency, Bakersfield, CA.* Preparation of the 2010 regional UWMP, for the Kern County Water Agency's (KCWA) Improvement District No. 4 (ID4), which represents the urban portion of KCWA's State Water Project wholesale service area includes the SWP, local groundwater, reliability programs, other imported supplies and recycled water. Ms. Everett is the technical lead on the UWMP development.

- *Castaic Lake Water Agency (CLWA), Upper Santa Clara River IRWMP Proposition 84 Implementation Grant Application, Santa Clarita, CA:* The Project is the preparation of an Implementation Grant application requesting funds from the Proposition 84 Integrated Regional Water Management (IRWM) Implementation Grant Program for five Candidate Projects within the Upper Santa Clara River IRWM Plan. Ms. Everett managed the effort and was the technical lead on the application preparation.

- *Castaic Lake Water Agency (CLWA), Upper Santa Clara River IRWMP Proposition 84 Planning Grant Application, Santa Clarita, CA:* The Project is the preparation of a Planning Grant application requesting funds from the Proposition 84 IRWM Planning Grant Program for the 2010 Update of the Upper Santa Clara River IRWM Plan. Ms. Everett managed the effort and was the technical lead on the application preparation.

- *Los Angeles County Department of Public Works, Antelope Valley Integrated Regional Water Management Plan (Plan):* Ms. Everett managed the development of the Plan, which was

designed with a regional focus for the sustainable management of water resources in the Antelope Valley Region for the next twenty-five years. Over 40 agencies within the Antelope Valley participated in the planning process.

- *Los Angeles County Department of Public Works, Antelope Valley Integrated Regional Water Management Plan, Proposition 50 Round 2 Step 1 & Step 2 Grant Application, Antelope Valley, CA:* Kennedy/Jenks submitted a proposal for an implementation grant requesting $25 million for seven projects that targeted reducing the mismatch between supply and demand projected for the Region by 2035. Ms. Everett managed the preparation of the Step 1 and Step 2 grant applications.

- *Los Angeles County Department of Public Works, Antelope Valley Integrated Regional Water Management Plan, Region Acceptance Process (RAP) Application, Antelope Valley, CA:* Kennedy/Jenks submitted a proposal successfully defending the IRWMP Region's boundary to the Department of Water Resources allowing the IRWMP Region to remain in the Proposition 84 IRWMP Program. Ms. Everett managed the RAP effort.

- *Kern County Water Agency, Tulare Lake Basin Portion of Kern County Integrated Regional Water Management Plan (Plan), Kern County, CA:* Ms. Everett is currently assisting in the development of the integrated regional planning document, and providing assistant management responsibilities. Over 40 agencies within the Kern Region are participating in the Kern Region IRWM planning process.

- *Kern County Water Agency, Tulare Lake Basin Portion of Kern County Integrated Regional Water Management Plan, Region Acceptance Process Application, Kern County, CA:* Kennedy/Jenks submitted a proposal successfully defending the IRWMP Region's boundary to the Department of Water Resources allowing the IRWMP Region to remain in the Proposition 84 IRWMP Program. Ms. Everett managed the RAP effort.

- *Castaic Lake Water Agency (CLWA), Water Supply Reliability Plan Update, Santa Clarita, CA:* The plan and update are needed in order to evaluate the technical, environmental, and economic issues associated with potential water supply reliability projects. Ms. Everett's responsibilities include characterization of the water supply and demands for the region, and general report content.

- *Los Angeles County Department of Public Works, North Los Angeles/Kern County Regional Recycled Water Master Plan Environmental Impact Report, Antelope Valley, CA:* Kennedy/Jenks assisted Environmental Science Associates in preparing the hydrology, hazards and hazardous materials, and geology sections of the Environmental Impact Report. Ms. Everett managed the Kennedy/Jenks team on this effort.

- *Ventura County Waterworks District No. 8 Recycled Water Master Plan, Simi Valley, CA:* This project consists of the design of a recycled water distribution system to serve municipal and industrial customers within the City of Simi Valley. Ms. Everett's responsibilities included characterization of the environmental issues associated with implementing the system, identification of required permits and approvals, and general report coordination.

Dana Haasz

Project Manager

Education

M.S., Applied Geography, New Mexico State University, Las Cruces, NM
B.S., Geography and Environmental Science, McGill University, Montreal, Canada

Affiliations

California Urban Water Conservation Council
Western Water Alliance Steering Committee and Hiring Committee
Technical Advisor to CALFED Appropriate Water Measurement Panel/Agricultural and Urban
Environmental Justice Coalition for Water Steering Committee
Water Education Foundation, Water Leader (2003) and Water Leader Mentor (2009)

Professional Summary

Dana Haasz has 13 years experience in water conservation, demand modeling and resource planning. She currently manages the water use efficiency projects and programs for Kennedy/Jenks. Projects range from planning, program assessment, demand modeling and helping agencies to meet regulatory requirements, to the development of implementation programs, budgets, monitoring and quantification.

Dana spent the six years as the Water Conservation Administrator at San Francisco Public Utilities Commission. Ms. Haasz has extensive experience in regulatory compliance issues and long-term water supply planning for the retail and wholesale service areas, including planning, organizing, developing and administering retail water conservation programs including the identification, evaluation, and public promotion of conservation with industry, builders, developers, public agencies, customers, and community groups. Ms. Haasz's activities also extended to policy development, from legislative initiatives and statewide conservation issues to development of a revolving loan program and other efficiency-related activities at the local level.

In Ms. Haasz's six years at San Francisco Public Utilities Commission, she directly managed and implemented the growth of the Conservation department from a customer-service based residential rebate program to a multi-faceted approach that includes all customers, various types of incentives and services, outreach, education, policy and coordination with local, regional and state level activities. Her approach towards the expansion of the program was to merge public policy needs with solid business principles and quantified outcomes so as to make obvious and appropriate efficiency decisions for the customer as well as honoring the agency's responsibility to the ratepayer.

Prior to the SFPUC, Dana developed modeling and theoretical skills at the Pacific Institute for Water, Development and Environment where she co-authored an analysis quantifying water conservation potential for the state and policies and programs designed to achieve that goal.

Project Experience

2010 Urban Water Management Plans (18 water systems), Golden State Water Company, Rancho Cordova, CA. Currently providing water conservation services for GSWC's 2010 UWMP update for the 18 water systems that meet the criteria for the requirements of an UWMP. Updates will include analysis of water conservation programs status for the purposes of evaluating compliance with AB 1420 and SBX7, in coordination with the local Alliance for Water Awareness and Conservation.

2010 Urban Water Management Plan Update, Stockton East Water District, Stockton, CA. Currently providing water conservation services for preparation of the District's 2010 UWMP update, including water supplies, demands, and conservation measures, as well as addressing AB 1420 and SBX7-7 regulations.

The update will also include a water shortage contingency plan as it applies to Stockton East Water District being an urban water wholesaler.

Complete Water Conservation and Demand Reduction Program Evaluation, City of Roseville, Roseville, CA. Developed an implementation plan, including a review of past activities, identification of potential conservation measures, cost benefit analysis, program modeling and design to prepare conservation plan for City of Roseville, that meets the 20x2020 requirements.

Water Conservation Efficiency Master Plan, City of Riverside, Riverside, CA developed a conservation implementation program for the City of Riverside. Evaluated Riverside's past water use efficiency program, identified potential conservation measures, performed cost benefit analysis, modeled potential programs and developed a scored options matrix to assist Riverside with efforts to effectively comply the 20x2020 requirements and guide program design and implementation.

2010 Urban Water Management Plan Update, Castaic Lake Water Agency, Santa Clarita, CA. Currently providing water conservation services for preparation of the 2010 regional Urban Water Management Plan (UWMP), which is being completed on behalf of CLWA and its four retail purveyors. The water supply analysis includes the SWP, local groundwater, reliability programs, other imported supplies and recycled water. The UWMP also includes an evaluation of the various alternative water management strategies and supplies available to the Valley and based on the evaluation, will recommend water supply strategies.

2010 Urban Water Management Plan Update, Mojave Water Agency, Apple Valley, CA. Currently providing water conservation services to produce Mojave Water Agency's (MWA) 2010 UWMP with particular focus on Best Management Practices (BMPs) and new regulations. A State Water Project contractor, MWA's plan is to be completed in cooperation with numerous retailers from within their service area. This update will also include analysis of the various agencies' water conservation programs status for the purposes of evaluating compliance with AB 1420 and SBX7, in coordination with the local Alliance for Water Awareness and Conservation.

2010 Urban Water Management Plan Update, Western Municipal Water District, Riverside County, CA. Currently providing water conservation services for preparation of the District's 2010 UWMP update, including water supplies, demands, and conservation measures.

2010 Park Water Company Urban Water Management Plan and Water Use Efficiency Plan, CA. Currently providing water conservation services for preparation of the District's 2010 UWMP update, including water supplies, demands, and conservation measures.

2010 Suburban Water Systems Urban Water Management Plan, Oxnard, CA. Currently providing water conservation services for preparation of the District's 2010 UWMP update, including water supplies, demands, and conservation measures.

2010 Urban Water Management Plan Update for Improvement District 4, Kern County Water Agency, Bakersfield, CA. Currently providing water conservation services for preparation of the 2010 regional UWMP, for the Kern County Water Agency's (KCWA) Improvement District No. 4 (ID4), which represents the urban portion of KCWA's State Water Project wholesale service area. The water supply analysis includes the SWP, local groundwater, reliability programs, other imported supplies and recycled water. In addition to the water supply analyses required by the UWMP Act, this UWMP update will also include analysis of local water conservation program status for the purposes of evaluating compliance with AB 1420 and SBX7.

2010 Urban Water Management Plan Update, San Bernardino Valley Municipal Water District, San Bernardino, CA. Currently providing water conservation services for update of the District's 2010 UWMP with particular focus on Best Management Practices (BMP's) and new regulations. The work will also include coordination with California Department of Water Resources reviews and approvals.

2010 Urban Water Management Plan, Lake Arrowhead Community Services District, Lake Arrowhead, CA. Currently providing water conservation services for production of this retail water purveyor's 2010 UWMP update.

2010 Urban Water Management Plan, North of the River Municipal Water District and Oildale Mutual Water Company, Kern County, CA. Currently providing water conservation services for preparation of the 2010 UWMP update for Kern County Water Agency Improvement District No. 4's (ID4) participating retail purveyors, North of the River Municipal Water District and Oildale Mutual Water Company. The UWMP update will provide information on ID4's wholesale service area and operations and will include data and information about the ID4 retail purveyor service areas and operations. The UWMP update will also include information on ID4 retail purveyor service areas that recover groundwater within ID4.

2010 Urban Water Management Plan, City of Ventura, CA. Currently providing water conservation services for production of the City's 2010 UWMP update. The water supply analysis includes local groundwater, reliability programs, other imported supplies and recycled water. In addition to the water supply analyses required by the UWMP Act, this UWMP update will also include analysis of local water conservation program status for the purposes of evaluating compliance with AB 1420 and SBX7.

2010 Urban Water Management Plan, Central Coast Water Authority, Ventura County, CA. Currently providing QA/QC and third-party technical review regarding water conservation practices for the CCWA's 2010 UWMP update.

2010 Urban Water Management Plan Update, Western Municipal Water District, Riverside County, CA. Currently providing water conservation services for preparation of the District's 2010 UWMP update, including water supplies, demands, and conservation measures.

Project Experience Prior to Kennedy/Jenks

Water Conservation Administrator, San Francisco Public Utilities Commission

Water Saver Program: Developed market-based approach to conservation programs. The program aimed to secure permanent water savings for large commercial and industrial customers by providing technical support and financial incentive incentives based on the volume of saved water. The program allowed SFPUC to support larger process-oriented uses and other specific needs that are not part of the traditional fixture-based rebate programs. Participants included hotels, hospitals, colleges, and food growers.

Unaccounted for Water Analysis: Managed the first large urban agency implementation of the full AWWA M36 Water Loss process. The multi-phase analysis to discover, diagnose, and develop an implementation plan for capturing water system losses consisted of quantification and categorization of losses, identifying cost effective potential recovery and ,disaggregating city zones to prioritize and develop leak detection and repair implementation plan and providing leak detection training to City staff at the SFPUC.

Data Management: Managed design and development of database designed to improve the analytic capacity of conservation programs and link activities to water savings - actual and estimated – customer type, spatial information and more. The system also incorporated administrative tasks such as issuing rebates, mailings, inspection scheduling and follow up.

Low-income Direct Install Program: Developed high-efficiency toilet (HET) direct-installation and water audit program in coordination with community groups in order to save water in a hard to reach population and mitigate the impacts of rising water rates. The program provided free HETs to single family customers and a voucher program for multi-family residents in low-income communities. Local nonprofit groups were enlisted and community members trained in conservation principles in order to help market the program. program received two grants of $200,000 each, one from the California Department of Water Resources and one from the U.S. Bureau of Reclamation.

Education: Developed materials and an implementation plan for a water resources education program that would be compliant with both state and CUWCC requirements.

Municipal: Launched municipal audit program with detailed potential efficiency improvements, costs and implementation recommendations.

Conservation Legislation: Developed and worked to pass local conservation ordinances including a residential retrofit on resale for ordinance and a replacement ordinance for commercial accounts. Improvements include fixture replacement (toilets, showerheads aerators) and leak repair. Worked with the San Francisco Department of Building Inspection to train City inspectors, develop implementation materials and process.

Baseline Analysis: Participated in modeling of baseline use in San Francisco by customer type, potential demand reduction opportunities, costs and implementation options. Preferred alternative became the basis for SFPUC program activities.

California Urban Water Conservation Council: Represented Group 1 water agencies as convener of the CUWCC, 2005-2006 / Represented Group 2 Environmental Organizations as convener 2003-2004.

Appendix C

Purveyor Supply and Demand Tables

TABLE C-1
AVERAGE/NORMAL YEAR: EXISTING WATER SUPPLIES

EXISTING SUPPLIES[a]	2015	2020	2025	2030	2035	2040	2045	2050
Existing Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	1,825	1,825	1,825	1,825	1,825	1,825	1,825	1,825
SCWD	10,500	10,500	10,500	11,500	11,500	11,500	11,500	11,500
VWC	11,675	11,675	11,675	11,675	11,675	11,675	11,675	11,675
Total	*24,000*	*24,000*	*24,000*	*25,000*	*25,000*	*25,000*	*25,000*	*25,000*
Saugus Formation								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	3,525	3,525	3,525	3,525	3,525	3,525	3,525	3,525
SCWD[d]	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
VWC	2,850	3,350	3,350	3,350	3,350	3,350	3,350	3,350
Total	*9,225*	*10,225*	*10,225*	*10,225*	*10,225*	*10,225*	*10,225*	*10,225*
Recycled Water[e]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	325	325	325	325	325	325	325	325
Total	*325*	*325*	*325*	*325*	*325*	*325*	*325*	*325*
Imported Water								
SWP Table A and Carryover[f]								
LACWWD 36[c]	1,656	1,943	2,217	2,489	2,688	2,901	3,091	3,269
NCWD	8,084	8,918	9,320	10,060	10,349	10,755	11,116	11,469
SCWD	23,918	24,263	24,268	23,963	24,541	24,979	25,369	25,787
VWC	24,442	22,776	21,795	20,888	19,822	18,765	17,825	16,875
Total	*58,100*	*57,900*	*57,600*	*57,400*	*57,400*	*57,400*	*57,400*	*57,400*
SWP Flexible Storage Accounts[g]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

TABLE C-1 CON'T

	2015	2020	2025	2030	2035	2040	2045	2050
Buena Vista-Rosedale								
LACWWD 36[(c)]	325	375	450	500	525	575	625	650
NCWD	1,600	1,750	1,825	1,975	2,050	2,100	2,175	2,250
SCWD	4,675	4,775	4,775	4,725	4,825	4,900	4,975	5,050
VWC	4,400	4,100	3,950	3,800	3,600	3,425	3,225	3,050
Total	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*
Nickel Water - Newhall Land								
VWC *Total*	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Banking Programs[(g)]								
Rosedale Rio-Bravo								
LACWWD 36[(c)]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic								
LACWWD 36[(c)]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic – Newhall Land								
VWC *Total*	0	0	0	0	0	0	0	0
TOTAL EXISTING SUPPLIES								
LACWWD 36[(c)]	1,981	2,318	2,667	2,989	3,213	3,476	3,716	3,919
NCWD	15,034	16,018	16,495	17,385	17,749	18,205	18,641	19,069
SCWD	41,943	42,888	42,893	43,538	44,216	44,729	45,194	45,687
VWC	45,299	43,833	42,702	41,645	40,379	39,147	38,007	36,882
Total	**104,257**	**105,057**	**104,757**	**105,557**	**105,557**	**105,557**	**105,558**	**105,557**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown in this table. As indicated in Table 3-10, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(e) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(f) SWP supplies are based on the Department of Water Resources "*2009 State Water Project Delivery Reliability Report*."

(g) Not needed in average/normal years.

TABLE C-2
AVERAGE/NORMAL YEAR: PLANNED AND TOTAL WATER SUPPLIES

PLANNED SUPPLIES[a]	2015	2020	2025	2030	2035	2040	2045	2050
Future Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC[d]	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Total	*-*	*1,000*	*2,000*	*3,000*	*4,000*	*5,000*	*6,000*	*7,000*
Saugus Formation								
LACWWD 36[c][e]	500	500	500	500	500	500	500	500
NCWD	875	875	875	875	875	875	875	875
SCWD	0	0	0	0	0	0	0	0
VWC	0	0	0	0	0	0	0	0
Total	*1,375*	*1,375*	*1,375*	*1,375*	*1,375*	*1,375*	*1,375*	*1,375*
Recycled Water[f]								
LACWWD 36[c]	0	50	50	50	50	50	50	50
NCWD	200	500	1,000	1,275	1,775	2,275	2,775	3,275
SCWD	100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC	675	1,675	2,675	4,175	5,675	7,675	9,675	11,875
Total	*975*	*2,725*	*5,225*	*7,775*	*10,275*	*13,775*	*17,275*	*20,975*
Banking Programs[g]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	0	0	0	0	0	0	0	0
Total	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
TOTAL PLANNED SUPPLIES								
LACWWD 36[c]	500	550	550	550	550	550	550	550
NCWD	1,075	1,375	1,875	2,150	2,650	3,150	3,650	4,150
SCWD	100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC	675	2,675	4,675	7,175	9,675	12,675	15,675	18,875
Total	**2,350**	**5,100**	**8,600**	**12,150**	**15,650**	**20,150**	**24,650**	**29,350**

TABLE C-2 CON'T

PURVEYOR EXISTING AND PLANNED SUPPLIES	2015	2020	2025	2030	2035	2040	2045	2050
LACWWD 36[(c)]	2,481	2,868	3,217	3,539	3,763	4,026	4,266	4,469
NCWD	16,109	17,393	18,370	19,535	20,399	21,355	22,291	23,219
SCWD	42,043	43,388	44,393	45,813	46,991	48,504	49,969	51,462
VWC	45,974	46,508	47,377	48,820	50,054	51,822	53,682	55,757
Total	**106,607**	**110,157**	**113,357**	**117,707**	**121,207**	**125,707**	**130,208**	**134,907**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production remains within the sustainable ranges identified in Table 3-7 of 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-10, existing and planned groundwater pumping remain within the basin operating plan shown on Table 3- 5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) Conversion of Newhall Land agricultural groundwater supplies to VWC M&I supplies.

(e) LACWWD 36 anticipates connecting a newly completed well in 2011.

(f) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(g) Not needed in average/normal years.

TABLE C-3
AVERAGE/NORMAL YEAR: DEMANDS WITH SBX7-7 REDUCTIONS AND COMPARISON TO TOTAL SUPPLIES

WATER DEMANDS W/ AND W/O CONSERVATION[a]	2015	2020	2025	2030	2035	2040	2045	2050
LACWWD 36[b]								
Demand w/o Conservation[c]	1,759	2,189	2,619	3,048	3,478	3,908	4,338	4,768
Anticipated Conservation Objective[d]	176	438	524	610	696	782	868	954
Reduction from Recycled Water[e]	0	50	50	50	50	50	50	50
Net Anticipated Water Conservation[f]	176	388	474	560	646	732	818	904
Demand w/ Conservation[g]	1,584	1,802	2,146	2,489	2,833	3,177	3,521	3,865
Existing and Planned Supplies	*2,481*	*2,868*	*3,217*	*3,539*	*3,763*	*4,026*	*4,266*	*4,469*
SBX7-7 Compliance Calculations								
NCWD								
Demand w/o Conservation[c]	12,571	14,246	15,922	17,598	19,273	20,949	22,624	24,300
20x2020 Reduction[h]	1,365	2,982	3,204	3,489	3,742	3,995	4,248	4,501
Reduction from Recycled Water[e]	200	500	1,000	1,275	1,775	2,275	2,775	3,275
Reduction from Water Conservation[i]	1,165	2,482	2,482	2,482	2,482	2,482	2,482	2,482
Demand w/ Conservation[j]	11,406	11,764	13,439	15,116	16,791	18,467	20,142	21,818
Existing and Planned Supplies	*16,109*	*17,393*	*18,370*	*19,535*	*20,399*	*21,355*	*22,291*	*23,219*
SCWD								
Demand w/o Conservation[c]	31,633	34,814	37,995	41,176	44,357	47,538	50,719	53,900
20x2020 Reduction[k]	3,524	7,557	8,067	8,576	9,085	9,595	10,104	10,614
Reduction from Recycled Water[e]	100	500	1,500	2,275	2,775	3,775	4,775	5,775
Reduction from Water Conservation[i]	3,424	7,057	7,057	7,057	7,057	7,057	7,057	7,057
Demand w/ Conservation[j]	28,209	27,757	30,938	34,119	37,300	40,481	43,662	46,843
Existing and Planned Supplies	*42,043*	*43,388*	*44,393*	*45,813*	*46,991*	*48,504*	*49,969*	*51,462*
VWC								
Demand w/o Conservation[c]	34,107	37,235	40,362	43,490	46,617	49,745	52,872	56,000
20x2020 Reduction[l]	3,962	8,648	9,372	10,095	10,819	11,542	12,266	12,990
Reduction from Recycled Water[e]	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Reduction from Water Conservation[i]	2,962	6,648	6,648	6,648	6,648	6,648	6,648	6,648
Demand w/ Conservation[j]	31,144	30,587	33,714	36,842	39,968	43,097	46,223	49,352
Existing and Planned Supplies	*45,974*	*46,508*	*47,377*	*48,820*	*50,054*	*51,822*	*53,682*	*55,757*

TABLE C-3 CON'T

REGIONAL SUMMARY	2015	2020	2025	2030	2035	2040	2045	2050
Demand w/o Conservation[(c)]	80,070	88,484	96,898	105,312	113,726	122,140	130,554	138,968
Total 20x2020 Reduction	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Total Reduction from Recycled Water[(m)]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Total Reduction from Water Conservation	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation	**72,343**	**71,908**	**80,236**	**88,564**	**96,892**	**105,220**	**113,549**	**121,877**
TOTAL EXISTING AND PLANNED SUPPLIES	**106,607**	**110,157**	**113,357**	**117,707**	**121,207**	**125,707**	**130,208**	**134,907**

Notes:

(a) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies. Known parties potentially seeking annexation include Legacy/Stevenson Ranch Phase 5, Tapia Canyon and Tesoro Del Valle.
(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.
(c) Demand w/o Conservation from Table 2-2.
(d) LACWWD 36 conservation objective estimated at 20% of projected demand commencing 2020; see Table 2-21.
(e) Recycled water projections from Table 4-3.
(f) Net Anticipated Conservation for LACWWD 36 is Anticipated Conservation Objective minus Reduction from Recycled Water.
(g) Demand w/ Conservation for LACWWD 36 is Demand w/o Conservation minus Net Anticipated Conservation.
(h) NCWD 20x2020 Reduction from Table 2-16. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(i) Reduction from Water Conservation is 20x2020 Reduction minus Reduction from Recycled Water for 2015 and 2020; the quantity of water conservation remains at least at 2020 amounts through 2050.
(j) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.
(k) SCWD 20x2020 Reduction from Table 2-18. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(l) VWC 20x2020 Reduction from Table 2-20. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(m) Recycled water reductions do not include demands from Honor Rancho.

TABLE C-4
SINGLE-DRY YEAR: EXISTING WATER SUPPLIES

EXISTING SUPPLIES[a]	2015	2020	2025	2030	2035	2040	2045	2050
Existing Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	1,150	1,150	1,150	1,225	1,250	1,250	1,250	1,225
SCWD	8,150	8,150	8,150	8,150	8,150	8,150	8,150	8,150
VWC	11,000	10,950	10,900	11,675	11,650	11,625	11,600	11,275
Total	*20,300*	*20,250*	*20,200*	*21,050*	*21,050*	*21,025*	*21,000*	*20,650*
Saugus Formation								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	4,975	4,975	4,975	4,975	4,975	4,975	4,975	4,975
SCWD[d]	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
VWC	11,925	11,925	11,925	11,925	11,925	11,925	11,925	11,925
Total	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*	*20,400*
Recycled Water[e]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	325	325	325	325	325	325	325	325
Total	*325*	*325*	*325*	*325*	*325*	*325*	*325*	*325*
Imported Water								
SWP Table A and Carryover[f]								
LACWWD 36[c]	405	436	440	444	468	499	522	543
NCWD	1,722	1,734	1,657	1,630	1,670	1,731	1,786	1,826
SCWD	6,171	5,892	5,208	4,736	4,720	4,710	4,701	4,696
VWC	3,602	2,938	2,694	2,290	2,242	2,161	2,091	2,036
Total	*11,900*	*11,000*	*9,999*	*9,100*	*9,100*	*9,101*	*9,100*	*9,101*
SWP Flexible Storage Accounts[g]								
LACWWD 36[c]	206	185	206	228	241	257	268	279
NCWD	877	738	776	838	859	890	918	939
SCWD	3,143	2,507	2,438	2,436	2,427	2,422	2,418	2,415
VWC	1,834	1,250	1,261	1,177	1,153	1,111	1,075	1,047
Total	*6,060*	*4,680*	*4,681*	*4,679*	*4,680*	*4,680*	*4,679*	*4,680*
Buena Vista-Rosedale								
LACWWD 36[c]	400	450	500	550	575	625	650	675
NCWD	1,650	1,800	1,900	2,025	2,075	2,150	2,225	2,250
SCWD	5,925	6,150	5,950	5,925	5,875	5,850	5,825	5,825

VWC		3,025	2,600	2,650	2,500	2,475	2,375	2,300	2,250
	Total	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*
Nickel Water - Newhall Land									
VWC	*Total*	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Banking Programs									
Rosedale Rio-Bravo[h]									
LACWWD 36[c]		775	900	1,000	1,075	1,125	1,200	1,250	1,275
NCWD		3,275	3,625	3,725	4,000	4,050	4,150	4,250	4,325
SCWD		11,750	12,275	11,725	11,575	11,400	11,300	11,200	11,125
VWC		4,200	3,200	3,550	3,350	3,425	3,350	3,300	3,275
	Total	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*	*20,000*
Semitropic[i]									
LACWWD 36[c]		510	594	0	0	0	0	0	0
NCWD		2,170	2,364	0	0	0	0	0	0
SCWD		7,778	8,035	0	0	0	0	0	0
VWC		4,541	4,007	0	0	0	0	0	0
	Total	*15,000*	*15,000*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic - Newhall Land[j]									
VWC	*Total*	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
TOTAL EXISTING SUPPLIES									
LACWWD 36[c]		2,296	2,565	2,146	2,297	2,409	2,581	2,690	2,772
NCWD		15,819	16,386	14,183	14,693	14,879	15,146	15,404	15,540
SCWD		46,417	46,509	36,971	36,322	36,072	35,932	35,794	35,711
VWC		47,009	43,752	39,862	39,799	39,752	39,429	39,173	38,690
	Total	**111,542**	**109,212**	**93,162**	**93,111**	**93,112**	**93,088**	**93,061**	**92,713**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown above. Existing pumping is consistent with Table 3-8 of the 2009 Groundwater Basin Yield Analysis for 1977 single-dry year. As indicated in Table 3-11, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(e) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(f) SWP supplies are based on the Department of Water Resources "2009 State Water Project Delivery Reliability Report."

(g) Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with Ventura County entities expires after 2015.

(h) CLWA has a maximum withdrawal capacity of 20,000 AFY and a storage capacity of 100,000 AF. As of 6/1/2011, there is 100,000 AF of recoverable water.

(i) CLWA has 45,920 AF of recoverable water as of 6/1/2011.

(j) Newhall Land has a maximum withdrawal capacity of 4,950 AFY and a storage capacity of 55,000 AF. As of 6/1/2011 there is 18,892 AF of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is assumed available to VWC.

TABLE C-5
SINGLE-DRY YEAR: PLANNED AND TOTAL WATER SUPPLIES

PLANNED SUPPLIES[a]	2015	2020	2025	2030	2035	2040	2045	2050
Future Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	200	250	300	850	850	875	900	750
VWC[d]	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Total	*200*	*1,250*	*2,300*	*3,850*	*4,850*	*5,875*	*6,900*	*7,750*
Saugus Formation								
LACWWD 36[c][e]	500	825	875	925	975	1,000	1,050	1,075
NCWD	1,400	2,950	3,025	3,150	3,200	3,275	3,325	3,400
SCWD	975	5,175	5,200	5,150	5,250	5,325	5,400	5,475
VWC (Restored Well)	825	3,777	3,777	3,777	3,777	3,777	3,777	3,750
VWC (New Wells)	-	973	823	698	498	323	148	-
Total	*3,700*	*13,700*	*13,700*	*13,700*	*13,700*	*13,700*	*13,700*	*13,700*
Recycled Water[f]								
LACWWD 36[c]	0	50	50	50	50	50	50	50
NCWD	200	500	1,000	1,275	1,775	2,275	2,775	3,275
SCWD	100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC	675	1,675	2,675	4,175	5,675	7,675	9,675	11,875
Total	*975*	*2,725*	*5,225*	*7,775*	*10,275*	*13,775*	*17,275*	*20,975*
Banking Programs[g]								
LACWWD 36[c]	0	0	440	488	1,028	1,097	1,147	1,193
NCWD	0	0	1,657	1,791	3,670	3,804	3,925	4,012
SCWD	0	0	5,208	5,205	10,374	10,351	10,332	10,321
VWC	0	0	2,694	2,516	4,928	4,749	4,596	4,474
Total	*0*	*0*	*10,000*	*10,000*	*20,000*	*20,000*	*20,000*	*20,000*
TOTAL PLANNED SUPPLIES								
LACWWD 36[c]	500	875	1,365	1,463	2,053	2,147	2,247	2,318
NCWD	1,600	3,450	5,682	6,216	8,645	9,354	10,025	10,687
SCWD	1,275	5,925	12,208	13,480	19,249	20,326	21,407	22,321
VWC	1,500	7,425	11,969	14,166	18,878	21,524	24,196	27,099
Total	**4,875**	**17,675**	**31,225**	**35,325**	**48,825**	**53,350**	**57,875**	**62,425**

TABLE C-5 CON'T

PURVEYOR EXISTING AND PLANNED SUPPLIES								
LACWWD 36[(c)]	2,796	3,440	3,511	3,760	4,462	4,728	4,937	5,090
NCWD	17,419	19,836	19,865	20,909	23,524	24,500	25,429	26,227
SCWD	47,692	52,434	49,179	49,802	55,321	56,258	57,201	58,032
VWC	48,509	51,177	51,831	53,965	58,630	60,953	63,369	65,789
Total	**116,417**	**126,887**	**124,387**	**128,436**	**141,937**	**146,438**	**150,936**	**155,138**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation, including 3,777 AFY of restored capacity from VWC Well 201 and approximately 10,000 AFY of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1977 single dry-year levels identified in Table 3-8 of the 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-11, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3- 5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) Conversion of Newhall Land agricultural groundwater supplies to VWC M&I supplies.

(e) Includes 500 AFY from a newly completed well in 2011.

(f) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(g) Includes 10,000 AF of additional banking programs by 2025 and an additional 10,000 AF by 2035.

TABLE C-6
SINGLE-DRY YEAR: DEMANDS WITH SBX7-7 REDUCTIONS AND COMPARISON TO TOTAL SUPPLIES

WATER DEMANDS W/ AND W/O CONSERVATION[a]	2015	2020	2025	2030	2035	2040	2045	2050
LACWWD 36[b]								
Demand w/o Conservation[c]	1,935	2,408	2,881	3,353	3,826	4,299	4,772	5,245
Anticipated Conservation Objective[d]	176	438	524	610	696	782	868	954
Reduction from Recycled Water[e]	0	50	50	50	50	50	50	50
Net Anticipated Water Conservation[f]	176	388	474	560	646	732	818	904
Demand w/ Conservation[g]	1,759	2,020	2,407	2,794	3,181	3,568	3,955	4,342
Existing and Planned Supplies	*2,796*	*3,440*	*3,511*	*3,760*	*4,462*	*4,728*	*4,937*	*5,090*
SBX7-7 Compliance Calculations								
NCWD								
Demand w/o Conservation[c]	13,828	15,671	17,514	19,358	21,200	23,044	24,886	26,730
20x2020 Reduction[h]	1,365	2,982	3,204	3,489	3,742	3,995	4,248	4,501
Reduction from Recycled Water[e]	200	500	1,000	1,275	1,775	2,275	2,775	3,275
Reduction from Water Conservation[i]	1,165	2,482	2,482	2,482	2,482	2,482	2,482	2,482
Demand w/ Conservation[j]	12,663	13,188	15,031	16,876	18,718	20,562	22,404	24,248
Existing and Planned Supplies	*17,419*	*19,836*	*19,865*	*20,909*	*23,524*	*24,500*	*25,429*	*26,227*
SCWD								
Demand w/o Conservation[c]	34,796	38,295	41,795	45,294	48,793	52,292	55,791	59,290
20x2020 Reduction[k]	3,524	7,557	8,067	8,576	9,085	9,595	10,104	10,614
Reduction from Recycled Water[e]	100	500	1,500	2,275	2,775	3,775	4,775	5,775
Reduction from Water Conservation[i]	3,424	7,057	7,057	7,057	7,057	7,057	7,057	7,057
Demand w/ Conservation[j]	31,372	31,238	34,737	38,236	41,736	45,235	48,734	52,233
Existing and Planned Supplies	*47,692*	*52,434*	*49,179*	*49,802*	*55,321*	*56,258*	*57,201*	*58,032*
VWC								
Demand w/o Conservation[c]	37,517	40,959	44,398	47,839	51,278	54,720	58,159	61,600
20x2020 Reduction[l]	3,962	8,648	9,372	10,095	10,819	11,542	12,266	12,990
Reduction from Recycled Water[e]	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Reduction from Water Conservation[i]	2,962	6,648	6,648	6,648	6,648	6,648	6,648	6,648
Demand w/ Conservation[j]	**34,555**	**34,310**	**37,750**	**41,191**	**44,630**	**48,072**	**51,511**	**54,951**
Existing and Planned Supplies	*48,509*	*51,177*	*51,831*	*53,965*	*58,630*	*60,953*	*63,369*	*65,789*

TABLE C-6 CON'T

REGIONAL SUMMARY	2015	2020	2025	2030	2035	2040	2045	2050
Demand w/o Conservation[(c)]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
Total 20x2020 Reduction	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Total Reduction from Recycled Water[(m)]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Total Reduction from Water Conservation	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**
TOTAL EXISTING AND PLANNED SUPPLIES	**116,417**	**126,887**	**124,387**	**128,436**	**141,937**	**146,438**	**150,936**	**155,138**

Notes:

(a) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies. Known parties potentially seeking annexation include Legacy/Stevenson Ranch Phase 5, Tapia Canyon and Tesoro Del Valle.
(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.
(c) Demand w/o Conservation from Table 2-2. Includes a 10% increase in demand during dry years.
(d) LACWWD 36 conservation objective estimated at 20% of projected demand commencing 2020; see Table 2-21.
(e) Recycled water projections from Table 4-3.
(f) Net Anticipated Conservation for LACWWD 36 is Anticipated Conservation Objective minus Reduction from Recycled Water.
(g) Demand w/ Conservation for LACWWD 36 is Demand w/o Conservation minus Net Anticipated Conservation.
(h) NCWD 20x2020 Reduction from Table 2-16. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(i) Reduction from Water Conservation is 20x2020 Reduction minus Reduction from Recycled Water for 2015 and 2020; the quantity of water conservation remains at least at 2020 amounts through 2050.
(j) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.
(k) SCWD 20x2020 Reduction from Table 2-18. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(l) VWC 20x2020 Reduction from Table 2-20. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(m) Recycled water reductions do not include demands from Honor Rancho.

TABLE C-7
EXISTING MULTIPLE-DRY YEAR: EXISTING WATER SUPPLIES

EXISTING SUPPLIES[a]	2015	2020	2025	2030	2035	2040	2045	2050
Existing Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	1,125	1,125	1,125	1,200	1,200	1,200	1,200	1,175
SCWD	7,650	7,675	7,700	8,175	8,175	8,175	8,175	8,025
VWC	11,650	11,625	11,600	12,450	12,450	12,450	12,450	12,125
Total	*20,425*	*20,425*	*20,425*	*21,825*	*21,825*	*21,825*	*21,825*	*21,325*
Saugus Formation								
LACWWD 36[c]								
NCWD	4,975	4,975	4,975	4,975	4,975	4,975	4,975	4,975
SCWD[d]	3,550	3,550	3,550	3,550	3,550	3,550	3,550	3,550
VWC	11,175	11,175	11,175	11,175	11,175	11,175	11,175	11,175
Total	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*	*19,700*
Recycled Water[e]								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC	325	325	325	325	325	325	325	325
Total	*325*	*325*	*325*	*325*	*325*	*325*	*325*	*325*
Imported Water								
SWP Table A and Carryover[f]								
LACWWD 36[c]	1,117	1,278	1,423	1,592	1,691	1,801	1,895	1,968
NCWD	4,915	4,149	4,543	5,058	5,310	5,592	5,834	6,029
SCWD	18,006	16,666	16,406	16,492	16,519	16,542	16,574	16,601
VWC	8,862	10,807	10,628	9,858	9,479	9,065	8,697	8,401
Total	*32,900*	*32,900*	*33,000*	*33,000*	*33,000*	*33,000*	*33,000*	*33,000*
SWP Flexible Storage Accounts[g]								
LACWWD 36[c]	51	45	50	56	60	64	67	70
NCWD	226	148	161	179	188	198	207	214
SCWD	826	593	582	585	586	586	588	589
VWC	407	384	377	350	336	321	308	298
Total	*1,510*	*1,170*	*1,170*	*1,170*	*1,170*	*1,170*	*1,170*	*1,170*
Buena Vista-Rosedale								
LACWWD 36[c]	400	450	500	550	575	625	650	675
NCWD	1,700	1,450	1,575	1,750	1,825	1,925	2,000	2,050
SCWD	6,250	5,800	5,650	5,675	5,675	5,650	5,650	5,650
VWC	2,650	3,300	3,275	3,025	2,925	2,800	2,700	2,625

	Total	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*	*11,000*
Nickel Water - Newhall Land									
VWC	*Total*	1,607	1,607	1,607	1,607	1,607	1,607	1,607	1,607
Banking Programs									
Rosedale Rio-Bravo[h]									
LACWWD 36[c]		577	662	723	801	842	890	931	961
NCWD		2,540	2,150	2,308	2,545	2,643	2,763	2,865	2,944
SCWD		9,306	8,636	8,336	8,297	8,222	8,174	8,139	8,107
VWC		2,577	3,552	3,633	3,357	3,292	3,173	3,065	2,988
	Total	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*	*15,000*
Semitropic[i]									
LACWWD 36[c]		390	447	0	0	0	0	0	0
NCWD		1,718	1,450	0	0	0	0	0	0
SCWD		6,294	5,826	0	0	0	0	0	0
VWC		3,098	3,777	0	0	0	0	0	0
	Total	*11,500*	*11,500*	*0*	*0*	*0*	*0*	*0*	*0*
Semitropic – Newhall Land[j]									
VWC		4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
TOTAL EXISTING SUPPLIES									
LACWWD 36[c]		2,536	2,882	2,696	3,000	3,168	3,380	3,543	3,674
NCWD		17,200	15,447	14,687	15,707	16,142	16,654	17,080	17,387
SCWD		51,882	48,745	42,224	42,774	42,727	42,678	42,676	42,522
VWC		47,300	51,502	47,570	47,096	46,540	45,866	45,278	44,494
	Total	**118,917**	**118,577**	**107,177**	**108,577**	**108,577**	**108,577**	**108,577**	**108,077**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Existing groundwater supplies represent the quantity of groundwater anticipated to be pumped with existing wells. As indicated in Tables 3-8 and 3-9 and Tables 3-4 and 3-5 of the 2009 Groundwater Basin Yield Analysis, individual purveyors may have well capacity in excess of quantities shown above. Existing pumping is consistent with Table 3-8 of the 2009 Groundwater Basin Yield Analysis for 1931-1934 multiple dry-year levels. As indicated in Table 3-12, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3-5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) SCWD's existing Saugus 1 and Saugus 2 wells resumed production in 2011 with the completion of the perchlorate treatment facility.

(e) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(f) SWP supplies are based on the Department of Water Resources "2009 State Water Project Delivery Reliability Report."

(g) Includes both CLWA and Ventura County entities flexible storage accounts. Initial term of agreement with Ventura County entities expires after 2015.

(h) CLWA has a maximum withdrawal capacity of 20,000 AFY and a storage capacity of 100,000 AF. As of 6/1/2011, there is 100,000 AF of recoverable water.

(i) CLWA has 45,920 AF of recoverable water as of 6/1/2011.

(j) Newhall Land has a maximum withdrawal capacity of 4,950 AFY and a storage capacity of 55,000 AF. As of 6/1/2011 there is 18,892 AF of recoverable water. Delivery of stored water from the Newhall Land's Semitropic Water Banking and Exchange Program is assumed available to VWC.

TABLE C-8
MULTIPLE-DRY YEAR: PLANNED AND TOTAL WATER SUPPLIES

PLANNED SUPPLIES[a]	2015	2020	2025	2030	2035	2040	2045	2050
Future Groundwater[b]								
Alluvial Aquifer								
LACWWD 36[c]	0	0	0	0	0	0	0	0
NCWD	0	0	0	0	0	0	0	0
SCWD	0	0	0	0	0	0	0	0
VWC[d]	0	1,000	2,000	3,000	4,000	5,000	6,000	7,000
Total	*0*	*1,000*	*2,000*	*3,000*	*4,000*	*5,000*	*6,000*	*7,000*
Saugus Formation								
LACWWD 36[c][e]	500	750	800	825	850	875	900	925
NCWD	1,250	3,875	3,950	4,050	4,075	4,125	4,175	4,225
SCWD	500	5,700	5,700	5,675	5,750	5,825	5,875	5,925
VWC (Restored Well)	2,375	1,625	1,500	1,400	1,275	1,125	1,000	875
VWC (New Wells)	0	0	0	0	0	0	0	0
Total	*4,625*	*11,950*	*11,950*	*11,950*	*11,950*	*11,950*	*11,950*	*11,950*
Recycled Water[f]								
LACWWD 36[c]	0	50	50	50	50	50	50	50
NCWD	200	500	1,000	1,275	1,775	2,275	2,775	3,275
SCWD	100	500	1,500	2,275	2,775	3,775	4,775	5,775
VWC	675	1,675	2,675	4,175	5,675	7,675	9,675	11,875
Total	*975*	*2,725*	*5,225*	*7,775*	*10,275*	*13,775*	*17,275*	*20,975*
Banking Programs[g]								
LACWWD 36[c]	0	0	323	362	769	819	861	895
NCWD	0	0	1,032	1,150	2,414	2,542	2,652	2,741
SCWD	0	0	3,729	3,748	7,509	7,519	7,534	7,546
VWC	0	0	2,416	2,240	4,309	4,120	3,953	3,819
Total	*0*	*0*	*7,500*	*7,500*	*15,000*	*15,000*	*15,000*	*15,000*
TOTAL PLANNED SUPPLIES								
LACWWD 36[c]	500	800	1,173	1,237	1,669	1,744	1,811	1,870
NCWD	1,450	4,375	5,982	6,475	8,264	8,942	9,602	10,241
SCWD	600	6,200	10,929	11,698	16,034	17,119	18,184	19,246
VWC	3,050	4,300	8,591	10,815	15,259	17,920	20,628	23,569
Total	**5,600**	**15,675**	**26,675**	**30,225**	**41,225**	**45,725**	**50,225**	**54,925**

TABLE C-8 CON'T

PURVEYOR EXISTING AND PLANNED SUPPLIES								
LACWWD 36[(c)]	3,036	3,682	3,869	4,237	4,837	5,124	5,354	5,544
NCWD	18,650	19,822	20,670	22,182	24,406	25,596	26,682	27,628
SCWD	52,482	54,945	53,152	54,472	58,761	59,797	60,860	61,768
VWC	50,350	55,802	56,161	57,912	61,799	63,786	65,906	68,063
Total	**124,517**	**134,252**	**133,852**	**138,802**	**149,802**	**154,302**	**158,802**	**163,002**

Notes:

(a) The distribution of existing and planned supplies does not represent a formal allocation of water supplies among purveyors.

(b) Planned groundwater supplies represent new groundwater well capacity that may be required by an individual purveyor's production objectives in the Alluvial Aquifer and the Saugus Formation, including 3,777 AFY of restored capacity from VWC Well 201 and approximately 10,000 AFY of new Saugus Formation well capacity. When combined with existing purveyor and non-purveyor groundwater supplies, total groundwater production is consistent with the 1931-1934 multiple dry-year levels identified in Table 3-8 of the 2009 Groundwater Basin Yield Analysis. As indicated in Table 3-12, existing and planned groundwater pumping remain within the groundwater operating plan shown on Table 3- 5.

(c) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.

(d) Conversion of Newhall Land agricultural groundwater supplies to VWC M&I supplies.

(e) Includes 500 AFY from a newly completed well in 2011.

(f) Per CLWA Draft Recycled Water Master Plan and Newhall Ranch Specific Plan.

(g) Includes 10,000 AF of additional banking programs by 2025 and an additional 10,000 AF by 2035.

TABLE C-9
MULTIPLE-DRY YEAR: DEMANDS WITH SBX7-7 REDUCTIONS AND COMPARISON TO TOTAL SUPPLIES

WATER DEMANDS W/ AND W/O CONSERVATION[a]	2015	2020	2025	2030	2035	2040	2045	2050
LACWWD 36[b]								
Demand w/o Conservation[c]	1,935	2,408	2,881	3,353	3,826	4,299	4,772	5,245
Anticipated Conservation Objective[d]	176	438	524	610	696	782	868	954
Reduction from Recycled Water[e]	0	50	50	50	50	50	50	50
Net Anticipated Water Conservation[f]	176	388	474	560	646	732	818	904
Demand w/ Conservation[g]	1,759	2,020	2,407	2,794	3,181	3,568	3,955	4,342
Existing and Planned Supplies	*3,036*	*3,682*	*3,869*	*4,237*	*4,837*	*5,124*	*5,354*	*5,544*
SBX7-7 Compliance Calculations								
NCWD								
Demand w/o Conservation[c]	13,828	15,671	17,514	19,358	21,200	23,044	24,886	26,730
20x2020 Reduction[h]	1,365	2,982	3,204	3,489	3,742	3,995	4,248	4,501
Reduction from Recycled Water[e]	200	500	1,000	1,275	1,775	2,275	2,775	3,275
Reduction from Water Conservation[i]	1,165	2,482	2,482	2,482	2,482	2,482	2,482	2,482
Demand w/ Conservation[j]	12,663	13,188	15,031	16,876	18,718	20,562	22,404	24,248
Existing and Planned Supplies	*18,650*	*19,822*	*20,670*	*22,182*	*24,406*	*25,596*	*26,682*	*27,628*
SCWD								
Demand w/o Conservation[c]	34,796	38,295	41,795	45,294	48,793	52,292	55,791	59,290
20x2020 Reduction[k]	3,524	7,557	8,067	8,576	9,085	9,595	10,104	10,614
Reduction from Recycled Water[e]	100	500	1,500	2,275	2,775	3,775	4,775	5,775
Reduction from Water Conservation[i]	3,424	7,057	7,057	7,057	7,057	7,057	7,057	7,057
Demand w/ Conservation[j]	31,372	31,238	34,737	38,236	41,736	45,235	48,734	52,233
Existing and Planned Supplies	*52,482*	*54,945*	*53,152*	*54,472*	*58,761*	*59,797*	*60,860*	*61,768*
VWC								
Demand w/o Conservation[c]	37,517	40,959	44,398	47,839	51,278	54,720	58,159	61,600
20x2020 Reduction[l]	3,962	8,648	9,372	10,095	10,819	11,542	12,266	12,990
Reduction from Recycled Water[e]	1,000	2,000	3,000	4,500	6,000	8,000	10,000	12,200
Reduction from Water Conservation[i]	2,962	6,648	6,648	6,648	6,648	6,648	6,648	6,648
Demand w/ Conservation[j]	**34,555**	**34,310**	**37,750**	**41,191**	**44,630**	**48,072**	**51,511**	**54,951**
Existing and Planned Supplies	*50,350*	*55,802*	*56,161*	*57,912*	*61,799*	*63,786*	*65,906*	*68,063*

TABLE C-9 CON'T

REGIONAL SUMMARY	2015	2020	2025	2030	2035	2040	2045	2050
Demand w/o Conservation[(c)]	88,077	97,333	106,588	115,843	125,099	134,354	143,609	152,865
Total 20x2020 Reduction	9,027	19,626	21,166	22,770	24,342	25,914	27,486	29,058
Total Reduction from Recycled Water[(m)]	1,300	3,050	5,550	8,100	10,600	14,100	17,600	21,300
Total Reduction from Water Conservation	7,727	16,576	16,662	16,748	16,833	16,919	17,005	17,091
Demand w/ Conservation	**80,350**	**80,757**	**89,926**	**99,096**	**108,265**	**117,434**	**126,604**	**135,773**
TOTAL EXISTING AND PLANNED SUPPLIES	**124,517**	**134,252**	**133,852**	**138,802**	**149,802**	**154,302**	**158,802**	**163,002**

Notes:

(a) Reflects existing and projected demands in CLWA service area only. CLWA's Annexation Policy requires annexing parties to provide additional fully reliable supplies. Known parties potentially seeking annexation include Legacy/Stevenson Ranch Phase 5, Tapia Canyon and Tesoro Del Valle.
(b) LACWWD 36 included for purposes of providing regional completeness; however, it is not required to prepare an UWMP.
(c) Demand w/o Conservation from Table 2-2. Includes a 10% increase in demand during dry years.
(d) LACWWD 36 conservation objective estimated at 20% of projected demand commencing 2020; see Table 2-21.
(e) Recycled water projections from Table 4-3.
(f) Net Anticipated Conservation for LACWWD 36 is Anticipated Conservation Objective minus Reduction from Recycled Water.
(g) Demand w/ Conservation for LACWWD 36 is Demand w/o Conservation minus Net Anticipated Conservation.
(h) NCWD 20x2020 Reduction from Table 2-16. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(i) Reduction from Water Conservation is 20x2020 Reduction minus Reduction from Recycled Water for 2015 and 2020; the quantity of water conservation remains at least at 2020 amounts through 2050.
(j) Demand w/ Conservation is Demand w/o Conservation minus Reduction from Water Conservation.
(k) SCWD 20x2020 Reduction from Table 2-18. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(l) VWC 20x2020 Reduction from Table 2-20. The 20% conservation requirement is assumed to continue through 2050 and continue to be met with a mixture of recycled water and conservation.
(m) Recycled water reductions do not include demands from Honor Rancho.

Appendix D

Recent Factors Affecting SWP Supplies

APPENDIX D
RECENT FACTORS AFFECTING SWP SUPPLIES

Since the last round of Urban Water Management Plans (UWMPs) were prepared in 2005, the California Department of Water Resources (DWR) has twice updated its State Water Project (SWP) Delivery Reliability Report. In each of its updates, DWR has projected further reductions in average SWP water deliveries than were projected in 2005. The 2009 Report is the most recent update, and identifies several emerging factors that have the potential to affect the availability and reliability of SWP supplies. Although the 2009 Report presents an extremely conservative projection of SWP delivery reliability, particularly in light of events occurring since its release, it remains the best available information concerning the SWP. Following is information and a brief summary of several factors identified in the 2009 Report having the potential to affect the availability and reliability of SWP supplies.

New U.S. Fish and Wildlife Service Biological Opinion for Delta Smelt and Related Litigation Matters

SWP operations have been challenged in connection with potential impacts to the Delta smelt, a small fish that resides only in the Delta and is protected under CESA and the ESA. In February 2005, the United States Fish and Wildlife Service (FWS) issued a "no jeopardy" determination and biological opinion (B.O.) analyzing potential impacts to the Delta smelt in connection with the long-term coordinated operations of the California State Water Project (SWP) and the federal Central Valley Project (CVP) through the year 2030. The project/action evaluated in the B.O., formally known as the "Operations Criteria and Plan" (or OCAP), includes existing pumping operations, proposals to increase SWP pumping over the next 30-year period, and other proposed long-term operational changes. In February 2005, several environmental groups filed suit in federal court against FWS and the Secretary of the Interior challenging the validity of the B.O. (*Natural Resources Defense Council v. Kempthorne*, USDC Case No. 05-CV-1207-OWW.)

In May 2007, the Federal District Court for the Eastern District of California determined that the B.O. violated the requirements of the ESA. In order that the SWP and CVP could continue to operate, the court established interim operating requirements for the Projects that would remain in place until a new B.O. was completed (the Interim Remedies)(December 14, 2007). The Interim Remedies were based on various factors occurring in the Delta, such as prevailing hydrologic and flow conditions, and the distribution and spawning status of Delta smelt. For the 2007-2008 water year, the Interim Remedies were reported to have reduced SWP supplies by approximately 500,000 acre-feet.

On December 15, 2008, FWS issued its new B.O. The B.O. concludes that the proposed long-term coordinated CVP and SWP operations will "jeopardize" the Delta smelt and "adversely modify" its critical habitat according to ESA standards. Pursuant to the ESA, because the B.O. is a "jeopardy" opinion, FWS was required to formulate and adopt as part of the B.O. a "Reasonable and Prudent Alternative" (RPA) to the proposed action that FWS believes will not cause jeopardy to the Delta smelt or adversely modify or destroy its critical habitat, and which can be implemented by Reclamation and DWR. (16 U.S.C. § 1536(b)(3)(A).) The RPA adopted as part of the B.O. imposed various new operating restrictions upon the CVP and SWP and has the potential to result in substantial water supply reductions from the Projects.

Soon after the B.O. was issued, DWR published information estimating that in comparison to the level of SWP exports from the Delta previously authorized under State Water

Resources Control Board (State Board) Decision 1641 (D-1641),[1] the FWS B.O. could reduce those deliveries by 18 to 29 percent during average and dry conditions, respectively. As with the Interim Remedies, potential water supply restrictions under the new B.O. are dependent on highly variable factors such as hydrologic conditions affecting Delta water supplies, flow conditions in the Delta, migratory and reproductive patterns of Delta smelt, and numerous other non-Project factors that impact the health and abundance of Delta smelt and its critical habitat.

Due to a number of alleged scientific and other deficiencies in the new FWS B.O., in early 2009 the State Water Contractors, the San Luis and Delta-Mendota Water Authority and several individual State and Federal contractor water agencies filed legal challenges against the B.O., which were consolidated in the Federal District Court for the Eastern District of California. (*The Consolidated Delta Smelt Cases*, Lead Case No. 1:09-CV-00407-OWW-GSA.) Early on in the proceedings, several of the plaintiff water agencies and the federal defendants filed cross-motions for summary judgment to determine whether a violation of the National Environmental Policy Act (NEPA) occurred in connection with federal defendants' adoption and implementation of the NMFS B.O. and its RPA. In a Memorandum Decision issued in November 2009, the court ruled that the moving plaintiffs were entitled to summary judgment on their claim that the federal defendants violated NEPA by failing to perform any NEPA analysis prior to adopting and implementing the new FWS B.O. and its RPA. (*The Consolidated Delta Smelt Cases*, Doc. No. 399 at 46-47.)

Separately, several of the plaintiffs filed a motion for preliminary injunction against the implementation of Component 2 (Action 3) of the RPA that proposed to restrict Delta exports during a particular timeframe in spring and summer months, depending on certain biological and environmental parameters. In May 2010, the court issued its Findings of Fact and Conclusions of Law Regarding Plaintiffs' Request for Preliminary Injunction Against Implementation of RPA Component 2 (a/k/a Action 3). In that decision, the court reconfirmed its earlier ruling that the federal defendants failed to examine the potential environmental and human consequences of the RPA actions adopted under the B.O. in violation of NEPA. (*Consolidated Delta Smelt Cases*, Doc. No. 704 at 120-122.) The court also ruled that the plaintiffs were likely to prevail on their claims that FWS violated the ESA and the federal Administrative Procedure Act (APA) in formulating and adopting RPA Component 2 without support of the best available science and without adequate explanation regarding its biological benefit to Delta smelt. (*Id.* at 123-125.)

In the meantime, the parties also filed cross motions for summary judgment to obtain a final ruling in the cases. Those motions were argued in early July 2010. In December 2010, the court issued a memorandum decision that invalidated the B.O. and RPA in several respects and remanded the matter to FWS. Further proceedings are expected to address interim operations of the SWP and CVP.

Because Delta smelt are also protected under the California ESA, the SWP and CVP are required to obtain take authorization from the California Department of Fish and Game (DFG). In July 2009, DFG issued a "consistency determination" pursuant to Fish and Game Code section 2080.1. That determination provides that operations of the SWP and CVP are in compliance with CESA so long as those operations occur in accordance with the FWS Delta smelt B.O. and RPA. Because the consistency determination posed a risk that the SWP could remain bound to the terms of the RPA even if the FWS B.O. was eventually overturned by a

[1] See additional discussion below regarding SWP exports as authorized under D-1641.

federal court, DFG's decision was challenged in state court by the State Water Contractors and the Kern County Water Agency. (*State Water Contractors v. California Department of Fish and Game, et al.*, Kern County Superior Court Case No. S-1500-CV-268074[2]; *Kern County Water Agency v. Department of Fish and Game, et al.*, Sacramento County Superior Court Case No. 34-2010-80000450.) The challenges assert, among other things, that DFG's consistency determination is invalid because it relies upon and seeks to enforce restrictions established under the new FWS B.O. that are alleged under *The Consolidated Delta Smelt Cases* to be invalid and unenforceable. The case is currently stayed by stipulation of the parties, pending the outcome of *The Consolidated Delta Smelt Cases*.

These litigation matters challenging the validity of the FWS B.O. and the DFG consistency determination give rise to the possibility that the restrictions on SWP exports could be relaxed and that SWP exports may return to the levels allowed by the Interim Remedies (above) or State Board Decision D-1641[3] pending issuance of a new B.O. and/or the implementation of the Bay-Delta Conservation Plan (BDCP). As an additional factor, by letter dated May 3, 2010, the federal Secretaries of the Department of Interior and the Department of Commerce have announced a joint initiative to develop a single integrated B.O. for the Delta and related water operations of the CVP and SWP.[4] The timing, nature and extent of the regulatory measures to be contained in any such B.O., and whether those measures would be legally challenged or upheld, cannot be predicted with any degree of certainty at this time.

New National Marine Fisheries Service Biological Opinion Salmon/Anadromous Species and Related Litigation Matters

SWP operations have also been challenged in connection with potential impacts to anadromous species in the San Francisco Bay-Delta estuary. In October 2004, the National Marine Fisheries Service (NMFS) issued a "no jeopardy" determination and B.O. analyzing potential impacts to federally listed winter-run and spring-run salmon and steelhead trout related to the long-term coordinated operations of the CVP and SWP through the year 2030. As with the 2005 FWS B.O. and *Kempthorne* case discussed above, OCAP was the project/action evaluated in the 2004 NMFS B.O., which included the Projects' existing Delta pumping operations, proposals to increase SWP pumping by 20 percent over the long term, and other operational changes. In August 2005, several environmental groups filed suit in federal court against NMFS and the Secretary of Commerce challenging the validity of the B.O. (*Pacific Coast Federation of Fishermen's Associations, et al. v. Gutierrez, et al*., Case No. 1:06-CV-00245-OWW-GSA.)

In April 2008, the United States District Court for the Eastern District of California issued

[2] In June 2010, the case was transferred to Sacramento, California, where it is now referenced as *State Water Contractors v. California Department of Fish and Game, et al.*, Sacramento County Superior Court Case No. 34-2010-80000552.

[3] D-1641 implements the objectives of the 1995 Bay-Delta Plan and imposes flow and water quality objectives to assure protection of beneficial uses in the Delta. The requirements of D-1641 address, among other things, standards for fish and wildlife protection, municipal and industrial water quality, agricultural water quality, and salinity. D-1641 imposed a new operating regime for the Delta, including measures such as X2, an export/inflow ratio, and the Vernalis Adaptive Management Program (VAMP). The standards under D-1641 are accomplished through requirements and conditions imposed on the water right permits for the SWP, the CVP and others. (*See,* California Water Plan Update 2009, Regional Reports Volume 3, Sacramento-San Joaquin River Delta at DB-6.)

[4] http://www.doi.gov/news/pressreleases/upload/Roy.pdf

its decision invalidating the NMFS B.O. for failing to comply with the requirements of the federal ESA. As with the *Kempthorne* case (above), the court did not vacate the B.O., meaning that SWP and CVP operations were authorized to continue pending the preparation of a new B.O. and any interim remedies imposed by the court. Remedy proceedings were held similar to those conduced in the *Kempthorne* case discussed above and, in separate Findings of Fact and Conclusions of Law issued in July and October 2008, Judge Wanger determined that additional water supply restrictions beyond those required in *Kempthorne* (i.e., the Interim Remedies for Delta smelt) were not required at that time for the anadromous species.

On June 4, 2009, NMFS issued a new B.O. regarding the effects of SWP and CVP operations on listed winter and spring-run salmon, steelhead trout, green sturgeon, and southern resident killer whales. Like the new FWS B.O. discussed above, the NMFS B.O. concludes that the proposed long-term coordinated operations of the CVP and SWP will jeopardize the species and adversely modify the critical habitats of most of those species. Pursuant to the ESA, because the B.O. is a "jeopardy" opinion, NMFS was required to formulate and adopt a Reasonable and Prudent Alternative (RPA) to the proposed action that NMFS believed would not cause jeopardy to the species or adversely modify or destroy their critical habitats, and which can be implemented by Reclamation and DWR. (16 U.S.C. § 1536(b)(3)(A).) The RPA adopted by NMFS imposed various new operating restrictions upon the CVP and SWP which have the potential to result in substantial reductions in water supply from the Projects.

NMFS calculated that its new B.O. has the potential to reduce SWP deliveries from the Delta by 7 percent in addition to the potential reductions under the new FWS B.O. for Delta smelt (above). DWR has estimated that average annual reductions to SWP deliveries could be closer to 10 percent beyond the restrictions imposed under the FWS B.O. (thus, a total of 28 to 39 percent during average and dry conditions, respectively, in comparison to SWP exports authorized under D-1641). As with the FWS B.O., potential water supply restrictions under the NMFS B.O. are dependent on several variable factors, such as hydrologic conditions in the Delta region, migratory and reproductive patterns of protected salmonid species, and other non-Project factors that impact the health and abundance of the species and their habitats.

In June 2009, numerous legal challenges were filed against the new NMFS B.O. and consolidated in the United States District Court for the Eastern District of California alleging, among other things, that the operating restrictions set forth in the B.O. are in violation of the federal ESA, the federal APA, and other laws. (*The Consolidated Salmonid Cases*, Lead Case No. 1:09-CV-1053-OWW-DLB.) Early in the proceedings, several of the plaintiff water agencies and the federal defendants filed cross-motions for summary judgment to determine whether a NEPA violation occurred in connection with federal defendants' adoption and implementation of the NMFS B.O. and its RPA. The court heard oral argument on the motions in February 2010, and took the matter under submission.

Separately, in January 2010, several of the plaintiff water agencies filed applications for a temporary restraining order and motions for preliminary injunction regarding the implementation of RPA Actions IV.2.1 and IV.2.3, which are designed to restrict Delta exports during a particular timeframe in spring and summer months, depending on certain biological and environmental parameters. In February 2010, the court issued its Memorandum Decision and Order Re Plaintiffs' Motion for Temporary Restraining Order. The decision found that federal defendants violated NEPA by failing to consider the potential human and environmental impacts

caused by implementation of the RPA Actions, and that a temporary injunction against RPA Action IV.2.3 would not cause jeopardy to the species, whereas a failure to enjoin the Action would cause irreparable water supply impacts to the plaintiffs. (*The Consolidated Salmonid Cases*, Doc. No. 202 at 20-22.) In subsequent rulings issued in March 2010, the court ordered that plaintiffs were entitled to summary judgment on their claims that federal defendants violated NEPA by failing to prepare any NEPA documentation in the adoption and implementation of the NMFS B.O. and its RPA. (*The Consolidated Salmonid Cases*, Doc. Nos. 266 and 288 at 3.)

Plaintiffs' motions for a preliminary injunction were heard in April and May 2010, and in May 2010 the court issued Findings of Fact and Conclusions of Law Re Plaintiffs' Request for Preliminary Injunction. In that decision, the court reconfirmed its previous ruling that federal defendants violated NEPA by failing to undertake an analysis of whether the RPA Actions adopted by NMFS under its new B.O. would adversely impact humans and the human environment. (*The Consolidated Salmonid Cases*, Doc. No. 347 at 129-130, 138.) Further, the court ruled that the plaintiff water agencies had a substantial likelihood of being able to show that the federal defendants violated the ESA and the APA by failing to adequately justify, through generally recognized scientific principles, the precise flow prescriptions imposed by RPA Actions IV.2.1 and IV.2.3. (*Id.* at 130, 133-134.)[5]

Following its May 18th ruling, the court conducted further proceedings and accepted additional evidence to address the proposed injunction and whether the relief requested by the plaintiffs would adversely affect the species (namely, Central Valley spring-run Chinook salmon and Central Valley steelhead). Based on those proceedings, in June 2010, the court issued Supplemental Findings of Fact and Conclusions of Law Re Plaintiffs' Request for Preliminary Injunction. (*The Consolidated Salmonid Cases*, Doc. No. 380.) The Supplemental Findings noted that if RPA Actions IV.2.1 and IV.2.3 were enjoined through June 15, 2010, the FWS B.O. for Delta smelt (above) would control Project operations between May 26th and June 15th, unless those restrictions were also enjoined, in which case Project operations would be controlled by D-1641.[6] (Doc. No. 380 at 12.) Accordingly, the court granted an injunction against RPA Actions IV.2.1 and IV.2.3 and authorized Project operations in accordance with D-1641, provided that export pumping could be reduced on shortened notice upon a showing of jeopardy to the species or adverse modification of its critical habitat. (*Id.* at 17-18.)

In August and November 2010, the parties also filed motions for summary judgment to obtain a final ruling in the cases. Those motions were argued on December 16 and 17, 2010, and the court is expected to issue a memorandum decision on the motions.

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[5] RPA Action IV.2.1 limits combined water exports by the CVP and SWP based on San Joaquin River flows as measured at Vernalis. (NMFS B.O. at 642.) When flows at Vernalis range from 0 to 6,000 cfs, Action IV.2.1 limits combined CVP and SWP exports to 1,500 cfs. (NMFS B.O. at 642.) When flows at Vernalis range from 6,000 to 21,750 cfs, Action IV.2.1 imposes an inflow to combined CVP and SWP exports ratio of 4:1. (NMFS B.O. at 642.) The pumping restrictions associated with Action IV.2.1 terminate May 31st. (NMFS B.O. at 641-642.) RPA Action IV.2.3 limits Old and Middle River (OMR) flows to no more negative than -2,500 cfs between January 1 and June 15, or until the average daily water temperature at Mossdale is greater than 72 degrees Fahrenheit for seven consecutive days, whichever occurs first. (NMFS B.O. at 648-650.)

[6] Among other things, D-1641 limits Project exports to a combined total of not more than 35 percent of total Delta inflow and further limits Project operations to ensure that certain water quality standards are met as measured by the location of the isohaline condition referred to as spring X2. (See *The Consolidated Salmonid Cases*, Doc. No. 380 at 12-14.)

Because the salmon species covered by the new NMFS B.O. are also protected under CESA, the SWP and CVP are required to obtain take authorization from DFG. In September 2009, DFG issued a "consistency determination" pursuant to Fish and Game Code section 2080.1. That determination provides that operations of the SWP and CVP are in compliance with CESA so long as those operations occur in accordance with the RPA set forth in the NMFS B.O. Because the consistency determination posed a risk that the SWP could remain bound to the terms of the RPA even if the NMFS B.O. was eventually overturned by a federal court, DFG's decision was challenged in state court by the State Water Contractors and the Kern County Water Agency. (*State Water Contractors v. California Department of Fish and Game, et al.*, Kern County Superior Court Case No. S-1500-CV-268497.)[7] The challenge asserts, among other things, that DFG's consistency determination is invalid because it relies upon and seeks to enforce restrictions established under the NMFS B.O. that are alleged under *The Consolidated Salmon Cases* to be invalid and unenforceable. As described above, the Federal District Court for the Eastern District of California has ruled that plaintiffs have a strong likelihood of being able to show that portions of the NMFS B.O. fail to comply with the ESA and the APA, and has enjoined implementation of several RPA Actions. Because the court's ruling effectively modified aspects of the NMFS B.O. for 2010, DWR requested that DFG make a determination that the NMFS B.O., as modified by the court, remained consistent with the provisions of CESA. In May 2010, DFG issued a new consistency determination, finding the court-modified NMFS B.O. consistent with CESA. In June 2010, an amended complaint was filed against the May 24th consistency determination. By stipulation of the parties, the case is currently stayed pending the outcome of *The Consolidated Salmonid Cases*.

The current legal challenges regarding the validity of the new NMFS B.O. and the DFG consistency determination give rise to the possibility that the restrictions on SWP exports could be relaxed and that SWP exports may return to the higher levels allowed by the Interim Remedies decision in *Kempthorne* (above) or D-1641 pending the issuance of a new B.O. and/or implementation of the BDCP. Furthermore, as noted above, in May 2010 the Department of Interior and the Department of Commerce announced a joint initiative to develop a single, integrated B.O. for the coordinated operations of the CVP and SWP in the Delta.[8] The timing, nature, and extent of the regulatory measures to be contained that B.O., and whether those measures would be legally challenged or upheld, cannot be predicted with any degree of certainty at this time.

Watershed Enforcers v. California Department of Water Resources

Another litigation matter concerning SWP operations is *Watershed Enforcers v. Cal. Dept. of Water Resources* (2010) 185 Cal. App. 4th 969 (Alameda County Superior Court Case No. RG06292124). In that case, a plaintiffs group filed suit against DWR alleging the SWP was being operated without "take authorization" under CESA. The case was heard by the Alameda County Superior Court in November 2006 and, in April 2007, the court ordered DWR to cease and desist further operations of the Harvey O. Banks pumping plant facilities of the SWP unless DWR obtained proper authorization from DFG for the take of Delta smelt and salmon species listed under CESA. The trial court decision was appealed by DWR and several water agency

[7] In June 2010, the case was transferred to Sacramento, California, where it is now referenced as *State Water Contractors v. California Department of Fish and Game, et al.,* Sacramento County Superior Court Case No. 34-2010-80000560.
[8] http://www.doi.gov/news/pressreleases/upload/Roy.pdf

parties and the court's order was stayed pending the appeal, meaning that DWR was not required to cease its operations of the Banks facilities.

As discussed above, the new FWS and NMFS B.O.s were issued while the *Watershed Enforcers* case was pending on appeal. Based on those new B.O.s, DFG issued consistency determinations and take authorization for the SWP under CESA with respect to Delta smelt and the listed anadromous species. (Also discussed above, those consistency determinations have been challenged in state court.) Thereafter, in September 2009, DWR and one of the water agency parties dismissed their appeals in the *Watershed Enforcers* case. The case remained active in 2009-2010, however, for purposes of resolving the discrete legal issue raised by the remaining water agency parties as to whether DWR is the type of entity that is subject to the take prohibitions under CESA. In a June 2010 decision, the First District Court of Appeal affirmed the trial court decision in all respects, including the determination that DWR qualifies as a "person" within the meaning of CESA, which means that DWR is subject to CESA's permitting requirements. (*Watershed Enforcers v. Department of Water Resources* (2010) 185 Cal. App. 4th 969, 973.)

California Department of Fish and Game Incidental Take Permit for Longfin Smelt and Related Litigation Matters

Regulatory actions related to longfin smelt also have the potential to affect the availability and reliability of SWP supplies. In February 2008, the California Fish and Game Commission (Commission) approved a petition to list the longfin smelt as a "candidate" species under CESA. Under CESA, once a species is granted candidate status, it is entitled to protections until the Commission determines whether to list the species as threatened or endangered. To afford such interim protection, in February 2008, the Commission adopted the first in a series of emergency take regulations that authorized the CVP and SWP to take longfin smelt, yet established certain operating restrictions on Project exports from the Delta in an effort to protect the species. The emergency regulations were proposed to remain in effect until February 2009, at which time the Commission was required to decide whether to list the longfin as a threatened or endangered species. Initially, the Commission's take regulation imposed the same Delta export restrictions that were established in the *Kempthorne* case (i.e., the Interim Remedies discussed above). In November 2008, however, the Commission revised its emergency regulations in a manner that threatened to impose export restrictions beyond those established for Delta smelt. According to information published by DWR, the Commission's 2008-2009 revised emergency take regulations had the potential to reduce SWP supplies in the January to February 2009 period by up to approximately 300,000 acre-feet under a worst-case scenario. Under other scenarios, however, the SWP delivery reductions were expected to be no greater than those imposed under the new FWS B.O. for Delta smelt. In December 2008, several water agency interests filed suit against the Commission's revised take regulation, alleging it violated CESA.

In March 2009, the Commission determined that the listing of longfin smelt as a "threatened" species was warranted under CESA. CESA sets forth a general prohibition against the take of a threatened species except as otherwise authorized by statute. One such authorization is provided by California Fish and Game Code section 2081, wherein DFG may authorize the incidental taking of a threatened species in connection with an otherwise lawful activity through the issuance of a permit. In February 2009, in advance of an official listing of the species as threatened, DFG issued Incidental Take Permit No. 2081-2009-001-03 (Permit)

to DWR which imposes terms and conditions on the ongoing and long-term operation of SWP facilities in the Delta for the protection of longfin smelt. The operating restrictions under the Permit are based in large part on the restrictions imposed on the SWP by the new FWS B.O. for Delta smelt (see above).

In June 2009, the Commission officially listed longfin smelt as a threatened species under CESA. As with the FWS B.O., potential water supply restrictions under the Permit are dependent on several variable factors, such as hydrologic conditions in the Delta region, migratory and reproductive patterns of longfin smelt, and other non-Project factors affecting longfin smelt abundance in the Delta. DWR has not indicated whether any particular reductions in SWP exports are likely to result from the Permit. As previously noted, however, DWR has estimated that the restrictions imposed by the FWS B.O. and RPA for Delta smelt could reduce SWP deliveries between 18 and 29 percent in comparison to Project deliveries authorized under D-1641. In March 2009, due to a number of alleged scientific and other deficiencies in the Permit, the State Water Contractors challenged the Permit in Sacramento County Superior Court. (*State Water Contractors v. California Dept. of Fish and Game, et al.*, Sac. Sup. Ct. Case No. 34-2009-80000203.) That case puts DFG's ability to enforce the Permit into question.

California Drought Conditions

On June 4, 2008, the Governor of California proclaimed a statewide drought due to record-low rainfall in Spring 2008 and court-ordered restrictions on Delta exports as discussed above. (Executive Order S-06-08.) Soon thereafter, the Governor proclaimed a state of drought emergency to exist within the Counties of Sacramento, San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and Kern. (Proclamation dated June 12, 2008.) On February 27, 2009, the Governor declared a statewide water supply emergency to combat California's third consecutive year of drought conditions, evidenced by low reservoir storage and estimated snowpack water content at that time. (Proclamation dated February 27, 2009.)

Since then, statewide hydrologic conditions have improved, although the State's water supply emergency declaration has not been lifted. In March 2010, DWR announced that both manual and electronic readings indicate that the water content in California's mountain snowpack was 107 percent of normal and stated that the "readings boost our hope that we will be able to increase the State Water Project allocation by this spring to deliver more water to our cities and farms." Among these readings, DWR reported that electronic sensor readings showed northern Sierra snow water equivalents at 126 percent of normal for that date, central Sierra at 93 percent, and southern Sierra at 109 percent.[9] As of January 2011, DWR reported snow water equivalents for the northern Sierra at 164 percent of normal, 186 percent of normal for the central Sierra, and 260 percent for the southern Sierra.[10] According to DWR's California Data Exchange Center, hydrologic conditions in California as of December 1, 2010 were as follows: statewide precipitation was 155 percent of average; statewide runoff was 115 percent of average; and key historical average statewide reservoir storage was at 105 percent, with two of the state's largest reservoirs, Lake Shasta (CVP) and Lake Oroville (SWP), respectively storing 116 percent and 75 percent of their historical averages.[11]

[9] http://www.water.ca.gov/news/newsreleases/2010/030310snow.pdf
[10] http://cdec.water.ca.gov/cgi-progs/snow/DLYSWEQ
[11] http://cdec.water.ca.gov/cgi-progs/reports/EXECSUM

APPENDIX D
RECENT FACTORS AFFECTING SWP SUPPLIES

Development of Delta Plan and Delta Flow Criteria Pursuant to New State Laws

In November 2009, the California Legislature enacted SBX7-1 as one of several bills passed as part of a comprehensive water package related to water supply reliability, ecosystem health, and the Delta. SBX7-1 became effective on February 3, 2010 and adds Division 35 to the California Water Code (commencing with Section 85300), referred to as the Sacramento-San Joaquin Delta Reform Act of 2009 (Act). Among other things, the Act creates the Delta Stewardship Council (Council) as an independent agency of the state. (Wat. Code § 85200.) SBX7-1 also amends the California Public Resources Code to specify changes to the Delta Protection Commission and to create the Delta Conservancy. (Pub. Res. Code §§ 29702-29780.) The Act directs the Council to develop a comprehensive management plan for the Delta by January 1, 2012 (Delta Plan) and to first develop an Interim Plan that includes recommendations for early actions, projects, and programs for the Delta. (*See generally*, Second Draft Interim Plan, Prepared for Consideration by the Delta Stewardship Council at 1.)

In addition to these and other requirements, SBX7-1 requires the State Board to use the best available scientific information to develop flow criteria for the Delta ecosystem necessary to protect public trust resources, including fish, wildlife, recreation and scenic enjoyment. Similarly, DFG is required to identify quantifiable biological objectives and flow criteria for species of concern in the Delta. In August 2010, the State Board adopted Resolution No. 2010-0039 approving its report entitled "Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem" (Flow Criteria). The State Board report concludes that substantially higher flows are needed through the Delta than in have occurred in previous decades in order to benefit zooplankton and various fish species. (Flow Criteria at 5-8.) Separately, in September 2010, DFG issued a draft report entitled "Quantifiable Biological Objectives and Flow Criteria for Aquatic and Terrestrial Species of Concern Dependent on the Delta" (DFG Report). The DFG Report is based on similar biological objectives and recommends Delta flows similar to those set forth in the State Board's Flow Criteria. (DFG Report at 13.) Notably, both the State Board and DFG recognize that their recommended flow criteria for the Delta do *not* balance the public interest or the need to provide an adequate and reliable water supply. (Flow Criteria at 4; DFG Report at 16.) Also of importance, both the State Board and DFG acknowledge that their recommended flow criteria do not have any regulatory or adjudicatory effect; however, they may be used to inform the Council as it prepares the Delta Plan, and may be considered as the Bay Delta Conservation Plan (BDCP) process moves forward. (Flow Criteria at 3, 10; DFG Report at ES-4.)

DWR's Final 2009 SWP Delivery Reliability Report

DWR continues to evaluate the issues affecting SWP exports from the Delta and how those issues may affect the long-term availability and reliability of SWP deliveries to the SWP Contractors. In September 2010, DWR released its Final 2009 SWP Delivery Reliability Report (DWR Report), which forecasts additional reductions to SWP supplies in comparison to the 2007 Report. According to DWR, the long-term average delivery of contractual SWP Table A supply is projected to be 60 percent under current and future conditions over the 20-year projection. (DWR Report at 43, 48, Tables 6.3 and 6.12.) Within that long-term average, SWP Table A deliveries can range from 7 percent (single dry year) to 68 percent (single wet year) of contractual amounts under current conditions, and from 11 percent (single dry year) to 97 percent (single wet year) under future conditions. (Id. at 43-44, 49, Tables 6.4, 6.5, 6.13 and 6.14.) Contractual amounts are projected to range from 32 to 38 percent during multiple-dry

year periods, and from 79 to 93 percent during multiple wet periods. (Id. at 49, Tables 6.13 and 6.14.)

To ensure a conservative analysis, the DWR Report expressly assumes and accounts for the institutional, environmental, regulatory, and legal factors affecting SWP supplies, including, but not limited to, water quality constraints, fishery protections, other D-1641 requirements and the operational limitations imposed by the FWS and NMFS B.O.s that are discussed above. The DWR Report also considers the potential effects of Delta levee failures and other seismic or flood events. (*See*, *e.g.*, DWR Report at 19-24, 25-28, 29-35, Appendices A, A-1, A-2, B.) Notably, the DWR Report assumes that all of these restrictions and limitations will remain in place over the next 20-year period and that no actions to improve the Delta will occur, even though numerous legal challenges, various Delta restoration processes, and new legal requirements for Delta improvements are currently underway (i.e., BDCP, Delta Vision, Delta Plan, etc.). Finally, DWR's long-term SWP delivery reliability analyses incorporate assumptions that are intended to account for potential supply shortfalls related to global climate change. (*See*, *e.g.*, DWR Report at 19, 29-30, Appendices A-B.) Based on these and other factors, the DWR Report presents a conservative projection of SWP delivery reliability.

Conclusion

DWR's most recently published SWP Delivery Reliability Report (September 2010) demonstrates that the projected long-term average delivery amounts of contractual SWP Table A supplies have decreased in comparison to previous estimates. However, as noted, the projections developed by DWR are predicated on conservative assumptions, which make the projections useful from a long-range urban water supply planning perspective.[12] Indeed, recent rulings in various legal actions and other factors described above, among others, support higher estimates of average annual SWP deliveries than projected in DWR's 2009 Report. While this may lead DWR to increase its projections in its next scheduled Report, the 2009 Report remains the best available information concerning the long-term delivery reliability of SWP supplies.

[12] *See*, *e.g.*, *Sonoma County Water Coalition v. Sonoma County Water Agency* (2010) 189 Cal.App.4th 33; *Watsonville Pilots Association v. City of Watsonville* (2010) 183 Cal.App.4th 1059; *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal.4th 412.

Appendix E

Demand Management Measures

Water Suppliers' AB1420 Compliance

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

ARNOLD SCHWARZENEGGER, *Governor*

RECEIVED
NOV 22 2010
By

November 9, 2010

Mr. Dirk Marks, Water Resources Manager
Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, California 91350-2173

Dear Mr. Marks:

The Department of Water Resources (DWR) has reviewed the Castaic Lake Water Agency's (CLWA) Self-Certification Statement – Table 1 dated October 26, 2010, regarding implementation of the Urban Best Management Practices (BMPs).

The purpose of DWR's review is to determine eligibility of CLWA to receive water management grant or loan funds. DWR has followed the *Draft AB 1420 Compliance Requirements* dated June 1, 2009. For detailed information, please visit http://www.water.ca.gov/wateruseefficiency/finance/.

Based on DWR's review of the information in Table 1, CLWA has and is currently implementing the BMPs consistent with AB 1420 and, therefore, is eligible to receive water management grant or loan funds.

DWR reserves the right to request additional information and documentation, including reports from CLWA to substantiate the accuracy of the information provided in Table 1. DWR may reverse or modify its eligibility determination and notify you and the funding agency if inaccuracies are found in the supporting documentation or in Table 1.

If you have any questions, please contact me at (916) 651-7025 or Jodi Evans at (916) 651-7026.

Sincerely,

Fethi BenJemaa
Ag Water Use Efficiency Section Chief

AB 1420 Self- Certification Statement Table 1

Note: Table 1 documents Status of Past and Current BMP implementation.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1, and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1, and Table 2 and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory Dirk Marks Title of Signatory Water Resources Manager Signature of signatory [signature] Dat 26-Oct-10

Application Date:

Proposal Identification Number: CUWCC Member? Yes/No Yes

Has Urban Water Supplier submitted a 2005 Urban Water Management Plan? Yes/No Yes Is the UWMP Plan Deemed Complete by DWR? Yes/No Yes

Applicant Name: Castaic Lake Water Agency

Project Title:

Applicant's Contact Information: Name: Dirk Marks Phone: 661-513-1297 E-mail: dmarks @clwa.org

Participants:

Retailer (List Below)	*Wholesaler (List Below)*

C1 C2 C3 C4 C5 *C6 C7 **C8 **C9 **C10 C11 C12 C13 C14 C15 C16 C17 C18

BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	BMP Implemented by Retailers and/or Wholesalers / *BMP*			Compliance Options/Alternative Conservation Approaches (1)			BMP Is Exempt (2)			BMP Implementation Requirements Met				
			Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 1 Water Survey for Single/Multi-Family Residential Customers														
	✓	BMP 2 Residential Plumbing Retrofit														
✓	✓	BMP 3 System Water Audits, Leak Detection		Yes		✓							Yes			Yes
✓	✓	BMP 3 Leak Repairs		Yes		✓							Yes			Yes
	✓	BMP 4 Metering with Commodity Rates for All New connections														
	✓	BMP 4 Retrofit of Existing Connections														

C1	C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
				BMP Implemented by Retailers and/or Wholesalers / *BMP*			**Compliance Options/Alternative Conservation Approaches (1)**			**BMP Is Exempt (2)**			**BMP Implementation Requirements Met**				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No	
	✓	BMP 5 Large Landscape Conservation Programs and Incentives															
	✓	BMP 6 High-Efficiency Washing Machine Rebate Programs															
✓	✓	BMP 7 Public Information		Yes		✓							Yes			Yes	
✓	✓	BMP 8 School Education		Yes		✓							Yes			Yes	
	✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts															
✓		BMP 10 Wholesale Agency Assistance Programs		Yes		✓							Yes			Yes	
	✓	BMP 11 Conservation Pricing															
✓	✓	BMP 12 Conservation Coordinator		Yes		✓							Yes			Yes	
	✓	BMP 13 Water Waste Prohibitions															
	✓	BMP 14 Residential ULFT Replacement Programs															

***C6:** Wholesaler may also be a retailer (supplying water to end water users)

****C8, **C9, **, and C10:** Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.

(1) For details, please see: http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.

(2) BMP is exempt based on cost-effectiveness, lack of funding, and lack of legal authority criteria as detailed in the CUWCC MOU

(3) Non MOU signatories must submit to DWR reports and supporting documents in the same format as CUWCC.

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY
EDMUND G. BROWN JR., *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

RECEIVED
JAN 31 2011
NCWD

January 26, 2011

Mr. Stephen L. Cole
General Manager
Newhall County Water Agency
Post Office Box 220970
Santa Clarita, California 91322-0970

Dear Mr. Cole:

The Department of Water Resources (DWR) has reviewed the Newhall County Water Agency's (NCWA) Self-Certification Statement – Tables 1 and 2 submitted on January 18, 2011, regarding implementation of the Urban Best Management Practices (BMPs).

The purpose of DWR's review is to determine eligibility of the NCWA to receive water management grant or loan funds. DWR has followed the *Draft AB 1420 Compliance Requirements* dated June 1, 2009. For detailed information, please visit http://www.water.ca.gov/wateruseefficiency/finance/.

Based on DWR's review of the information in Tables 1 and 2, the NCWA has and is currently implementing the BMPs consistent with AB 1420 and, therefore, is eligible to receive water management grant or loan funds.

DWR reserves the right to request additional information and documentation, including reports from the NCWA to substantiate the accuracy of the information provided in Tables 1 and 2. DWR may reverse or modify its eligibility determination and notify you and the funding agency if inaccuracies are found in the supporting documentation or in Tables 1 and 2.

If you have any questions, please contact me at (916) 651-7025 or Jodi Evans at (916) 651-7026.

Sincerely,

Fethi BenJemaa
Ag Water Use Efficiency Section Chief

AB 1420 Self- Certification Statement Table 1

Note: Table 1 documents Status of Past and Current BMP implementation.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1, and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1, and Table 2 and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory Stephen L Cole Title of Signatory General Manager Signature of signatory Date 11/23/10

Application Date: 11/23/2010

Proposal Identification Number: CUWCC Member? Yes/No Yes

Has Urban Water Supplier submitted a 2005 Urban Water Management Plan? Yes/No Yes Is the UWM Plan Deemed Complete by DWR? Yes/No Submitting 2010

Applicant Name: Newhall County Water District

Project Title: Santa Clara River Sewer Trunk Line Relocation "Phase 1"

Applicant's Contact Information: Name: Michael Alvord Phone: 661-259-3610 E-mail: malvord@ncwd.org

Participants:

Retailer (List Below)	*Wholesaler (List Below)*
Newhall County Water District	*Castaic Lake Water Agency*

C1 C2 C3 C4 C5 *C6 C7 **C8 **C9 **C10 C11 C12 C13 C14 C15 C16 C17 C18

BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	BMP Implemented by Retailers and/or Wholesalers / *BMP*			Compliance Options/Alternative Conservation Approaches (1)			BMP Is Exempt (2)			BMP Implementation Requirements Met				
			Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 1 Water Survey for Single/Multi-Family Residential Customers	✓				✓					No		12/30/2008		Yes
	✓	BMP 2 Residential Plumbing Retrofit	✓				✓					No		12/30/2008		Yes
✓	✓	BMP 3 System Water Audits, Leak Detection	✓	✓		✓						Yes	Yes	12/30/2008		Yes
✓	✓	BMP 3 Leak Repairs	✓	✓		✓						Yes	Yes	12/30/2008		Yes
	✓	BMP 4 Metering with Commodity Rates for All New connections	✓			✓						Yes		12/30/2008		Yes
	✓	BMP 4 Retrofit of Existing Connections	✓			✓						Yes		12/30/2008		Yes

C1	C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
				BMP Implemented by Retailers and/or Wholesalers / *BMP*			**Compliance Options/Alternative Conservation Approaches (1)**			**BMP Is Exempt (2)**			**BMP Implementation Requirements Met**				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 5 Large Landscape Conservation Programs and Incentives	✓	✓		✓						Yes		12/30/2008		Yes
	✓	BMP 6 High-Efficiency Washing Machine Rebate Programs	✓				✓					No		12/30/2008		Yes
✓	✓	BMP 7 Public Information	✓	✓		✓						Yes	Yes	12/30/2008		Yes
✓	✓	BMP 8 School Education	✓	✓		✓						Yes	Yes	12/30/2008		Yes
	✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts	✓	✓		✓						Yes		12/30/2008		Yes
✓		BMP 10 Wholesale Agency Assistance Programs		✓		✓							Yes	12/30/2008		Yes
	✓	BMP 11 Conservation Pricing	✓									Yes		12/30/2008		Yes
✓	✓	BMP 12 Conservation Coordinator	✓	✓		✓						Yes	Yes	12/30/2008		Yes
	✓	BMP 13 Water Waste Prohibitions	✓			✓						Yes		12/30/2008		Yes
	✓	BMP 14 Residential ULFT Replacement Programs	✓	✓		✓						Yes		12/30/2008		Yes

***C6:** Wholesaler may also be a retailer (supplying water to end water users)

****C8, **C9, **, and C10:** Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.

(1) For details, please see: http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.

(2) BMP is exempt based on cost-effectiveness, lack of funding, and lack of legal authority criteria as detailed in the CUWCC MOU

(3) Non MOU signatories must submit to DWR reports and supporting documents in the same format as CUWCC.

AB 1420 Self- Certification Statement Table 2

Provide Schedule, Budget, and Finance Plan to Demonstrate Commitment to Implement All BMP's to Become in Compliance with BMP Implementation - Commencing Within 1st Year of Agreement for Which Applicant Receives Funds.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1 and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1 and Table 2, and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory Stephen L Cole Title of Signatory General Manager Signature of signatory Date 11/23/10

Application Date: 11/23/2010

Proposal Identification Number:

CUWCC Member? Yes/No: Yes

Applicant Name: Newhall County Water District

Is the UWM Plan Deemed Complete by DWR? Yes/No: Submitting 2010

Project Title: Santa Clara River Sewer Trunk Line Relocation "Phase 1"

Applicant's Contact Information: Name: Michael Alvord

	Retailer (List Below)		
Participants:	Newhall County Water District		

C1	C2	C3	C4	C5	*C6	C7	C8	**C9	**C10	**C11	C12			C13	C14	C15	C16	C17	C18	C19
				BMP Implemented by Retailers and/or Wholesalers				Compliance Options / Alternative Conservation Approaches (1)			BMP is Exempt (2)			Implementation Scheduled to Commence within 1st Year of Agreement						
CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	Alternative Conservation Approaches Yes/No	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested, if Available. (See AB 1420 Compliance Table 3) Yes/No
	1. Utility Operations Programs																			
1.11			BMP 12 Conservation Coordinator																	
1.12			BMP 13 Water Waste Prohibitions																	
1.13			BMP 10 Wholesale Agency Assistance Programs																	
1.20			BMP 3 System Water Audits, Leak Detection/**Repair**																	
1.30			BMP 4 Metering with Commodity Rates for All New/**Retrofit of Existing** connections																	
1.40			BMP 11 Conservation Pricing																	
	2. Educational Programs																			
2.10			BMP 7 Public Information																	
2.20			BMP 8 School Education																	
	3. Residential																			
3.11		✓	BMP 1 **Indoor** Water Survey for Single/Multi-Family Residential Customers	Yes	No		Yes		✓					Jul-11	90%	Jun-13	$2,500.00	Water Rates	Yes	
3.12		✓	BMP 1 **Outdoor** Water Survey for Single/Multi-Family Residential Customers	Yes	No		Yes		✓					Jul-11	90%	Jun-13	$2,500.00	Water Rates	Yes	
3.20		✓	BMP 2 Residential Plumbing Retrofit	Yes	No		Yes		✓					Jul-11	50%	Jun-15	$6,000.00	Water Rates	Yes	

CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	BMP Implemented by Retailers and/or Wholesalers				Compliance Options / Alternative Conservation Approaches (1)			BMP is Exempt (2)			Implementation Scheduled to Commence within 1st Year of Agreement						
				Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	Alternative Conservation Approaches Yes/No	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested, if Available. (See AB 1420 Compliance Table 3) Yes/No
3.30		✓	BMP 6 High-Efficiency Washing Machine Rebate Programs	Yes	No		Yes		✓					Jul-11	0%	Jun-17	$18,000.00	Water Rates	Yes	
3.40			BMP 14 Residential ULFT Replacement Programs																	
4. Commercial, Industrial, Institutional																				
4.00			BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts																	
5. Landscape																				
5.00			BMP 5 Large Landscape Conservation Programs and Incentives																	

*C6: Wholesaler may also be a retailer (supplying water to end water users)
**C9, ** C10, and **C11: Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.
(1) For details, please see http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.
(2) BMP is exempt based on cost-effectiveness, lack of funding, or lack of legal authority, as detailed in the CUWCC MOU.

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY
EDMUND G. BROWN JR., *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

January 26, 2011

Mr. Matthew Dickens
Resource Conservation Manager
Valencia Water Company
Post Office Box 5904
24631 Avenue Rockefeller
Valencia, California 91380

Dear Mr. Dickens:

The Department of Water Resources (DWR) has reviewed the Valencia Water Company's (VWC) Self-Certification Statement – Table 1 submitted on January 13, 2011, regarding implementation of the Urban Best Management Practices (BMPs).

The purpose of DWR's review is to determine eligibility of the VWC to receive water management grant or loan funds. DWR has followed the *Draft AB 1420 Compliance Requirements* dated June 1, 2009. For detailed information, please visit http://www.water.ca.gov/wateruseefficiency/finance/.

Based on DWR's review of the information in Table 1, the VWC has and is currently implementing the BMPs consistent with AB 1420 and, therefore, is eligible to receive water management grant or loan funds.

DWR reserves the right to request additional information and documentation, including reports from the VWC to substantiate the accuracy of the information provided in Table 1. DWR may reverse or modify its eligibility determination and notify you and the funding agency if inaccuracies are found in the supporting documentation or in Table 1.

If you have any questions, please contact me at (916) 651-7025 or Jodi Evans at (916) 651-7026.

Sincerely,

Fethi BenJemaa
Ag Water Use Efficiency Section Chief

AB 1420 Self- Certification Statement Table 1

Note: Table 1 documents Status of Past and Current BMP implementation.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1, and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1, and Table 2 and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory_Matthew S. Dickens_____Title of Signatory Resource Conservation Manager_ Signature of signatory_____ Date 12/21/2010

Application Date:

Proposal Identification Number: [ ] CUWCC Member? Yes/No [Yes]

Has Urban Water Supplier submitted a 2005 Urban Water Management Plan? Yes/No [Yes] Is the UWM Plan Deemed Complete by DWR? Yes/No [Yes]

Applicant Name: Castaic Lake Water Agency

Project Title:

Applicant's Contact Information: Name: Matthew S. Dickens Phone: 661-295-6543 E-mail: mdickens@valenciawater.com

Participants:

Retailer (List Below)	*Wholesaler (List Below)*
Valencia Water Company	*Castaic Lake Water Agency*

C1	C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
				BMP Implemented by Retailers and/or Wholesalers / *BMP*			**Compliance Options/Alternative Conservation Approaches (1)**			**BMP Is Exempt (2)**			**BMP Implementation Requirements Met**				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No	
	✓	BMP 1 Water Survey for Single/Multi-Family Residential Customers	Yes			X						Yes		3/30/2009		Yes	
	✓	BMP 2 Residential Plumbing Retrofit	Yes			X						Yes		3/30/2009		Yes	
✓	✓	BMP 3 System Water Audits, Leak Detection	Yes			X						Yes		3/30/2009		Yes	
✓	✓	BMP 3 Leak Repairs	Yes			X						Yes		3/30/2009		Yes	
	✓	BMP 4 Metering with Commodity Rates for All New connections	Yes			X						Yes		3/30/2009		Yes	
	✓	BMP 4 Retrofit of Existing Connections	Yes			X						Yes		3/30/2009		Yes	

C1	C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
				BMP Implemented by Retailers and/or Wholesalers / *BMP*			**Compliance Options/Alternative Conservation Approaches (1)**			**BMP Is Exempt (2)**			**BMP Implementation Requirements Met**				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 5 Large Landscape Conservation Programs and Incentives	Yes			X						Yes		3/30/2009		Yes
	✓	BMP 6 High-Efficiency Washing Machine Rebate Programs	Yes			X						No		3/30/2009		Yes
✓	✓	BMP 7 Public Information	Yes			X						Yes		3/30/2009		Yes
✓	✓	BMP 8 School Education	Yes			X						Yes		3/30/2009		Yes
	✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts	Yes			X						Yes		3/30/2009		Yes
✓		BMP 10 Wholesale Agency Assistance Programs	NA			NA						NA		NA		NA
	✓	BMP 11 Conservation Pricing	Yes			X						Yes		3/30/2009		Yes
✓	✓	BMP 12 Conservation Coordinator	Yes			X						Yes		3/30/2009		Yes
	✓	BMP 13 Water Waste Prohibitions	Yes			X						Yes		3/30/2009		Yes
	✓	BMP 14 Residential ULFT Replacement Programs	Yes			X						Yes		3/30/2009		Yes

***C6:** Wholesaler may also be a retailer (supplying water to end water users)

****C8, **C9, **, and C10:** Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.

(1) For details, please see: http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.
(2) BMP is exempt based on cost-effectiveness, lack of funding, and lack of legal authority criteria as detailed in the CUWCC MOU
(3) Non MOU signatories must submit to DWR reports and supporting documents in the same format as CUWCC.

AB 1420 Self- Certification Statement Table 2

Provide Schedule, Budget, and Finance Plan to Demonstrate Commitment to Implement All BMP's to Become in Compliance with BMP Implementation - Commencing Within 1st Year of Agreement for Which Applicant Receives Funds.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1 and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1 and Table 2, and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory Matthew S. Dickens **Title of Signatory** Resource Conservation Manager **Signature of signatory** _____ **Date** 12/22/2010

Application Date:

Proposal Identification Number:

CUWCC Member? Yes/No: Yes

Applicant Name: Castaic Water Agency

Is the UWM Plan Deemed Complete by DWR? Yes/No: Yes

Project Title:

Applicant's Contact Information: Name: Matthew S. Dickens

	Retailer (List Below)		
Participants:	Valencia Water Company		

C1	C2	C3	C4	C5	*C6	C7	C8	**C9	**C10	**C11	C12			C13	C14	C15	C16	C17	C18	C19
				BMP Implemented by Retailers and/or Wholesalers				Compliance Options / Alternative Conservation Approaches (1)			BMP is Exempt (2)			Implementation Scheduled to Commence within 1st Year of Agreement						
CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	Alternative Conservation Approaches Yes/No	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested, if Available. (See AB 1420 Compliance Table 3) Yes/No
1. Utility Operations Programs																				
1.11	✓	✓	BMP 12 Conservation Coordinator	Yes				X												
1.12		✓	BMP 13 Water Waste Prohibitions	Yes				X												
1.13	✓		BMP 10 Wholesale Agency Assistance Programs																	
1.20	✓	✓	BMP 3 System Water Audits, Leak Detection/Repair	Yes				X												
1.30		✓	BMP 4 Metering with Commodity Rates for All New/**Retrofit of Existing** connections	Yes				X												
1.40		✓	BMP 11 Conservation Pricing	Yes				X												
2. Educational Programs																				
2.10	✓	✓	BMP 7 Public Information	Yes				X												
2.20	✓	✓	BMP 8 School Education	Yes				X												
3. Residential																				
3.11		✓	BMP 1 **Indoor** Water Survey for Single/Multi-Family Residential Customers	Yes				X												
3.12		✓	BMP 1 **Outdoor** Water Survey for Single/Multi-Family Residential Customers	Yes				X												
3.20		✓	BMP 2 Residential Plumbing Retrofit	Yes				X												

CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	BMP Implemented by Retailers and/or Wholesalers				Compliance Options / Alternative Conservation Approaches (1)			BMP is Exempt (2)			Implementation Scheduled to Commence within 1st Year of Agreement						
				Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	Alternative Conservation Approaches Yes/No	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested, if Available. (See AB 1420 Compliance Table 3) Yes/No
3.30		✓	BMP 6 High-Efficiency Washing Machine Rebate Programs	Yes				X			X									
3.40		✓	BMP 14 Residential ULFT Replacement Programs	Yes				X												
4. Commercial, Industrial, Institutional																				
4.00		✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts	Yes				X												
5. Landscape																				
5.00		✓	BMP 5 Large Landscape Conservation Programs and Incentives	Yes				X												

*C6: Wholesaler may also be a retailer (supplying water to end water users)
**C9, ** C10, and **C11: Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.
(1) For details, please see http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.
(2) BMP is exempt based on cost-effectiveness, lack of funding, or lack of legal authority, as detailed in the CUWCC MOU.

STATE OF CALIFORNIA – CALIFORNIA NATURAL R. URCES AGENCY
EDMUND G. BROWN JR., *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

March 16, 2011

Ms. Cathy Z. Hollomon
Associate Water Resources Planner
Santa Clarita Water District
Post Office Box 903
Santa Clarita, California 91380-9003

Dear Ms. Hollomon:

The Department of Water Resources (DWR) has reviewed the Santa Clarita Water District's (SCWD) Self-Certification Statement – Tables 1 and 2 submitted on February 15, 2011, regarding implementation of the Urban Best Management Practices (BMPs).

The purpose of DWR's review is to determine eligibility of SCWD to receive water management grant or loan funds. DWR has followed the *Draft AB 1420 Compliance Requirements* dated June 1, 2009. For detailed information, please visit http://www.water.ca.gov/wateruseefficiency/finance/.

Based on DWR's review of the information in Tables 1 and 2, SCWD has and is currently implementing the BMPs consistent with AB 1420 and, therefore, is eligible to receive water management grant or loan funds.

DWR reserves the right to request additional information and documentation, including reports from SCWD to substantiate the accuracy of the information provided in Tables 1 and 2. DWR may reverse or modify its eligibility determination and notify you and the funding agency if inaccuracies are found in the supporting documentation or in Tables 1 and 2.

If you have any questions, please contact me at (916) 651-7025 or Jodi Evans at (916) 651-7026.

Sincerely,

Fethi BenJemaa
Ag Water Use Efficiency Section Chief

AB 1420 Self- Certification Statement Table 1

Note: Table 1 documents Status of Past and Current BMP implementation.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification StatementTable 1, and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1,and Table 2 and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, theFunding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory Cathy Z. Hollomon **Title of Signatory** Associate Water resources Planner **Signature of signatory**_____ **Date** _____

Application Date:

Proposal Identification Number: | **CUWCC Member? Yes/No** No (see letter)

Has Urban Water Supplier submitted a 2005 Urban Water Management Plan? Yes/No Yes | **Is the UWM Plan Deemed Complete by DWR? Yes/No** Yes

Applicant Name: Santa Clarita Water Division

Project Title:

Applicant's Contact Information: **Name:** Cathy Z. Hollomon **Phone:** 661-964-3997 **E-mail:** chollomon@scwater.org

Participants:

Retailer (List Below)	*Wholesaler (List Below)*
Santa Clarita water Division	

C1	C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
				BMP Implemented by Retailers and/or Wholesalers / *BMP*			**Compliance Options/Alternative Conservation Approaches (1)**			**BMP Is Exempt (2)**			**BMP Implementation Requirements Met**				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs		Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 1 Water Survey for Single/Multi-Family Residential Customers		✓				✓					No		3/2/2008		Yes
	✓	BMP 2 Residential Plumbing Retrofit		✓			✓						No		3/2/2008		Yes
✓	✓	BMP 3 System Water Audits, Leak Detection		✓			✓						Yes		3/2/2008		Yes
✓	✓	BMP 3 Leak Repairs		✓			✓						Yes		3/2/2008		Yes
	✓	BMP 4 Metering with Commodity Rates for All New connections		✓			✓						Yes		3/2/2008		Yes
	✓	BMP 4 Retrofit of Existing Connections		✓			✓						Yes		3/2/2008		Yes

C1	C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
				BMP Implemented by Retailers and/or Wholesalers / *BMP*			**Compliance Options/Alternative Conservation Approaches (1)**			**BMP Is Exempt (2)**			**BMP Implementation Requirements Met**				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 5 Large Landscape Conservation Programs and Incentives	✓		✓	✓						No		3/2/2008		Yes
	✓	BMP 6 High-Efficiency Washing Machine Rebate Programs	✓			✓						No		3/2/2008		Yes
✓	✓	BMP 7 Public Information	✓		✓	✓						Yes		3/2/2008		Yes
✓	✓	BMP 8 School Education	✓		✓	✓						Yes		3/2/2008		Yes
	✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts	✓			✓						No		3/2/2008		Yes
✓		BMP 10 Wholesale Agency Assistance Programs										NA				Yes
	✓	BMP 11 Conservation Pricing	✓			✓						Yes		3/2/2008		Yes
✓	✓	BMP 12 Conservation Coordinator	✓			✓						Yes		3/2/2008		Yes
	✓	BMP 13 Water Waste Prohibitions	✓			✓						Yes		3/2/2008		Yes
	✓	BMP 14 Residential ULFT Replacement Programs	✓		✓	✓						No		3/2/2008		Yes

***C6:** Wholesaler may also be a retailer (supplying water to end water users)
****C8, **C9, **, and C10:** Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.

(1) For details, please see: http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.
(2) BMP is exempt based on cost-effectiveness, lack of funding, and lack of legal authority criteria as detailed in the CUWCC MOU
(3) Non MOU signatories must submit to DWR reports and supporting documents in the same format as CUWCC.

AB 1420 Self- Certification Statement Table 2

Provide Schedule, Budget, and Finance Plan to Demonstrate Commitment to Implement All BMP's to Become in Compliance with BMP Implementation - Commencing Within 1st Year of Agreement for Which Applicant Receives Funds.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1 and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1 and Table 2, and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory_Cathy Z. Hollomon___Title of Signatory _Associate Water Resources PLanner_ Signature of signatory_____ Date _____

Application Date:

Proposal Identification Number:

CUWCC Member? **Yes/No** No (see letter)

Applicant Name: Cathy Z. Hollomon

Is the UWM Plan Deemed Complete by DWR? **Yes/No** Yes

Project Title:

Applicant's Contact Information: **Name** Santa Clarita Water Division

	Retailer (List Below)		
Participants:			

C1	C2	C3	C4	C5	*C6	C7	C8	**C9	**C10	**C11	C12			C13	C14	C15	C16	C17	C18	C19
				BMP Implemented by Retailers and/or Wholesalers				**Compliance Options / Alternative Conservation Approaches (1)**			**BMP is Exempt (2)**			**Implementation Scheduled to Commence within 1st Year of Agreement**						
CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	Alternative Conservation Approaches Yes/No	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested, if Available. (See AB 1420 Compliance Table 3) Yes/No
1. Utility Operations Programs																				
1.11	✓	✓	BMP 12 Conservation Coordinator																	
1.12		✓	BMP 13 Water Waste Prohibitions																	
1.13	✓	✓	BMP 10 Wholesale Agency Assistance Programs																	
1.20	✓	✓	BMP 3 System Water Audits, Leak Detection/**Repair**																	
1.30		✓	BMP 4 Metering with Commodity Rates for All New/**Retrofit of Existing** connections																	
1.40		✓	BMP 11 Conservation Pricing																	
2. Educational Programs																				
2.10	✓	✓	BMP 7 Public Information																	
2.20	✓	✓	BMP 8 School Education																	
3. Residential																				
3.11		✓	BMP 1 **Indoor** Water Survey for Single/Multi-Family Residential Customers						✓					Jul-08	30	Jun-15	program to be combined with BMP 5 - large landscape Conservation, which focuses on HOA properties	water rates	Yes	

CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	BMP Implemented by Retailers and/or Wholesalers				Compliance Options / Alternative Conservation Approaches (1)			BMP is Exempt (2)			Implementation Scheduled to Commence within 1st Year of Agreement						
				Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	Alternative Conservation Approaches Yes/No	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested, if Available. (See AB 1420 Compliance Table 3) Yes/No
3.12			BMP 1 **Outdoor** Water Survey for Single/Multi-Family Residential Customers						✓					Jul-09	30	Jun-15	program to be combined with BMP 5 - large landscape Conservation, which focuses on HOA properties	water rates	Yes	
3.20		✓	BMP 2 Residential Plumbing Retrofit					✓						Jun-08	80	Jun-13	$4,000	water rates	Yes	
3.30		✓	BMP 6 High-Efficiency Washing Machine Rebate Programs					✓						Jul-11	0	Jun-20	$37,500	water rates	Yes	
3.40		✓	BMP 14 Residential ULFT Replacement Programs					✓						Jun-07	40	Jun-15	$20,000	water rates	Yes	
4. Commercial, Industrial, Institutional																				
4.00		✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts					✓						Jun-09	20	Jun-15	$30,000	water rates	Yes	
5. Landscape																				
5.00		✓	BMP 5 Large Landscape Conservation Programs and Incentives					✓						Jun-09	20	Jun-15	$100,000	water rates	Yes	

*C6: Wholesaler may also be a retailer (supplying water to end water users)
**C9, ** C10, and **C11: Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.
(1) For details, please see http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.
(2) BMP is exempt based on cost-effectiveness, lack of funding, or lack of legal authority, as detailed in the CUWCC MOU.

CLWA DMM Materials

CUWCC BMP COVERAGE REPORT FOR WHOLESALE AGENCIES

Foundation Best Management Practices for Urban Water Efficiency

Agency: Castaic Lake Water Agency **District Name:** Castaic Lake Water Agency **CUWCC Unit #:** 6278

Primary Contact Stephanie Anagnoson **Email:** sanagnoson@clwa.org

Base Year: Calendar or FiscalYear Reporting Report Date: 27-May-11

Foundational BMPs

BMP 1.1.3 Wholesale Agency Assistance Programs

Date of 2009 Data Download

Date of 2010 Data Download

a) Financial investments and building partnerships Value of resources provided to retailers for: **2009**	**2009 Monetary Amount for Financial Incentives**	**2009 Monetary Amount for Equivalent Resources**
BMP 2.1 Public Outreach	$ 81,000	$ 200,700
BMP 2.2 Education	$ 100,000	$ 266,373
BMPs 3, 4, 5 (not designated by BMP)	$ 43,975	$ 133,773
Total Value of Resources	$ 224,975	$ 600,846
	On Track	On Track

"On Track" if Retailer accepted offer and Wholesaler provided resources. "Not on Track" if Retailer accepted offer and Wholesaler did not provde resources.

a) Financial investments and building partnerships Value of resources provided to retailers for: **2010**	**2010 Monetary Amount for Financial Incentives**	**2010 Monetary Amount for Equivalent Resources**
BMP 2.1 Public Outreach	$ 89,000	$ 264,200
BMP 2.2 Education	$ 108,000	$ 244,195
BMPs 3, 4, 5 (not designated by BMP)	$ 127,645	$ 671,593
Total Value of Resources	$ 324,645	$ 1,179,988
	On Track	On Track

Agency: Castaic Lake Water Agency **District Name:** Castaic Lake Water Agency **CUWCC Unit #:** 6278

	2009 Technical Support Description	2010 Technical Support Description	
b) Technical Support	Provide conservation coordinator servies; fund and prepare Urban Water Management Plan and other planning documents; conduct Valley-wide public outreach for conservation.	Provide conservation coordinator services; fund and prepare Urban Water Management Plan and other planning documents; conduct Valley-wide public outreach for conservation; manage residential high-efficiency toilet rebate program, residential landscape program (with weather-based irrigation incentive), commercial, industrial and institutional program and large landscape audit program.	" On Track" if Retailer accepted and Wholesaler provided and described Technical Support
	On Track	On Track	

	2009		2010	
	c) Retail Angency	**Programs Managed for Retailers**	**c) Retail Angency**	**Programs Managed for Retailers**
				" On Track" if Retailer accepted and Wholesaler provided and lists programs managed for retailers

	2009		2010	
d) Water Shortage Allocation				
Has Water shortage plan or policy been adopted?	November 9, 2005	Adoption Date	November 9, 2005	"OnTrack" if plan /policy adopted and document provided. "Not on Track" if no water shortage plan or policy adopted or document not provided.
	2005UWMPCh8WaterShortage	File Name	2005UWMPCh8WaterShortage	
	On Track		On Track	
e) Non signatory Reporting of BMP implementation by non-signatory agencies	n/a		n/a	Report if possible

	List Efforts to recruit retailers	List Efforts to recruit retailers	
f) Encourage CUWCC Membership List Efforts to recruit retailers	Santa Clarita Water Division has been encouraged to join during conservation coordinator meetings.	Santa Clarita Water Division has been encouraged to join during conservation coordinator meetings.	"On Track" if efforts listed or dues paid.
	On Track	On Track	

Agency: Castaic Lake Water Agency | **District Name:** Castaic Lake Water Agency | **CUWCC Unit #:** 6278

BMP 1.2 Water Loss Control

Date of 2009 Data Submittal: #N/A
Date of 2010 Data Submittal: June 1, 2011

	2009	
Complete a prescreening Audit	Yes	On Track if Yes
Metered Sales AF	37,820	Metered sales to retail agencies
Verifiable Other Uses AF	37,820	
Total Supply AF	39,051	Into wholesale system
(Metered Sales + System uses)/ Total Supply >0.89	1.94	On Track if =>.89, Not on Track if No
If ratio is less than 0.9, complete a full scale Audit in 2009?	Yes	On Track if Yes
Verify Data with Records on File?	Yes	On Track if Yes
Operate a system Leak Detection Program?	Yes	On Track if Yes

Comments: On Track

For wholesalers AWWA methodology applies to supplies to wholesalers, sales to retail agencies or sub wholesalers, and pipelines operated by wholesalers. End use retail customers are not considered in this

	2010	
Compile Standard Water Audit using AWWA Software?	Yes	On Track if Yes, Not on Track if No
AWWA file provided to CUWCC?	Yes	On Track if Yes, Not on Track if No
AWWA Water Audit Validity Score?	77	Info only until 2012
Completed Training in AWWA Audit Method?	no	Info only until 2012
Completed Training in Component Analysis Process?	No	Info only until 2012
Complete Component Analysis?	no	Info only until 2012
Repaired all leaks and breaks to the extent cost effective?	Yes	On Track if Yes, Not on Track if No
Locate and repair unreported leaks to the extent cost effective.	Yes	On Track if Yes, Not on Track if No
Maintain a record-keeping system for the repair of reported leaks, including time of report, leak location, type of leaking pipe segment or fitting, and leak running time from report to repair.		Info only until 2012

Provided 7 types of Water Loss Control Info

Leaks Repaire	Value Real Losses	Value Apparent Losses	Miles Surveyed	Press Reduction	Cost Interventions	Water Lost from Leaks AF
0	$ 560,689	$ 152,318	0	No	$ -	no data

info only until 2012

On Track

Agency: Castaic Lake Water Agency **District Name:** Castaic Lake Water Agency **CUWCC Unit #:** 6278

1.3 METERING WITH COMMODITY RATES FOR ALL NEW CONNECTIONS AND RETROFIT OF EXISTING CONNECTIONS

Date of 2009 Data Submittal: June 1, 2011
Date of 2010 Data Submittal: June 1, 2011

	2009	2010	
Exemption requested?	No	No	
At least as Effective As Requested?	No	No	
Does Agency have Unmetered Deliveries to Retail Agencies or Other Wholesalers?	No	No	
Metered Accounts billed by volume of use	Yes	Yes	Volumetric billing required for all connections on same schedule as metering
Completed a written plan, policy or program to test, repair and replace meters	No	No	info only until 2012
	On Track	On Track	

Agency: Castaic Lake Water Agency
WHOLESALE Water Supplier

District Name: Castaic Lake Water Agency

CUWCC Unit #: 6278

Coverage Report Date: May 19, 2011

Primary Contact Stephanie Anagnoson

Email: sanagnoson@clwa.org

BMP 2. EDUCATION PROGRAMS

date 2009 datafile downloaded: June 1, 2011

date 2010 datafile downloaded:

BMP 2.1 Public Outreach Actions Implemented and Reported to CUWCC

	2009	2010
1) Contacts with the public (minimum = 4 times per year)	134	129
2) Water supplier contacts with media (minimum = 4 times per year, i.e., at least quarterly).	219	50
3) An actively maintained website that is updated regularly (minimum = 4 times per year, i.e., at least quarterly).	Yes	Yes
4) Description of materials used to meet minimum requirement.	Website General water conservation information Email Messages Newsletter articles on conservation Articles or stories resulting from outreach Editorial board visits News releases Radio contacts	Newsletter articles on conservation Website General water conservation information Email Messages Landscape water conservation media campaig Articles or stories resulting from outreach Editorial board visits Radio and TV contacts
5) Annual budget for public outreach program.	$ 378,747	$ 1,063,235
6) Description of all other outreach programs	n/a	watering index (updated weekly) 3 Easy Tips (water conservation social marketing campaign) (updated throughout the summer) Water Conservation Tips (updated weekly) CII Water Conservation (updated throughout year)
	On Track for 5 Actions	On Track for 5 Actions

All 6 action types implemented and reported to CUWCC to be 'On Track')

Agency: Castaic Lake Water Agency
WHOLESALE Water Supplier

District Name: Castaic Lake Water Agency

CUWCC Unit #: 6278

Coverage Report Date: May 19, 2011

2.2 School Education Programs Implemented and Reported to CUWCC

date 2009 datafile downloaded: June 1, 2011

date 2010 datafile downloaded: June 1, 2011

	2009	2010	
Does this wholesale agency implement School Education Programs for Sub Wholesalers or Retail unility's benefit?	Yes	Yes	
Names of Sub Wholesale and Retail Agencies benefiting from Program?	Newhall County Water District, Santa Clarita Water Division, Valencia Water Company	Newhall County Water District, Santa Clarita Water Division, Valencia Water Company	
1) Curriculum materials developed and/or provided by wholesale agency	Curricula that covers science, social studies, and math standards mandated by State of California	Curricula that covers science, social studies, and math standards mandated by State of California	All 5 actions types implemented and reported to CUWCC to be 'On Track'
2) Materials meet state education framework requirements and are grade-level appropriate?	Yes	Yes	
3) Materials Distributed to K-6?	Yes	Yes	
Describe K-6 Materials	Materials cover science, social studies, and math standards mandated by State of California as they relate to water, water quality, water conservation and water supply issues.	Materials cover science, social studies, and math standards mandated by State of California as they relate to water, water quality, water conservation and water supply issues.	Describe materials to meet minimum requirements
Materials distributed to 7-12 students?	Yes	Yes	Info Only
4) Annual budget for school education program.	$ 337,164	$ 352,195	
5) Description of all other water supplier education programs	n/a	n/a	
	On Track	On Track	

AWWA WLCC Free Water Audit Software: Reporting Worksheet

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WAS v4.2

Back to Instructions

? Click to access definition

Water Audit Report for: Castaic Lake Water Agency
Reporting Year: 40796 7/2009 - 6/2010

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources:	?	8	36,675.000	acre-ft/yr
Master meter error adjustment (enter positive value):	?	8	3.600	over-registered acre-ft/yr
Water imported:	?	8	34,885.000	acre-ft/yr
Water exported:	?	10	34,610.000	acre-ft/yr
WATER SUPPLIED:			36,946.400	acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

					Pcnt:	Value:
Billed metered:	?	10	35,353.000	acre-ft/yr		
Billed unmetered:	?	10	0.000	acre-ft/yr		
Unbilled metered:	?	10	0.000	acre-ft/yr		
Unbilled unmetered:	?		461.830	acre-ft/yr	1.25%	

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied **OR** value

AUTHORIZED CONSUMPTION:	?		35,814.830	acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

1,131.570 acre-ft/yr

Apparent Losses

					Pcnt:	Value:
Unauthorized consumption:	?		92.366	acre-ft/yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	?	5	357.101	acre-ft/yr	1.00%	
Systematic data handling errors:	?	5		acre-ft/yr		

Systematic data handling errors are likely, please enter a non-zero value; otherwise grade = 5

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Apparent Losses:	?		449.467	

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	?		682.103	acre-ft/yr
WATER LOSSES:			1,131.570	acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER:	?		1,593.400	acre-ft/yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	?	10	43.0	miles	
Number of active AND inactive service connections:	?	10	25		
Connection density:			1	conn./mile main	
Average length of customer service line:	?	10		ft	(pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	?	10	110.0	psi	

COST DATA

Total annual cost of operating water system:	?	10	$107,299,883	$/Year
Customer retail unit cost (applied to Apparent Losses):	?	5	$1.04	$/1000 gallons (US)
Variable production cost (applied to Real Losses):	?	5	$822.00	$/acre-ft

Retail costs are less than (or equal to) production costs; please review and correct if necessary

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	4.3%
Non-revenue water as percent by cost of operating system:	1.0%
Annual cost of Apparent Losses:	$152,318
Annual cost of Real Losses:	$560,689

Operational Efficiency Indicators

Apparent Losses per service connection per day:	16050.33	gallons/connection/day
Real Losses per service connection per day*:	N/A	gallons/connection/day
Real Losses per length of main per day*:	14,161.45	gallons/mile/day
Real Losses per service connection per day per psi pressure:		gallons/connection/day/psi
? Unavoidable Annual Real Losses (UARL):	Not Valid	

*** UARL cannot be calculated as either average pressure, number of connecions or length of mains is too small: SEE UARL DEFINITION ***

From Above, Real Losses = Current Annual Real Losses (CARL):	682.10	
? Infrastructure Leakage Index (ILI) [CARL/UARL]:		

* only the most applicable of these two indicators will be calculated

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 77 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Customer metering inaccuracies
3: Customer retail unit cost (applied to Apparent Losses)

For more information, click here to see the Grading Matrix worksheet

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

Primary contact:

First name: Stephanie

Last name: Anagnoson

Email: sanagnoson@clwa.org

You must enter the reporting unit number that we have on record for your agency. Click here to open a table to obtain this number.

Link to FAQs

2009

BMP 1.1 Operations Practices

Comments:

See the complete MOU: View MOU

See the coverage requirements for this BMP:

Conservation Coordinator

Conservation Coordinator ◯ Yes ◯ No

Contact Information

First Name	Thomas
Last Name	Hawes
Title	water conservation program coordin
Phone	661.513.1231
Email	thawes@clwa.org

Note that the contact information may be the same as the primary contact information at the top of the page. If this is your case, excuse the inconvenience but please enter the information again.

Water Waste Prevention

Water Agency shall do one or more of the following:

a. Enact and enforce an ordinance or establish terms of service that prohibit water waste
b. Enact and enforce an ordinance or establish terms of service for water efficient design in new development
c. Support legislation or regulations that prohibit water waste
d. Enact an ordinance or establish terms of service to facilitate implementation of water shortage response measures
e. Support local ordinances that prohibit water waste
f. Support local ordinances that establish permits requirements for water efficient design in new

To document this BMP, provide the following:

a. A description of, or electronic link to, any ordinances or terms of service
b. A description of, or electronic link to, any ordinances or requirements adopted by local jurisdictions or regulatory agencies with the water agency's service area.
c. A description of any water agency efforts to cooperate with other entities in the adoption or enforcement of local requirement
d. description of agency support positions with respect to adoption of legislation or regulations

You can show your documentation by providing files, links (web addresses), and/or entering a description.

File name(s): Email files to natalie@cuwcc.org

Web address(s) URL: comma-separated list: http://dpw.lacounty.gov/wwd/web/docs/Water%20Wasting%20Ordinance%20final.pdf

Enter a description:

We can provide documentation on the following aspects of water waste prevention:
c. Supported local ordinance that prohibits water waste in unincorporated LA County (http://dpw.lacounty.gov/wwd/web/docs/Water%20Wasting%20Ordinance%20final.pdf)
d. Supported City of Santa Clarita's Municipal Code 9.38.015 Water Conservation Action Plan.

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

Primary contact:

First name: Stephanie

Last name: Anagnoson

Email: sanagnoson@clwa.org

You must enter the reporting unit number that we have on record for your agency. Click here to open a table to obtain this number.

Link to FAQs

2010

BMP 1.1 Operations Practices

Comments:

See the complete MOU: View MOU

See the coverage requirements for this BMP:

Conservation Coordinator

Conservation Coordinator ◯ Yes ◯ No

Contact Information

First Name	Thomas
Last Name	Hawes
Title	water conservation program coordin
Phone	661.513.1231
Email	thawes@clwa.org

Note that the contact information may be the same as the primary contact information at the top of the page. If this is your case, excuse the inconvenience but please enter the information again.

Water Waste Prevention

Water Agency shall do one or more of the following:

a. Enact and enforce an ordinance or establish terms of service that prohibit water waste
b. Enact and enforce an ordinance or establish terms of service for water efficient design in new development
c. Support legislation or regulations that prohibit water waste
d. Enact an ordinance or establish terms of service to facilitate implementation of water shortage response measures
e. Support local ordinances that prohibit water waste
f. Support local ordinances that establish permits requirements for water efficient design in new

To document this BMP, provide the following:

a. A description of, or electronic link to, any ordinances or terms of service
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c. A description of any water agency efforts to cooperate with other entities in the adoption or enforcement of local requirement
d. description of agency support positions with respect to adoption of legislation or regulations

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Web address(s) URL: comma-separated list: http://dpw.lacounty.gov/wwd/web/docs/Water%20Wasting%20Ordinance%20final.pdf

Enter a description:

We can provide documentation on the following aspects of water waste prevention:
c. Supported local ordinance that prohibits water waste in unincorporated LA County (http://dpw.lacounty.gov/wwd/web/docs/Water%20Wasting%20Ordinance%20final.pdf)
c. Suppported AB 1881, landscape ordinance

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

Primary contact:

First name: Stephanie

Last name: Anagnoson

Email: sanagnoson@clwa.org

You must enter the reporting unit number that we have on record for your agency. Click here to open a table to obtain this number.

Link to FAQs

View MOU

2009 BMP 1.2 Water Loss Control

Did your agency complete a pre-screening system audit in 2009? Yes ◉ No ○

If yes, answer the following:

Determine metered sales in AF: 37,820.00

Definition: other accountable uses not included in metered sales, such as unbilled water use, fire suppression, etc.

Determine system verifiable uses AF: 37,820.00

Determine total supply into the system in AF: 39,051.00

Does your agency keep necessary data on file to verify the answers above? Yes ◉ No ○

Did your agency complete a full-scale system water audit during 2009? Yes ○ No ◉

Does your agency maintain in-house records of audit results or the completed AWWA worksheet for the completed audit which could be forwarded to CUWCC? Yes ◉ No ○

Did your agency operate a system leak detection program? Yes ◉ No ○

Comments:

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

Primary contact:

First name: Stephanie

Last name: Anagnoson

Email: sanagnoson@clwa.org

You must enter the reporting unit number that we have on record for your agency. Click here to open a table to obtain this number.

Link to FAQs

2010 BMP 1.2 Water Loss Control

View MOU

AWWA Water Audit

Agency to complete a Water Audit & Balance Using The AWWA Software (●) Yes ( ) No

Email to natalie@cuwcc.org - Worksheets (AWWA Water Audit). Enter the name of the file below:

CLWA Water Audit 2010

Water Audit Validity Score from AWWA spreadsheet: 77

Agency Completed Training In The AWWA Water Audit Method ( ) Yes (●) No

Agency Completed Training In The Component Analysis Process ( ) Yes (●) No

Completed/Updated the Component Analysis (at least every 4 years)? ( ) Yes (●) No

Component Analysis Completed/Updated Date:

Water Loss Performance

Agency Repaired All Reported Leaks & Breaks To The Extent Cost Effective (●) Yes ( ) No

Recording Keeping Requirements:

Date/Time Leak Reported	Leak Location
Type of Leaking Pipe Segment or Fitting	Leak Running Time From Report to Repair
Leak Volume Estimate	Cost of Repair

Agency Located and Repaired Unreported Leaks to the Extent Cost Effective (●) Yes ( ) No

Type of Program Activities Used to Detect Unreported Leaks

monthly reconciling of water purchased to water sold

Annual Summary Information

Complete the following table with annual summary information (required for reporting years 2-5 only)

Total Leaks Repaired	Economic Value Of Real Loss	Economic Value Of Apparent Loss	Miles Of System Surveyed For Leaks	Pressure Reduction Undertaken for loss reduction	Cost Of Interventions	Water Saved (AF/Year)
0	$560,689.00	$152,318.00				

Comments:

Please note that the AWWA M36 spreadsheet presents a number of unanswerable questions for wholesalers, including line 65 (average length of customer line --- we have only retailers as customers). We also have trouble with line 78 (our retail costs are less than production costs) and line 101 (UARL).

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

Primary contact:

First name: Stephanie

Last name: Anagnoson

Email: sanagnoson@clwa.org

You must enter the reporting unit number that we have on record for your agency. Click here to open a table to obtain this number.

BMP 1.3 Metering with Commodity

Link to FAQs

See the complete MOU: View MOU

See the coverage requirements for this BMP:

Implementation

Does your agency have any unmetered service connections? Yes No

If YES, has your agency completed a meter retrofit plan? Yes No

Enter the number of previously unmetered accounts fitted with meters during reporting year:

Are all new service connections being metered? Yes No

Are all new service connections being billed volumetrically? Yes No

Has your agency completed and submitted electronically to the Council a written plan, policy or program to test, repair and replace meters? Yes No

Please Fill Out The Following Matrix

Account Type	# Metered Accounts	# Metered Accounts Read	# Metered Accounts Billed by Volume	Billing Frequency Per Year	# of estimated bills/yr
Other	26	26	26	Monthly	12
Other				Monthly	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	

Number of CII Accounts with Mixed-use Meters: 0

Number of CII Accounts with Mixed-use Meters Retrofitted with Dedicated Irrigation Meters during Reporting Period: 0

Feasibility Study

Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters? Yes No

If YES, please fill in the following information:

A. When was the Feasiblity Study conducted

B. Email or provide a link to the feasibility study (or description of):

File name(s): Email files to natalie@cuwcc.org Enter the file name here e.g. WaterWastePreventionOrdinan

Web address(s) URL: comma-separated list Enter the URL to your documentation.

General Comments about BMP 1.3:

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

Primary contact:

First name: Stephanie

Last name: Anagnoson

Email: sanagnoson@clwa.org

You must enter the reporting unit number that we have on record for your agency. Click here to open a table to obtain this number.

BMP 1.3 Metering with Commodity

2010

Link to FAQs

See the complete MOU: View MOU

See the coverage requirements for this BMP:

Implementation

Does your agency have any unmetered service connections? ○ Yes ○ No

If YES, has your agency completed a meter retrofit plan? ○ Yes ○ No

Enter the number of previously unmetered accounts fitted with meters during reporting year:

Are all new service connections being metered? ○ Yes ○ No

Are all new service connections being billed volumetrically? ○ Yes ○ No

Has your agency completed and submitted electronically to the Council a written plan, policy or program to test, repair and replace meters? ○ Yes ○ No

Please Fill Out The Following Matrix

Account Type	# Metered Accounts	# Metered Accounts Read	# Metered Accounts Billed by Volume	Billing Frequency Per Year	# of estimated bills/yr
Other	26	26	26	Monthly	12
Other				Monthly	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	
Other				Other	

Number of CII Accounts with Mixed-use Meters: 0

Number of CII Accounts with Mixed-use Meters Retrofitted with Dedicated Irrigation Meters during Reporting Period: 0

Feasibility Study

Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters? ○ Yes ○ No

If YES, please fill in the following information:

A. When was the Feasiblity Study conducted

B. Describe, upload or provide an electronic link to the Feasibility Study Upload File

File name(s): Email files to natalie@cuwcc.org Enter the file name here e.g. WaterWastePreventionOrdinanc

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Comments:

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Agency name: Castaic Lake Water Agency

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Primary contact:

First name: Stephanie

Last name: Anagnoson

Email: sanagnoson@clwa.org

Click here to open a table that displays your agency name reporting unit name and reporting unit number. Please ensure that you enter the correct information.

Link to FAQs

2009

BMP 2.1 Public Outreach

View MOU

Is your agency performing Public Outreach for your Retailers?

Are there one or more retail agencies that count on your agency to help them comply with this BMP? ○ Yes ○ No

Enter the name(s) of the retail agency (comma delimited): Newhall County Water District, Santa Clarita Water Division, Valencia Water Company, LA County Waterworks #36

Is your agency performing public outreach?

Report a minimum of 4 water conservation related contacts your agency had with the public during the year.

Public Information Programs List

Did at least one contact take place during each quarter of the reporting year? ✓

Number of Public Contacts	Public Information Programs
4	Newsletter articles on conservation
52	Website
37	General water conservation information
4	Email Messages
37	Landscape water conservation media campaigns

Contact with the Media

Are there one or more retail agencies that count on your agency to help them comply with this BMP? ○ Yes ○ No

Enter the name(s) of the retail agency (comma delimited): Newhall County Water District, Santa Clarita Water Division, Valencia Water Company, LA County Waterworks #36

OR Wholesale Agency (Contacts with the Media)

Media Contacts List

Did at least one contact take place during each quarter of the reporting year? ✓

Number of Media Contacts	Did at least one contact take place during each quarter of the reporting year?	Media Contact Types
45		Articles or stories resulting from outreach
0		Editorial board visits
5		News releases
163		Radio contacts
1,040		Television contacts
5		Written editorials

Is a Wholesale Agency Performing Website Updates?

Did one or more retail agencies rely on your agency's responsibility for meeting the requirements of and for CUWCC reporting of this BMP? ○Yes ○No

Enter the name(s) of the retail agency (comma delimited)

Santa Clarita Water Division

Is Your Agency Performing Website Updates?

Enter your agency's URL (website address): http://www.clwa.org

Describe a minimum of four water conservation related updates to your agency's website that took place during the year:

watering index (updated weekly)
Plants of the Conservatory Garden
Water Conservation Tips
Fire-Retardant, Water-wise Plants
Water Conservation Tips (updated weekly)

Did at least one Website Update take place during each quarter of the reporting year? ○Yes ○No

Public Outreach Annual Budget

Enter budget for public outreach programs. You may enter total budget in a single line or brake the budget into discrete categories by entering many rows. Please indicate if personnel costs are included in the entry.

Category	Amount		Personnel Costs Included? If yes, check the box.	Comments	
PR Consulting	$150,512		✓	Social marketing campaign	
Public Outreach	$33,512		✓	Public events	
Publications	$51,512		✓	Quarterly newsletter, yearly water quality rep	
BMP Implement	$143,211		✓	Conservation Programs, including outreach	

Comments:

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

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2010

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The fields in red are required.

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Reporting unit number: 6278

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Email: sanagnoson@clwa.org

Click here to open a table that displays your agency name reporting unit name and reporting unit number. Please ensure that you enter the correct information.

Link to FAQs

2009

BMP 2.2 School Education Programs

View MOU

School Programs

Is your agency implementing school programs which can be counted to help another agency comply with this BMP? ○ Yes ○ No

Enter retailer names, separated by commas: Newhall County Water District, Santa Clarita Water Division, Valencia Water Company

☑ Materials meet state education framework requirements?

Description of Materials: Curricula that covers science, social studies, and math standards mandated by State of California

☑ Materials distributed to K-6 Students?

Description of materials distributed to K-6 Students: Materials cover science, social studies, and math standards mandated by State of California as they relate to water, water quality, water conservation and water supply issues.

Number of students reached: 11,135

☑ Materials distributed to 7-12 Students?

Description of materials distributed to 7-12 Students: Soil Permeability,Water Born Diseases, and Water Quality materials for 7-8 grades that correlate to the State of California Standards.

Number of Distribution: 812

Annual budget for school education program: $337,164.00

Description of all other water supplier education programs:

School Program Activities

Classroom presentations:

Number of presentations: 445 Number of attendees: 11135

Large group assemblies:

Number of presentations: 0 Number of attendees: 0

Children's water festivals or other events:

Number of presentations: 1 Number of attendees: 5000

Cooperative efforts with existing science/water education programs (various workshops, science fair awards or judging) and follow-up:

Number of presentations: 0 Number of attendees: 0

Other methods of disseminating information (i.e. themed age-appropriate classroom loaner kits):

Description

Number distributed

Staffing children's booths at events & festivals:

Number of booths: 4 | Number of attendees: 6700

Water conservation contests such as poster and photo:

Description

Number distributed

Offer monetary awards/funding or scholarships to students:

Number Offered: 5 | Total Funding: 16500

Teacher training workshops:

Number of presentations: 0 | Number of attendees: 0

Fund and/or staff student field trips to treatment facilities, recycling facilities, water conservation gardens, etc.:

Number of tours or field trips: 159 | Number of participants: 5565

College internships in water conservation offered:

Number of internships: 0 | Total funding: 0

Career fairs/workshops:

Number of presentations: 1 | Number of attendees: 5,000

Additional program(s) supported by agency but not mentioned above:

Description

Number of events (if applicable): 37 | Number of participants: 10000

Total reporting period budget expenditures for school education programs (include all agency costs): $337164

Comments

The fields in red are required.

Agency name: Castaic Lake Water Agency

Reporting unit name (District name): Castaic Lake Water Agency

Reporting unit number: 6278

Primary contact:

First name: Stephanie

Last name: Anagnoson

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2010

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View MOU

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Number of attendees: 5000

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Description

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College internships in water conservation offered:

Number of internships: 0 | Total funding: 0

Career fairs/workshops:

Number of presentations: 1 | Number of attendees: 5,000

Additional program(s) supported by agency but not mentioned above:

Description

Number of events (if applicable): 37 | Number of participants: 10000

Total reporting period budget expenditures for school education programs (include all agency costs): $337164

Comments

AWWA WLCC Free Water Audit Software: Reporting Worksheet

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WAS v4.2

Back to Instructions

? Click to access definition

Water Audit Report for: Santa Clarita Water Division
Reporting Year: 2009 1/2009 - 12/2009

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources:	7	10,077.000	acre-ft/yr	
Master meter error adjustment (enter positive value):	2	1,334.000	under-registered	acre-ft/yr
Water imported:	7	17,739.000	acre-ft/yr	
Water exported:	n/a	0.000	acre-ft/yr	
WATER SUPPLIED:		29,150.000	acre-ft/yr	

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:	Value:
Billed metered:	7	26,132.000	acre-ft/yr		
Billed unmetered:	10	59.000	acre-ft/yr		
Unbilled metered:	n/a	0.000	acre-ft/yr		
Unbilled unmetered:	7	39.000	acre-ft/yr		39.000
AUTHORIZED CONSUMPTION:		26,230.000	acre-ft/yr		

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)

2,920.000 acre-ft/yr

Apparent Losses

				Pcnt:	Value:
Unauthorized consumption:	3	5.000	acre-ft/yr		5.000
Customer metering inaccuracies:	5	263.960	acre-ft/yr	1.00%	
Systematic data handling errors:	5		acre-ft/yr		

Systematic data handling errors are likely, please enter a non-zero value; otherwise grade = 5

Apparent Losses: 268.960

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: 2,651.040 acre-ft/yr

WATER LOSSES: 2,920.000 acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER: 2,959.000 acre-ft/yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	5	308.0	miles	
Number of active AND inactive service connections:	7	28,687		
Connection density:		93	conn./mile main	
Average length of customer service line:	10	15.0	ft	(pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	7	95.0	psi	

COST DATA

Total annual cost of operating water system:	8	$15,613,461	$/Year
Customer retail unit cost (applied to Apparent Losses):	7	$1.26	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	7	$263.54	$/acre-ft

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	10.2%
Non-revenue water as percent by cost of operating system:	5.5%
Annual cost of Apparent Losses:	$147,620
Annual cost of Real Losses:	$698,655

Operational Efficiency Indicators

Apparent Losses per service connection per day:	8.37	gallons/connection/day
Real Losses per service connection per day*:	82.50	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.87	gallons/connection/day/psi
? Unavoidable Annual Real Losses (UARL):	700.26	acre-feet/year
From Above, Real Losses = Current Annual Real Losses (CARL):	2,651.04	acre-feet/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	3.79	

* only the most applicable of these two indicators will be calculated

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 64 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Master meter error adjustment
2: Water imported
3: Customer metering inaccuracies

For more information, click here to see the Grading Matrix worksheet

VWC DMM Materials

AWWA WLCC Free Water Audit Software: Reporting Worksheet

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WAS v4.0

Back to Instructions

? Click to access definition

Water Audit Report for: VALENCIA WATER COMPANY
Reporting Year: 2009 1/2009 - 12/2009

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources:	?	10	15,320.591	acre-ft/yr	
Master meter error adjustment (enter positive value):	?	4	110.308	over-registered	acre-ft/yr
Water imported:	?	10	14,730.873	acre-ft/yr	
Water exported:	?	10	0.000	acre-ft/yr	
WATER SUPPLIED:			29,941.156	acre-ft/yr	

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

					Pcnt:	Value:
Billed metered:	?	10	28,964.492	acre-ft/yr		
Billed unmetered:	?	7	0.000	acre-ft/yr		
Unbilled metered:	?	10	0.737	acre-ft/yr		
Unbilled unmetered:	?		374.264	acre-ft/yr	1.25%	

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied **OR** value

AUTHORIZED CONSUMPTION:	?		29,339.493	acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

601.663 acre-ft/yr

Apparent Losses

					Pcnt:	Value:
Unauthorized consumption:	?		74.853	acre-ft/yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	?	10	145.554	acre-ft/yr	0.50%
Systematic data handling errors:	?		0.000	acre-ft/yr	

Systematic data handling errors are likely, please enter a non-zero value; otherwise grade = 5

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Apparent Losses:	?	220.407	

Real Losses

Real Losses = Water Losses - Apparent Losses:	?	381.256	acre-ft/yr
WATER LOSSES:		601.663	acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER:	?	976.664	acre-ft/yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	?	10	352.3	miles	
Number of active AND inactive service connections:	?	10	29,948		
Connection density:			85	conn./mile main	
Average length of customer service line:	?	10	0.0	ft	(pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	?	8	86.0	psi	

COST DATA

Total annual cost of operating water system:	?	10	$19,374,217	$/Year
Customer retail unit cost (applied to Apparent Losses):	?	10	$1.10	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	?	10	$208.49	$/acre-ft/yr

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	3.3%
Non-revenue water as percent by cost of operating system:	1.4%
Annual cost of Apparent Losses:	$105,802
Annual cost of Real Losses:	$79,486

Operational Efficiency Indicators

Apparent Losses per service connection per day:	6.57	gallons/connection/day
Real Losses per service connection per day*:	11.37	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.13	gallons/connection/day/psi
? Unavoidable Annual Real Losses (UARL):	200.84	million gallons/year
? Infrastructure Leakage Index (ILI) [Real Losses/UARL]:	0.62	

* only the most applicable of these two indicators will be calculated

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 89 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Master meter error adjustment
2: Unauthorized consumption
3: Systematic data handling errors

For more information, click here to see the Grading Matrix worksheet

AWWA WLCC Free Water Audit Software: Reporting Worksheet

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WAS v4.0

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? Click to access definition

Water Audit Report for: VALENCIA WATER COMPANY
Reporting Year: 2010 1/2010 - 12/2010

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources:	?	10	16,080.171	acre-ft/yr	
Master meter error adjustment (enter positive value):	?	4	115.777	over-registered	acre-ft/yr
Water imported:	?	10	11,212.962	acre-ft/yr	
Water exported:	?	10	0.000	acre-ft/yr	
WATER SUPPLIED:			27,177.356	acre-ft/yr	

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

					Pcnt:	Value:
Billed metered:	?	10	26,512.654	acre-ft/yr		
Billed unmetered:	?	7	0.000	acre-ft/yr		
Unbilled metered:	?	10	0.779	acre-ft/yr		
Unbilled unmetered:	?		339.717	acre-ft/yr	1.25%	

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied **OR** value

AUTHORIZED CONSUMPTION:	?		26,853.150	acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

324.206 acre-ft/yr

Apparent Losses

					Pcnt:	Value:
Unauthorized consumption:	?		67.943	acre-ft/yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	?	10	133.233	acre-ft/yr	0.50%	
Systematic data handling errors:	?		0.000	acre-ft/yr		

Systematic data handling errors are likely, please enter a non-zero value; otherwise grade = 5

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Apparent Losses:	?		201.177

Real Losses

Real Losses = Water Losses - Apparent Losses:	?	123.029	acre-ft/yr
WATER LOSSES:		324.206	acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER:	?	664.702	acre-ft/yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	?	10	357.4	miles	
Number of active AND inactive service connections:	?	10	30,080		
Connection density:			84	conn./mile main	
Average length of customer service line:	?	10	0.0	ft	(pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	?	10	86.0	psi	

COST DATA

Total annual cost of operating water system:	?	10	$19,083,083	$/Year
Customer retail unit cost (applied to Apparent Losses):	?	10	$1.10	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	?	10	$245.96	$/acre-ft/yr

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	2.4%
Non-revenue water as percent by cost of operating system:	1.1%
Annual cost of Apparent Losses:	$96,571
Annual cost of Real Losses:	$30,260

Operational Efficiency Indicators

Apparent Losses per service connection per day:	5.97	gallons/connection/day
Real Losses per service connection per day*:	3.65	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.04	gallons/connection/day/psi
? Unavoidable Annual Real Losses (UARL):	202.33	million gallons/year
? Infrastructure Leakage Index (ILI) [Real Losses/UARL]:	0.20	

* only the most applicable of these two indicators will be calculated

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 89 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Master meter error adjustment
2: Unauthorized consumption
3: Systematic data handling errors

For more information, click here to see the Grading Matrix worksheet

NCWD DMM Materials

AWWA WLCC Free Water Audit Software: Reporting Worksheet

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WAS v4.2

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Water Audit Report for: Newhall County Water District

Reporting Year: 2010 7/2009 - 6/2010

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: ACRE-FEET PER YEAR

WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources:	?	10	5,828.810	acre-ft/yr
Master meter error adjustment (enter positive value):	?			acre-ft/yr
Water imported:	?	10	4,108.730	acre-ft/yr
Water exported:	?			acre-ft/yr
WATER SUPPLIED:			9,937.540	acre-ft/yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

					Pcnt:	Value:
Billed metered:	?	10	9,281.320	acre-ft/yr		
Billed unmetered:	?	n/a		acre-ft/yr		
Unbilled metered:	?	10	22.290	acre-ft/yr		
Unbilled unmetered:	?		124.219	acre-ft/yr	1.25%	

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied **OR** value

AUTHORIZED CONSUMPTION:	?		9,427.829	acre-ft/yr

WATER LOSSES (Water Supplied - Authorized Consumption)

509.711 acre-ft/yr

Apparent Losses

					Pcnt:	Value:
Unauthorized consumption:	?		0.000	acre-ft/yr		

Enter a positive value, otherwise a default percentage of 0.25% and a grading of 5 is applied

Customer metering inaccuracies:	?	10	0.000	acre-ft/yr		
Systematic data handling errors:	?	10	5.000	acre-ft/yr		
Apparent Losses:	?		5.000			

? Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	?		504.711	acre-ft/yr
WATER LOSSES:			509.711	acre-ft/yr

NON-REVENUE WATER

NON-REVENUE WATER:	?		656.220	acre-ft/yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	?	10	158.5	miles	
Number of active AND inactive service connections:	?	10	9,604		
Connection density:			61	conn./mile main	
Average length of customer service line:	?	6	15.0	ft	(pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	?	6	100.0	psi	

COST DATA

Total annual cost of operating water system:	?	10	$3,530,399	$/Year
Customer retail unit cost (applied to Apparent Losses):	?	10	$0.97	$/100 cubic feet (ccf)
Variable production cost (applied to Real Losses):	?	10	$355.25	$/acre-ft

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	6.6%
Non-revenue water as percent by cost of operating system:	6.6%
Annual cost of Apparent Losses:	$2,108
Annual cost of Real Losses:	$179,298

Operational Efficiency Indicators

Apparent Losses per service connection per day:	0.46	gallons/connection/day
Real Losses per service connection per day*:	46.92	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.47	gallons/connection/day/psi
? Unavoidable Annual Real Losses (UARL):	280.34	acre-feet/year
From Above, Real Losses = Current Annual Real Losses (CARL):	504.71	acre-feet/year
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	1.80	

* only the most applicable of these two indicators will be calculated

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 96 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Unauthorized consumption

2: Unbilled unmetered

3: Average length of customer service line

For more information, click here to see the Grading Matrix worksheet

Appendix F

Draft Water Shortage Contingency Plans/Ordinances

This appendix contains examples that were adopted in 1991 to address water shortage conditions and will be used as models for future water shortage contingency ordinances.

Appendix I

DROUGHT EMERGENCY WATER SHARING AGREEMENT

1. Parties. The parties to this agreement are: Valencia Water Company, Santa Clarita Water Company, Los Angeles County Waterworks District No. 36-Val Verde, Newhall County Water District, and the Castaic Lake Water Agency.

2. Critical Water Shortage Conditions. The State of California is experiencing a fifth year of drought, which has caused critical water shortages in many areas of the state, including the service area of the Castaic Lake Water Agency. The Agency has recently been informed that the State Water Project will have insufficient water to meet its demands for the coming year.

3. Water Sharing Agreement. In order to alleviate the emergency water shortage caused by the Drought and by insufficient agency water to meet demands, the undersigned parties agree to cooperate in sharing available water from all sources among themselves without regard to water, contractual or other rights for the duration of the emergency, and to facilitate among themselves water transfers, exchanges, and wheeling arrangements.

4. Preservation of Rights. By entering into this emergency water pooling and transfer, the parties do not waive their individual claims to water rights, or to contractual or other claims to water or the use of water. Each party agrees that no party hereto will lose any water right, contract right, or other entitlement to water by entering into this agreement,

nor shall any party attempt to use this agreement or the emergency exchange of water as a basis for a claim against any other party of a continued right to the use of that water. This agreement shall not be construed as constituting any alteration in the respective priorities or terms of any of the rights held by any party, nor as an admission with respect to any rights or claims. Each party further agrees that no party hereto will lose any water or other right by a claim of non-use by another party, prescription, or dedication to public use by entering into this agreement.

5. Termination. This agreement shall terminate upon the cessation of drought conditions affecting the service area of the Castaic Lake Water Agency, or January 1, 1992, whichever is sooner, but may be extended by mutual consent of all the parties.

6. Counterparts. This agreement shall be executed in counterparts, each of which shall be deemed an original.

7. Effective Date. The effective date of this agreement shall be that date upon which all the parties hereto have executed the agreement.

Valencia Water Company

Date: FEBRUARY 13, 1991

Attest:

by _____

_____

Santa Clarita Water Company

Date: February 26, 1991

by W. J. Manthey

Attest:

Benjamin L. Borelli

Los Angeles County Waterworks
District No. 36

Date: 8/27/91

by ORIGINAL SIGNED BY

Attest:

~~Pg~~ 21

Newhall County Water District

Date: 2/19/91

by ORIGINAL SIGNED BY

Attest:

~~Pg~~ 22

Castaic Lake Water Agency

Date: 2/28/91

by ORIGINAL SIGNED BY

Attest:

~~Pg~~ 23

s/Los Angeles County Waterworks District No. 36

Date: AUG 27 1991

by Michael D. Antonovich

Attest:
ATTEST: LARRY J. MONTEILH
EXECUTIVE OFFICER —
CLERK OF THE BOARD OF SUPERVISORS
By Lynne C. Valle, Deputy

s/Newhall County Water District

Date:

Attest:

by

s/Castaic Lake Water Agency

Date: 2/28/91

Attest:

by

APPROVED AS TO FORM
DE WITT W. CLINTON, County Counsel

BY
DEPUTY

ADOPTED
BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES

S 9 1 AUG 27 1991

LARRY J. MONTEILH
EXECUTIVE OFFICER

s/ Newhall County Water District Date: 2/19/71

Attest:

by [signature] President [signature] Secy

s/ Castaic Lake Water Agency Date: _____

Attest:

by _____ _____

s/Los Angeles County Waterworks
District No. 36

Date:

Attest:

by

s/Newhall County Water District

Date:

Attest:

by

s/Castaic Lake Water Agency

Date: 2/28/91

Attest:

by

Appendix II

RESOLUTION NO.804

RESOLUTION OF THE BOARD OF DIRECTORS OF CASTAIC LAKE WATER AGENCY RECOGNIZING REDUCTIONS IN REQUESTED DELIVERY OF STATE WATER PROJECT SUPPLY FOR YEAR 1991 AND MANDATING A PROGRAM OF WATER CONSERVATION IN THE SANTA CLARITA VALLEY

WHEREAS, the Castaic Lake Water Agency is a public entity organized and operating pursuant to the California Water Code, Appendix, Chapter 103, and is primarily empowered to supply water at wholesale to retail water distributors within the Santa Clarita Valley; and

WHEREAS, the Agency's source of water is by contract with the State Water Project of the California Department of Water Resources; and

WHEREAS, the State Water Project, and the entire State of California is experiencing protracted drought conditions of unprecedented recent duration; and

WHEREAS, the California Department of Water Resources in a letter dated February 2, 1991 advised the Agency to plan for "severe reductions" in its State Water Project supply; and

WHEREAS, the letter further reported, "there is a 50% probability that the Department will only be able to deliver about half of the water requested for municipal and industrial use in 1991"; and

WHEREAS, half of the requested State Water Project supply of the Castaic Lake Water Agency would be 13,050 acre feet: and

WHEREAS, the retail water distributors within the Santa Clarita Valley operate ground water production facilities that have been planned to make up some portion of the delivery reductions in State Project Water; and

WHEREAS, the retail water distributors and the Agency, have pursuant to Water Code, Sections 10610 through 10656, adopted a URBAN WATER MANAGEMENT PROGRAM for retail sales which contains water conservation measures including, metering, leak detection, public education, public information, home retrofit devices, drip and sprinkler irrigation restrictions, and a landscape suggestion for use of drought tolerant plantings; and

WHEREAS, heretofore, the Castaic Lake Water Agency adopted Resolution No. 667 relating to a voluntary water conservation program to reduce water consumption by 10 percent; and

WHEREAS, it is now essential to enact a mandatory program;

NOW, THEREFORE, BE IT RESOLVED that this Agency's Board of Directors does hereby find and determine the following:

1. That the General Manager of the Agency be authorized to execute a "Drought Emergency Water Sharing Agreement" with the local water purveyors to make it clear that emergency drought sharing of Agency water supplies during year 1991 not result in any waiver of contractual or other right to use of Agency water.

2. That the General Manager confer with the retail water purveyors to coordinate the distribution and use of the limited State Project Water supply to maximize the distribution of the ground water production capacity of the combined facilities operated by the retail water purveyors.

3. That the Agency request both the City of Santa Clarita and the County of Los Angeles to adopt mandatory water use ordinances with terms generally as follows:

I. A WATER CONSERVATION ORDINANCE WHICH SHALL TERMINATE ON JANUARY 1, 1992 UNLESS RENEWED OR TERMINATED EARLIER

A. Hose Watering-Prohibition.

No person shall hose-water or wash down any sidewalks, walkways, driveways, parking areas, or other paved surfaces. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infraction.

B. Watering of Lawns and Landscaping

1. No person shall water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 5:00 p.m.

2. No person shall water or cause to be watered any lawn or landscaping more than once a day.

3. No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

4. It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

5. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

C. Indoor Plumbing and Fixtures.

1. It shall be the duty of all persons to inspect all accessible indoor plumbing and faucets for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

2. Any new or replacement toilets installed in any residence or business shall be of a low-flow variety.

3. Willful violation hereof shall be an infraction punishable by a fine of $500.00.

D. Washing Vehicles

No vehicle of any type may be washed, except at a commercial car wash, unless such vehicle is washed by using a hand-held bucket or a water-hose equipped with an automatic shutoff nozzle. No person shall leave a water hose running while washing a vehicle or at any other time. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infraction.

E. Public Eating Places

No restaurant, cafeteria, coffee shop, or other public place where food is sold or served shall serve drinking water to any customer unless specifically requested to do so by such customer. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

F. Decorative Fountains

No person shall use water to clean, fill, or maintain levels in decorative fountains unless such water flows through a recycling system. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

4. That the above cited three paragraphs are deemed appropriate as PHASE ONE of the Agency's mandatory conservation program with recognition of the possibility that the California Department of Water Resources may declare deeper finite reductions for the municipal and industrial water supplies of the State Water Project. Residents of the Agency are put on notice that further and additional phases of the mandatory conservation program may be enacted by the Agency and could include the following:

A. Odd/Even landscape irrigation restriction, based upon address

B. A financial penalty of say triple the water rate for metered water service that exceeds historic use

C. Complete prohibition of landscape irrigation

I, the undersigned, hereby certify: That I am the duly appointed and acting Secretary of the Castaic Lake Water Agency, and that at a special meeting of the Board of Directors of said Agency held on Monday, February 11, 1991, the foregoing Resolution No. 804 was duly and regularly adopted by said Board, and that said resolution has not been rescinded or amended since the date of its adoption, and that it is now in full force and effect.

Betty L. Castleberry
Secretary

DATED: 2/12/91

Appendix III

ORDINANCE NO. 101

WATER CONSERVATION ORDINANCE OF
NEWHALL COUNTY WATER DISTRICT

* * * * * * * * * * * * * * *

BE IT ORDAINED BY THE BOARD OF DIRECTORS OF NEWHALL COUNTY WATER DISTRICT, LOS ANGELES COUNTY, CALIFORNIA AS FOLLOWS:

Section 1: Because of the water supply conditions prevailing within the District's service area, the general welfare requires that water resources available to the District be put to the maximum beneficial use to the extent to which they are capable, and that the waste or unreasonable use, or unreasonable method of use of water be prevented, and that the conservation of such water be practiced with the view to the reasonable and beneficial use thereof in the interest of the people of the District, and for the public welfare. The purpose of this Ordinance is to provide a water conservation plan to minimize the effect of a shortage of water supplies on the customers of the District.

Section 2: No customer of the District shall make, cause, use or permit the use of water from the District in a manner contrary to any provision of this Ordinance.

Section 3: Watering of Lawns or Landscaping.

(a) No person shall water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 5:00 p.m.

(b) No person shall water or cause to be watered any lawn or landscaping more than once a day.

(c) No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

(d) It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

Section 4: Indoor Plumbing and Fixtures.

(a) It shall be the duty of all persons to inspect all accessible indoor plumbing and faucets for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

(b) For new or replacement toilets installed in any residence or business, local low-flow types are recommended.

Section 5: Washing Vehicles. No vehicle of any type may be washed, except at a commercial car wash, unless such vehicle is washed by using a hand-held bucket or a water-hose equipped with an automatic shutoff nozzle. No person shall leave a water hose running while washing a vehicle or at any other time.

Section 6: Public Eating Places. No restaurant, cafeteria, coffee shop or other public place where food is sold or served shall serve drinking water to any customer unless specifically requested to do so by such customer.

Section 7: No person shall use water to clean, fill or maintain levels in decorative fountains unless such water flows through a recycling system.

Section 8: Water Conservation Kits. Water conservation kits are available without charge to the District's customers at the District's office. In most cases, the kits include a plastic displacement bag, two sets of shower flow restrictors, two dye tablets to check for toilet leaks and a brochure which explains the use of the kit. The kits are to be installed by the District's customers.

Section 9: Effective Date. The water use restrictions of this Ordinance are effective immediately. Other provisions of this Ordinance are effective on March 21, 1991.

ADOPTED, SIGNED AND APPROVED by the Board of Directors of NEWHALL COUNTY WATER DISTRICT this 19th day of February, 1991.

MARY JUNE HERRINGTON, President
of the Board of Directors of the
NEWHALL COUNTY WATER DISTRICT

A T T E S T:

JAMES E. JINKS, Secretary of
the Board of Directors of the
NEWHALL COUNTY WATER DISTRICT

STATE OF CALIFORNIA)
) ss.
COUNTY OF LOS ANGELES)

I hereby certify that the foregoing Ordinance No. 101 was duly and regularly adopted and passed by the Board of Directors of the NEWHALL COUNTY WATER DISTRICT at a regular meeting thereof on the 19th day of February, 1991 by the following vote of the members thereof:

AYES:	DIRECTORS:	Herrington, Hayes, Wade, Agajanian and Whiteside
NOES:	DIRECTORS:	None
ABSENT:	DIRECTORS:	None
ABSTAINED:	DIRECTORS:	None

JAMES E. JINKS, Secretary of
the Board of Directors of the
NEWHALL COUNTY WATER DISTRICT

ORDINANCE NO. 102

ORDINANCE AMENDING SECTION 3 OF ORDINANCE NO. 101 OF NEWHALL COUNTY WATER DISTRICT RE WATER CONSERVATION

* * * * * * * * * * * * * * *

BE IT ORDAINED BY THE BOARD OF DIRECTORS OF NEWHALL COUNTY WATER DISTRICT, LOS ANGELES COUNTY, CALIFORNIA AS FOLLOWS:

Section 1: Section 3 of Ordinance No. 101 is amended to provide as follows:

"Section 3: Watering of Lawns or Landscaping.

(a) No person shall water or cause to be watered any lawn or landscaping between the hours of 8:00 a.m. and 6:00 p.m.

(b) No person shall water or cause to be watered any lawn or landscaping more than once a day, or for a period of time not to exceed ten minutes per watering station or cycle.

(c) No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

(d) It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable."

Section 2: The provisions of this Ordinance shall be effective on November 19, 1991.

ADOPTED, SIGNED AND APPROVED by the Board of Directors of NEWHALL COUNTY WATER DISTRICT this 15th day of October, 1991.

MARY JUNE HERRINGTON, President of the Board of Directors of the NEWHALL COUNTY WATER DISTRICT

A T T E S T:

JAMES E. JINKS, Secretary of the Board of Directors of the NEWHALL COUNTY WATER DISTRICT

STATE OF CALIFORNIA)
) ss.
COUNTY OF LOS ANGELES)

I hereby certify that the foregoing Ordinance No. 102 was duly and regularly adopted and passed by the Board of Directors of the NEWHALL COUNTY WATER DISTRICT at a regular meeting thereof on the 15th day of October, 1991 by the following vote of the members thereof:

AYES:	DIRECTORS:	Herrington, Hayes, Wade, Agajanian and Whiteside
NOES:	DIRECTORS:	None
ABSENT:	DIRECTORS:	None
ABSTAINED:	DIRECTORS:	None

JAMES E. JINKS, Secretary of the Board of Directors of the NEWHALL COUNTY WATER DISTRICT

Appendix IV

ORDINANCE NO. 91-16

AN ORDINANCE OF THE CITY OF SANTA CLARITA
ADDING CHAPTER 9.38 TO TITLE 9
OF THE SANTA CLARITA MUNICIPAL CODE

WHEREAS, the State of California is experiencing a prolonged drought; and

WHEREAS, the delivery of State Project Water to the Castaic Lake Water Agency has been reduced by 90% of the requested delivery levels.

THE CITY COUNCIL OF THE CITY OF SANTA CLARITA DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. The Santa Clarita Municipal Code is amended adding Chapter 9.38 to Title 9 relating to water conservation to read as follows:

CHAPTER 9.38

WATER CONSERVATION

Sections:

9.38.010 Drought Committee
9.38.015 Water Conservation Regulations
9.38.020 Penalties
9.38.025 Termination of Ordinance
9.38.030 Ordinance 91-16 Amended

9.38.010 Drought Committee

A. A drought committee shall be established, whose function shall be:

1. to review all available data on water consumption, water supply and ground water conditions;

2. to evaluate the level of compliance with the terms of this Ordinance;

3. to evaluate the level of achievement of the stated water consumption reductions;

4. to make recommendations to the City Council concerning the timing of and need for implementation of future additional water restrictions as may be developed; and

5. to make recommendations to the water purveyors in the City of Santa Clarita concerning additional measures to encourage water conservation, including but not limited to; conservation goals for individual water accounts, surcharges for excessive water use and the installation of flow restriction devices in water services.

B. The members of the Drought Committee shall include representatives from the staff of the City of Santa Clarita, the Upper Santa Clara Water Committee, other appointees as the City Council deems appropriate, and the staff of the Castaic Lake Water Agency.

9.38.015 Water Conservation Regulations

A. Water conservation shall be achieved through the restriction and/or prohibition of various types of water use. The restrictions and prohibitions shall be implemented immediately.

B. The following conditions and restrictions shall apply to the use of water within the City of Santa Clarita:

1. Hose Water Prohibition.

a. No person shall hose-water or wash down any sidewalks, walkways, driveways, parking areas, or other paved surface.

2. Watering of Lawns and Landscaping.

a. No person shall water or cause to be watered any lawn or landscaping between the hours of 8:00 a.m. and 6:00 p.m. except as provided in Section 9.38.015.B.2.e.

b. Lawns and landscaping shall be watered no more frequently than every other day.

c. No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or to excessive watering.

d. It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

e. Commercial gardeners and landscapers, municipal water uses, commercial nurseries, golf courses and other water-dependent industries shall not water or cause to be watered any lawn of landscaping between the hours of 10:00 a.m. and 3:00 p.m., and no more frequently than every other day, unless reclaimed water is used.

f. The maintenance and testing of irrigation systems may be performed without the restrictions specified in Section 9.38.015.B.2.a and 9.38.015.B.2.e.

3. Indoor Plumbing.

   a. Accessible indoor plumbing and fixtures must be inspected for leaks and repaired as soon as reasonably practicable.

   b. New and replacement toilets, showers and faucets shall be of a low-flow type. New or replacement faucets shall be equipped with aerators.

4. Washing Vehicles.

   a. Vehicles must be washed by hand-held bucket or with a hose equipped with automatic shutoff nozzle. Hoses may not be left running.

   b. These restrictions shall not be applied to commercial vehicle washing facilities and operations.

5. Public Eating Places.

   a. Water may be served only upon request by the customer.

6. Decorative Fountains.

   a. Water may not be used to clean, fill or maintain levels in decorative fountains unless the fountain has a water recycling system.

7. Landscaping and Irrigation Plans.

   a. All new landscaping and irrigation improvements shall be approved by the City of Santa Clarita Director of Parks and Recreation prior to construction.

   b. No person or entity shall be required to implement any landscaping requirements of any association, developer or governing agency until the termination of this ordinance.

C. Conservation Goal

1. The goal of this Water Conservation Ordinance is to achieve at least 25% reduction of overall water consumption within the City of Santa Clarita.

9.38.020 Penalties.

A. Willful violations of the terms of this Ordinance shall be subject to written warnings and/or citations. A written warning shall be issued upon the first violation of any part of this Ordinance. The second violation shall result in a fine of $50.00. The third violation shall result in a fine of $100.00, and all subsequent violations shall result in a fine of $300.00 for each violation.

9.38.025 Termination of Ordinance.

A. This Ordinance shall terminate on January 1, 1992, unless renewed or termination earlier by ordinance.

Section 2. The City Council hereby declares that the provisions of this Ordinance are severable and if for any reason a court or competent jurisdiction shall hold any sentence, paragraph or section of this Ordinance to be invalid, such decision shall not affect the validity of the remaining parts of this Ordinance.

Section 3. This Ordinance is adopted as an urgency measure. The facts of the urgency are these: The State of California is currently suffering from the effects of a five-year drought, and the deliveries of State Project water to local water agencies are being reduced. This Ordinance restricts or prohibits certain types of water usage. The immediate enactment of this Ordinance is therefore necessary to ensure the adequacy of the water supply for the City of Santa Clarita and is thereby directly related to public health, safety and welfare. Therefore, this Ordinance shall be effective immediately upon adoption.

Section 4. The City Clerk shall certify to the passage of this Ordinance and shall cause it to be published in the manner prescribed by law.

9.38.030 Ordinance 91-12 Amended

A. Ordinance 91-12 is hereby amended, deleting Section 9.38.015.b.8 in its entirety.

PASSED, APPROVED AND ADOPTED this 13th day of March, 1991.

Carl Boyer
CARL BOYER, MAYOR

ATTEST:

Donna M. Grindey
DONNA GRINDEY, CITY CLERK

STATE OF CALIFORNIA)
COUNTY OF LOS ANGELES) ss.
CITY OF SANTA CLARITA)

I, Donna M. Grindey, City Clerk of the City of Santa Clarita, do hereby certify that the foregoing Ordinance No. 91-16 was duly adopted as an urgency ordinance at a regular meeting of the City Council on the 13th day of March, 1991, by the following four-fifths vote, to wit:

AYES: COUNCILMEMBERS Darcy, Heidt, McKeon, Boyer

NOES: COUNCILMEMBERS Klajic

ABSENT: COUNCILMEMBERS None

Donna M. Grindey
CITY CLERK

AGN:gmm-394

ORDINANCE NO. 91-48

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF SANTA CLARITA, CALIFORNIA, AMENDING CHAPTER 9.38 OF THE SANTA CLARITA MUNICIPAL CODE RELATING TO WATER CONSERVATION

THE CITY COUNCIL OF THE CITY OF SANTA CLARITA, CALIFORNIA, DOES ORDAIN AS FOLLOWS:

SECTION 1. The Santa Clarita Municipal Code is hereby amended at Subsection 9.38.015.B.2.b to read as follows:

b. Lawns and landscaping shall be watered no more than 10 minutes per watering station or cycle per day.

SECTION 2. The Santa Clarita Municipal Code at Subsection 9.38.015.B.2.e is hereby amended to read as follows:

e. Commercial gardeners and landscapers, municipal water uses, commercial nurseries, golf courses and other water-dependent industries shall not water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 3:00 p.m., and no more than 10 minutes per watering station or cycle per day unless reclaimed water is used. This subsection does not apply to residential lawns which are subject to the time limitations indicated in the other subsections of this Ordinance.

SECTION 3. Section 9.38.015.C.1 is hereby amended to read as follows:

1. The goal of this Water Conservation Ordinance is to achieve a significant reduction of overall water consumption within the City of Santa Clarita.

SECTION 4. This Ordinance is adopted as an urgency measure. The facts of the urgency are these: The State of California is currently suffering from the effects of a five-year drought, and the deliveries of State Project water to local water agencies are being reduced. This Ordinance restricts or prohibits certain types of water usage. The immediate enactment of this Ordinance is therefore necessary to ensure the adequacy of the water supply for the City of Santa Clarita and is thereby directly related to public health, safety and welfare. Therefore, this Ordinance shall be effective immediately upon adoption.

SECTION 5. The City Clerk shall certify to the passage of this Ordinance and shall cause it to be published in the manner prescribed by law.

PASSED, APPROVED AND ADOPTED this 8th day of October, 1991.

Carl Boyer

Carl Boyer, Mayor

ATTEST:

Donna M. Grindey

Donna M. Grindey, City Clerk

STATE OF CALIFORNIA)
COUNTY OF LOS ANGELES) ss
CITY OF SANTA CLARITA)

I, Donna M. Grindey, City Clerk of the City of Santa Clarita, do hereby certify that the foregoing Ordinance No. 91-48 was duly adopted as an urgency ordinance at a regular meeting of the City Council on the 8th day of October, 19 91 by the following four-fifths vote, to wit:

AYES: COUNCILMEMBERS: Darcy, Heidt, McKeon, Boyer

NOES: COUNCILMEMBERS: Klajic

ABSENT: COUNCILMEMBERS: None

Donna M. Grindey

Donna M. Grindey, City Clerk

Appendix V

ORDINANCE NO. 91-0046U

An urgency ordinance amending Title 11, Chapter 11.38 of the Los Angeles County Code relating to Water and Sewers to add Part 4, Water Conservation.

The Board of Supervisors of the County of Los Angeles ordains as follows:

Section 1. Title 11, Chapter 11.38 of the County Code is amended by adding Part 4, to read:

Part 4. Water Conservation Requirements For The Unincorporated Los Angeles County Area.

Section 11.38.620 Hose Watering Prohibition. No person shall hose water or wash down any sidewalks, walkways, driveways, parking areas or other paved surfaces, except as is required for the benefit of public health and safety. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.630 Watering of Lawns and Landscaping.

a). No person shall water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 5:00 p.m.

b). No person shall water or cause to be watered any lawn or landscaping more than once a day.

c). No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

d). It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

e). Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.640 Indoor Plumbing and Fixtures.

a). It shall be the duty of all persons to inspect all accessible indoor plumbing and faucets for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

b). Willful violation hereof shall be an infraction punishable by a fine of $500.00.

Section 11.38.650 Washing Vehicles.
No motor vehicle, boat, trailer or other type of mobile equipment may be washed, except at a commercial car wash or with reclaimed water, unless such vehicle is washed by using a hand-held bucket or a water-hose equipped with an automatic shutoff nozzle. No person shall leave a water hose running while washing a vehicle or at any other time. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.660 Public Eating Places.
No restaurant, hotel, cafeteria, cafe or other public place where food is sold or served shall serve drinking water to any customer unless specifically requested to

do so by such customer. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.670 Decorative Fountains.
No person shall use water to clean, fill or maintain levels in decorative fountains, ponds, lakes, or other similar aesthetic structures unless such water flows through a recycling system. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 2. This ordinance shall terminate on January 1, 1993, unless renewed or terminated earlier by ordinance.

Section 3. Due to the severity of the drought in the State of California, there is an immediate need to prohibit the wasting of water in the Los Angeles County unincorporated area to better utilize the available water supplies. This ordinance is urgently needed for the preservation of the public health, safety and general welfare and shall take effect immediately.

Section 4. This ordinance shall be published in

Metropolitan News Enterprise

a newspaper printed and published in the County of Los Angeles.

Michael D. Antonovich
Chairman

ATTEST:

Executive Officer
Board of Supervisors
of the County of Los Angeles

I hereby certify that at its meeting of March 21, 1991, the foregoing ordinance was adopted by the Board of Supervisors of said County of Los Angeles by the following vote, to wit:

Ayes:	Noes:
Supervisors Gloria Molina	Supervisors None
Edmund D. Edelman	
Deane Dana	
Michael D. Antonovich	

Executive Officer
Board of Supervisors
of the County of Los Angeles

Effective Date: March 21, 1991

Operative Date: _____

I hereby certify that pursuant to Section 25103 of the Government Code, delivery of this document has been made.
LARRY J. MONTEILH
Executive Officer
Clerk of the Board of Supervisors
By _____ DEPUTY

APPROVED AS TO FORM:
DE WITT W. CLINTON
County Counsel
By _____
GERALD F. CRUMP
Chief Assistant County Counsel

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. . . S A M P L E N O T I C E . . .

LOS ANGELES COUNTY WATER WASTING ORDINANCE
NOTICE OF WARNING

Date _____

Address: _____
_____
_____
_____

Dear Customer:

Due to the severity of the current drought, the County Board of Supervisors, on March 21, 1991, adopted an Ordinance that specifies a number of water saving measures. The Ordinance applies to the unincorporated areas of the County and includes the following provisions:

__ Washing down of paved surfaces is prohibited, except as required for public health and safety.

__ Lawn and landscape watering is prohibited between the hours of 10:00 a.m. and 5:00 p.m.

__ Landscape watering that results in runoff into adjoining streets, parking lots or alleys due to misdirected sprinklers or excessive watering is prohibited.

__ Leaking hoses, faucets and sprinkling systems must be repaired as soon as is reasonably practicable.

__ Leaks to indoor plumbing systems must be repaired as soon as is reasonably practicable.

__ Washing of a motor vehicle, boat or trailer is prohibited except at a commercial car wash or with a hand-held bucket or water hose equipped with an automatic shutoff nozzle.

__ Serving drinking water to customers at public eating places is prohibited unless specifically requested by such customers.

__ Water cannot be used in decorative fountains, ponds, lakes and other similar aesthetic structures unless the water flows through a recycling system.

We observed the violation(s) of the above noted provisions on your property. We request your support in complying with the provisions of this ordinance so that we can avoid unnecessary waste and stretch our limited water supplies for the duration of the drought. Violation of this Ordinance is punishable by a fine of up to $500. If you have any questions regarding this ordinance or its enforcement please contact (your office and phone number).

(WW3901)

Appendix VI

RESOLUTION

ADOPTING A WATER SHORTAGE CONTINGENCY PLAN
FOR THE SANTA CLARITA WATER COMPANY

WHEREAS, the California Legislature enacted Assembly Bill 11X during the 1991 Extraordinary Session of the California Legislature (an act to amend the California Water Code Sections 10620, 10621, 10631, and 10652, and to add Section 10656 to the California Water Code, relating to water); and

WHEREAS, AB 11X mandates that every urban water supplier providing municipal water directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre feet of water annually to develop a Water Shortage Contingency Plan; and

WHEREAS, AB 11X mandates that said Plan be filed with the California Department of Water Resources by January 31, 1992; and

WHEREAS, the Santa Clarita Water Company is an urban supplier of water providing water to more than 3,000 customers, and has therefore prepared and circulated for public review a Draft Water Shortage Contingency Plan, in compliance with the requirements of AB 11X, has held a properly noticed public hearing on January 29, 1992, regarding said Draft Plan, and has thereafter prepared a Final Water Shortage Contingency Plan;

NOW, THEREFORE, BE IT RESOLVED by the Santa Clarita Water Company's Board as follows:

1. A Final Water Shortage Contingency Plan is hereby adopted and is attached hereto as Exhibit "A" hereof, which exhibit is hereby incorporated herein;

2. The President is hereby authorized and directed to file the Plan with the California Department of Water Resources;

3. The President is hereby also authorized to follow lawful procedures to declare a Water Shortage Emergency and to implement this Water Shortage Contingency Plan; and

4. The President shall recommend to the Santa Clarita Water Company's Board additional procedures, rules, and regulations to carry out effective and equitable allocation of water resources during a water shortage.

Appendix VI

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WHEREAS, AB 11X mandates that said Plan be filed with the California Department of Water Resources by January 31, 1992; and

WHEREAS, the Santa Clarita Water Company is an urban supplier of water providing water to more than 3,000 customers, and has therefore prepared and circulated for public review a Draft Water Shortage Contingency Plan, in compliance with the requirements of AB 11X, has held a properly noticed public hearing on January 29, 1992, regarding said Draft Plan, and has thereafter prepared a Final Water Shortage Contingency Plan;

NOW, THEREFORE, BE IT RESOLVED by the Santa Clarita Water Company's Board as follows:

1. A Final Water Shortage Contingency Plan is hereby adopted and is attached hereto as Exhibit "A" hereof, which exhibit is hereby incorporated herein;

2. The President is hereby authorized and directed to file the Plan with the California Department of Water Resources;

3. The President is hereby also authorized to follow lawful procedures to declare a Water Shortage Emergency and to implement this Water Shortage Contingency Plan; and

4. The President shall recommend to the Santa Clarita Water Company's Board additional procedures, rules, and regulations to carry out effective and equitable allocation of water resources during a water shortage.

Newhall County Water District's Ordinance No. 112

ORDINANCE NO.112
WATER CONSERVATION, SHORTAGE, DROUGHT AND EMERGENCY RESPONSE ORDINANCE

* *

Section 1: ***PURPOSE*****:** Article 10, Section 2 of the California Constitution declares that waters of the State are to be put to beneficial use, that waste, unreasonable use, or unreasonable method of use be prevented, and that water be conserved for the public welfare. The specific provisions of this Ordinance are necessary and proper to conserve water resources and minimize cost to the customer. This ordinance requires that available water resources be put to the maximum beneficial use, and that water efficient practices be used to reach this objective. This further finds that water supplies may be reduced because of drought, failure of facilities, or catastrophic events such as earthquakes and regional power failures. Anti-waste and water conservation requirements are necessary to achieve demand reduction without unneeded hardship.

Section 2: ***DEFINITIONS AND TERMS:***

A. ***Water efficient practices****:* Cost-effective practices that require the least amount of water to generate the greatest benefit (water and cost savings) to the customer.

B. ***Water Waste:*** To use or expend water carelessly or needlessly.

C. ***Water User:*** Business or residential customer.

D. ***Water Conservation Stages:*** The General Manager shall determine the conservation stage, except that the Board shall determine any conservation stage more restrictive than Stage 1. A water deficiency occurs when the current or near-term water demand exceeds the current or near-term water supply.

Stage 1 Water Alert: Water deficiencies range between 1 and 15 percent.

Stage 2 Water Warning: Water deficiencies range from more than 15 and up to 25 percent.

Stage 3 Water Emergency: Water deficiencies range from more than 25 and up to 35 percent.

Stage 4 Water Crisis: Water deficiencies are more than 35 percent.

E. ***Water Deficiency:*** A water deficiency occurs when the current or near-term water demand exceeds the current or near-term water supply, based on a yearly assessment. (Percent or deficiency = (1 – water supply/water demand) x 100

F. ***Water Conservation Goals:***

Stage 1 Water Alert: ***Achieve a Conservation level of up to 10 percent.***

Stage 2 Water Warning: ***Achieve a Conservation level of up to 20 percent.***

Stage 3 Water Emergency: ***Achieve a Conservation level of up to 30 percent.***

Stage 4 Water Crisis: ***Achieve a Conservation level of over 30 percent.***

Section 3: ***WATER CONSERVATION ACTION PLAN:*** This plan establishes water conservation measures to be taken in response to current and anticipated levels of deficiency in State and/or local water supplies. No Water User shall waste water or make, cause, or permit the use of water for any purpose contrary to any provision of this Ordinance, or in quantities in excess of the use permitted by the conservation stage in effect pursuant to this Ordinance.

3.1 Efficient Water Use. *Because more severe effects of a water shortage are often brought about due to wasteful water use habits carried over from times of sufficient supply, certain voluntary water-use practices are encouraged at all times.*

3.1.1 Outdoor Water Use Efficiency Guidelines and Recommendations:

a) Sprinklers should be maintained and adjusted so that overspray, runoff, and water waste is avoided. The most effective and water-efficient irrigation should be used, and drip irrigation should be considered where appropriate.

b) All leaks in plumbing and irrigation systems should be repaired promptly

c) Vehicles should be washed using a hose equipped with automatic shutoff nozzle.

d) Sidewalks, walkways, driveways, parking lots or any other hard-surfaced areas should not be washed down, except for health and safety purposes.

e) Low-water-use native or drought-tolerant vegetation should be used to minimize the need for irrigation. Plants and trees with similar water needs should be grouped together for most efficient irrigation. (Please see our website (agency site) for more information and links to other websites listing drought tolerant plants.)

f) Landscape should be installed in a manner that will reduce the amount of water needed for irrigation. For example, the use of mulches and watering basins is encouraged where appropriate.

g) Irrigation should occur during optimal watering hours, avoiding wind and heat. The following hours are considered the most efficient hours for (Agency)customers to effectively irrigate lawns and landscaped areas:

Winter/Fall (November through April) – 6 PM to 10 AM

Spring/Summer (May through October) –8 PM to 9 AM

h) Water usage on any decorative fountains, ponds or other types of water streams should be minimized by incorporating a water recycling system so the water is continually recovered and reused.

i) Pool and spa safety covers or evaporation-reducing water treatments should be considered if safe and appropriate for the situation. These will help minimize water loss due to evaporation. Pool and spa chemistry should be balanced and maintained to help reduce the frequency of pool/spa draining and refilling.

3.1.2 Indoor Water Use Efficiency Guidelines and Recommendations:

a) All leaks and/or damage to faucets, toilets, and indoor pipes should be repaired immediately.

b) Low flow devices for indoor plumbing fixtures including faucets, kitchen spray nozzles, toilets, and showers should be used where possible.

c) Install 1.3 or less gallon per flush (gpf) high efficiency toilets or .08/1.6 gallon per flush (gpf) dual-flush toilets.

d) Water-efficient Energy Star® approved appliances including, but not limited to, clothes washers and dishwashers should be used.

e) Clothes washers and dishwashers should be run using full loads to maximize water efficiency.

f) A source specific hot water dispenser or a whole house hot water recirculation system should be considered. These devices generate hot water within seconds, minimizing running the water until it is hot.

g) All commercial establishments where food or beverages are provided should encourage the serving of water to their customers only when specifically requested by the customer.

3.1.3 New Construction Water Efficiency Guidelines: As new technology advances, builders of new structures or persons retrofitting existing facilities should consider options such as evapotranspiration-controlled sprinkler systems, grey water or non-potable water systems (where legally acceptable), storm water cisterns, and landscape designs minimizing the use of turf and water-intensive plants. Businesses should review industry-specific guidance for ways to reduce water usage and should consider programs such as multi-pass cooling towers and process water recycling. Conveyor car wash and commercial laundry systems must utilize a recirculating system. Decorative water fountains, ponds or other types of water streams must incorporate a water recycling system.

3.2 Water Conservation Stage 1 Water Alert –: *At this stage of water deficiency, the Water Users are strongly encouraged to adhere to all the guidelines in section 3.1, Water Use Efficiency Guidelines. The following practices are also strongly suggested during Stage 1 water deficiencies:*

a) Outdoor irrigation of all vegetation including lawns and landscaping is limited to three times per week and no more than 10 minutes per watering station. Irrigation should occur during the following hours:

Winter/Fall (November through April) – 6 PM to 10 AM

Spring/Summer (May through October) – 8 PM to 9 AM

b) Repair all water leaks within five (5) days of notification by Water Purveyor.

3.3 ***<u>Water Conservation Stage 2 Water Warning:</u>*** *At this stage of water deficiency, Efficient Water Use Guidelines (3.1.1-3.1.2 above) and Stage 1 practices (3.2 above) become mandatory requirements. Further mandatory practices during Stage 2 are as follows:*

- ***a)*** All new landscaping shall be limited to widely accepted drought-tolerant plants requiring less than typical water requirements.
- ***b)*** No new lawns, whether by seed or sod, shall be installed.
- ***c)*** No filling of pools or spas. Water levels may be maintained.
- ***d)*** No filling of or re-filling of decorative fountains, ponds or other types of water streams, except to the extent needed to sustain aquatic life, provided that such animals are of significant value and have been actively managed within the water feature prior to the enactment of a stage 2 water warning.
- ***e)*** Repair all water leaks within seventy-two (72) hours of notification by Water Purveyor.

3.4 ***<u>Water Conservation Stage 3 Water Emergency:</u>*** *At this stage of water deficiency, Efficient Water Use Guidelines (3.1.1-3.1.2 above), Stage 1 practices (3.2 above), and Stage 2 practices (3.3 above) become mandatory requirements. Further mandatory practices during Stage 3 are as follows:*

- ***a)*** No new applications for service will be accepted.
- ***b)*** No water for grading will be allowed.
- ***c)*** Washing vehicles is prohibited, except at commercial facilities that recycle water.
- ***d)*** Street cleaning with potable water is prohibited.
- ***e)*** Repair all water leaks within forty-eight (48) hours of notification by Water Purveyor.

3.5 ***<u>Water Conservation Stage 4 Water Crisis:</u>*** *At this stage of water deficiency, Efficient Water Use Guidelines (3.1.1- 3.1.2 above), Stage 1 practices (3.2 above), Stage 2 practices (3.3 above), and Stage 3 practices (3.4 above) become mandatory requirements. Further mandatory practices during Stage 4 are as follows:*

- ***a)*** Outdoor irrigation of all vegetation including lawns and landscaping is prohibited. Existing trees and larger shrubs will be exempt.
- ***b)*** No new landscaping shall be permitted.

Repair all water leaks within twenty-four (24) hours of notification by Water Purveyor.

Section 4: ***ENFORCEMENT:***

4.1 ***Efficient Water Use and Stage 1 Enforcement:***

a) Any notification of signs or indications of water leaks or water waste will be documented. The Purveyor will confirm the water waste prior to any further action.

b) The Purveyor shall determine the action to be taken to inform the Water User of the guidelines in this Ordinance and to encourage more efficient and cost-effective water use.

4.2 ***Stage 2, 3 and 4 Enforcement.*** *The Purveyor has the duty and is authorized to enforce provisions of Stage 2, 3, and 4 of this Ordinance. If a violation is ongoing, the Purveyor may disconnect service until the violation is corrected.*

4.2.1 ***First Violation.*** For a first violation, an elevated usage letter shall be issued to the Water User.

4.2.2 ***Second Violation.*** For a second violation, a corrective action letter shall be issued to the Water User, and a fine of $40 shall be added to the Water User's bill at the property where the violation occurred if the corrective action is not taken within 10 days after receiving the written warning.

4.2.3 ***Third Violation.*** For a third violation, a fine of $100 shall be added to the Water User's bill at the property where the violation occurred if the corrective action is not taken within 10 days after receiving the written warning. In addition to the fine, the Purveyor may require installation of a flow restricting device on the Water User's service connection.

4.2.4 ***Fourth Violation.*** For the fourth and any additional violations, a fine of $250 shall be added to the Water User's bill at the property where the violation occurred. The Purveyor may also discontinue the Water User's water service at the property where the violation occurred. Re-connection shall be permitted only when there is reasonable protection against future violations, such as a flow-restricting device on the customer's service connection, as determined at the Purveyor's discretion.

4.3 ***District Enforcement Costs.*** The Purveyor shall be reimbursed for its costs and expenses in enforcing the provisions of this Ordinance, including such costs as incurred for Purveyor staff to investigate and monitor the Water User's compliance with the terms of this Ordinance. The charges for the installation of flow restricting devices or for discontinuing or restoring water service, as the Purveyor incurs those charges, shall be added to the Water User's bill at the property where the enforcement costs were incurred.

Section 5: ***ADMINISTRATION:***

5.1 ***General.*** The provisions of this Ordinance shall be administered and enforced by the Purveyor , who may delegate such enforcement to one or more employees or contractors of the Purveyor. The Purveyor may implement additional demand reduction practices, including surcharges, rationing, and specific water allocations, in times of severe shortage or emergency situations.

5.1.1 ***Water Utility Accounts.*** Accounts shall not be established for new customers, including the transfer of accounts upon change of ownership, until the customer agrees to comply with the provisions of this Ordinance.

5.1.2 ***Discretionary Exemptions.*** The Purveyor may, in its discretion, exempt Water Users and individual facilities of Water Users from the provisions of this Ordinance, or impose reasonable conditions in lieu of compliance with this Ordinance, if it is found that any of the following conditions exist:

a) Hardship. The requirements of this Ordinance would cause an unnecessary and undue hardship upon the Water User, the Water User facility or the public.

b) Health and Safety. Strict compliance with the requirements of this Ordinance would create an emergency condition, as determined by the Purveyor or other governmental entity with appropriate jurisdiction, affecting the health, protection or safety of the Water User or the public.

c) No Impact on Water Use. The granting of the exemption or imposition of reasonable conditions in lieu of compliance with this Ordinance would not increase the quantity of water consumed by the Water User or otherwise adversely affect service to other Water Users. In other words, the Water User will create an offset. In granting any such relief, the departure from the requirements of this Ordinance shall be limited to the minimum necessary to address the circumstances upon which such departure is required by a Water User.

5.1.3 ***Appeals.*** Any customer or applicant for a water service may appeal any decision under this Ordinance to the Purveyor whose decision shall be final.

RULE N0. 14.1

WATER CONSERVATION AND RATIONING PLAN

GENERAL INFORMATION (C)

1. If water supplies are projected to be insufficient to meet normal customer demand, and are beyond the control of the utility, the utility may elect to implement voluntary conservation using the portion of this plan set forth in Section A of this Rule, after notifying the Director of the Commission's Division of Water and Audits of its intent, via a letter in both hard-copy and e-mailed formats.

2. Prior to declaration of mandatory rationing, a utility may request authorization of a Schedule 14.1 – Staged Mandatory Water Conservation and Rationing tariff, via a Tier 2 advice letter.

3. If, in the opinion of the utility, more stringent water measures are required, the utility shall request Commission authorization to implement the staged mandatory conservation and rationing measures set forth in Sections B through E.

4. The utility shall file a Tier 1 advice letter to request activation of a particular stage of Schedule 14.1 – Staged Mandatory Water Conservation and Rationing tariff.

   a. If a Declaration of Mandatory Rationing is made by utility or governing agency, or

   b. If the utility is unable to address voluntary conservation levels set by itself, supplier, or governing agency, or

   c. If the utility chooses to subsequently activate a different stage

5. When Schedule 14.1 is in effect and the utility determines that water supplies are again sufficient to meet normal demands, and mandatory conservation and rationing measures are no longer necessary, the utility shall seek Commission approval via a Tier 1 advice letter to de-activate the particular stage of mandatory rationing that had been authorized.

6. In the event of a water supply shortage requiring a voluntary or mandatory program, the utility shall make available to its customers water conservation kits as required by its version of Rule 20. The utility shall notify all customers of the availability of conservation kits via a bill insert or direct mailers.

(continued) (C)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

A. CONSERVATION - NON-ESSENTIAL OR UNAUTHORIZED WATER USE (C)

No customer shall use utility-supplied water for non-essential or unauthorized uses, including but not limited to:

1. Use of potable water for more than minimal landscaping, as defined in the landscaping regulated of the jurisdiction or as described in Article 10.8 of the California Government Code in connection with new construction;
2. Use through any meter when the company has notified the customer in writing to repair a broken or defective plumbing, sprinkler, watering or irrigation system and the customer has failed to effect such repairs within five business days;
3. Use of potable water which results in flooding or runoff in gutters or streets;
4. Individual private washing of cars with a hose except with the use of a positive action shut-off nozzle. Use of potable water for washing commercial aircraft, cars, buses, boats, trailers, or other commercial vehicles at any time, except at commercial or fleet vehicle or boat washing facilities operated at a fixed location where equipment using water is properly maintained to avoid wasteful use;
5. Use of potable water washing buildings, structures, , driveways, patios, parking lots, tennis courts, or other hard-surfaced areas, except in the cases where health and safety are at risk;
6. Use of potable water to irrigate turf, lawns, gardens, or ornamental landscaping by means other than drip irrigation, or hand watering without quick acting positive action shut-off nozzles, on a specific schedule, for example: 1) before 9:00 a.m. and after 5:00 p.m.; 2) every other day; or 3) selected days of the week;
7. Use of potable water for watering streets with trucks, except for initial wash-down for construction purposes (if street sweeping is not feasible), or to protect the health and safety of the public;

(continued) (C)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

A. CONSERVATION – NON-ESSENTIAL OR UNAUTHORIZED WATER USE (CONT.) (C)

8. Use of potable water for construction purposes, such as consolidation of backfill, dust control, or other uses unless no other source of water or other method can be used.
9. Use of potable water for construction purposes unless no other source of water or other method can be used;
10. Use of potable water for street cleaning;
11. Operation of commercial car washes without recycling at least 50% of the potable water used per cycle;
12. Use of potable water for watering outside plants, lawn, landscape and turf areas during certain hours if and when specified in Schedule No. 14.1 when the schedule is in effect;
13. Use of potable water for decorative fountains or the filling or topping off of decorative lakes or ponds. Exceptions are made for those decorative fountains, lakes, or ponds which utilize recycled water;
14. Use of potable water for the filling or refilling of swimming pools.
15. Service of water by any restaurant except upon the request of a patron; and
16. Use of potable water to flush hydrants, except where required for public health or safety.

B. STAGED MANDATORY RATIONING OF WATER USAGE

1. Prior to declaration of mandatory rationing, a utility may request authorization of a Schedule 14.1 – Staged Mandatory Water Conservation and Rationing tariff, via a Tier 2 advice letter, with full justification. The utility may not institute Schedule 14.1 until it has been authorized to do so by the Commission.

(continued) (C)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

B. STAGED MANDATORY RATIONING OF WATER USAGE (Cont) (C)

a. A staged Schedule 14.1 that has been authorized by the Commission shall remain dormant until triggered by specific conditions detailed in the Schedule 14.1 tariff and utility has requested and received authorization for activating a stage by Commission.

b. Notice of the Tier 2 advice letter and associated public participation hearing shall be provided to customers under General Order (GO) 96-B rules.

c. Utility shall comply with all requirements of Sections 350-358 of the California Water Code.

d. The Tier 2 advice letter requesting institution of a Schedule 14.1 shall include but not be limited to:

   i. Proposed Schedule 14.1 tariff, which shall include but not be limited to:

      1. Applicability,
      2. Territory applicable to,
      3. A detailed description of each Stage of Rationing,
      4. A detailed description of the Trigger that Activates each Stage of Rationing,
      5. A detailed description of each water use restriction for each stage of rationing.
      6. Water use violation levels, written warning levels, associated fines, and exception procedures,
      7. Conditions for installation of a flow restrictor,
      8. Charges for removal of flow restrictors, and
      9. Special Conditions (C)

(continued)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

B. STAGED MANDATORY RATIONING OF WATER USAGE (Cont) (C)

ii. Justification for, and documentation and calculations in support of plan, including but not limited to each item in B.1.d.i above.

2. Number of Stages requested by each utility/district may vary, depending on specifics of water shortage event.

3. The utility shall file a Tier 1 advice letter to request activation of a particular stage of Schedule 14.1 – Staged Mandatory Water Conservation and Rationing tariff.

a. If a Declaration of Mandatory Rationing is made by utility or governing agency,

b. If the utility is unable to address voluntary conservation levels set by itself or governing agency, or

c. If the utility chooses to subsequently activate a different stage.

d. The Tier 1 advice letter requesting activation of a Schedule 14.1 shall include but not be limited to:

i. Justification for activating this particular stage of mandatory rationing, as well as period during which this particular stage of mandatory conservation and rationing measures will be in effect.

ii. When the utility requests activation of a particular Stage, it shall notify its customers as detailed in Section E, below.

4. All monies collected by the utility through water use violation fines shall not be accounted for as income.

5. All expenses incurred by utility to implement Rule 14.1 and Schedule 14.1 that have not been considered in a General Rate Case or other proceeding, shall be recoverable by utility if determined to be reasonable by Commission.

a. These monies shall be accumulated by the utility in a separate memorandum account for disposition as directed or authorized from time to time by the Commission. (C)

(continued)

Valencia Water Company
24631 Avenue Rockefeller
Valencia, CA 91355
Los Angeles County

Original Cal. P.U.C. Sheet No. 617-W
Canceling _____ Cal. P.U.C. Sheet No. _____

RULE NO. 14.1

WATER CONSERVATION AND RATIONING PLAN

C. ENFORCEMENT OF STAGED MANDATORY CONSERVATION AND RATIONING (N)

1. The water use restrictions of the conservation program, in Section A of this rule, become mandatory when the authorized Schedule 14.1-Staged Mandatory Rationing Program is triggered, the utility files a Tier 1 advice letter requesting activation of a particular stage, and authorization is received from the Commission.

a. In the event a customer is observed to be using water for any nonessential or unauthorized use as defined in Section A of this rule, the utility may charge a water use violation fine in accordance with Schedule No. 14.1.

2. The utility may, after one verbal and one written warning, install a flow-restricting device on the service line of any customer observed by utility personnel to be using water for any non-essential or unauthorized use as defined in Section A above.

3. A flow restrictor shall not restrict water delivery by greater than 50% of normal flow and shall provide the premise with a minimum of 3 Ccf/person/month. The restricting device may be removed only by the utility, only after a three-day period has elapsed, and only upon payment of the appropriate removal charge as set forth in Schedule No. 14.1.

4. After the removal of the restricting device, if any non-essential or unauthorized use of water shall continue, the utility may install another flow-restricting device. This device shall remain in place until water supply conditions warrant its removal and until the appropriate charge for removal has been paid to the utility.

5. Any tampering with flow restricting device by customer can result in fines or discontinuation of water use at the utility's discretion.

6. If, despite installation of such flow-restricting device pursuant to the provisions of the previous enforcement conditions, any such non-essential or unauthorized use of water shall continue, then the utility may discontinue water service to such customer. In such latter event, a charge as provided in Rule No. 11 shall be paid to the utility as a condition to restoration of service. (N)

(continued)

(To be inserted by utility)
Advice Letter No. 134
Decision No. _____

Issued by
Keith Abercrombie
NAME
General Manager
TITLE

(To be inserted by Cal. P.U.C.)
Date Filed MAR - 3 2011
Effective MAR - 3 2011
Resolution No. _____

Valencia Water Company
24631 Avenue Rockefeller
Valencia, CA 91355
Los Angeles County

Original Cal. P.U.C. Sheet No. 618-W
Canceling _____ Cal. P.U.C. Sheet No. _____

RULE N0. 14.1

WATER CONSERVATION AND RATIONING PLAN

C. ENFORCEMENT OF STAGED MANDATORY CONSERVATION AND RATIONING (Cont) (N)

7. All monies collected by the utility through water use violation fines shall not be accounted for as income. All expenses incurred by utility to implement Rule 14.1 and Schedule 14.1 that have not been considered in a General Rate Case or other proceeding, shall be recoverable by utility if determined to be reasonable by Commission. These additional monies shall be accumulated by the utility in a separate memorandum account for disposition as directed or authorized from time to time by the Commission.

8. The charge for removal of a flow-restricting device shall be in accordance with Schedule No. 14.1.

D. APPEAL PROCEDURE

1. Any customer who seeks a variance from any of the provisions of this water conservation and rationing plan shall notify the utility in writing, explaining in detail the reason for such a variation. The utility shall respond to each such request in writing.

2. Any customer not satisfied with the utility's response may file an appeal with the staff of the Commission. The customer and the utility will be notified of the disposition of such appeal by letter from the Executive Director of the Commission. (N)

(continued)

(To be inserted by utility)

Advice Letter No. 134

Decision No. _____

Issued by

Keith Abercrombie
NAME

General Manager
TITLE

(To be inserted by Cal. P.U.C.)

Date Filed MAR - 3 2011

Effective MAR - 3 2011

Resolution No. _____

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

D. APPEAL PROCEDURE

3. If the customer disagrees with such disposition, the customer shall have the right to file a formal complaint with the Commission. Except as set forth in this Section, no person shall have any right or claim in law or in equity, against the utility because of, or as a result of, any matter or thing done or threatened to be done pursuant to the provisions of this water conservation and rationing plan. (N)

E. PUBLICITY

1. As stated under Section B.1.b and c, when a utility requests authorization of a Schedule 14.1 – Staged Mandatory Water Conservation and Rationing tariff, via a Tier 2 advice letter, it shall provide notice of the Tier 2 advice letter and associated public meeting provided to customers, under General Order (GO) 96-B rules, and shall comply with all requirements of Sections 350-358 of the California Water Code (CWC), including but not limited to the following:

a. In order to be in compliance with both the GO and CWC, the utility shall provide notice via both newspaper and bill insert/direct mailing.

b. Utility shall file one notice for each advice letter filed, that includes both notice of the filing of the Tier 2 advice letter as well as the details of the public meeting (date, time, place, etc).

c. The public meeting shall be held after the utility files the Tier 2 advice letter, and before the Commission authorizes implementation of the tariff.

d. Utility shall consult with Division of Water and Audits staff prior to filing advice letter, in order to determine details of public meeting. (N)

(continued)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

E. PUBLICITY (Cont)

2. In the event that a Schedule 14.1-Staged Mandatory Rationing Plan is triggered, and a utility requests activation through the filing of a Tier 1 advice letter, the utility shall notify its customers and provide each customer with a copy of Schedule 14.1 by means of bill insert or direct mailing. Notification shall take place prior to imposing any fines associated with this plan. (N)

3. During the period that a stage of Schedule 14.1 is activated, the utility shall provide customers with updates in at least every other bill, regarding its water supply status and the results of customers' conservation efforts. (N)

CALIFORNIA PUBLIC UTILITIES COMMISSION

Water Division

INSTRUCTIONS FOR WATER CONSERVATION, RATIONING AND SERVICE CONNECTION MORATORIA

Standard Practice U-40-W

SAN FRANCISCO, CALIFORNIA

July 2007

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Issued July 2007
Revising July 2004

INSTRUCTIONS FOR WATER CONSERVATION,
RATIONING AND SERVICE CONNECTION MORATORIA

A—PURPOSE AND SCOPE

1. The purpose of this standard practice is to provide guidance to Water Division staff, to the public and to utilities as to steps to be taken when the utility suffers from a water shortage. The three levels of action are voluntary rationing, mandatory rationing and a service connection moratorium.

B—BACKGROUND

2. General Order 103, Chart 1, and Standard Practice U-22-W, Determination of Water Supply Requirements of Water Systems, address water supply requirements, but supply can be affected temporarily due to drought or decreased production of a utility's wells. When this happens, utilities may have to resort to mandatory conservation or may have to institute a service connection moratorium.

3. Parties may also protest service area extensions (see Standard Practice U-14-W) over concern that the available supplies may be inadequate to serve the new customers, which would be the equivalent of a service connection moratorium (see Section F)[1].

4. The position of the Commission in overall water supply planning was set forth in Decision 99-04-061, April 22, 1999 (see Appendix A to this Standard Practice).

C—DEVELOPMENT OF CONSERVATION AND RATIONING

5. In mid-1976, due to a drought, the Commission opened an Order Instituting Investigation (OII, Case No. 10114, June 8, 1976) to determine what actions to take. In early 1977, the Commission issued an emergency decision that allowed water utilities to distribute water conservation kits and to implement cost effective water conservation programs.

6. The Commission was once again faced with drought conditions in mid-1988. The Commission opened OII 89-03-005 that allowed all classes of water utilities to file a water conservation and rationing plan consisting of two distinct parts: Rule 14.1 (a "voluntary conservation" program) and Schedule 14.1 (the mandatory rationing and penalty part). This plan was based primarily upon the Department of Water Resources and Metropolitan Water District's model plans, but also

[1] In Resolution No. 4154, August 5, 1999, the Sierra Club protested Valencia Water Company's Advice Letters 84 and 85 for service area extension. The Commission found in the favor of Valencia, that it had adequate supplies, but ordered the utility to file its Water Management Program by application so the long-term water availability issues could be heard.

incorporated aspects of the North Marin Water District, East Bay Municipal Utility District, and California Water Service Company's existing conservation and rationing plans. The main objective of Rule 14.1 and Schedule 14.1 was to have a plan readily available for any utility that needed conservation and/or rationing methods. This plan allowed regulated utilities to achieve conservation of 17.5% to 26%.

7. The drought was officially declared over in February 1993 and the OII was closed. Because history shows that drought occurs in California about once every ten years, Rule 14.1 has remained in place. When conditions become severe, the utility may file an advice letter to institute Schedule 14.1. The Commission must approve implementation of this schedule by resolution.

D—VOLUNTARY RATIONING

8. Voluntary rationing consists of the steps described in Rule 14.1 (Appendix B). This Tariff Rule should be in the tariff book of every utility that might suffer from a water shortage.

E—MANDATORY RATIONING

9. Mandatory rationing consists of the steps described in Schedule 14.1. The utility adds schedule 14.1 to its tariff book by filing an advice letter with full justification. Staff will prepare a resolution for consideration by the Commission. The Commission must approve the imposition of mandatory conservation.

10. Schedule 14.1 may be modified to fit the needs of the utility and its particular water shortage situation. The following provisions are examples of what might be included in a typical Schedule 14.1:

A. Prohibit nonessential and unauthorized water use, including:
   i. use for more than minimal landscaping in connection with new construction;
   ii. use through any meter when the company has notified the customer in writing to repair a broken or defective plumbing, sprinkler, watering or irrigation system and the customer has failed to effect such repairs within five days;
   iii. use of water which results in flooding or runoff in gutters or streets;
   iv. use of water through a hose for washing cars, buses, boats, trailers or other vehicles without a positive automatic shut-off valve on the outlet end of the hose;
   v. use of water through a hose for washing buildings, structures, sidewalks, walkways, driveways, patios, parking lots, tennis courts, or other hard-surfaced areas;
   vi. use of water to clean, fill or maintain levels in decorative fountains;

vii. use of water for construction purposes unless no other source of water or other method can be used;
viii. service of water by any restaurant except upon the request of a patron; and
ix. use of water to flush hydrants, except where required for public health or safety.

B. Establish customer water allocations at a percentage of historical usage with the corresponding billing periods of a non-drought year being the base.

C. Establish an allocation of a percentage of historical usage with the corresponding billing periods of a non-drought year being the base for consumption for users of process water (water used to manufacture, alter, convert, clean, grow, heat or cool a product, including water used in laundries and car wash facilities that recycle the water used).

D. Establish a minimum allocation of a number of Ccf per month (one Ccf is one hundred cubic feet) for any customer regardless of historical usage.

E. Establish an exceptions procedure for customers with no prior billing period record or where unusual circumstances dictate a change in allocation.

F. Establish a penalty ("conservation fee") of $2.00 per Ccf for usage over allocated amounts, provided, however, that banking of underusage from month to month is allowed.

G. Provide that penalty funds are not to be accounted for as income, but are to be kept in a separate reserve account for disposition as directed by the Commission.

H. Provide that, after written warning for nonessential or unauthorized water use, for subsequent violations the utility may install a flow restrictor to be left in a minimum of three days. The second time a flow restrictor is installed it may be left in until rationing ends.

I. Establish charges of $25, $50, or actual cost depending on meter size for removing restrictors, and provide that continuing nonessential or unauthorized use may result in disconnection.

J. Establish an appeal procedure first through the utility, then to the Commission staff through the Executive Director, then to the Commission via a formal complaint.

F—SERVICE CONNECTION MORATORIUM

11. A service connection moratorium is sometimes imposed by the California Department of Health Services. The California Water Code, Section 350 et seq.,

provides that any public water supplier may, after public notice and hearing, declare a water shortage emergency within its service area whenever it determines that the ordinary demands and requirements of its consumers cannot be satisfied without depleting the water supply to the extent that there would be insufficient water for human consumption, sanitation, and fire protection. After it has declared a water shortage emergency, it must adopt such regulations and restrictions on water delivery and consumption as it finds will conserve its water supply for the greatest public benefit. Section 357 requires that suppliers which are subject to regulation by the CPUC shall secure its approval before making such regulations and restrictions effective.

12. Section 2708 of the Public Utilities Code states:

> **2708.** Whenever the commission, after a hearing had upon its own motion or upon complaint, finds that any water company which is a public utility operating within this State has reached the limit of its capacity to supply water and that no further consumers of water can be supplied from the system of such utility without injuriously withdrawing the supply wholly or in part from those who have theretofore been supplied by the corporation, the commission may order and require that no such corporation shall furnish water to any new or additional consumers until the order is vacated or modified by the commission. The commission, after hearing upon its own motion or upon complaint, may also require any such water company to allow additional consumers to be served when it appears that service to additional consumers will not injuriously withdraw the supply wholly or in part from those who theretofore had been supplied by such public utility.

13. To establish a service connection moratorium the utility must:

a. Hold a public meeting under Section 350 and 351 of the Water Code
b. Add the following language to each service schedule:

> "MORATORIUM
> No service shall be provided to any premises not previously served within the _____ Service Area as defined on the Service Area Map filed as a part of these tariffs."

G—EXEMPTIONS

14. Some decisions to impose a moratorium contain exceptions. For example in Citizen's Utilities (CUCC) Montara District:

> "The moratorium shall not apply to owners of real property who are customers of CUCC on or before the date of this order, or their successors in interest, if any change in the use of their property

will not increase their demand upon the system." (D.86-05-078, Ordering Paragraph 3.)

15. D.86-05-078 also provided that prospective customers could seek an exemption from the moratorium by filing an application with the Commission showing that extraordinary circumstances required an exemption.

16. In D.00-06-020, June 8, 2000 the Commission granted an application and authorized Citizens Utilities to install a water service connection to applicant's property at APN 037-278-090 following cessation of service at applicant's property at 888 Ocean Boulevard in Montara. Costs were to be borne by applicant. The order made it clear that water service could not be reinstated at 888 Ocean Boulevard absent a lifting or easing of the moratorium. Such determinations were also delegated to staff[2].

[2] D.86-05-078, May 28, 1986, Ordering Paragraph 4.

The Commission's Role in Water Planning

The two state agencies primarily responsible for overseeing water planning are the California Department of Water Resources, which is manages the State Water Project and produces the California Water Plan, and the State Water Quality Control Board and Regional Water Quality Control Boards which have authority over water allocation and water quality protection.

In addition to the state agencies which have broad planning and management powers, local government also has a part in water use decisions. For example, county boards of supervisors, county water agencies, land use planning agencies, city governments, municipal water districts and many special districts all have a role in the use of water in California.

In this context, the Commission has recognized the futility of one party taking unilateral action to protect a groundwater basin:

> Rehabilitation of the Santa Maria Groundwater Basin is not the responsibility of, and is beyond the physical and financial resources of any single individual, company, or agency. Even if [Southern California Water Company] were to stop drawing from the basin entirely and injected into the basin the entire 7,900 AFY it desires to obtain from the [Central Coast Water Authority], the basin's fundamental problems of declining quantity and water quality would not be solved. Most simply put, the basin's salvation as a water resource requires the immediate, undivided, sincere and selfless attention of all its users.

(Re Southern California Water Company, 48 CPUC2d 511, 519 (D.93-03-066)(emphasis in original).)

The Commission's role is limited to ensuring that each jurisdictional water utility provides its customers with "just and reasonable service, . . . and facilities as are necessary to promote the safety, health, comfort and convenience of its patrons, employees, and the public." (§ 451.) The Commission has further delineated the service standard in its General Order 103 where it proscribes Standards of Service

including water quality, water supply, and water pressure, as well as many other details of service.

The Commission has not, however, dictated to investor-owned utilities what method of obtaining water must be used to meet its present and future responsibility of providing safe and adequate supply of water at reasonable rates. (Southern California Water, 48 CPUC2d at 517.)

Which is not to suggest that the Commission ignores issues of water availability in its regulation of water utilities. The Commission requires that all water utilities prepare, file, and update a water management plan which includes identification of water sources as well as consumption projections over 15 years. These plans are updated by the utility as part of its general rate case.

RULE N0. 14.1
WATER CONSERVATION AND RATIONING PLAN

GENERAL INFORMATION

If water supplies are projected to be insufficient to meet normal customer demand, and are beyond the control of the utility, the utility may elect to implement voluntary conservation using the portion of this plan set forth in Section A of this Rule after notifying the Commission's Water Division of its intent. If, in the opinion of the utility, more stringent water measures are required, the utility shall request Commission authorization to implement the mandatory conservation and rationing measures set forth in Section B.

The Commission shall authorize mandatory conservation and rationing by approving Schedule No. 14.1, Mandatory Water Conservation and Rationing. When Schedule No. 14.1 has expired, or is not in effect, mandatory conservation and rationing measures will not be in force. Schedule No. 14.1 will set forth water use violation fines, charges for removal of flow restrictors, and the period during which mandatory conservation and rationing measures will be in effect.

When Schedule No. 14.1 is in effect and the utility determines that water supplies are again sufficient to meet normal demands, and mandatory conservation and rationing measures are no longer necessary, the utility shall seek Commission approval to rescind Schedule No. 14.1 to discontinue rationing.

In the event of a water supply shortage requiring a voluntary or mandatory program, the utility shall make available to its customers water conservation kits as required by Rule 20. The utility shall notify all customers of the availability of conservation kits.

(continued)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

A. CONSERVATION - NON-ESSENTIAL OR UNAUTHORIZED WATER USE

No customer shall use utility-supplied water for non-essential or unauthorized uses as defined below:

1. Use of water through any connection when the utility has notified the customer in writing to repair a broken or defective plumbing, sprinkler, watering or irrigation system and the customer has failed to make such repairs within 5 days after receipt of such notice.

2. Use of water which results in flooding or run-off in gutters, waterways, patios, driveway, or streets.

3. Use of water for washing aircraft, cars, buses, boats, trailers or other vehicles without a positive shut-off nozzle on the outlet end of the hose. Exceptions include washing vehicles at commercial or fleet vehicle washing facilities operated at fixed locations where equipment using water is properly maintained to avoid wasteful use.

4. Use of water through a hose for washing buildings, structures, sidewalks, walkways, driveways, patios, parking lots, tennis courts, or other hard-surfaced areas in a manner which results in excessive run-off or waste.

5. Use of water for watering streets with trucks, except for initial wash-down for construction purposes (if street sweeping is not feasible), or to protect the health and safety of the public.

6. Use of water for construction purposes, such as consolidation of backfill, dust control, or other uses unless no other source of water or other method can be used.

7. Use of water for more than minimal landscaping in connection with any new construction.

(continued)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

A. CONSERVATION – NON-ESSENTIAL OR UNAUTHORIZED WATER USE (CONT.)

8. Use of water for outside plants, lawn, landscape, and turf areas more often than every other day, with even numbered addresses watering on even numbered days of the month and odd numbered addresses watering on the odd numbered days of the month, except that this provision shall not apply to commercial nurseries, golf courses and other water-dependent industries.

9. Use of water for watering outside plants, lawn, landscape and turf areas during certain hours if and when specified in Schedule No. 14.1 when the schedule is in effect.

10. Use of water for watering outside plants and turf areas using a hand-held hose without a positive shut-off valve.

11. Use of water for decorative fountains or the filling or topping off of decorative lakes or ponds. Exceptions are made for those decorative fountains, lakes, or ponds which utilize recycled water.

12. Use of water for the filling or refilling of swimming pools.

13. Service of water by any restaurant except upon the request of the patron.

B. RATIONING OF WATER USAGE

In the event the conservation measures required by Section A are insufficient to control the water shortage, the utility shall, upon Commission approval, imposed mandatory conservation and rationing. Rationing shall be in accordance with the conditions set forth in Schedule No. 14.1 as filed at the time such rationing is approved by the Commission.

Before mandatory conservation and rationing is authorized by the Commission, the utility shall hold public meetings and takes all other applicable steps required by Sections 350 through 358 of the California Water Code.

(continued)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

C. ENFORCEMENT OF MANDATORY CONSERVATION AND RATIONING

1. The water use restrictions of the conservation program, in Section A of this rule, become mandatory when the rationing program goes into effect. In the event a customer is observed to be using water for any nonessential or unauthorized use as defined in Section A of this rule, the utility may charge a water use violation fine in accordance with Schedule No. 14.1.

2. The utility may, after one verbal and one written warning, install a flow-restricting device on the service line of any customer observed by utility personnel to be using water for any non-essential or unauthorized use as defined in Section A above.

3. A flow restrictor shall not restrict water delivery by greater than 50% of normal flow and shall provide the premise with a minimum of 6 Ccf/month. The restricting device may be removed only by the utility, only after a three-day period has elapsed, and only upon payment of the appropriate removal charge as set forth in Schedule No. 14.1.

4. After the removal of the restricting device, if any non-essential or unauthorized use of water shall continue, the utility may install another flow-restricting device. This device shall remain in place until water supply conditions warrant its removal and until the appropriate charge for removal has been paid to the utility.

5. If, despite installation of such flow-restricting device pursuant to the provisions of the previous enforcement conditions, any such non-essential or unauthorized use of water shall continue, then the utility may discontinue water service to such customer. In such latter event, a charge as provided in Rule No. 11 shall be paid to the utility as a condition to restoration of service.

6. Any monies collected by the utility through water use violation fines shall not be accounted for as income, but shall be accumulated by the utility in a separate account for disposition as directed or authorized from time to time by the Commission.

7. The charge for removal of a flow-restricting device shall be in accordance with Schedule No. 14.1.

(continued)

RULE N0. 14.1
(continued)

WATER CONSERVATION AND RATIONING PLAN

D. APPEAL PROCEDURE

Any customer who seeks a variance from any of the provisions of this water conservation and rationing plan shall notify the utility in writing, explaining in detail the reason for such a variation. The utility shall respond to each such request.

Any customer not satisfied with the utility's response may file an appeal with the staff of the Commission. The customer and the utility will be notified of the disposition of such appeal by letter from the Executive Director of the Commission.

If the customer disagrees with such disposition, the customer shall have the right to file a formal complaint with the Commission. Except as set forth in this Section, no person shall have any right or claim in law or in equity, against the utility because of, or as a result of, any matter or thing done or threatened to be done pursuant to the provisions of this water conservation and rationing plan.

E. PUBLICITY

In the event the utility finds it necessary to implement this plan, it shall notify customers and hold public hearings concerning the water supply situation, in accordance with Chapter 3, Water Shortage Emergencies, Sections 350 to 358, of the California Water Code. The utility shall also provide each customer with a copy of this plan by means of billing inserts or special mailings; notification shall take place prior to imposing any fines associated with this plan. In addition, the utility shall provide customers with periodic updates regarding its water supply status and the results of customers' conservation efforts. Updates may be by bill insert, special mailing, poster, flyer, newspaper, television or radio spot/advertisement, community bulletin board, or other appropriate methods.

SCHEDULE NO. 14.1
MANDATORY WATER CONSERVATION AND RATIONING

APPLICABILITY

This schedule applies to all water customers served under all tariff rates schedules authorized by the Commission. It is only effective in times of rationing, as required by Rule No. 14.1, and only for the period noted in the Special Conditions section below.

TERRITORY

This schedule is applicable within the entire territory served by the utility.

WATER USE VIOLATION FINE

When this schedule is in effect, the water use restrictions of the conservation program, in Section A of Rule 14.1, become mandatory. If a customer is seen violating the water usage restrictions, as outlined in Rule No. 14.1 and the Special Conditions below, the customer will be subject to the following fine structure:

First offense - written warning	
Second offense - (of the same restriction)	$25
Third offense - (of the same restriction)	$50
Each additional offense - (of the same restriction)	$25 more than the previous fine imposed.

Offenses for separate water use restrictions will each start at the warning stage.

The water use violation fine is in addition to the regular rate schedule charges.

(continued)

SCHEDULE NO. 14.1
MANDATORY WATER CONSERVATION AND RATIONING (CONT.)

FLOW RESTRICTOR REMOVAL CHARGE

The charge for removal of a flow-restricting device shall be:

Connection Size	Removal Charges
5/8" to 1"	$25.00
1-1/2" to 2"	$50.00
3" and larger	Actual cost

SPECIAL CONDITIONS

1. This tariff schedule shall remain in effect for period of six (6) months from the effective date set forth below.

2. There shall be no use of utility-supplied water for outside plants, lawn, landscape, and turf areas between the hours of 3:00 a.m. to 8:00 p.m., regardless of address or day of the month.

3. Water use violation fines may be applied to violations of Section A of Rule No. 14.1, which prohibits non-essential and unauthorized uses of water.

4. Water use violation fines must be separately identified on each bill.

5. All bills are subject to the reimbursement fee set forth on Schedule No. UF.

LACWWD No. 36 Water Shortage Conservation Ordinance

MINUTES OF THE BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES, STATE OF CALIFORNIA

Sachi A. Hamai, Executive Officer-
Clerk of the Board of Supervisors
383 Kenneth Hahn Hall of Administration
Los Angeles, California 90012

At its meeting held October 7, 2008, the Board took the following action:

72

The following item was called up for consideration:

Urgency Ordinance for introduction amending the County Code, Title 11 - Health and Safety, to readopt Part 4 of Chapter 11.38 - Water Conservation Requirements for the Unincorporated County area, which establishes water conservation and waste prevention requirements with a written warning for the first violation and a fine of $100 for each subsequent violation; and find that adoption of ordinance is exempt from the California Environmental Quality Act.

On motion of Supervisor Molina, seconded by Supervisor Antonovich, duly carried by the following vote: Ayes: Supervisors Molina, Yaroslavsky, Knabe, Antonovich and Burke; Noes: None, the Board introduced, waived reading and adopted the attached Ordinance No. 2008-0052U entitled, "An urgency ordinance amending Title 11 - Health and Safety of the Los Angeles County Code, relating to water conservation requirements for the Unincorporated Los Angeles County Area." This ordinance shall take effect October 7, 2008.

02100708_72

Attachment

Copies distributed:
Each Supervisor
Chief Executive Officer
County Counsel
Acting Director of Public Works
Acting Director of Beaches and Harbors
Director of Internal Services
Director of Parks and Recreation
Director of Planning
Director of Public Health

(ALSO SEE BOARD ORDER NO. 40 THIS DATE)

ANALYSIS

This ordinance amends Title 11 – Health and Safety of the Los Angeles County Code, relating to Water and Sewers, to readopt Part 4 of Chapter 11.38 – Water Conservation Requirements for the Unincorporated Los Angeles County Area.

Pursuant to Section 2 of Ordinance No. 91-0046U, Part 4 of Chapter 11.38 – Water Conservation Requirements for the Unincorporated Los Angeles County Area, terminated on January 1, 1993. This ordinance readopts the same provisions, which were previously set forth in Part 4, except that this ordinance does not have a sunset date, revises the fine amounts, and sets forth a review mechanism.

This ordinance is an urgency measure and requires a four-fifths vote by the Board of Supervisors for adoption.

RAYMOND G. FORTNER, JR.
County Counsel

By
TRUC L. MOORE
Deputy County Counsel
Public Works Division

TLM:ia

08/13/08 (Requested)

09/17/08 (Revised)

ORDINANCE NO. 2008-00052U

An urgency ordinance amending Title 11 – Health and Safety of the Los Angeles County Code, relating to water conservation requirements for the Unincorporated Los Angeles County Area.

The Board of Supervisors of the County of Los Angeles ordains as follows:

SECTION 1. Chapter 11.38, Part 4, is hereby readopted as amended to read as follows:

Part 4. Water Conservation Requirements for the Unincorporated Los Angeles County Area

11.38.620 Hose watering prohibition.

No person shall hose water or wash down any sidewalks, walkways, driveways, parking areas or other paved surfaces, except as is required for the benefit of public health and safety. Willful violation hereof shall be subject to a written warning for the first violation, and shall be an infraction punishable by a fine of $100.00 ~~for the first infraction and $500.00 each~~ for each subsequent ~~infractions~~violation.

11.38.630 Watering of lawns and landscaping.

A. No person shall water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 5:00 p.m.

B. No person shall water or cause to be watered any lawn or landscaping more than once a day.

C. No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

D. It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks, and to cause all leaks to be repaired as soon as is reasonably practicable.

E. Willful violation hereof shall be subject to a written warning for the first violation, and shall be an infraction punishable by a fine of $100.00 ~~for the first infraction and $500.00 each~~ for each subsequent ~~infractions~~violation.

11.38.640 Indoor plumbing and fixtures.

A. It shall be the duty of all persons to inspect all accessible indoor plumbing and faucets for leaks, and to cause all leaks to be repaired as soon as is reasonably practicable.

B. Willful violation hereof shall be subject to a written warning for the first violation, and shall be an infraction punishable by a fine of ~~$500~~100.00 for each subsequent violation.

11.38.650 Washing vehicles.

No motor vehicle, boat, trailer, or other type of mobile equipment may be washed, except at a commercial carwash or with reclaimed water, unless such vehicle is washed by using a hand-held bucket or a water-hose equipped with an automatic shutoff nozzle. No person shall leave a water hose running while washing a vehicle or at any other time. Willful violation hereof shall be subject to a written warning for the

first violation, and shall be an infraction punishable by a fine of $100.00 ~~for the first infraction and $500.00 each~~ for each subsequent ~~infractions~~violation.

11.38.660 Public eating places.

No restaurant, hotel, cafeteria, café, or other public place where food is sold or served shall serve drinking water to any customer unless specifically requested to do so by such customer. Willful violation hereof shall be subject to a written warning for the first violation, and shall be an infraction punishable by a fine of $100.00 ~~for the first infraction and $500.00 each~~ for each subsequent ~~infractions~~violation.

11.38.670 Decorative fountains.

No person shall use water to clean, fill, or maintain levels in decorative fountains, ponds, lakes, or other similar aesthetic structures unless such water flows through a recycling system. Willful violation hereof shall be subject to a written warning for the first violation, and shall be an infraction punishable by a fine of $100.00 ~~for the first infraction and $500.00 each~~ for each subsequent ~~infractions~~violation.

11.38.680 Procedural requirements.

The Director of Public Works, with input and concurrence from the Director of Public Health, shall periodically review the provisions of this Part and recommend necessary updates to the Board of Supervisors. The review of these provisions and preparation of resulting recommendations, if any, shall be performed, at a minimum, every two years following the first review, which shall to be completed by December 31, 2010.

SECTION 2. Due to the severity of the drought in the State of California, there is an immediate need to prohibit the wasting of water in the Los Angeles County unincorporated area to better utilize the available water supplies. This ordinance is urgently needed for the preservation of the public health, safety, and general welfare, and shall take effect immediately.

[1138WATERTMCC]

SECTION 3. This ordinance shall be published in The Metropolitan News a newspaper printed and published in the County of Los Angeles.

Yvonne B. Burke
Chair

ATTEST:

Sachi A. Hamai
Executive Officer -
Clerk of the Board of Supervisors
County of Los Angeles

I hereby certify that at its meeting of October 7, 2008 the foregoing ordinance was adopted by the Board of Supervisors of said County of Los Angeles by the following vote, to wit:

	Ayes		Noes
Supervisors	Gloria Molina	Supervisors	None
	Zev Yaroslavsky		
	Don Knabe		
	Michael D. Antonovich		
	Yvonne B. Burke		

Effective Date: October 7, 2008

~~Operative Date:~~ _____

Sachi A. Hamai
Executive Officer -
Clerk of the Board of Supervisors
County of Los Angeles

APPROVED AS TO FORM:
RAYMOND G. FORTNER, JR.
County Counsel

By Leela Kapur
Leela Kapur
Chief Deputy County Counsel

S:\Ordinances\County Counsel\2008\2008-0052U

Appendix G

CLWA Groundwater Management Plan
(provided on CD)

Groundwater Management Plan

Santa Clara River Valley Groundwater Basin, East Subbasin

Los Angeles County, California

CASTAIC LAKE WATER AGENCY

December, 2003

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

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I. Introduction

Castaic Lake Water Agency

Castaic Lake Water Agency (CLWA) was formed in 1962 as a State Water Project Contractor to provide wholesale water supply from the State Water Project (SWP) to retail water purveyors in the Upper Santa Clara River area, most notably to Newhall County Water District, Los Angeles County Waterworks District No. 36, Santa Clarita Water Company and Valencia Water Company. In 2001, as part of legislation authorizing CLWA to provide retail water service to individual municipal customers in addition to its ongoing wholesale water supply, Assembly Bill 134 included a requirement that CLWA prepare a groundwater management plan in accordance with the provisions of Water Code Section 10750 et seq., which was originally enacted by, and is commonly known as, Assembly Bill 3030. This groundwater management plan has been prepared to satisfy the requirements of AB 134 and to both complement and formalize a number of existing water supply and water resource planning and management activities in the CLWA service area.

The CLWA service area encompasses all of the existing and currently planned municipal water service areas of the Upper Santa Clara River area, i.e. the suburban areas generally proximate to the Santa Clara River in Los Angeles County, generally between hills of the San Gabriel Mountains and the Santa Susana Mountains on the north and south, and between the Los Angeles/Ventura County line and Lang Station on the west and east, respectively. The extent of the CLWA service area and the geographical locations of the individual water purveyors within the CLWA service area are illustrated in Figure 1-1.

Santa Clara River Valley Groundwater Basin, East Subbasin

The groundwater basin generally beneath the CLWA service area, identified in DWR Bulletin 118 as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), is comprised of two aquifer systems, the Alluvium generally underlying the Santa Clara River and its several tributaries, and the Saugus Formation which underlies much of the entire Upper Santa Clara River area. The mapped extent of the Santa Clara River Valley East Subbasin in Bulletin 118, which is approximately the outer extent of the Alluvium and the Saugus Formation, and its

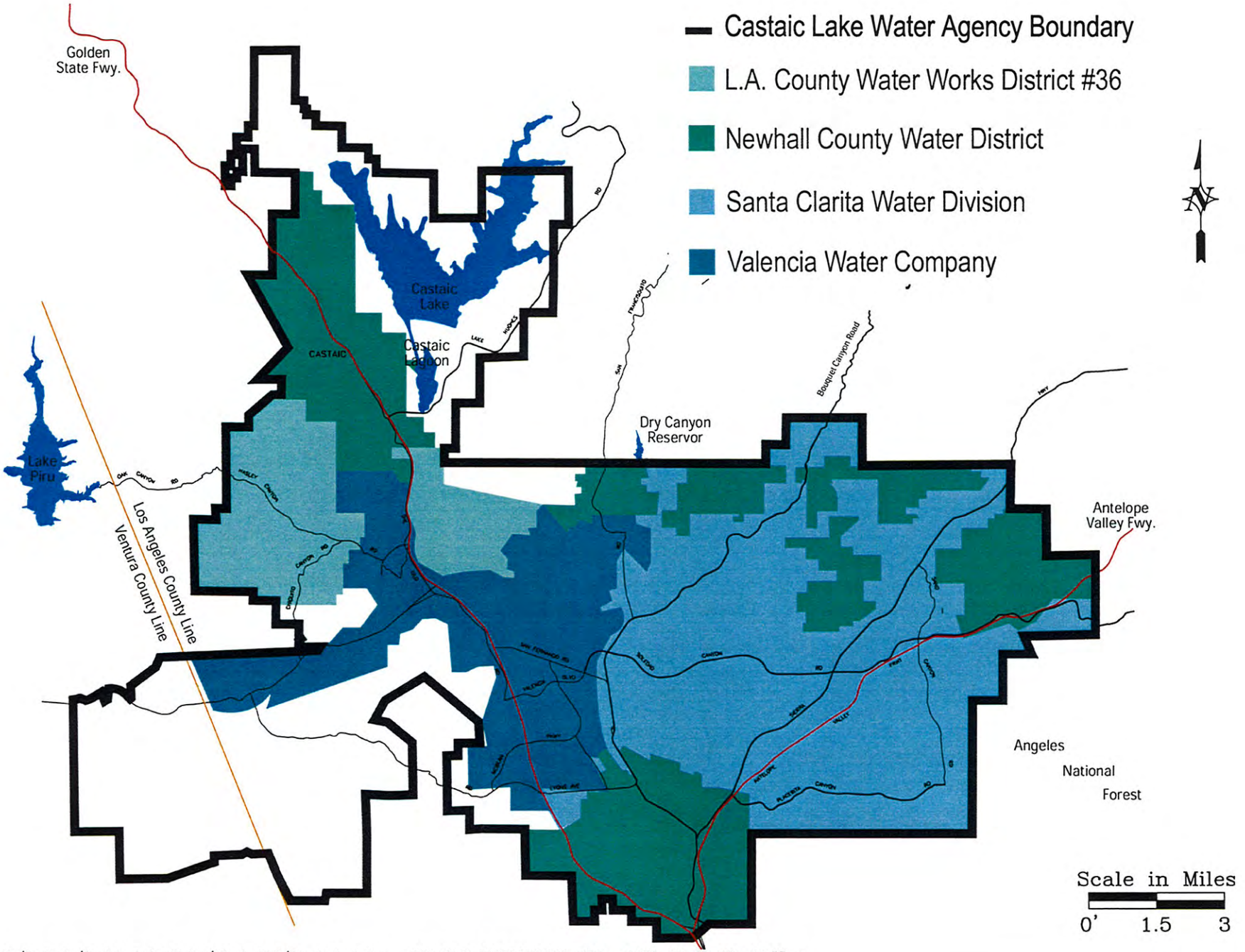

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Figure 1-1
CLWA and Purveyors` Service Areas

relationship to the extent of the CLWA service area are illustrated in Figure 1-2.

The two aquifer systems that comprise the groundwater basin are described in detail in this plan. For purposes of this plan, the groundwater basin is encompassed by the CLWA service area, and CLWA is the logical public water supply agency to prepare and implement a groundwater management plan for the Santa Clara River Valley East groundwater subbasin.

Overview of Water Requirements and Supplies

Historically, while development of local water supplies dates back at least 100 years, the earliest complete records of water use in the basin date from the late 1940's, when practically all water demand was for agricultural use. From that time through the early 1960's, agricultural water use, which was solely supplied by local groundwater, ranged from about 27,000 to about 42,000 acre-feet per year (afy). Over the succeeding three decades, agricultural water use progressively declined, into the range of about 8,000 to 10,000 afy, followed by a slight increase into the range of about 12,000 to 15,000 afy over the last ten years. Current projections are for agricultural water use to substantially decline, to about 7,000 afy, over the next 20 years.

Significant municipal water use in the basin did not begin until the early 1960's, when municipal uses, which were met exclusively at that time by local groundwater, were in the range of about 5,000 to 10,000 afy. By 1980, when supplemental surface water from the State Water Project (SWP) began to be imported to the basin, municipal water demands had increased to about 22,000 afy. Since then, municipal water demands have further increased, to their current level of about 61,000 afy, about 60 percent of which is supplied by SWP water, with the balance supplied by local groundwater. Current projections are for municipal water requirements to increase to about 106,000 afy over the next 20 years.

Historical and projected water requirements and supplies in the basin are discussed in more detail in Section IV of this Plan.

Water Code Section 10750 et. seq.

In 1992, the California State Legislature adopted Assembly Bill 3030 (AB 3030); that legislation was subsequently incorporated into the Water Code, Section 10750 et seq., to encourage local public agencies/water purveyors to adopt a formal plan to manage groundwater resources within

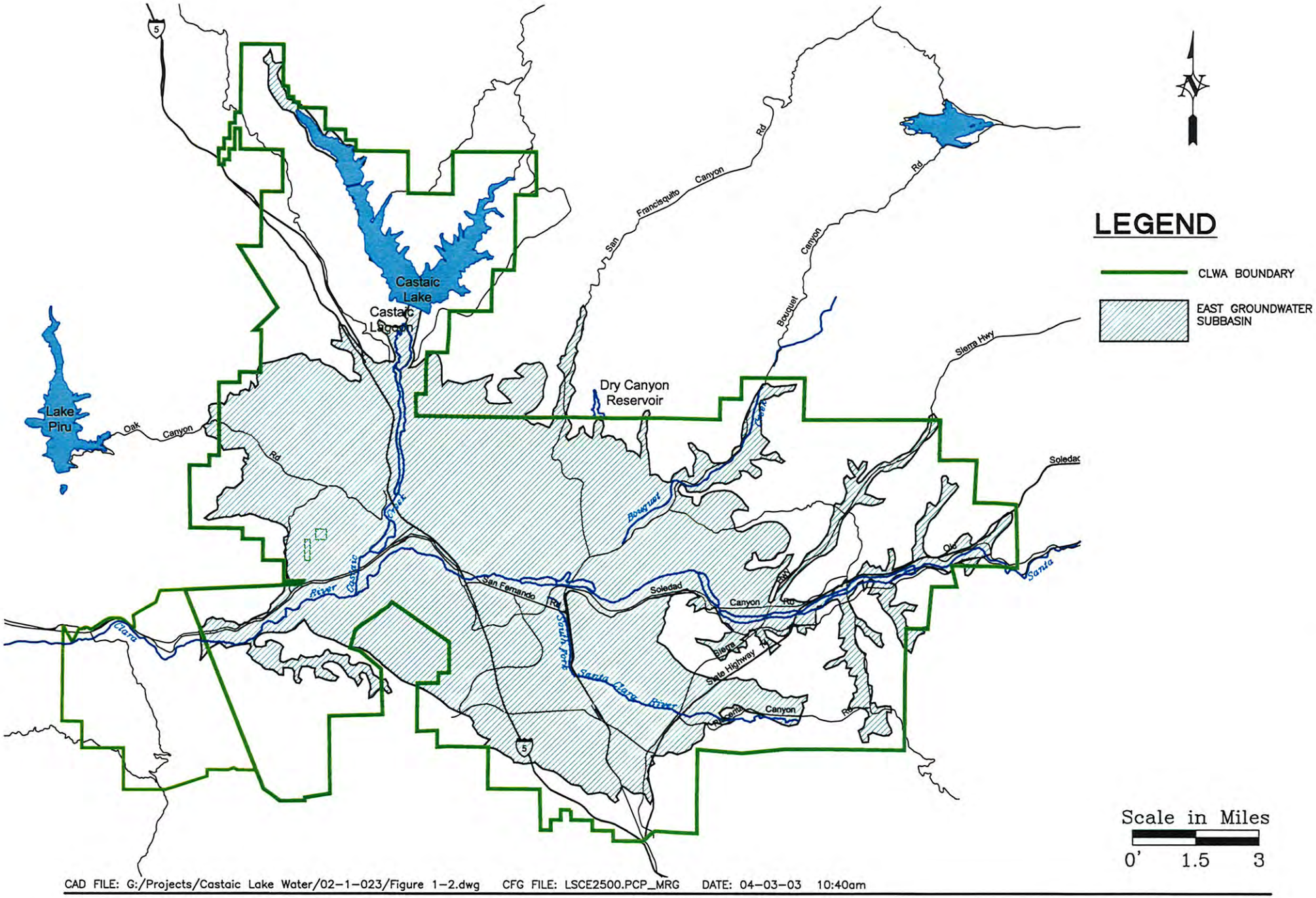

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Figure 1-2
Santa Clara River Valley
East Groundwater Subbasin

their jurisdictions. Within the scope of Water Code Section 10753.8, a local groundwater management plan can potentially include up to twelve specific components. Although the plan need not be restricted to those specific components, the listed components are quite broad and cover essentially all of the groundwater management elements which are part of this plan or are likely to be considered for implementation into this plan in the foreseeable future. To a considerable extent, a number of the groundwater management activities listed in Water Code Section 10753.8 have been implemented in the Santa Clara River Valley East groundwater subbasin as part of an organized effort by the local municipal water purveyors, including CLWA, to manage the groundwater basin within its sustainable yield for the benefit of local water supply, and also to integrate management of the basin with the management of surface and groundwater immediately downstream on the Santa Clara River, in this case specifically with United Water Conservation District in Ventura County, as discussed in more detail herein.

The potential components of a groundwater management plan listed in Water Code Section 10753.8 include:

- the control of saline water intrusion.
- identification and management of wellhead protection areas and recharge areas.
- regulation of the migration of contaminated groundwater.
- the administration of a well abandonment and well destruction program.
- mitigation of conditions of overdraft.
- replacement of groundwater extracted by water producers.
- monitoring of groundwater levels and storage.
- facilitating conjunctive use operations.
- identification of well construction policies.
- the construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.
- the development of relationships with state and federal regulatory agencies.
- the review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination.

In 2002, the Legislature adopted Senate Bill 1938 (SB 1938) to amend and add to Water Code Section 10750 et seq. regarding the implementation of local groundwater management plans. While the provisions of SB 1938 did not alter the potential components of a local groundwater management plan, as listed above, it did add the following notable provisions:

- The local agency, in preparing a groundwater management plan, shall make available to the public a written statement describing how interested parties may participate in developing the plan; for purposes of carrying out the preceding requirement, the local agency may appoint, and consult with, a technical advisory committee consisting of interested parties. AB 134 actually anticipated this last item by requiring CLWA to form an Advisory Committee to review its Plan. The membership of the Advisory Committee was specified to consist of one representative from each retail water purveyor within CLWA and one representative from each groundwater producer within CLWA who pumped more than 100 acre-feet in the preceding water year (2000). In conformance with that requirement, CLWA formed an Advisory Committee consisting of representatives from the following organizations, who collectively fulfill the description of the membership specified in AB134:

    - CLWA Santa Clarita Water Division
    - Los Angeles County Sheriff's Department
    - Los Angeles County Waterworks District No. 36
    - Newhall County Water District
    - Newhall Land and Farming Company
    - Robinson Ranch
    - Valencia Water Company

- In order to qualify for funding assistance for groundwater projects or groundwater quality projects, for funds administered by DWR, a local agency must accomplish all the following relative to groundwater management:

    - prepare and implement, or participate in, or consent to be subject to, a groundwater management plan, a basin-wide management plan, or other integrated regional water management program or plan that meets the provisions listed below.

    - include groundwater management components that address monitoring and management of water levels, groundwater quality degradation, inelastic land subsidence, and changes in surface flows and quality that either affect groundwater or are affected by groundwater pumping.

- include provisions to cooperatively work with other public (and presumably private) entities whose service area or boundary overlies the groundwater basin.

- include mapping of the groundwater basin, as defined in DWR's Bulletin 118, and the boundaries of the local agency subject to the plan, plus the boundaries of other local agencies that overlie the basin.

- adopt monitoring protocols designed to detect changes in groundwater levels, groundwater quality, inelastic land subsidence (for basins where subsidence has been identified as a potential problem), and flow and quality of surface water that either directly affect groundwater, or are directly affected by groundwater pumping.

Of the potential groundwater management activities listed in Water Code Section 10753.8, those already being investigated and actively implemented as part of less formal groundwater management by the purveyors include avoidance of overdraft, implementation of conjunctive use, monitoring of groundwater levels and quality, initiation of groundwater contamination control, analysis of basin yield for ongoing avoidance of overdraft, and annual analysis and reporting on basin conditions. The historic focus of informal groundwater management in the Santa Clara River Valley East groundwater subbasin has been on water supply, quantity and quality, to avoid conditions of overdraft, primarily by augmenting local groundwater supplies with a supplemental, imported surface water supply from the State Water Project. More recently, efforts have been added to include ongoing monitoring and the compilation of data into a data management system that is integrated with a comparable database system for the downstream surface water resources and groundwater basins on the Santa Clara River. Recent efforts have also included initiation of a process to develop a numerical groundwater flow model of the basin for analysis of basin response to various water supply, recharge, and conjunctive use management alternatives that might be applicable for the basin. The potential groundwater management provisions not historically implemented have been those more focused on groundwater contamination; however, very recent activities have added this component to local groundwater management as a result of impacts on several municipal water supply wells from a former munitions manufacturing site in the basin, as discussed in more detail herein.

In summary, in many respects, the local municipal water purveyors, including CLWA, have

already begun developing and implementing important parts of a formal local groundwater management program as part of developing reliable water supplies for in-basin needs. To ensure the reliability of the groundwater component of water supplies to meet existing and projected demands, those parts of local groundwater management planning already include monitoring, formulation of a data base, and integration with the database for adjoining downstream basins, analysis of groundwater conditions and annual reporting on water conditions in the basin, initiation of groundwater flow modeling, ongoing conjunctive use of local groundwater and imported SWP supplies, and initiation of investigation and control of localized groundwater contamination. The groundwater management plan described herein can be envisioned as a formalization, and some expansion, of those ongoing management efforts in the Santa Clara River Valley East groundwater subbasin.

The balance of this plan is organized to first establish a set of management objectives, or goals, for the basin; to then describe existing groundwater basin conditions, including areas of concern and identified problems; to present historical and projected water demands in the basin; and to finally present a set of groundwater management actions which, in aggregate, are the elements of this groundwater management plan.

II. Management Objectives (Goals) for the Basin

Prior to 1980, all water supplies in the Upper Santa Clara River Area were developed from local groundwater. Since 1980, the major water purveyors within the CLWA service area have developed their water supplies from a combination of local groundwater and imported supplemental surface water from the State Water Project (SWP). CLWA is the state SWP Contractor which holds the contract for SWP water. CLWA also operates the treatment and distribution system for delivery of SWP water to the local purveyors. Some imported SWP water has historically been delivered for non-municipal uses although, in aggregate, total non-municipal uses have been almost negligible (less than one percent).

A relatively small fraction of water supply in the area is still devoted to agricultural and other irrigation, and essentially all of that remains developed from groundwater. Over the last two decades, that use has been in a range between about 10,000 and 17,000 acre-feet per year.

The development and importation of a supplemental surface water supply from the State Water Project represents the first of a number of water resource and water supply management actions, all of which are formalized in this plan, aimed at what can be considered to be the overall goals or objectives for the basin. In no priority, those management objectives for the basin can be expressed as follows:

1. Development of an integrated surface water, groundwater, and recycled water supply to meet existing and projected demands for municipal, agricultural, and other water supply; since pumpage for other uses is from the same aquifer system, this objective includes agricultural, small community, non-agricultural irrigation, and individual domestic uses.

2. Assessment of groundwater basin conditions to determine a range of operational yield values that will make use of local groundwater conjunctively with SWP and recycled water to avoid groundwater overdraft and the undesirable effects associated with it. In effect, this objective equates to more detailed quantification of the yield of the basin in order to continue to avoid overdraft, consistent with what has historically been the case in the basin. In addition to avoiding the traditional overdraft symptoms

and effects, e.g. chronic water level decline, loss of groundwater storage, onset of land subsidence, groundwater quality degradation, a corresponding basin objective is to manage groundwater levels and associated groundwater discharge to the Santa Clara River at the west end of the basin, and thus not adversely impact surface and groundwater discharges to the downstream basin(s).

3. Preservation of groundwater quality for beneficial use in the basin, and for beneficial use of surface water and groundwater discharges from the basin. Included in this management goal will be the active characterization and solution of any groundwater contamination problems, through cooperation with responsible parties or through independent action if timely action by responsible parties is not forthcoming and the preceding management objectives are thereby impacted or constrained.

4. Preservation of interrelated surface water resources. Included in this management goal will be the maintenance of appropriate surface water flows and non-degradation of surface water quality as a result of managing groundwater conditions to meet the other management goals for the basin.

Quantitatively, the preceding goals translate into general preservation of groundwater levels and quality in the Alluvial aquifer system consistent with the last 30 years, including fluctuations through seasonal demands and local hydrologic variations (wet and dry periods). As discussed in more detail in the next chapter, the hydrogeologic setting in the area has resulted in smaller Alluvial groundwater level fluctuations toward the western half of the basin (generally west of Bouquet Canyon), and larger fluctuations to the east. However, largely due in part to the importation of supplemental surface water over the last 20 years, and the integrated or conjunctive use of that supplemental water with local groundwater, there has been no chronic decline in groundwater levels or storage. A continuation of such basin conditions, possibly complemented by management actions to decrease the historical water level fluctuations in the eastern part of the basin, will accomplish the second basin objective (continued avoidance of overdraft as has been the ongoing historical condition in the basin) while continuing to utilize local groundwater to meet part of projected water requirements. Corresponding management actions to sustain recharge and not overdraft groundwater storage will accomplish the third basin objective by replenishing the aquifer system with sufficient water to sustain what has been generally consistent quality of groundwater on a long-term basis.

In general, the same goals of preservation of groundwater levels and quality pertain to the Saugus Formation as well as to the Alluvium. However, while those goals are generally expected to equate to Alluvial pumping rates comparable to recent historical pumping, the Saugus Formation may be intermittently utilized at higher than historical pumping rates for dry-period and/or emergency water supply. Interpretation of historical pumping fluctuations and corresponding aquifer response suggests that such intermittent utilization of a small fraction of the Saugus' large storage capacity can successfully contribute to a firming of local water supplies while still accomplishing all the management objectives listed above, primarily via reduction in Saugus pumping during wet-normal conditions, possibly complemented by management actions to accelerate recharge of the Saugus.

III. Groundwater Basin Conditions

Occurrence of Groundwater

Groundwater in the Santa Clara River Valley East groundwater subbasin occurs in two aquifer systems, the Alluvium associated with the Santa Clara River and its tributaries, and the Saugus Formation. There are also some scattered outcrops of Terrace deposits in the basin that likely have the capacity to contain limited amounts of groundwater; however, since these deposits are located in limited areas that are situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers and have consequently not been developed for water supply.

The Alluvial aquifer system, of Quaternary to Holocene (Recent) geologic age, consists primarily of stream channel and flood plain deposits of the Santa Clara River and its tributaries. The Alluvium is deepest along the center of the present river channel, with a maximum thickness of about 200 feet near the area known as Saugus. It thins toward the flanks of the adjoining hills and toward the eastern and western boundaries of the basin and, in the tributaries, becomes a mere veneer in their upper reaches. The spatial extent of the Alluvium throughout the basin is illustrated in Figure 3-1.

The Alluvium is the most permeable of the local aquifer units. Based on well yields and aquifer testing, transmissivity values in the range of 50,000 to 500,000 gallons per day per foot (gpd/ft) have been reported for the Alluvium, with the higher values where the Alluvium is thickest in the center of the valley and generally west of Bouquet Canyon (Slade 1986 and 2002). The amount of groundwater in storage can vary considerably because of the effects of recharge, discharge and pumping from the aquifer. The maximum storage capacity of the Alluvium has been estimated to be about 240,000 acre-feet (af) (Slade, 1986 and 2002).

The Saugus Formation, of Pliocene to Pleistocene geologic age, has traditionally been divided into two stratigraphic units: the lowermost, geologically older Sunshine Ranch member, which is of mixed marine to terrestrial (non-marine) origin; and the overlying, or upper, portion of the Formation which is entirely terrestrial in origin. The Sunshine Ranch Member of the Saugus Formation has a maximum thickness of about 3,000 to 3,500 feet in the central part of the valley;

III. Groundwater Basin Conditions

Occurrence of Groundwater

Groundwater in the Santa Clara River Valley East groundwater subbasin occurs in two aquifer systems, the Alluvium associated with the Santa Clara River and its tributaries, and the Saugus Formation. There are also some scattered outcrops of Terrace deposits in the basin that likely have the capacity to contain limited amounts of groundwater; however, since these deposits are located in limited areas that are situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers and have consequently not been developed for water supply.

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however, due to its marine origin and fine-grained nature, it is not considered to be a viable source of groundwater for municipal or other comparable supply. Above the Sunshine Ranch Member, the Saugus Formation is coarser grained, consisting mainly of lenticular beds of sandstone and conglomerate that are interbedded with lesser amounts of sandy mudstone, which were deposited in stream channels, flood plains, and alluvial fans by one or more ancestral drainage systems in the valley. The sand and gravel units that represent aquifer materials in the upper part of the Saugus Formation are generally located between depths of about 300 and 2,500 feet. The spatial extent of the Saugus Formation throughout the basin is illustrated in Figure 3-1.

While much thicker and more spatially extensive throughout the basin when compared to the Alluvium, and while significant in terms of groundwater storage and individual well capacity, the Saugus Formation has typically lower values of transmissivity, in the range of 80,000 to 160,000 gpd/ft, with the higher values in the upper portions of the Formation (Slade, 1988 and 2002). The storage capacity of the Saugus has most recently been estimated to be 1.65 million acre-feet between depths of 300 feet and 2,500 feet (or the base of the Saugus or the base of fresh water if shallower than 2,500 ft.) (Slade, 2002).

Historical Groundwater Development

Of the two aquifer systems in the basin, the predominant development of groundwater for agricultural and municipal water supply has historically been from the Alluvium, a condition that remains the case at present. Prior to 1980, all water supply in the valley was developed from local groundwater; since 1980, local groundwater has been supplemented by imported surface water from the State Water Project. Details of historical water requirements, and water supplies to meet those requirements, are discussed and illustrated in Chapter IV of this Plan.

In general, over the last two decades, since the inception of SWP deliveries in 1980, total pumpage from the Alluvium has ranged from a low of about 20,000 afy (in 1983) to slightly more than 43,000 afy (in 1999). For comparison, agricultural pumpage from the Alluvium throughout the 1950's was consistently in the range of about 33,000 to 41,000 afy. During that same time, municipal pumpage was quite small, less than 4,000 afy. Overall, over the last two decades, there has been a change in municipal/agricultural pumping distribution, toward a slightly higher fraction for municipal water supply (from about 50% to nearly 60% of alluvial pumpage) which is indicative of the general land use changes in the area.

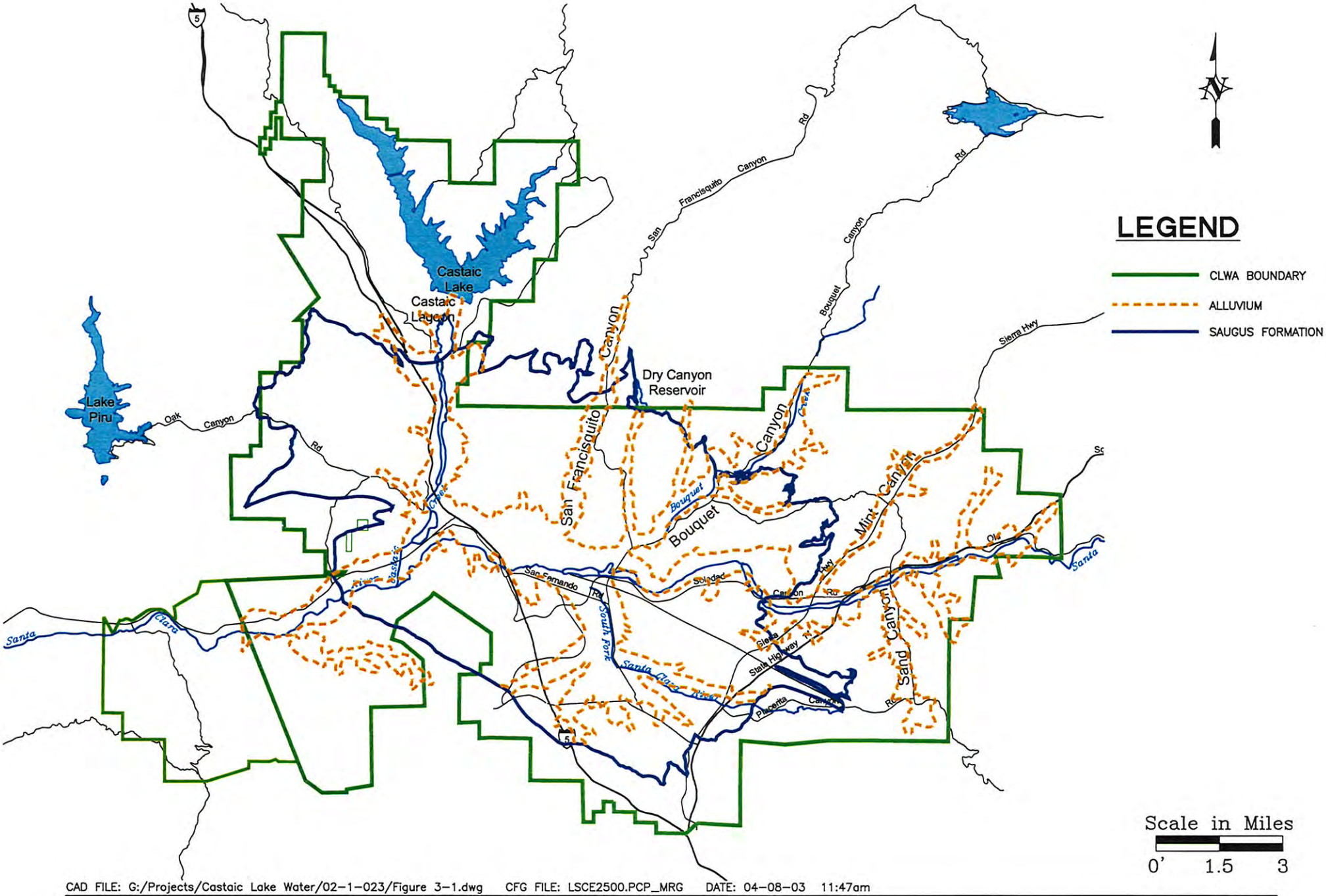

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Figure 3-1
Alluvial and Saugus Formations
Santa Clara River Valley East Groundwater Subbasin

Since 1980, total pumpage from the Saugus Formation has ranged between about 3,850 afy and nearly 15,000 afy; average pumpage over that period has been about 6,900 afy. The great majority of pumpage from the Saugus is for municipal supply (nearly 6,300 afy, or 92 percent, on average). For comparison, although historical Saugus pumping records prior to 1980 are limited, there appears to have been essentially no pumping from the Saugus prior to 1960 (on the order of about 100 af in most years, beginning in 1948), and some increased pumping for agricultural water supply beginning in about 1962 (about 900 af). The largest amount of agricultural pumping from the Saugus was during the mid-1960's, when annual Saugus pumpage was about 3,000 af. Agricultural pumping from the Saugus declined to near zero by the late 1970's, but has been generally in the 500 to 1,000 afy range since 1982. There was no Saugus pumpage for municipal supply in the early 1960's; limited data suggests that municipal pumping from the Saugus began in the 1970's, and reached nearly 5,000 afy by 1980-81. The most significant period of Saugus pumpage was 1991 through 1994, when pumpage ranged from 10,600 afy to nearly 15,000 afy and averaged over 12,000 afy, during which time SWP water deliveries were reduced at the end of extended drought conditions.

Groundwater Monitoring Network and Program

There is no formal groundwater monitoring network of wells for groundwater level measurements and/or groundwater quality sampling in the basin. Consequently, one component of this Plan is to formalize both a network of wells for groundwater monitoring and a program for water level measurements, water quality sampling, and other pertinent groundwater data collection (Primary Plan Element 1). Despite the lack of an existing formal groundwater monitoring network and program, however, there is a significant amount of historical groundwater data, some of which dates back into the 1940's, on which to base reasonable assessments of groundwater conditions in the basin. For example, groundwater level measurements have been made over varying periods of record in a total of 154 wells, mostly alluvial wells, throughout the basin. Similarly, groundwater quality data, consisting of varying numbers of constituents analyzed, are available from some wells, but a much smaller number than is the case for groundwater level data. These data, along with direct measurements or indirect estimates of pumpage, primarily from high capacity municipal and agricultural wells, allow for analysis of groundwater basin conditions, as discussed in this Plan, and also provide the bases on which a groundwater model can be developed (Primary Plan Element 3) and on which various management criteria such as operational yield, baseline groundwater quality, etc. can be determined (Primary Plan Elements 3, 6, etc.).

Groundwater Levels and Storage

Groundwater level data in various parts of the basin illustrate basin response to the historical pumpage from the Alluvium. Organized into hydrograph form (depth to groundwater or groundwater elevation vs. time), historical groundwater levels were lower in the 1950's and 60's than current levels in the middle to western part of the basin, logically in response to the higher pumpage of the 1950's before the importation of SWP water and the associated increase in return flows to the river that have augmented groundwater recharge in that part of the basin. Groundwater levels in those areas notably recovered as pumpage declined through the 1960's and 1970's. They have subsequently sustained generally high levels for much of the last 30 years, with two dry-period exceptions: mid-1970's and late 1980's - early 1990's; recoveries to previous high groundwater levels have followed both of those dry-period declines. Based on this data, there is no evidence of any historic or recent trend toward permanent water level or storage decline. In general, throughout the Alluvium, groundwater levels have been generally higher over the last 30 years than was consistently the case for the preceding 20 years (1950's - 60's).

During the last 20 to 30 years, in essentially all the alluvial portions of the basin, groundwater levels have fluctuated from near the ground surface when the basin is full, to as much as 100 feet lower during intermittent dry periods of reduced recharge. Selected hydrographs of groundwater elevations illustrate the above described conditions throughout the basin. Figure 3-2 illustrates groundwater level conditions and trends at multiple locations in the Alluvium along the main channel of the Santa Clara River, from east near the mouth of Sand Canyon, to the area between Mint Canyon and Bouquet Canyon, to farther west immediately below the mouth of Bouquet Canyon. Similar long-term conditions are evident in the tributary canyons.

A comment about some of the groundwater fluctuations illustrated in Figure 3-2 is appropriate since they are illustrative of the most substantial intermittent changes in the basin. As noted above, the Alluvium has historically experienced a number of alternating wet and dry hydrologic conditions as illustrated in Figure 3-2. Since the Alluvium is thinner to the east, the fluctuations in water levels of 75 to 100 feet impact well yields and pumping capacities when water levels are occasionally lower. When that occurs, as is currently the case due to locally dry hydrologic conditions, the affected purveyors shift a portion of their water demands to imported SWP water, thus reducing pumpage and reducing drawdown of water levels. Recovery of groundwater levels

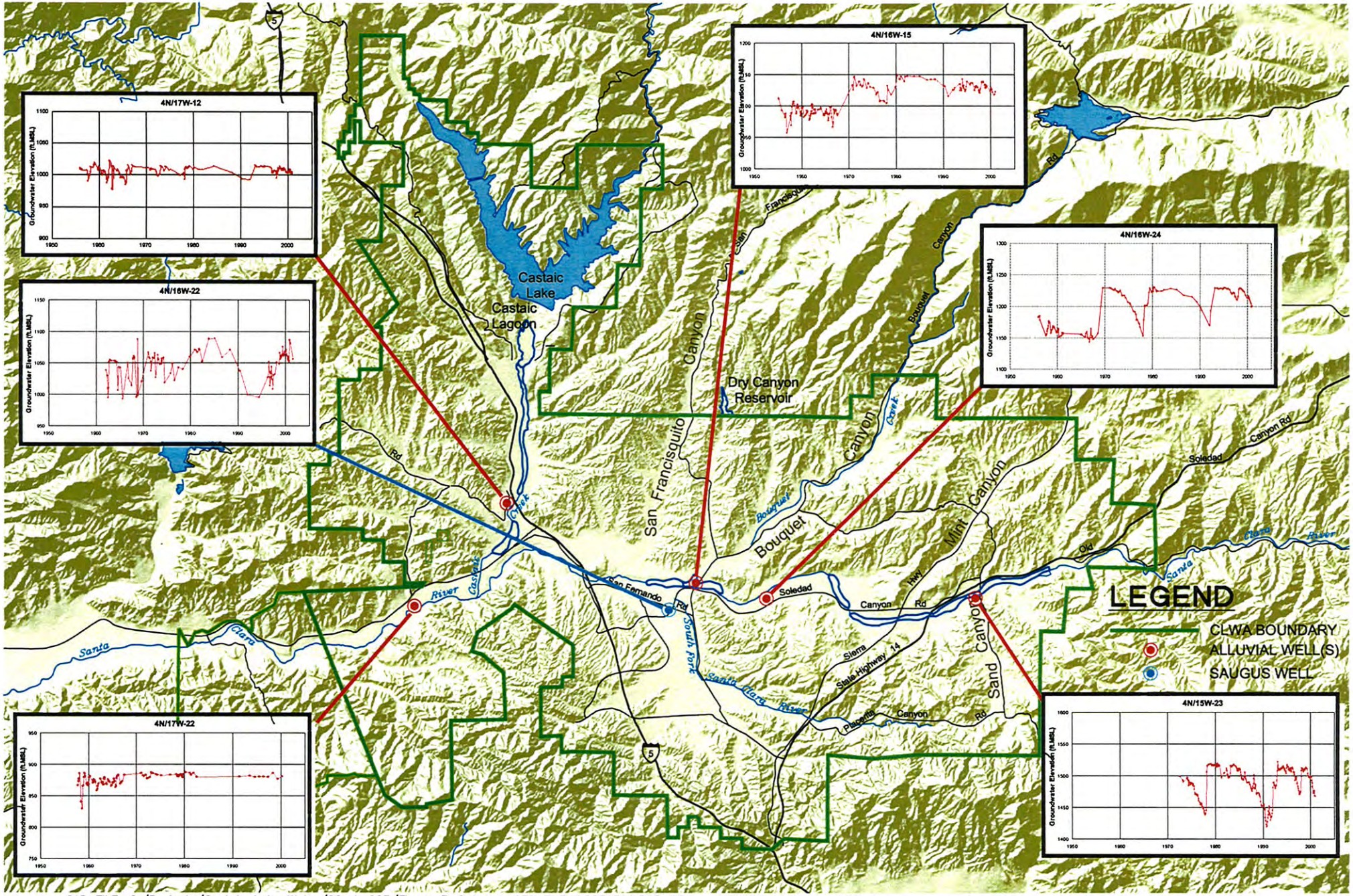

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Figure 3-2
Historical Groundwater Elevations
Santa Clara River Valley East Groundwater Subbasin

and storage occurs upon a return of stream flow to contribute to natural recharge.

Depending on the period of available data, all the hydrographs of alluvial groundwater levels show the same general picture: recent (last 30 years) groundwater levels are generally higher than over the preceding 20 years. In some locations, there are intermittent dry-period declines (and an associated use of some groundwater from storage) followed by wet-period recoveries (and associated refilling of storage space). On a long-term basis, whether over the last 20 years since the inception of conjunctive use via importation of SWP water, or over the last 40 to 50 years, the Alluvium shows no signs of water level-related overdraft, i.e., no trend toward decreasing groundwater levels and storage, a condition that is intended to be maintained via implementation of this Plan, e.g. via Primary Plan Elements 3 and 5.

Unlike the Alluvium, there are limited Saugus water level data; however, the limited data indicate that, although there have been seasonal water level changes in response to pumpage, the long-term trend in the Saugus (over the last 35 to 40 years) has been one of relative groundwater level stability (see, for example, Figure 3-2). There is no trend toward a sustained decline in Saugus water levels or storage that would be indicative of overdraft.

Land subsidence as a result of groundwater extractions is a concern in a number of groundwater basins in California. The potential for land subsidence caused by groundwater extractions derives from a combination of the geologic makeup of the aquifer materials and the history of groundwater level fluctuations. In the Santa Clara Valley East Subbasin, the most notable groundwater level fluctuations have occurred in the Alluvium to the east of Bouquet Canyon, with the greatest fluctuations (up to nearly 100 feet) recorded in the vicinity of Sand Canyon. Fortunately, those fluctuations have been intermittent, and have varied directly with local wet and dry conditions. From a subsidence perspective, they have also fluctuated in an unconfined aquifer that is comprised of essentially all coarse-grained material. The lack of any significant fine-grained material in the aquifer where groundwater levels have fluctuated results in two notable local conditions in regards to subsidence: there is no recorded historical subsidence or indirect evidence of its occurrence, i.e. subsidence-related impacts on surface structures, drainage facilities, etc.; and there is minimal potential for inelastic subsidence to occur in response to ongoing groundwater level fluctuations in the Alluvium.

The Saugus Formation contains a greater fraction of fine-grained material interbedded with the coarser aquifer materials that yield water to wells. Consequently, the Saugus has a greater

potential to undergo consolidation, with attenuant subsidence impacts at the ground surface, if groundwater levels are substantially lowered for long time periods. Historical Saugus pumping has not caused such conditions to occur. Current water supply planning, as described in this Plan, is to rely on the Saugus Formation for a relatively small component of water supply on an ongoing basis, with intermittent increased pumping during dry periods.

The long-term objective for groundwater management, as described in this Plan, is to not overdraft either the Alluvium or the Saugus, i.e. to not chronically lower groundwater levels. Satisfaction of the latter objective will have the correlative impact of minimizing the potential for inelastic land subsidence attributable to pumping from the Saugus Formation; combined with the lack of fine-grained material in the Alluvium, satisfaction of that objective will also have the correlative impact of ensuring the improbability of any subsidence attributable to pumping from that aquifer.

Groundwater Quality

Groundwater quality is, or course, a key factor in assessing both the Alluvial aquifer and the Saugus Formation as municipal and agricultural water supplies. At present, however, there is no convenient long-term record of water quality, i.e. water quality data in one or more wells that span several decades and continue to the present. Thus, in order to examine a long-term record of water quality in the Alluvium, an integration of individual records from several wells, completed in the same aquifer materials and in close proximity to each other, can be used to generally show long-term trends in groundwater quality. Figure 3-3 illustrates groundwater quality conditions and trends at multiple locations in the Alluvium along the main channel of the Santa Clara River from the area near the mouth of Mint Canyon, to areas immediately above and near the mouth of Bouquet Canyon, to the area below San Francisquito Canyon. Based on these records of groundwater quality, there have been historical fluctuations in concentrations of total dissolved solids (TDS), as well as corresponding fluctuations of individual constituents of TDS. In general, however, and similar to groundwater levels, there has been no long-term trend toward groundwater quality degradation.

Groundwater quality variations are common throughout the Alluvium and generally correlate inversely with precipitation and stream flow: wet periods have produced substantial recharge of higher quality (low TDS) water and dry periods have resulted in the notable declines in water levels described above, with a corresponding increase in TDS (and individual component

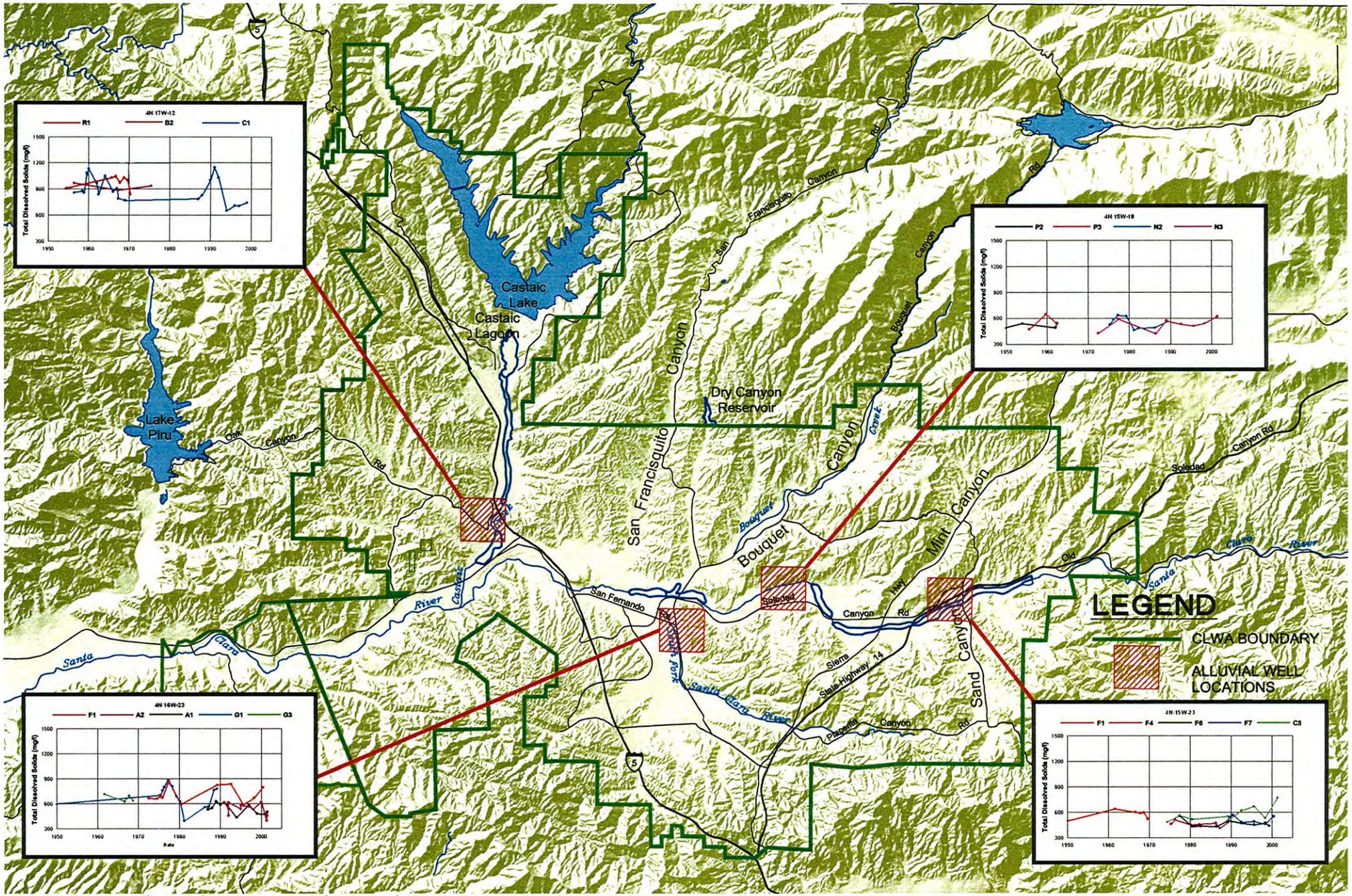

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Figure 3-3
Historical Groundwater Quality by Section
Santa Clara River Valley East Groundwater Subbasin

constituents) in the deeper parts of the Alluvium.

Due to a much more limited number of wells and the limited spatial extent of groundwater development in the Saugus Formation, long-term Saugus groundwater quality data are not sufficiently extensive to permit any sort of basin-wide analysis or assessment of pumping-related impacts on quality. Based on the most complete historical record, over the last 35 years, however, groundwater quality in the Saugus has remained generally constant. The Saugus Formation is, on a groundwater quality basis, a viable agricultural and municipal water supply.

The most notable groundwater quality issue in the basin centers around the detection and impact of perchlorate on several Saugus wells and one Alluvial well in the central part of the basin near the location of the former Whittaker Bermite facility, which is immediately southeast of the confluence of the main Santa Clara River and its South Fork tributary. In 1997, routine water quality sampling detected the presence of perchlorate in four municipal wells completed in the Saugus Formation (CLWA Santa Clarita Water Division Saugus Wells 1 and 2, Newhall County Water District Well 11, and Valencia Water Company Well 157). While there remains no primary or secondary drinking water standard for perchlorate, and although only some of the detected concentrations of perchlorate in the Saugus wells exceeded the Action Level established by the State Department of Health Services at that time (18 ug/l), all those wells were inactivated by their respective owners after detection of perchlorate; those wells remain out of municipal water supply service since then.

More recently, in late 2002, routine water quality sampling of Alluvial wells detected perchlorate in one of them (CLWA Santa Clarita Water Division Stadium Well) at a concentration which slightly exceeds the current Action Level (4 ug/l). This well has also been voluntarily inactivated, and remains removed from municipal water supply service.

This Plan, notably through Primary Plan Elements 1, 6 and 8, is intended to incorporate both short-term and long-term groundwater quality considerations in the management of the groundwater basin in order to formalize groundwater quality monitoring and assessment, to investigate and correct groundwater contamination problems, and to preserve or improve groundwater quality for ongoing water supply as well as for avoiding adverse water quality impacts on interconnected surface waters.

Areas of Concern and Identified Problems

A number of concerns have been expressed about groundwater conditions in the basin. While not all of the expressed concerns have been substantiated, they are listed and briefly discussed here, and they are addressed in the management objectives for the basin, intended to be achieved via implementation of the various primary and secondary elements in this Plan.

At present, the most notable concern in the basin is the impact of perchlorate contamination on a number of municipal water supply wells, thus affecting the available pumping capacity from some municipal wells. While perchlorate impacts on a few wells do not preclude the ability to pump groundwater in accordance with existing water supply plans, activities to characterize the contamination, and ultimately to control it and treat it, have been initiated in order to return the impacted wells' pumping capacity to water supply service. Primary Element 8 is included in this Plan to formalize the addressing of groundwater contamination issues in the basin.

Concern has also been expressed that groundwater development in the basin will adversely impact the quantity and/or quality of surface flows leaving the basin via the Santa Clara River. Such concern extends to the potential impact on groundwater in the next downstream basin, the Piru Basin in Ventura County. While there are no established provisions regarding surface flows out of the Santa Clara River Valley East subbasin, Primary Element 2 is included in this Plan to formally address the monitoring and management of surface water flows and quality within, and flowing out of, the basin. Some work is already ongoing related to this area of concern via a Memorandum of Understanding (MOU) among CLWA, other retail water purveyors within CLWA's service area, and United Water Conservation District, which manages surface water and groundwater in the downstream basins on the Santa Clara River in Ventura County. That cooperative effort, which is incorporated into this Plan via Primary Element 9, includes integration of databases, development of a numerical groundwater flow model, and interpretation and reporting on surface water and groundwater conditions.

A third expressed concern in the basin, is that groundwater is already overdrafted. Associated with that expressed concern is a related issue that reliance on overdrafted groundwater results in an overstated water supply in the basin. As discussed earlier in this section, long-term groundwater levels, storage, and quality all indicate the basin is in balance (i.e., no overdraft exists). As also discussed above, the importation of supplemental surface water over the last 23 years, and the associated initiation of conjunctive use operations have directly resulted in an

overall adequacy of water supplies while sustaining an undepleted groundwater supply. Primary Elements 3, 4 and 5 are key parts of this Plan to more formally quantify the yield of the groundwater basin, and to continue to meet overall water requirements via continuation of conjunctive use of local groundwater with imported supplemental surface water, ultimately complemented by integration of recycled water for non-potable water supply (Primary Element 7).

Finally with regard to areas of concern in the basin, the historically larger fluctuations in the eastern part of the basin have been highlighted for their impacts on private wells in that area. Some focused study has been done to address whether certain pumping directly affects private wells in Sand Canyon; its conclusions were that such direct effects were not occurring. Subsequently, a nearby development contracted for delivery of up to 120 acre-feet of imported SWP water from CLWA in order to reduce its use of groundwater for domestic and irrigation water supply. Primary Element 1 is partly intended to acquire site-specific data regarding private wells, their locations, the aquifers in which they are completed, their yields and pumping capacities as well as their quality, and their water level records. Primary Element 3 is partly intended to analyze such data in order to assess whether local aquifer depletion is occurring and, if so, what remedy is appropriate.

IV. Historical and Projected Water Requirements and Supplies

Historical Water Requirements

The initial development of water supplies in the Santa Clarita area began in the 1800's for irrigation on the San Francisquito Ranch after its purchase by Henry Mayo Newhall. While there are some records in the form of waterworks drawings that show early diversion and distribution facilities on the ranch in 1911 and some mapping of well locations in the 1930's, the earliest complete records of water use date from shortly after the end of World War II. From 1947 through the mid 1960's, groundwater pumping for agriculture ranged from about 27,000 to about 42,000 acre-feet per year (afy). For most of the same period, until 1960, there are no detailed records of water use for municipal supply. The first records of municipal water use begin in 1960, when municipal water requirements were about 5,000 afy; by the mid-1960's, municipal water requirements had increased to about 10,000 afy. Throughout that time, all municipal water supply was from local groundwater.

From the mid-1960's through about 1980, groundwater pumping for agricultural water supply declined into the range of about 10,000 to 15,000 afy. In the late 1980's through the early 1990's, agricultural groundwater pumping further declined into the range of about 8,000 to 10,000 afy; over about the last ten years, agricultural water requirements, which continue to be fully met by local groundwater pumping, have been in the range of about 12,000 to 15,000 afy. The history and trends of agricultural water use in the basin are illustrated in Figure 4-1.

Detailed records of municipal water use are not available from the mid-1960's through 1980, when imported surface water was first used in the basin for municipal water supply. However, the available municipal water use data at the beginning and at the end of that period, combined with estimated declining agricultural water use for the same period, suggest there was a generally steady increase in municipal water use from about 11,000 af in 1966 to about 22,000 af in 1980. Since then, municipal water use has increased to about 68,000 afy. With the addition of imported surface water from the State Water Project beginning in 1980, however, groundwater pumping for municipal supply declined in the early 1980's. Throughout the 1990's, municipal

pumping fluctuated between about 27,000 and 32,000 afy. The history and trend of municipal groundwater use in the basin are illustrated in Figure 4-1.

As noted above, until 1980, all water supply in the basin was from local groundwater. Imported surface water was first available from the State Water Project (SWP) in 1980, when a total of 1,125 af were imported into the basin. Since then, importations of SWP water have increased in two separate steady trends, interrupted by a notable decrease at the end of, and following, the 1987-1992 drought period: a steady increase beginning in 1980, to about 21,600 afy in each of 1989 and 1990, followed by a substantial decrease, to less than 8,000 af in 1991, and then a steady increase back to about 21,000 afy in 1997 and 1998, followed by further increases to nearly 42,000 af in 2002. The history and trends in importation of SWP water to the basin are illustrated in Figure 4-2, which also illustrates the historical trends in groundwater pumping and total water use in the basin since the importation of SWP water.

In the context of this groundwater management plan, the historical utilization of imported SWP water to augment local groundwater represents the initiation of conjunctive use of surface water and groundwater supplies, a groundwater management principle which is intended to be continued via adoption of Primary Element 5 of this plan.

Projected Water Requirements

Detailed projections of municipal water requirements were most recently completed as part of the Urban Water Management Plan prepared by CLWA and the municipal water purveyors (Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company) in 2000. Those projections, which are forecast for a 20-year period, also recognize an ongoing but decreasing agricultural water demand over the same period, from about 15,000 afy in 2005 to about 7,000 afy by 2020. The municipal water demand projections in the Urban Water Management Plan are derived from utilization and interpretation of multiple projection methods, including per-capita water-use applied to population projections; extrapolation of number of service connections (using two different projection techniques, an average rate and an accelerated rate projection) applied to the rate of service connection additions since 1990; and land use projections combined with unit water use factors on multiple land use categories (urban, including residential, commercial, industrial and recreational; irrigated agricultural; and vacant and open space). The water demand projections in the Urban Water Management Plan also consider weather effects (variations due to hot-dry years vs. cool-wet years) and conservation

Historical Groundwater Production
Upper Santa Clara Valley Groundwater Basin
East Subbasin

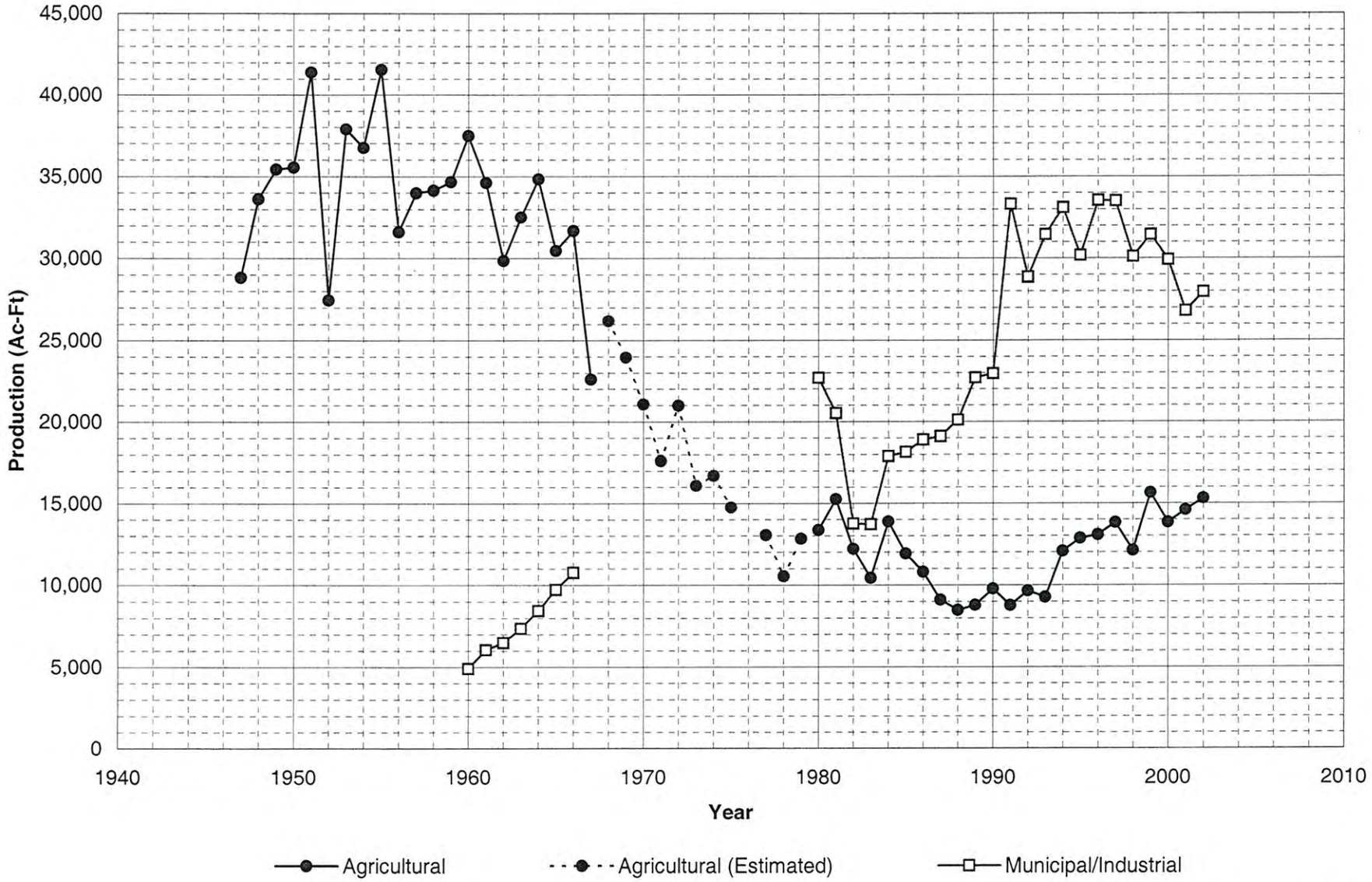


Figure 4-1

effects on water usage.

The net result of application and interpretation of the various water demand projection methods in the 2000 Urban Water Management Plan is summarized in Figure 4-2, which reflects projected urban and agricultural water demand through 2020, absent potential increased conservation savings, which are estimated to be ten percent of urban water demand. Numerically, urban water use without increased conservation savings is projected to increase to nearly 67,000 afy by 2005, and then continue to increase to 106,000 afy by 2020. As noted above, agricultural water use over the same period is projected to decrease to 15,000 afy by 2005, followed by an ongoing decrease to 7,100 afy by 2020. In addition to the graphical presentation of projected water demands in the basin through 2020 in Figure 4-2, projected water demands are tabulated, both with and without potential increased conservation savings, in Table 4-1.

Table 4-1
Projected Normal/Average Year Water Demands
(acre-feet per year)

	2005	**2010**	**2015**	**2020**
Urban Agriculture	66,600 15,100	77,700 12,400	90,900 9,800	106,000 7,100
Total Projected Demand	**81,700**	**90,100**	**100,700**	**113,100**
Increased Conservation Savings	6,600	7,700	9,100	10,600
Total Projected Demand *(with increased conservation)*	**75,100**	**82,400**	**91,600**	**102,500**

Existing and Projected Water Supplies

As noted above, existing water supplies to meet current water demands are comprised of local groundwater and imported SWP surface water. In 2001, for example, to meet a total water demand of nearly 76,800 af, local groundwater pumping amounted to 41,400 af, (about 54% of total demand) and imported SWP water amounted to 35,400 af (about 46% of total demand).

Water supplies to meet projected water demands are expected to continue to be primarily a combination of local groundwater and imported SWP surface water, augmented by local recycled

Historical and Projected Water Use
Upper Santa Clara Valley Groundwater Basin
East Subbasin

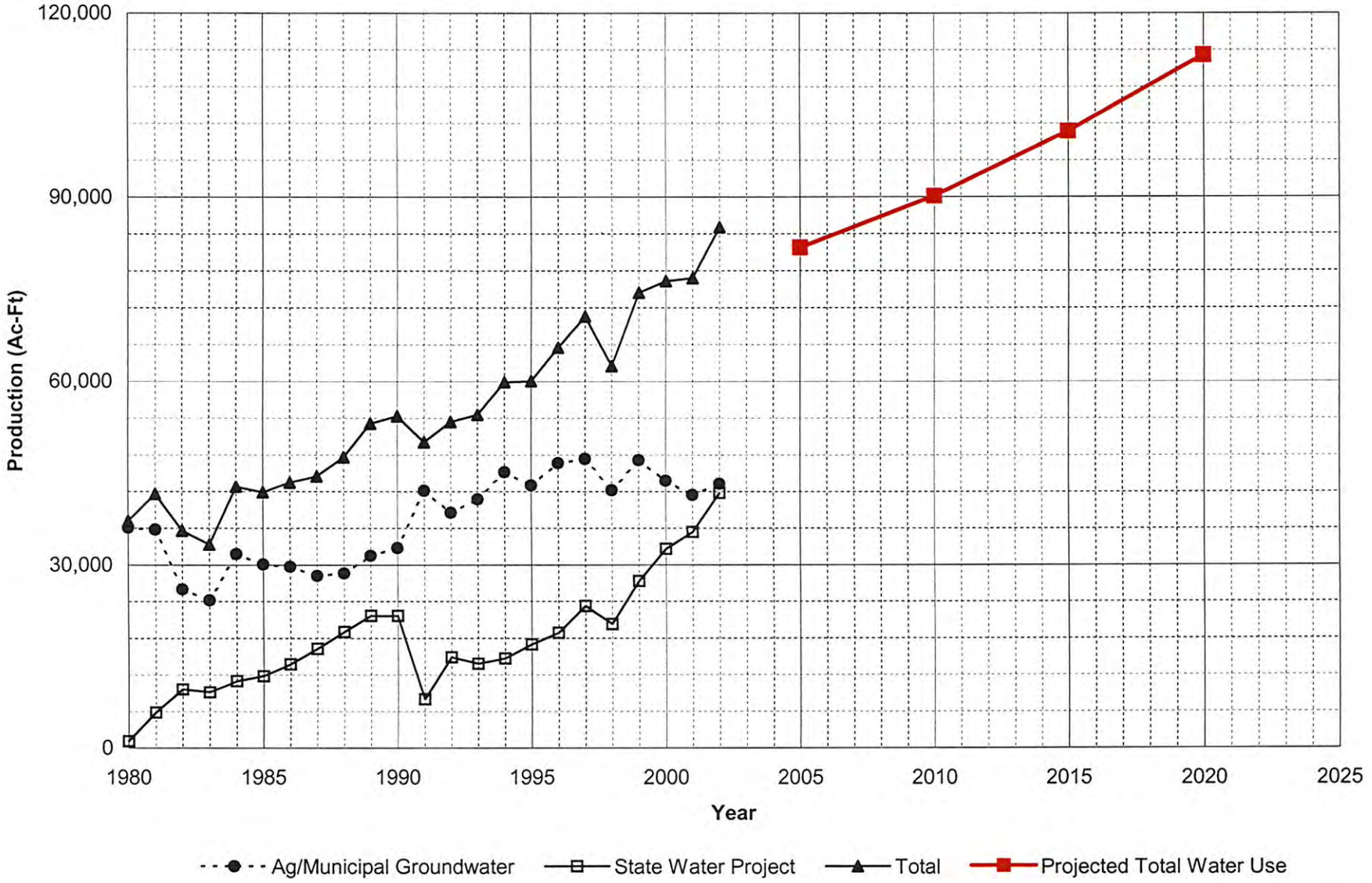


Figure 4-2

water and possibly some water supply derived from water transfers and desalination outside the basin.

Local Groundwater - Local groundwater has historically been developed from the two aquifers that comprise the groundwater basin, the Alluvium that underlies the Santa Clara River and its tributaries, and the Saugus Formation that underlies much of the CLWA service area. Those two aquifers, and the groundwater basin they comprise, are the focus of this groundwater management plan. Based on historical experience and observation of groundwater conditions, it is currently expected that ongoing utilization of local groundwater will continue to be in amounts that are generally comparable to what has historically been pumped, 30,000 to 40,000 afy from the Alluvium and 7,500 to 15,000 afy from the Saugus Formation. It is also expected that there is some additional development potential in the Saugus Formation, in the range of 10,000 to 20,000 af which might be intermittently extracted during one or more dry years when supplemental imported water supplies might be reduced. Ultimately, it is expected that local groundwater will continue to be a component of water supply in the basin at appropriate production levels from both aquifers. The intent of this groundwater management plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, i.e. avoidance of overdraft (Primary Plan Element 3), no degradation of quality (Primary Plan Element 6), no adverse impacts to surface waters (Primary Plan Element 2), all via continuation of conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Primary Plan Element 5) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Primary Plan Elements 1 and 2).

Supplemental (SWP) Surface Water - CLWA has a Table A contract amount of 95,200 af of water from the SWP. CLWA's original contract, signed in 1963, was for 23,000 af; that Table A amount was later increased to 41,500 af. In 1988, CLWA purchased a Table A amount of 12,700 af from Devil's Den Water District, and it acquired another 41,000 af of Table A amount in 1999 from Kern County Water Agency and its member district, the Wheeler Ridge-Maricopa Water Storage District. There is ongoing CEQA-related litigation over the most recent acquisition of the 41,000 af Table A amount. However, there has been no invalidation of the completed agreement to transfer the 41,000 af Table A amount to CLWA and current water supply planning includes that Table A amount as CLWA corrects the CEQA technicality by preparing a new EIR to address the environmental consequences of the transfer.

Recycled Water - In 1993, CLWA prepared a draft Recycled Water System Master Plan that outlined a multi-phase program to integrate recycled water into the overall water supply system in the basin. Phase I of that project, which will deliver approximately 1,700 afy, began deliveries of recycled water for golf course irrigation in mid-2003. Overall, by 2020, recycled water is expected to ultimately reclaim up to 17,000 afy of treated waste water suitable for irrigation of golf courses, landscaping, and other non-potable uses.

V. Elements of the Groundwater Management Plan

As part of long-term water supply planning in the Santa Clara River Valley East groundwater subbasin, Castaic Lake Water Agency (CLWA) and the municipal water purveyors in the basin, in concert with other groundwater pumpers in the basin, began conjunctive use operations in 1980 by importing supplemental surface water from the State Water Project and integrating it with local groundwater to meet all the water requirements in the basin. Prior to that time, and continuing to the present, various groundwater pumpers and other entities in the basin, including CLWA, have collected groundwater and related data on which historical and ongoing analyses of groundwater basin conditions have been made. Those monitoring efforts and basin analyses have allowed CLWA and other entities in the basin to progressively define and understand basin conditions, and to continue to meet increasing water demands over the last 23 years. Information derived from the monitoring and management efforts to date has allowed the various public and private pumpers in the basin to continue to rely on the groundwater basin for some or all of their water supply without significant concern that the resource was either overdrafted or otherwise negatively impacted.

In light of the preceding, complemented most recently by the Memorandum of Understanding process that has initiated integrated management with United Water Conservation District, which serves as the manager of adjacent downstream basins on the Santa Clara River (as described in Primary Element 9), local groundwater management has already been initiated consistent with the opportunity provided by Water Code Section 10753. However, despite those ongoing accomplishments, CLWA recognizes the concerns and issues that are discussed herein relative to groundwater and the adequacy of water supplies in the basin. With that recognition, and in part prompted by the requirements of AB 134, CLWA has prepared this broader-based groundwater management plan.

To continue historical groundwater management activities and to address identified concerns and issues related to groundwater and water supply in the area, this Groundwater Management Plan has been developed to provide a framework for present and future actions. As has been the case for the groundwater management activities by CLWA and other local entities over the past 23 years, it is expected that this plan will be updated as new data are developed, particularly in light

of the key role that groundwater monitoring (water levels and quality) has played, and will continue to play, in defining groundwater conditions and aquifer response to management actions.

The management objectives, or goals, for the Santa Clara River East groundwater basin include the following:

Goal 1: Development of Local Groundwater for Water Supply
Goal 2: Avoidance of Overdraft and Associated Undesirable Effects
Goal 3: Preservation of Groundwater Quality
Goal 4: Preservation of Interrelated Surface Water Resources

To accomplish those goals, with recognition of the opportunities encouraged by Water Code Section 10750 et seq. for local agency management of groundwater resources, this plan incorporates a number of components which are divided into primary, or essential, elements and secondary, or potential, elements. In both categories, the elements formally recognize the effectiveness of a number of ongoing water resource management activities. They recognize the need for additional activity, such as expanded conjunctive use of supplemental surface water, and recycled water, with local groundwater. They also reflect the wider focus on local groundwater management, such as continuing cooperation with the municipal water purveyors and other pumpers in the basin, and with other water resource management entities on the Santa Clara River, most notably United Water Conservation District, to address the impacts of regional resource opportunities and/or challenges. In summary, this Groundwater Management Plan will enable CLWA, the retail water purveyors, and their neighbors to continue use of local groundwater for regular water supply, to expand their use of local groundwater during dry periods or emergencies, and to work with other agencies via implementation of the following management plan elements.

Primary (Essential) Plan Elements

1. Monitoring of Groundwater Levels, Quality, Production and Subsidence
2. Monitoring and Management of Surface Water Flows and Quality
3. Determination of Basin Yield and Avoidance of Overdraft
    - wet and dry period pumping
    - control of well field drawdown

4. Development of Regular and Dry Year/Emergency Water Supply
5. Continuation of Conjunctive Use Operations
6. Long Term Salinity Management
7. Integration of Recycled Water
8. Identification and Mitigation of Soil and Groundwater Contamination
    - involvement with other local agencies in investigation, cleanup, and closure
9. Development and Continuation of Local, State and Federal Agency Relationships
10. Groundwater Management Reports

Secondary (Potential) Elements

1. Continuation of Public Education and Water Conservation Programs
2. Identification and Management of Recharge Areas and Wellhead Protection Areas
    - involvement in land use planning process
3. Identification of Well Construction, Abandonment, and Destruction Policies
    - water quality protection
    - manage vertical distribution of pumpage
4. Provisions to Update the Groundwater Management Plan

Primary Element 1 - Monitoring of Groundwater Levels, Quality, Production, and Subsidence

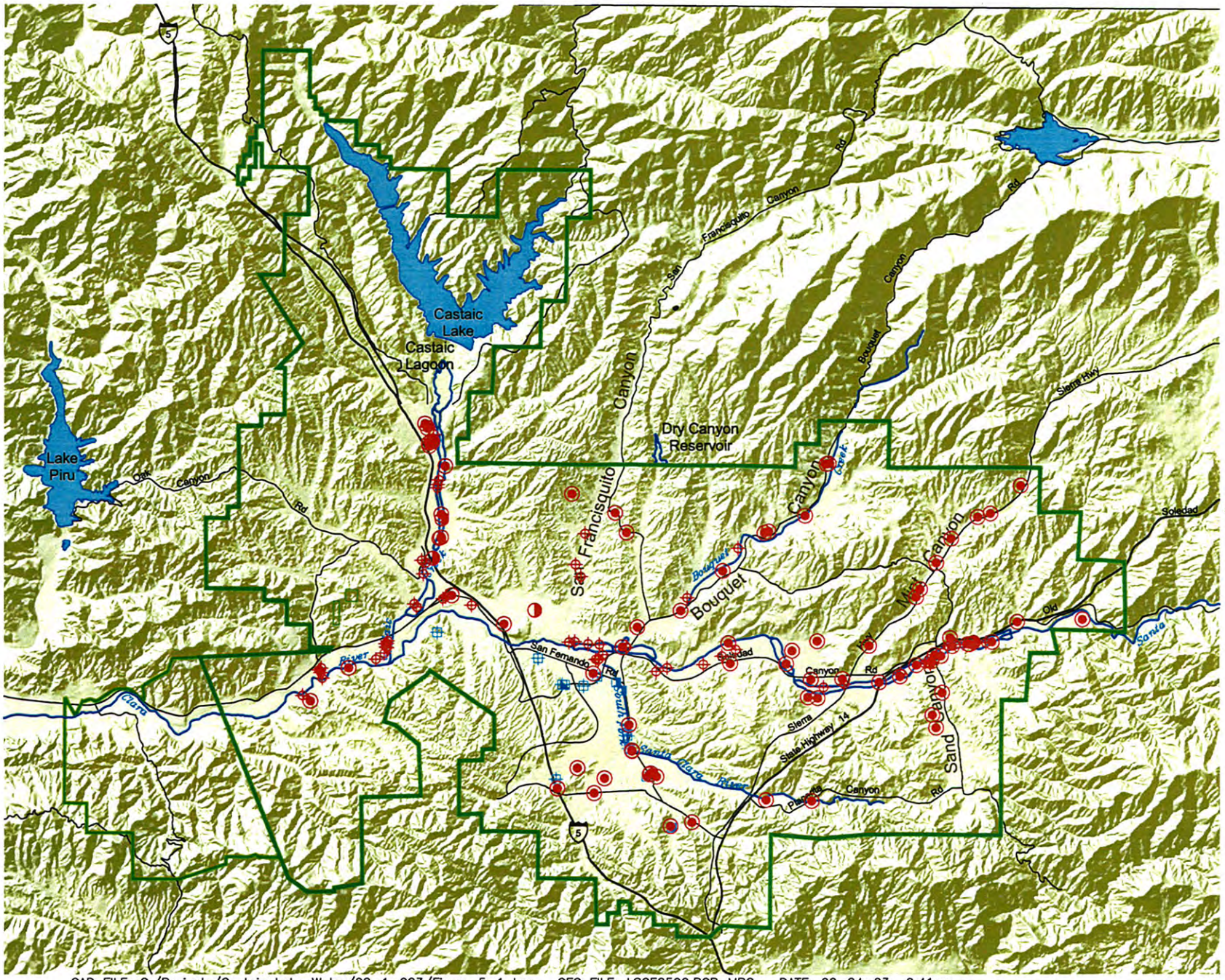
Prior to 1980, all water supply in the Upper Santa Clara River Area was developed from local groundwater; since 1980, imported surface water has become an increasing component of overall water supply in the area, but groundwater continues to meet all agricultural water demand and a significant part of municipal water demand. As a result of the long term development and use of groundwater in the area, there is a fairly substantial amount of historical groundwater level data, and a useful amount of groundwater quality data and groundwater pumping data that has been collected in the basin. All the available historical groundwater level, quality, and pumping data have been organized into a computerized data base for the Upper Santa Clara River Area. That data base, while separate, has been coordinated with an equivalent data base maintained by United Water Conservation District for the downstream basins on the Santa Clara River. The intent of database coordination has been to facilitate interpretation and reporting on groundwater and other water resource related issues by the respective agencies overlying the various basins along the river.

The networks of wells from which groundwater level and groundwater quality data have been collected are illustrated in Figures 5-1 and 5-2. The networks are comprised of a combination of active production wells, inactive production wells, and dedicated monitoring wells, shown on Figures 5-1 and 5-2. Data collection has historically varied from randomly infrequent to regularly scheduled but infrequent (e.g. semi-annual). The historical data collection efforts cannot be classified as an organized area-wide program of groundwater data collection, there are generally sufficient data available on which to interpret basin conditions. Ultimately, it is recognized that monitoring of existing wells, and expansion of the network of both production and monitoring wells, are key to accomplishing all the goals for the basin in this management plan. Monitored groundwater levels, quality, and pumping will collectively provide the basis for defining basin conditions and developing operational protocols that allow conjunctive use to support ongoing groundwater supply while avoiding undesirable conditions such as chronically depressed groundwater levels or degraded groundwater quality. Thus, a primary element of this plan is to develop and implement a groundwater monitoring program that is comprised of a network of wells, mostly as illustrated in Figures 5-1 and 5-2, but possibly expanded to include some dedicated monitoring wells as well as some potential new production wells. The frequencies and types of groundwater data collection will vary as a function of specific monitoring objectives in various parts of the basin. For initial implementation purposes , basin-wide groundwater monitoring protocols (locations and types of measurements, frequencies, etc.) are included in the Appendix to this Plan.

It should be noted, in light of the lack of historical subsidence and the low potential for it to occur as discussed in Section III above, that no formal subsidence monitoring is planned, i.e. no extensometers, fixed-point ground surveys or remote sensing. However, if the analysis of planned additional dry-year pumping indicates the potential for subsidence attributable to lower groundwater levels, monitoring or other appropriate action (e.g. re-distributed or reduced pumping) will be undertaken.

Primary Element 2 - Monitoring and Management of Surface Water Flows and Quality

The geologic and hydrologic configuration of the groundwater basin and the Santa Clara River system that overlies the aquifers in the basin is such that the River and the Alluvial aquifer can directly interact. Further, although the Saugus Formation has hydraulic characteristics that indicate it to be locally confined, groundwater can move between the Alluvium and the Saugus. The net result of the overall river-aquifer configuration is that groundwater is readily recharged



LEGEND

- ACTIVE ALLUVIAL WELL
- INACTIVE ALLUVIAL WELL
- ACTIVE SAUGUS WELL
- INACTIVE SAUGUS WELL
- SAUGUS MONITORING WEL
- UNKNOWN ALLUVIAL WELL
- CLWA BOUNDARY

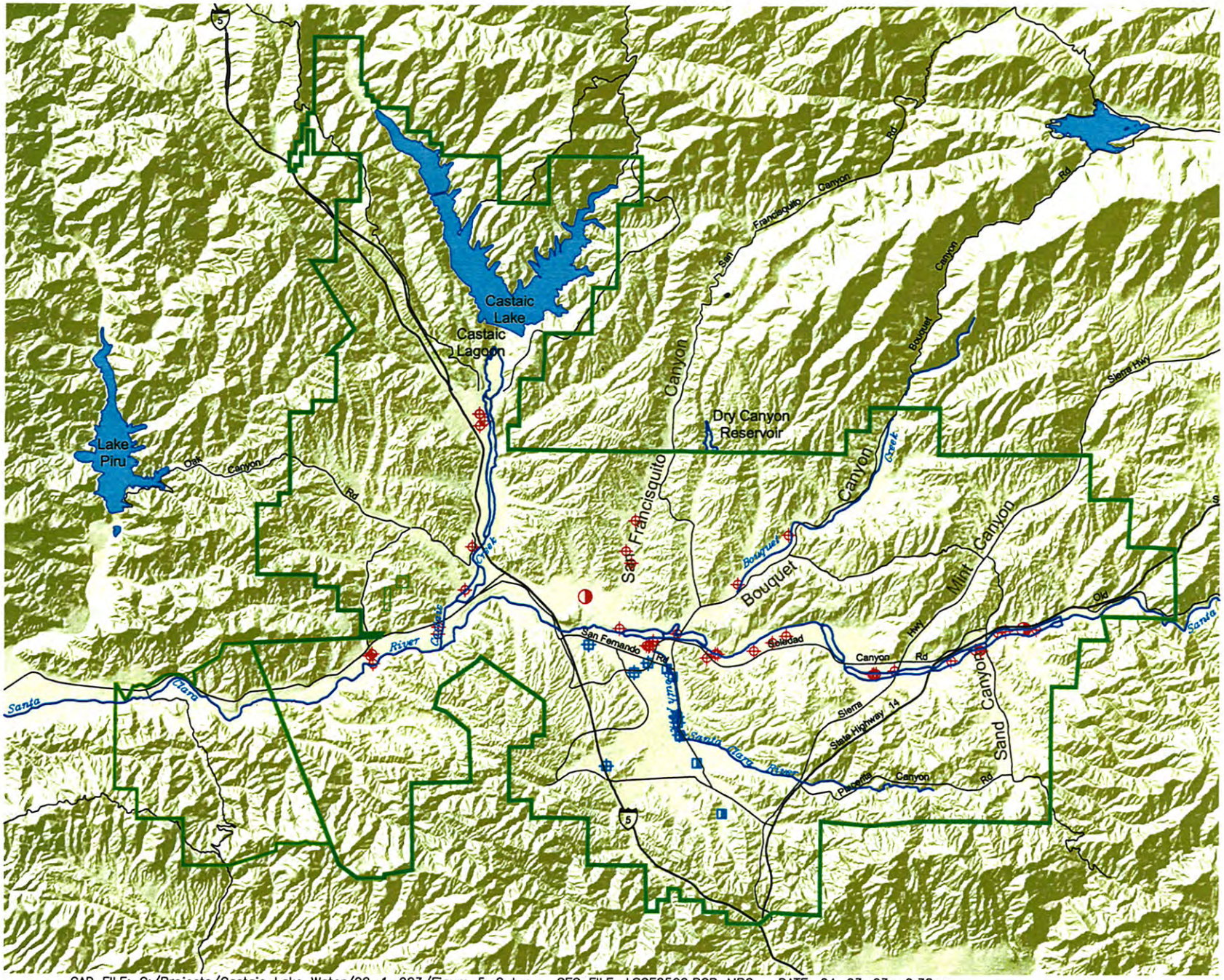
Scale in Miles

0' 1.5 3

CAD FILE: G:/Projects/Castaic Lake Water/02-1-023/Figure 5-1.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 02-24-03 9:41am

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure 5-1
Water Level Monitoring Well Network
Santa Clara River Valley East Groundwater Subbasin



LEGEND

- ACTIVE ALLUVIAL WELL
- INACTIVE ALLUVIAL WELL
- ACTIVE SAUGUS WELL
- INACTIVE SAUGUS WELL
- CLWA BOUNDARY

Scale in Miles

0' 1.5 3

CAD FILE: G:/Projects/Castaic Lake Water/02-1-023/Figure 5-2.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 04-03-03 9:38am

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Figure 5-2
Water Quality Monitoring Network
Santa Clara River Valley East Groundwater Subbasin

by periodic natural surface water flows in parts of the basin, generally to the east of Bouquet Canyon; and groundwater discharges to the river in other parts of the basin, generally to the west of Bouquet Canyon. As a result of the latter groundwater discharges to the river, in combination with treated waste water discharges from the two local regional treatment plants, there is a significant surface water outflow from the basin in the Santa Clara River. That surface water flow to the west across the County line has increased over the last 20 years (Figure 5-3).

When considered in concert with the other elements of this groundwater management plan, a number of challenges related to surface water flow and quality are evident. First, knowledge of surface flow rates and quality, and variations in both, will be essential to incorporating surface water considerations into management of the interconnected aquifer system. Thus, monitoring of surface water flows and quality will be part of this plan; and the resultant data will be incorporated in the database of groundwater data that results from implementation of this element and Primary Element 1.

Secondly, continuation of some surface flow and non-degradation of surface water quality would appear to be appropriate objectives, particularly as recycled water use is integrated into the overall water supply in the basin, and as dry-year dependence on groundwater increases. Those issues have begun to be addressed in the MOU process with neighboring United Water Conservation District, as described in Primary Element 9 of this Plan, but they will be addressed on a more comprehensive basis as monitored data is collected, as a numerical groundwater flow model is developed and utilized (Primary Element 3), and as recycled water becomes part of the integrated water supply (Primary Element 7). Basin management of surface water flows and quality will also relate to potential groundwater management actions intended to augment yield, e.g. artificial groundwater recharge (Primary Elements 3 and 5), and groundwater management actions intended to preserve groundwater quality (Primary Element 6). For initial implementation purposes, surface water monitoring protocols (locations and types of measurements, frequencies, etc.) are included in the Appendix to this Plan.

In light of the preceding, this plan element is included in the overall groundwater management plan to address surface water flows and quality in concert with analysis and management of groundwater levels and quality. The implementation of this plan element will be essential to accomplishment of the fourth management objective (goal) for the basin.

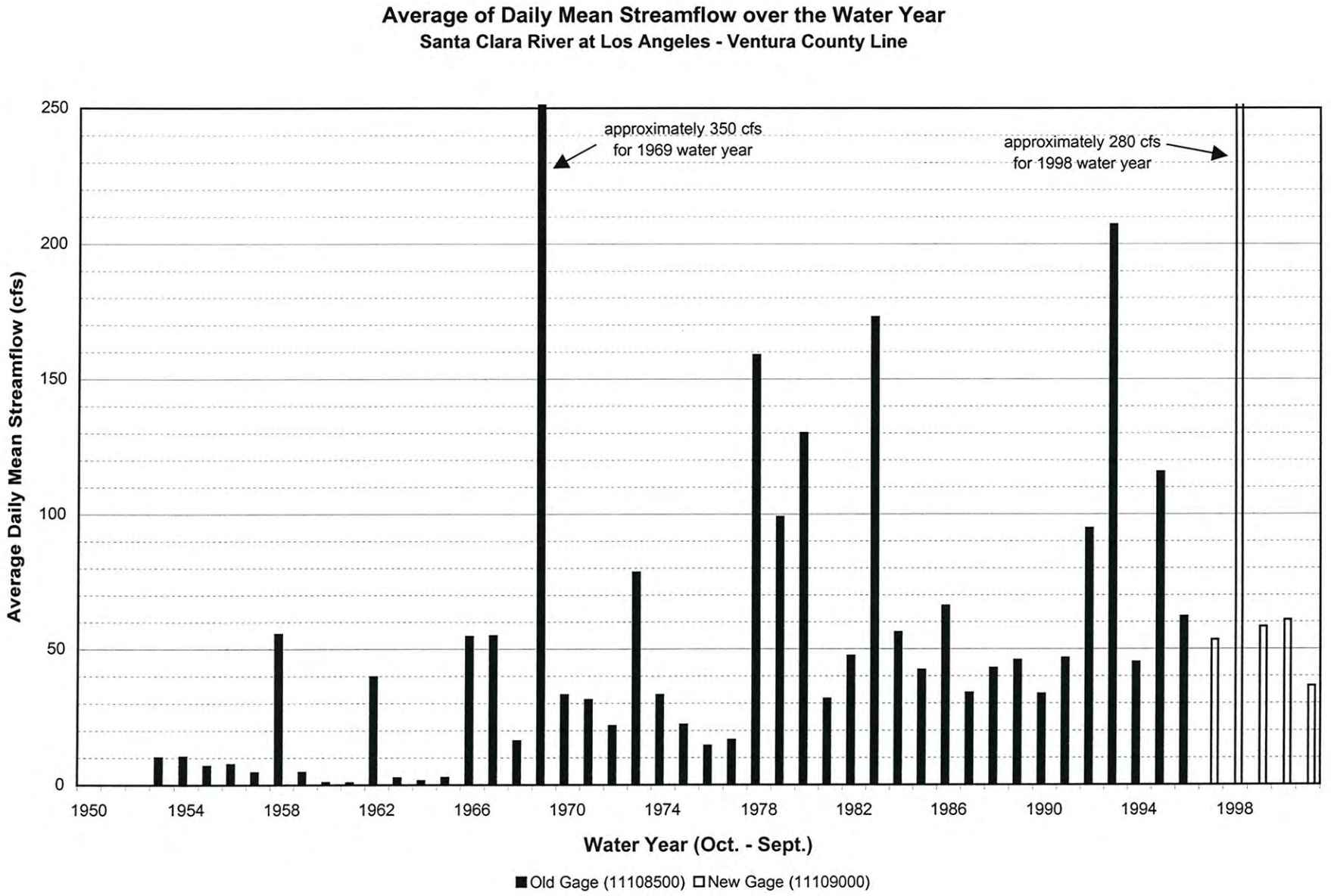
Average of Daily Mean Streamflow over the Water Year
Santa Clara River at Los Angeles - Ventura County Line
approximately 350 cfs
for 1969 water year
approximately 280 cfs
for 1998 water year
Average Daily Mean Streamflow (cfs)
250
200
150
100
50
0
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
Water Year (Oct. - Sept.)
Old Gage (11108500)
New Gage (11109000)

Figure 5-3

Primary Element 3 - Determination of Basin Yield and Avoidance of Overdraft

In order to accomplish all the goals for the basin, it will be essential to determine what yield can be developed on both a regular and an intermittent (dry period or emergency) basis. Such a determination of basin yield will be made to accomplish the main objective of operating within the yield of the groundwater basin, avoidance of overdraft.

On a long-term basis, there has not been any widespread, steady degradation of groundwater conditions that might be indicative of overdraft, i.e. decrease in groundwater levels or storage as a result of pumping in excess of the yield of the basin. There have been, and continue to be, short-term fluctuations in groundwater levels that are basically related to variations in local hydrological conditions, alternating increases and decreases in storage in response to wet and dry conditions (and associated fluctuations in recharge and pumping). Such fluctuations are typical of groundwater basin conditions in any conjunctive use setting, such as in this basin; groundwater is utilized from storage during dry years, or dry periods, and that storage is replenished during alternate wet years, or periods. The observation of these historical groundwater conditions, in combination with knowledge of pumpage from both the Alluvial and Saugus Aquifers, has led to current operational practices as well as general expectations regarding the approximate yield of the local groundwater system.

While historical operating experience, complemented by observed groundwater conditions, is an appropriate basis for generally planning for available groundwater supplies, it is possible and appropriate to more precisely analyze the basin to determine values or ranges of yield under varying hydrologic conditions, and to assess the impacts of various management actions that might be implemented in the basin. The MOU process described in Primary Element 9 of this Plan includes the development of a numerical groundwater flow model which is intended to be utilized for determination of the yield of the basin under existing land use and under existing groundwater and surface water development conditions. It is also expected to be used for implementation of this Plan Element to assess the yield of the basin under future land use conditions as well as future ranges of surface water importation, groundwater development, and recycled water use through varying hydrologic conditions, i.e. wet and dry periods that affect the availability of imported surface water.

The ultimate intent of this Plan Element is to develop an understanding and quantification of the yield of the basin, under varying hydrologic conditions and developing local cultural conditions,

so that groundwater development and use can be managed in such a way to meet an appropriate fraction of total water demand while avoiding levels of groundwater use that would result in overdraft conditions. Thus, implementation of this Plan Element is essential to accomplishing the first and second management objectives (goals) for the basin.

Primary Element 4 - Development of Regular and Dry Year/Emergency Water Supply

The most recent updated Urban Water Management Plan (UWMP, December 2000) prepared by CLWA and the retail water purveyors in the basin (Newhall County Water District, Santa Clarita Water Company and Valencia Water Company) includes plans to develop 30,000 to 40,000 acre-feet per year (afy) from the Alluvial aquifer and 7,500 to 15,000 afy from the Saugus Formation in average/normal years. Both ranges of numbers are consistent with recent historical pumping that has not resulted in any indication of overdraft or other undesirable conditions. The UWMP also includes plans to slightly reduce Alluvial pumping in dry years (in recognition of historical experience with decreased groundwater levels in the eastern part of the basin during dry periods) to 30,000 to 35,000 afy, while potentially increasing dry-period Saugus pumping to 21,000 to 35,000 afy depending on the duration of dry conditions.

A major consideration in this plan is the accomplishing ~~of~~ this element in concert with Primary Element 3, i.e. development of both regular and dry year/emergency groundwater supply within the yield of the basin in order to avoid overdraft. Toward that goal, the model described in Primary Element 3 will be used to analyze projected results, i.e. groundwater levels, storage and stream flow impacts, in order to design the optimal distribution of pumpage or to refine the ranges of regular or dry period/emergency pumping volumes. The result will facilitate a water transmission and distribution design, and will also facilitate planning for supplemental water supplies and planning for proactive recharge activities to augment basin yield as necessary to meet water supply requirements. Thus, implementation of this Plan Element, within the confines of Primary Element 3, will be essential to accomplishment of the first management objective (goal) for the basin.

Primary Element 5 - Continuation of Conjunctive Use Operations

Beginning with the initial delivery of imported surface water from the State Water Project (SWP) in 1980, CLWA and the retail water purveyors in the basin have been practicing the conjunctive

use of imported surface water and local groundwater. Conjunctive use in this setting has consisted of meeting water demands with a combination of imported surface water and local groundwater. Groundwater pumping has remained within a range that has not caused any evidence of overdraft, or associated undesirable impacts, and has fluctuated within that range to meet a larger fraction of water demand during periods of reduced surface water availability, such as at the end of the 1987-1992 drought and for several years immediately thereafter. Imported surface water use, on the other hand, progressively increased from 1980 through 1990, substantially decreased in the early 1990's due to extended drought conditions in Northern California, returned slowly to pre-drought levels over about a five year period, and has progressively increased again since 1996. The historical trend in water demand and the trends in groundwater and imported (SWP) surface water use to meet that demand are illustrated in Figure 5-4.

Conjunctive use of local groundwater and imported surface water will continue to be a key element in meeting all the goals for the basin, most notably utilizing groundwater for water supply without overdrafting the basin. Historical experience with groundwater pumping and aquifer response to varying hydrologic conditions has shown that the groundwater basin can support notable variations in pumping during wet and dry periods, but it cannot support continuous pumping at rates high enough to meet total local water demand. Thus, utilization of imported surface water in conjunction with local groundwater is essential to the management of groundwater for water supply without overdrafting that resource.

As part of conjunctively using surface water and groundwater, it is recognized that, particularly when the surface water supply is imported from the State Water Project, there will be variations in the amount of available surface water supply from year to year. Similarly, there are expected to be variations in local groundwater conditions as a function of local hydrologic conditions which affect, among other things, the natural recharge to the groundwater basin from year to year. In the case of this basin, local (Southern California) hydrology which affects local groundwater conditions may not necessarily be the same as the hydrology in a distant (i.e., northern California) location that directly affects the availability of supplemental, imported surface water in any given year. Thus, conjunctive use management is necessary to ensure that the groundwater basin is maintained to meet a regular component of water supply and to also provide a larger component of water supply during "dry periods" that affect supplemental surface water availability. Conjunctive use management is similarly important to ensure that local groundwater can be replenished, via reduced pumping and/or as a result of wetter local

Historical and Projected Water Use
Upper Santa Clara Valley Groundwater Basin
East Subbasin

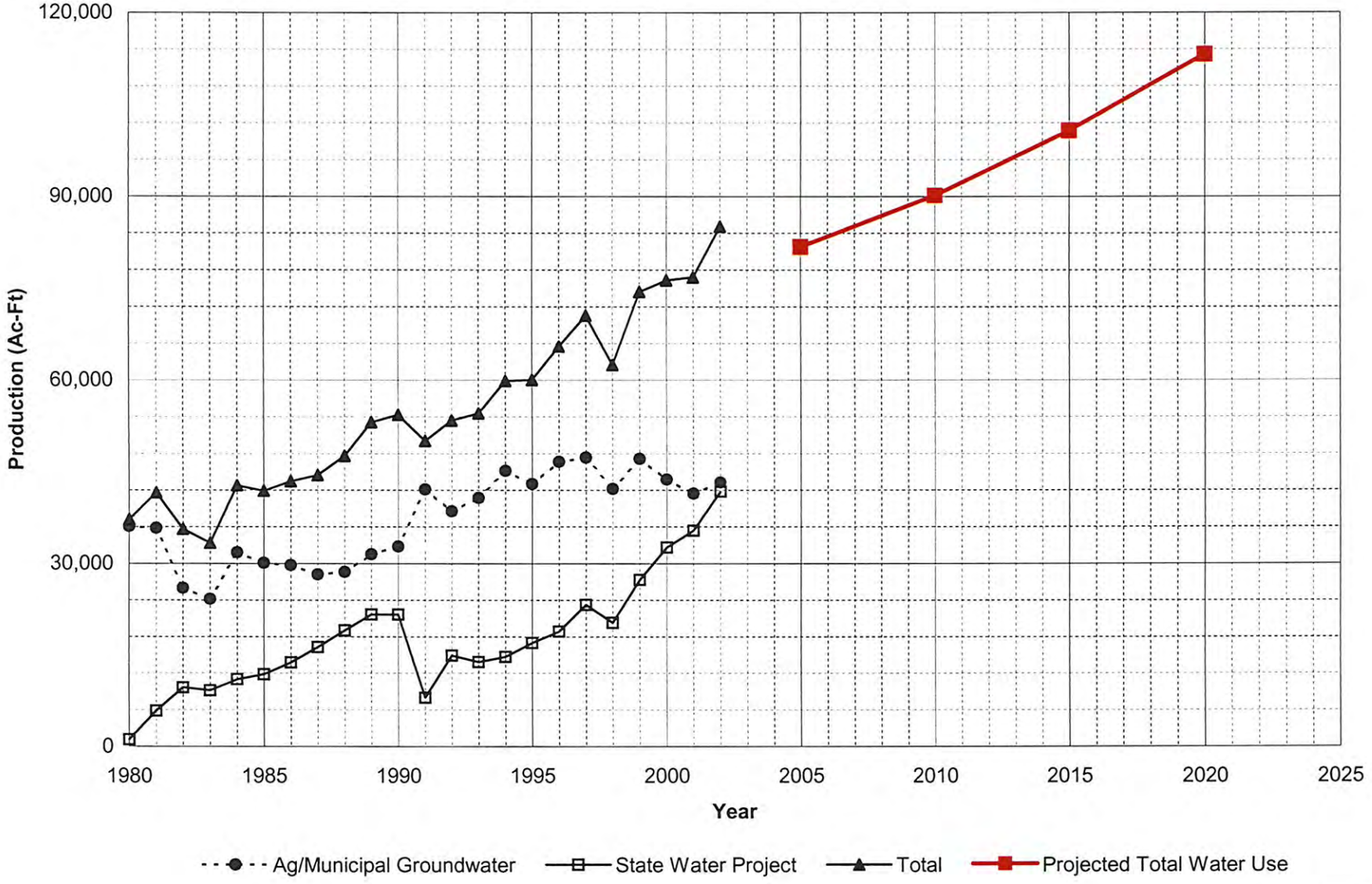

Figure 5-4

hydrologic conditions, during periods of wet/normal surface water availability. In light of all the preceding, implementation of this Plan Element is essential to accomplishing all the management objectives (goals) for the basin.

Primary Element 6 - Long Term Salinity Management

In general, groundwater quality in the basin is such that groundwater supplies meet standards for beneficial use in the basin, most of which is for municipal (domestic) use but some of which remains for agricultural and some other irrigation (non-domestic) use. There also have been no notable historical trends of groundwater quality degradation in the basin over time. However, a number of geologic and hydrologic factors suggest that observations and interpretation of groundwater quality warrant attention to ensure long-term preservation of groundwater quality. Notable among those geologic and hydrologic factors are: 1) the largely "closed" geologic nature of the aquifer system at the western limit of the basin (other than a thin section of Alluvium beneath the Santa Clara River, there is no continuity of aquifer materials between the Santa Clara River Valley East groundwater subbasin and the next downstream groundwater basin on the Santa Clara River, the Piru Basin in Ventura County); 2) the predominant groundwater flow direction in the basin toward the west, where there is the lack of continuity of aquifer materials for groundwater outflow; 3) a certain amount of rising groundwater discharge into the Santa Clara River; and 4) an increasing discharge of treated waste water into the Santa Clara River toward the western end of the basin which, when accounting for the planned use of a substantial amount of recycled water in the Basin (Primary Element 7) will result in higher salt concentrations than other sources of water supply in the Basin. The combination of the preceding factors suggests that, on a long-term basis, there could be an accumulation of dissolved minerals in the aquifer system if salinity is not managed in a way to avoid undesirable groundwater quality degradation. Consequently, this primary element is included in the overall groundwater management plan to include the interpretation of groundwater quality data (Primary Element 1) and to incorporate groundwater quality as an important consideration in the implementation of the other elements of the plan, most notably Continuation of Conjunctive Use Operations (Primary Element 5), Integration of Recycled Water (Primary Element 7), and Identification and Cleanup of Contaminated Groundwater (Primary Element 8). The Long Term Salinity Management element of the plan is essential to accomplishing the third management objective (goal) of preserving groundwater quality in the basin.

Primary Element 7 - Integration of Recycled Water

In 1993, CLWA prepared a Reclaimed Water System Master Plan that outlined a multi-phase program to deliver highly treated, recycled water in the Valley. At that time, potential recycled water uses in excess of 10,000 afy, of which about 9,000 afy were located within the CLWA service area, were identified. The first phase of the Reclaimed Water System Master Plan to deliver 1,700 afy has been environmentally reviewed and is being implemented, with initial deliveries having commenced in August 2003.

The 1993 recycled water plan expected to reclaim up to 10,000 afy. CLWA has been updating that plan to ultimately provide up to about 17,000 afy for irrigation and other non-potable uses. It has also been recognized that, if the Newhall Ranch project is approved, total annual demands for recycled water in the area could ultimately approach 20,000 afy.

This plan element is included in the groundwater management plan primarily because recycled water use in the Valley will supplant a substantial fraction of fresh water demand that would otherwise be met with potable water from some combination of pumped groundwater and imported surface (SWP) water. With total municipal, agricultural and other water demands projected to increase from about 75,000 afy at present to slightly more than 100,000 afy by 2020, the progressive increase in recycled water use from 1,700 afy to as much as 17,000 to 20,000 afy, recycled water use would reduce demands on potable sources (groundwater and imported SWP water) by up to nearly 20 percent. Accomplishment of this Plan Element will benefit the accomplishment of Elements 3 and 4, and will also contribute to the accomplishment of all four of the Basin Goals.

Primary Element 8 - Identification and Mitigation of Soil and Groundwater Contamination

As in numerous other groundwater basins in California, there have been a number of leaking underground storage tanks or other similar situations which have released organic constituents into soil, and possibly into groundwater, in the basin. None of those has impacted municipal or other water supply wells and, consequently, there has been no adverse impact on groundwater supply in municipal or other water supply systems in the basin. However, the detection of perchlorate in the discharge from four Saugus wells (CLWA Santa Clarita Water Division Saugus Wells 1 and 2, Newhall County Water District Well 11, and Valencia Water Company Well 157) in 1997, followed by the detection of perchlorate in one Alluvial well (CLWA Santa Clarita Water Division Stadium Well) in 2002, has led to the inactivation of all those wells.

They remain out of municipal water supply service to date.

Experts retained by CLWA have opined that the cause of perchlorate contamination in the Saugus Formation is former operations associated with munitions manufacturing on property formerly owned by Whittaker-Bermite Corporation, which is immediately adjacent to all the impacted wells. Investigation and characterization of the perchlorate contamination, and initiation of control and cleanup are ongoing; however, remediation actions have not yet commenced. Consequently, the municipal water purveyors continue to be impacted by the loss of water supply capacity of the impacted wells. Associated with that loss is a concern about the migration of perchlorate contamination in a generally downgradient direction, toward other active wells completed in the Saugus Formation and the Alluvium and toward other potential well sites. In light of both the inactivation of wells and the potential downgradient impact on the aquifers, CLWA and the other retail water purveyors had initiated both legal action against responsible parties and technical investigation of the contamination. Recently the parties have entered into an interim settlement agreement which is intended to complete investigation and characterization of the contamination in a collaborative effort. This effort will facilitate and expedite remediation actions.

The primary purpose for technical investigation of the perchlorate contamination by CLWA and the other municipal purveyors is to ultimately recover the currently unavailable water supply capacity that has resulted from the inactivation of impacted wells. Conceptually, that may be accomplished by some combination of reactivation of impacted wells and new well construction. CLWA has joined with the U.S. Army Corps of Engineers in a study to develop information about the contamination. CLWA and the retail water purveyors have also independently commissioned an assessment to conclude what treatment technology is appropriate for removal of perchlorate from pumped groundwater; they have also independently commissioned the application of a numerical groundwater flow and quality model to determine an optimal pumping program for 1) perchlorate removal from the aquifer, 2) control of its migration in the aquifer, and 3) restoration of impacted pumping capacity for water supply. With data derived from that work, CLWA and the other purveyors are preparing to submit an application to the State Department of Health Services, by late 2004, for a permit to return to pumping from the locally impaired Saugus Formation. The proposed pumping would be combined with approved wellhead treatment to render the treated water suitable for municipal supply. In addition to the latter objective to recover currently inactivated water supply, the proposed pumping would be designed and operated to remove contaminated groundwater and to control any further migration

of contaminated groundwater toward other Saugus wells to the west. CLWA and the retail water purveyors then expect to be able to design and implement, alone or in concert with responsible parties, a contamination control and treatment program at or near their impacted wells that can, in part, make groundwater available for municipal or other beneficial use. They also expect that such a program will provide some hydraulic and associated water quality protection for other parts of the aquifer system to keep contamination from impacting other wells or other parts of the aquifers in which water supply wells might be completed.

Regarding the balance of the aquifer system, water supply planning to date (i.e. the current Urban Water Management Plan) includes expanded development of the Saugus Formation for dry-period and emergency water supply. Data development and control and treatment of groundwater contamination in the Saugus Formation will be critical to accomplishing that water supply plan. In terms of this groundwater management plan, accomplishment of this plan element will contribute to the accomplishment of all four management objectives (goals) for the basin.

Primary Element 9 - Development and Continuation of Local, State and Federal Agency Relationships

As the local SWP contractor, CLWA has long-established working relationships with local and state agencies that will continue on an ongoing basis. By nature of its primary function, CLWA will continue to interact with state agencies, most notably the Department of Water Resources, on the operation of the State Water Project. The latter, of course, has been the source of supplemental imported surface water that has made the initiation and continuation of conjunctive use operations possible since 1980. It will also be the primary component, with local groundwater, in continuation of conjunctive use operations in the future (Primary Element 5 of this Plan).

CLWA is the treated surface water provider to all the retail water purveyors, including Newhall County Water District, Los Angeles County Waterworks District No. 36, Valencia Water Company, and its own Santa Clarita Water Division. CLWA has a historical and ongoing working relationship with all those local agencies, as well as with other local groundwater pumpers, to manage water supplies to effectively meet water demands within the available yields of imported surface water and local groundwater. In fact, the Advisory Council convened to assist in the preparation of this Plan is comprised representatives of all the local water purveyors

and significant groundwater pumpers.

A local Memorandum of Understanding (MOU) process among CLWA, other purveyors within CLWA's service area, and United Water Conservation District (UWCD) in neighboring Ventura County is a classic illustration of a local agency relationship that has produced the beginnings of local groundwater management, now embodied in this comprehensive plan, most notably in Primary Elements 1 through 5. In 2001, out of a willingness to seek opportunities to work together and develop programs that mutually benefit the region as well as their individual communities, those agencies prepared and executed the MOU that initiated a collaborative and integrated approach to several of the aspects of water resource management that are now included in this Plan. UWCD manages surface water and groundwater resources in seven groundwater basins, all located in Ventura County, downstream of the East Subbasin of the Santa Clara River Valley that is the focus of this Plan. United is thus a logical partner in the cooperation of management efforts to accomplish the objectives (goals) for this basin, particularly as they relate to preservation of surface water resources that flow through the respective basins. As a result of that MOU, the cooperating agencies have integrated their database management efforts (part of Primary Elements 1 and 2 of this Plan), have initiated the development of a numerical groundwater flow model (for utilization in Primary Elements 3, 4 and 5 of this Plan), and are continuing to prepare reports on the status of basin conditions, as well as on geologic and hydrologic aspects of the overall stream-aquifer system.

A local extension of the interaction among CLWA, the retail water purveyors, and UWCD is an ongoing working relationship with the City of Santa Clarita. CLWA and the retail water purveyors meet regularly with City staff and also present water supply conditions via study sessions with the City Council on a routine basis. It is expected that the implementation of this Plan will result in the availability of a broader range of information transfer with the City relative to the existing and future water supply to its residents. An additional expectation of this Plan with respect to the relationship among CLWA, the retail water purveyors, and the City is the intent of CLWA and the purveyors to provide input to the City as a reviewer of proposed development relative to any potential contamination of groundwater associated with such proposed development. CLWA provides input to the City, as suggested in Water Code Section 10753.8, via review of land use plans and coordination with the City Planning Department to identify and assess any development-related activities which might pose a risk of groundwater contamination. By expressing this expectation of its groundwater management plan, CLWA is not intending to insert itself into the jurisdiction or authorization of any other land use permitting

agency; rather, CLWA is intending to provide review and input to the land use permitting process to protect the groundwater supply against any potential contamination that might occur as a result of any given development project.

This Primary Element is included in this Plan to formalize the historical local and state agency working relationships as part of comprehensively managing local groundwater, in concert with imported surface water and local recycled water, to accomplish all the management objectives (goals) for the basin.

Primary Element 10 - Groundwater Management Reports

As briefly described in the Introduction of this Plan, local groundwater management planning already includes, among several other activities, analysis of groundwater conditions and preparation of annual reports on groundwater and all other aspects of water resources and water supplies in the Santa Clara River Valley East groundwater basin. In addition, recently formalized cooperative work with neighboring UWCD includes both regular reporting on the status of groundwater conditions and specific reporting on geologic and hydrologic aspects of the overall stream-aquifer system. For example, documentation of the numerical groundwater modeling work currently in progress is expected to be the first of the latter reports in the next year.

Beginning in 1998, CLWA and the retail water purveyors in the basin have prepared a series of annual reports, known locally as the Santa Clarita Valley Water Report, to describe all aspects of water supply and water resource conditions in the basin. That report provides current information to local City and County land use agencies, and to other interested parties, about current water requirements, use of groundwater and treated imported surface water to meet those water requirements, groundwater conditions (pumping, groundwater levels and quality, etc.), local surface water conditions, the status of imported surface water supplies including details of delivered SWP water in the reported year as well as an up-to-date summary of available imported SWP water for the next year, a short-term projection of water requirements in the next year, and other appropriate details about water requirements and supplies such as, for example, the status of introducing recycled water as a component of non-potable water supply.

In light of the frequency and comprehensive nature of the annual Water Reports, and also in light of the planned preparation of more detailed technical reports on various aspects of the basin as appropriate, the continued preparation of those reports will serve as regular and

complete reporting on all aspects of this groundwater management plan.

Secondary Element 1 - Continuation of Public Education and Water Conservation Programs

CLWA has provided water conservation and public education programs that will continue and will be expanded as a complement to and an element of this groundwater management plan. The expansion of water conservation will largely stem from CLWA's having signed the "Memorandum of Understanding Regarding Water Conservation in California" (Urban MOU) in 2001, which made CLWA a wholesaler member of the California Urban Water Conservation Council. CLWA has thus committed to implementation of cost-effective water conservation measures known as Best Management Practices (BMPs) that are included in the Urban MOU and are intended to reduce California's long-term urban water demands. The BMPs have been incorporated into the water demand management measures section of the Urban Water Management Planning Act.

Water conservation and related public education measures have generally been developed in California to achieve the following goals:

- meet legal mandates
- reduce average annual potable water demands
- reduce sewer flows
- reduce water demands during peak seasons
- meet drought restrictions.

As a wholesaler of imported surface water CLWA has implemented the following BMPs for several years prior to signing the MOU:

- distribution system water audits, leak detection and repair
- public information
- school education
- wholesale agency assistance
- conservation pricing
- conservation coordinator.

As a signatory to the MOU, CLWA's water conservation and public education program will expand to include the following BMPs found to be locally cost-effective, as detailed in the 2000 Urban Water Management Plan for CLWA and the Santa Clarita Valley retail purveyors.

- water survey programs for single-family residential and multi-family residential programs
- residential plumbing retrofits
- metering with commodity rates for all new connections and retrofit of existing connections
- large landscape conservation programs and incentives
- high-efficiency washing machine rebate programs (when also provided by local energy providers or wastewater utilities)
- conservation programs for commercial, industrial, and institutional accounts
- wholesale agency programs to financially or otherwise support water conservation efforts by retailers (this measure will be expanded)
- residential ultra-low-flow toilet replacement program.

This Secondary Element, while identical to independent CLWA efforts in water conservation and public education, is incorporated in this Plan to complement other Plan elements, and to move toward accomplishment of all management objectives (goals) for the groundwater basin.

Secondary Element 2 - Identification and Management of Recharge Areas and Wellhead Protection Areas

The 1986 Amendments to the federal Safe Drinking Water Act (SDWA) established a new Wellhead Protection Program (WPP) to protect groundwater that supplies drinking water wells for public water systems. Each state was required to prepare a WPP and submit it to the USEPA by June 19, 1989. However, California did not develop an active state-wide Wellhead Protection Program at that time. Subsequently, in 1996, reauthorization of the SDWA established a related program called the Source Water Assessment Program. In 1999, the California Department of Health Services (DHS) Division of Drinking Water and Environmental Management developed its Drinking Water Source Assessment Program (DWSAP), and EPA approved it. The overall objective of the DWSAP is to ensure that the quality of drinking water sources is protected.

As discussed in Section 1 of this Plan, the potential groundwater management plan component

"identification and management of wellhead protection areas and recharge areas" is stated, even in the most recently amended version of Water Code Section 10753.8, as one that "may" be included. However, the wellhead protection aspect of this component, which was optional when AB 3030 was adopted, is now essentially required as a result of the 1996 SDWA reauthorization. In California, the DWSAP satisfies the mandates of both the 1986 and 1996 SDWA amendments. The California DWSAP includes delineation of the areas (i.e., protection areas or Groundwater Protection Zones) surrounding an existing or proposed drinking water source where contaminants have the potential to migrate and reach that source. The program includes preparation of an inventory of activities that may lead to the release of contaminants within these zones. The activities, referred to in the DWSAP as Potentially Contaminating Activities, include such land uses as gas stations and dry cleaners, as well as many other land uses. The activities also include known contaminant plumes regulated by local, state, and federal agencies. The zones, which are calculated based on local hydrogeological conditions and also well operation and construction parameters, represent the approximate area from which groundwater may be withdrawn during 2, 5, and 10 year time periods. These zones also represent the area in which contaminants released to groundwater could migrate and potentially affect the groundwater extracted by wells located within the designated zones. The DWSAP assessment also includes a risk or vulnerability ranking based on a combined numerical score that results from points assigned to various evaluations conducted as part of the DWSAP process. This ranking provides a relative indication of the potential susceptibility of drinking water sources to contamination.

Although DHS is responsible for conducting drinking water source assessments for systems existing prior to the adoption of the California program, DHS has encouraged purveyors to perform their own assessments. Assessments for existing systems were due at the end of 2002; however, DHS received an extension allowing its assessment work to be completed by May 2003. Permitting of a new water supply well requires that a DWSAP be completed as part of the permit process, and this is responsibility of the applicant. Within CLWA, DWSAP assessments have been completed for the three municipal water purveyors who utilize groundwater for some of their water supply, including 15 for the CLWA Santa Clarita Water Division, 20 for Valencia Water Company, and 13 for Newhall County Water District.

The results of the DWSAPs can be used as a planning tool to guide land use development in the vicinity of water sources. The DWSAPs prepared for water sources in the basin should, in some fashion, be reviewed every five years and updated more frequently as appropriate. The collective DWSAP information can also be integrated with other management activities (e.g., the

geographical position of potential or existing contaminating activities can be incorporated in the monitoring program database; plume extents, as available, can be graphically displayed by aquifer and isoconcentrations) to aid siting of new wells, particularly when contaminant migration problems are also evaluated with respect to local hydrogeological conditions and the potential influence of nearby wells on plume migration.

In addition to the wellhead protection program that is focused on wells that are sources of drinking water, a broader aspect of this Plan Element is protection of the overall recharge areas of the aquifer system in the basin. As discussed in Section III, the most developed aquifer, the Alluvium, has experienced historical fluctuations in groundwater levels in the eastern portion of the basin, but has had essentially constant groundwater levels in the western portion of the basin. The characteristic difference between the two portions of the basin, generally divided at the confluence of the Santa Clara River and its Bouquet Canyon tributary, is the perennial flow in the Santa Clara River to the west of that location versus the intermittent flow in the river to the east. The intermittent fluctuations in groundwater levels east of Bouquet Canyon are indicative of rapid response, i.e. recharge, from streamflow when it is present. Similarly, the relatively constant groundwater levels west of Bouquet Canyon are indicative of ongoing response, i.e. recharge, from the perennial flow in the river. In light of those conditions, part of this Plan Element is intended to protect the overall channel system of the Santa Clara River and its tributary system, notably where they overlie Alluvial aquifer materials of significant extent. Protection in this case is intended to mean preservation of the infiltration capacity of the stream channel so that both intermittent and perennial flows can continue to recharge the aquifer as has historically occurred.

Finally, with regard to protection of recharge areas, it is expected that additional exploration and development of the Saugus Formation, for additional water supply as described in this Plan, will lead to further understanding of the locations and mechanisms for recharge of that aquifer, which is exposed at the surface throughout much of the area of this Plan. As that understanding evolves, part of this Plan Element will be to identify means of ensuring that significant portions of Saugus recharge are not compromised by land development activities.

This Plan Element is included to incorporate the DWSAP efforts and the overall protection of groundwater recharge into the local groundwater management plan. Completion of DWSAP efforts to comply with state DHS requirements and preservation of overall aquifer recharge are key parts of accomplishing the first and third management objectives (goals) for the basin.

Secondary Element 3 - Identification of Well Construction, Abandonment, and Destruction Policies

Well construction permitting in the basin is administered by the Los Angeles County Health Department, which effectively implements the State Well Standards for water wells, monitoring wells, and cathodic protection wells. Permitting of municipal supply wells is also within the purview of the State Department of Health Services. One goal of this management plan for the area, protection and preservation of groundwater quality requires that all wells be properly constructed and maintained during their operational lives, and properly destroyed after their useful lives, so that they not adversely affect groundwater quality by, for example, serving as conduits for movement of contaminants from the ground surface and/or from a poor quality aquifer to one of good quality. Toward that end, this element is included in the overall plan to support well construction and destruction policies, and to participate in their implementation in the Basin, particularly with regard to surface and inter-aquifer well sealing and proper well destruction, which are critical in the management of a multiple aquifer system that has some connection with the Santa Clara River and its tributaries.

Secondary Element 4 - Provisions to Update the Groundwater Management Plan

The primary and secondary elements of this local area groundwater management plan reflect the current understanding of the occurrence of groundwater in the Santa Clara River East Valley groundwater subbasin, and specific problems or areas of concern about that resource. Those management elements are designed to achieve specified goals to develop local groundwater for regular and dry year/emergency water supply while protecting and preserving groundwater quantity and quality for overlying beneficial use into the foreseeable future, and while also protecting and preserving valuable surface water resources that are directly related or connected to groundwater. While the groundwater management plan provides a framework for present and future actions, new data will be developed as a result of implementing the plan. That new data could define conditions which will require modifications to currently definable management actions. As a result, this plan is intended to be a flexible document which will be reviewed and updated to modify existing elements and/or incorporate new elements as appropriate in order to recognize and respond to future groundwater and surface water conditions. Although not intended to be a rigid schedule, review and updating of this plan will initially be conducted in five years, with subsequent future updates scheduled as appropriate at that time. In accordance with Primary Element 10, the retail purveyors and CLWA will continue to produce the Santa

Clarita Valley Water Report on an annual basis. Data and information from these reports will be compiled and utilized as part of the review and updating of this plan.

Appendix I

Groundwater and Surface Water Monitoring Protocols

The CLWA Groundwater Management Plan includes two Elements (Primary Elements 1 and 2) that relate directly to ongoing, and expanded as appropriate, monitoring of key hydrologic quantities associated with the implementation of the Plan. Notable among the data to be collected are groundwater levels, groundwater quality, pumpage from water supply wells, and surface water flows and quality. Other hydrologic data such as precipitation are intended to be measured and maintained in accordance with the standards in place for the respective precipitation gage stations in the Valley; consequently, this Appendix does not address the specific establishment of protocols for precipitation gaging. On another matter of hydrologic data, land subsidence, the Plan discusses the low probability for subsidence in the Valley, particularly as related to historical groundwater pumping from both the Alluvial and Saugus Formation aquifers. Consequently, the Appendix does not address the establishment of protocols for measuring land subsidence. As noted in the Plan, if future analysis of increased pumping from the Saugus Formation, as currently planned, suggests changes in groundwater levels that might be conducive to inelastic subsidence, the need for subsidence monitoring will be reconsidered at that time; and some combination of land surface elevation surveying, remote sensing of land surface deformation, and measurement of earth consolidation via extensometers would be considered as part of establishing protocols for monitoring subsidence.

Groundwater Monitoring

For purposes of Plan implementation, the most essential groundwater-related data are water levels, water quality, and pumpage. Consequently, the following discussion of monitoring protocols focuses on those hydrologic parameters.

Groundwater Levels - The distribution and frequency of current groundwater level measurements in Alluvial wells and in Saugus Formation wells are illustrated in Figures A1 and A2, respectively. Tables A1, A1a and A2 show the dates that groundwater level measurements were made in Alluvial and Saugus Formation wells. As discussed in the Plan, for the Alluvium, the distribution of monitoring is sufficient to interpret water level and groundwater storage trends. Thus, it is intended that the fundamental distribution and frequency of Alluvial groundwater level measurements remain generally as illustrated in Figure A1: general semi-annual measurements complemented by some quarterly measurements disbursed throughout the Alluvial aquifer. The only exception to the preceding intention is in the western-most portion of the Alluvium, where agricultural pumping remains the water supply objective and water level measurements are primarily annual. In part to conform to the balance of Alluvial groundwater

level measurements, and more importantly to monitor stream-aquifer connection near the western, or downgradient, end of the Alluvium in the basin, it is the intent of Plan implementation to increase that water level monitoring to semi-annual to quarterly frequency.

In the Saugus Formation, the distribution of groundwater level measurements is limited by the number and location of wells; the locations in Figure A2 reflect where the Saugus has been developed for water supply. Ultimately, as future exploration and development of the Saugus expand, it is expected that the distribution of groundwater level measurements will expand to those future well locations. For Plan implementation purposes, the existing monthly frequency of water level monitoring is intended to continue.

Water level measurement methodology, which is dominated by utilization of electric sounders, is expected to remain largely unchanged. Some calibrated airlines and possibly some dedicated electro-hydraulic transducers are expected to complement electric sounders in certain wells. All those water level measurement methods are sufficiently accurate to satisfy the needs to which the resultant data is to be put.

Groundwater Quality - The distribution and frequency of current groundwater quality monitoring in Alluvial wells and in Saugus Formation wells are illustrated in Figures A3 and A4, respectively. Tables A3 and A4 show the dates that groundwater quality (total dissolved solids) was monitored in Alluvial and Saugus wells. For the most part, the distribution and frequency of water quality sampling are sufficient to interpret general quality trends. One notable constraint in the Alluvium, however, is the discontinuation of water quality data collection in some wells since 1988, mostly toward the western, or downgradient, end of the basin. In order to restore an ongoing historical record, part of Plan implementation will be to attempt to re-establish regular, i.e. yearly to triennial, water quality sampling and analyses in those wells with some form of historical water quality record. In the same vein, part of Plan implementation will include selection of a number of wells in key locations, e.g. near the mouths of canyons, for semi-annual analysis of indicator parameters as a basis for assessing seasonal or other variations in groundwater quality.

Finally with regard to groundwater quality, the spatial limitations on Saugus water quality data are comparable to the limitations related to Saugus groundwater levels, but as a result of the limited, localized development of the Saugus for water supply. While the regular monitoring of quality will continue via Plan implementation, the expansion of Saugus water quality data is expected to follow the expanded exploration and development of that aquifer as described for

groundwater levels above.

Production (Pumpage) - The great majority of water supply wells in the basin are now dedicated to municipal supply; consequently, those wells are equipped with production meters which allow direct monitoring of pumpage on any desired frequency, e.g. instantaneous flow rate, or cumulative volumes on a daily, monthly, or other frequency. A few wells remain dedicated to agricultural water supply, and those wells are not equipped with flow meters. However, long-standing practice at all those wells has been to meter power consumption for each well and to combine that data with the results of annual pump performance testing in order to indirectly compute approximate pumpage from each agricultural well. That methodology is sufficiently accurate for ongoing documentation of pumpage and interpretation of basin response to pumping; it is also sufficiently accurate for groundwater flow model input as part of assessing basin yield, all as part of this Plan. Consequently, implementation of this Plan includes regular reading of flow meters on municipal supply wells and continued indirect computation of agricultural pumpage from the remaining agricultural water supply wells in the basin.

Surface Water Monitoring

Part of Plan implementation is the development of a surface water quality monitoring network. Of particular concern is establishing a surface water quality data set that, combined with groundwater data, will allow for a more detailed analysis of stream-aquifer interactions. The data of primary interest for this and other Plan purposes are surface water flow and surface water quality, discussed below.

Surface Water Flow - The existing surface water flow monitoring network within the basin consists of stream flow gaging stations along the Santa Clara River and its tributaries, and measurements of discharge to the River from the Saugus and Valencia Water Reclamation Plants. Monitoring of stream flow gages along the River and its tributaries has been mostly sporadic and limited to times prior to 1977, although measurements at some gages resumed in 2002. One exception is the gage at the Los Angeles-Ventura County line, where the daily mean stream flow was monitored from 1953 to 1996; the gage was replaced with one downstream near Piru in 1996. The Los Angeles County Sanitation Districts monitors the average discharge flow of treated wastewater from the Saugus and Valencia Water Reclamation Plants to the Santa Clara River.

Plan implementation will include evaluating the distribution, future accessibility and

configuration of the existing stream flow gaging stations to determine if they will be suitable for inclusion in the ongoing surface water flow monitoring network. Plan implementation will further include installation and operation of gage station modifications, as well as installation and operation of additional dedicated gaging stations as determined to be required.

Surface Water Quality - Surface water quality has been analyzed at many locations along the Santa Clara River and its tributaries but, with few exceptions, the data is limited to several measurements at each location. Water quality in the Santa Clara River at the Los Angeles-Ventura County line was analyzed on a semi-annual basis from 1951 to 1988, and is currently measured quarterly by United Water Conservation District. Since 2002, the Los Angeles County Department of Public Works has monitored water quality in the Santa Clara River near Interstate 5 during four wet weather events and at two other times each year to comply with the requirements of a National Pollution Discharge Elimination System (NPDES) permit that covers the County and 84 incorporated cities. The Saugus and Valencia Water Reclamation Plants also monitor the quality of the treated wastewater they discharge to the Santa Clara River as part of compliance with the requirements of their NPDES permits.

Plan implementation will include identifying key locations for future surface water quality monitoring, identification of constituents of concern and monitoring frequency for each location, and implementation of appropriate sampling and analytical methodology at the selected key sites.

Table A1
Dates of Historic Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin

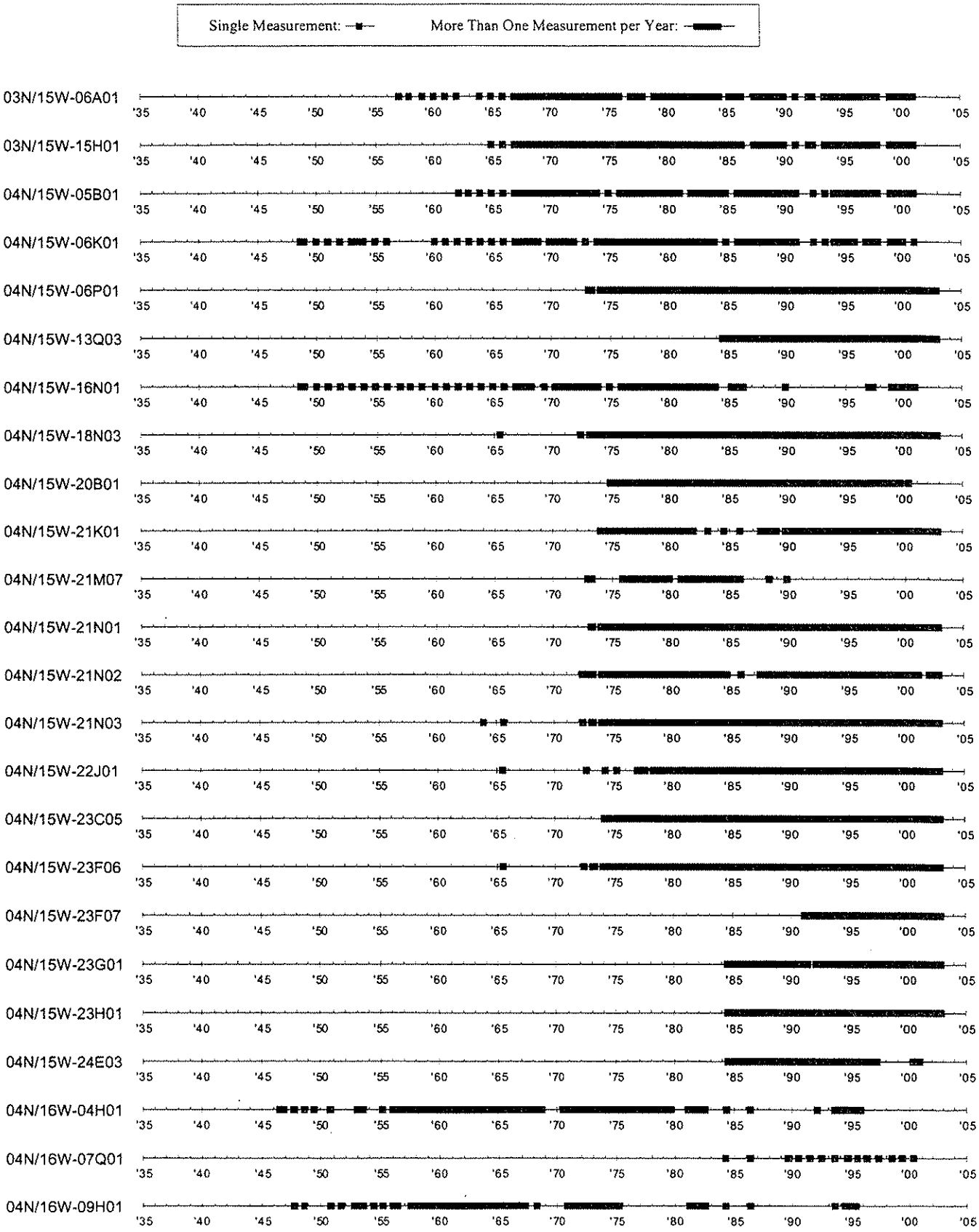

Table A1 - Continued
Dates of Historic Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin

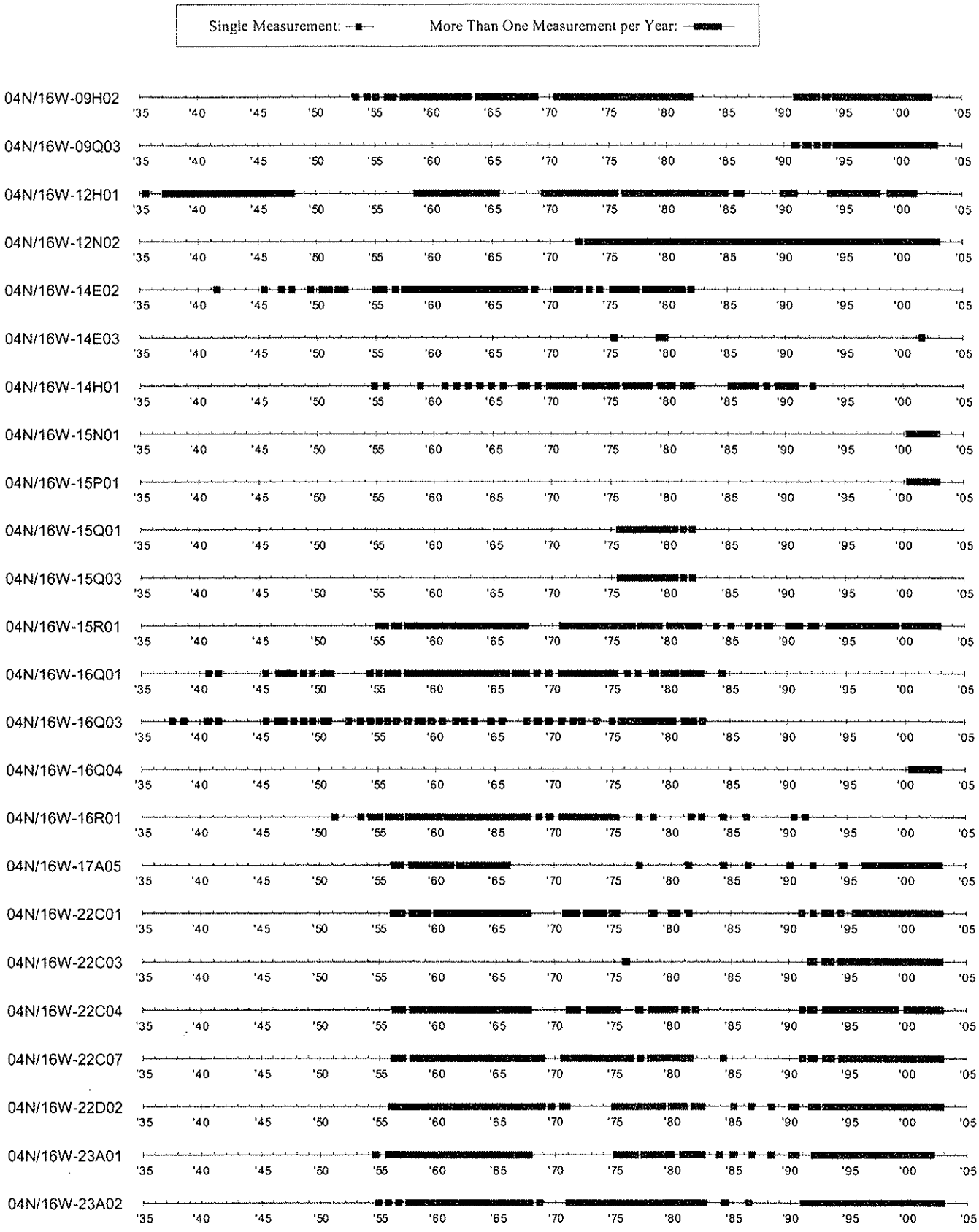

Table A1 - Continued
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Santa Clara River Valley Groundwater Basin, East Subbbasin

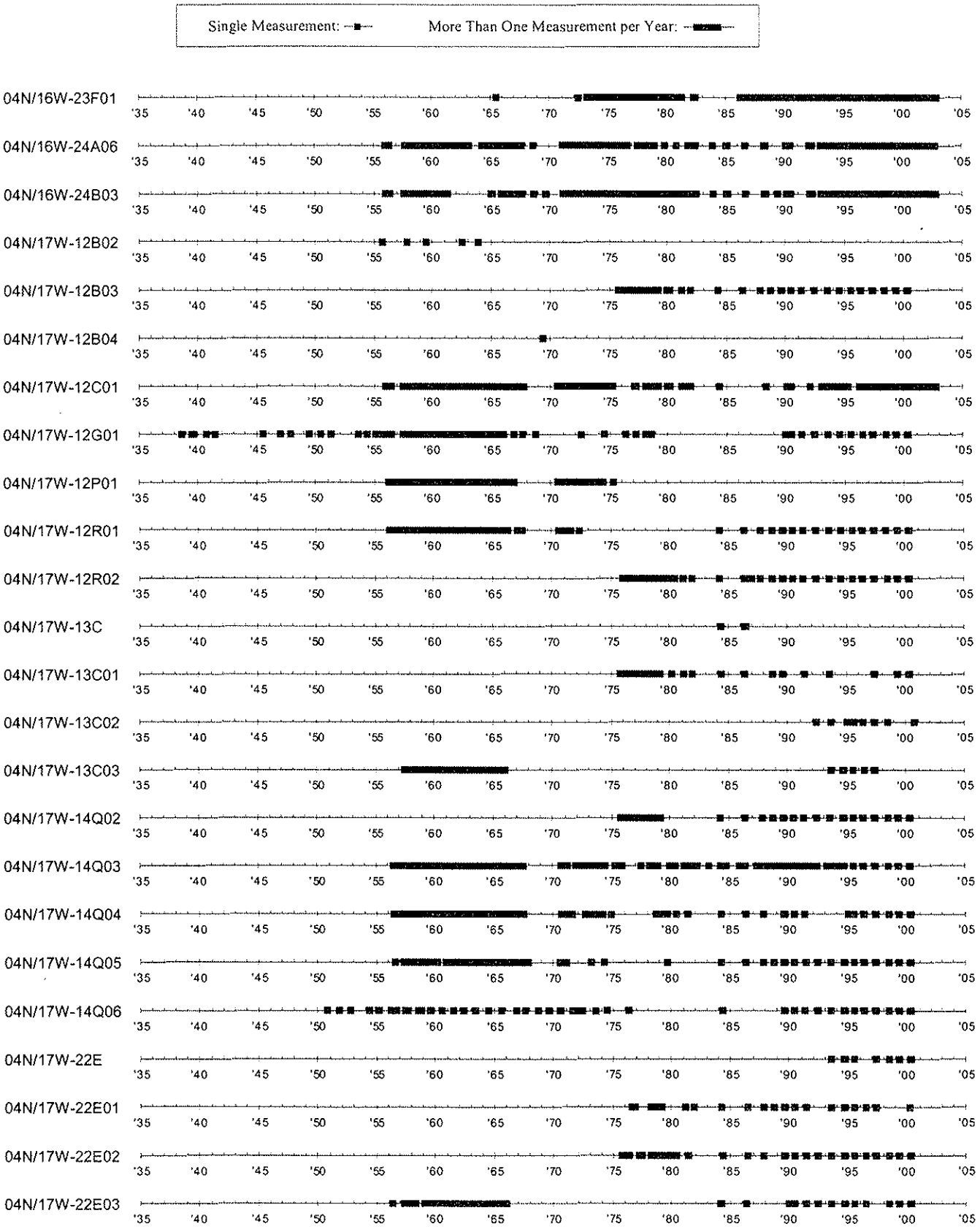

Table A1 - Continued
Dates of Historic Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin

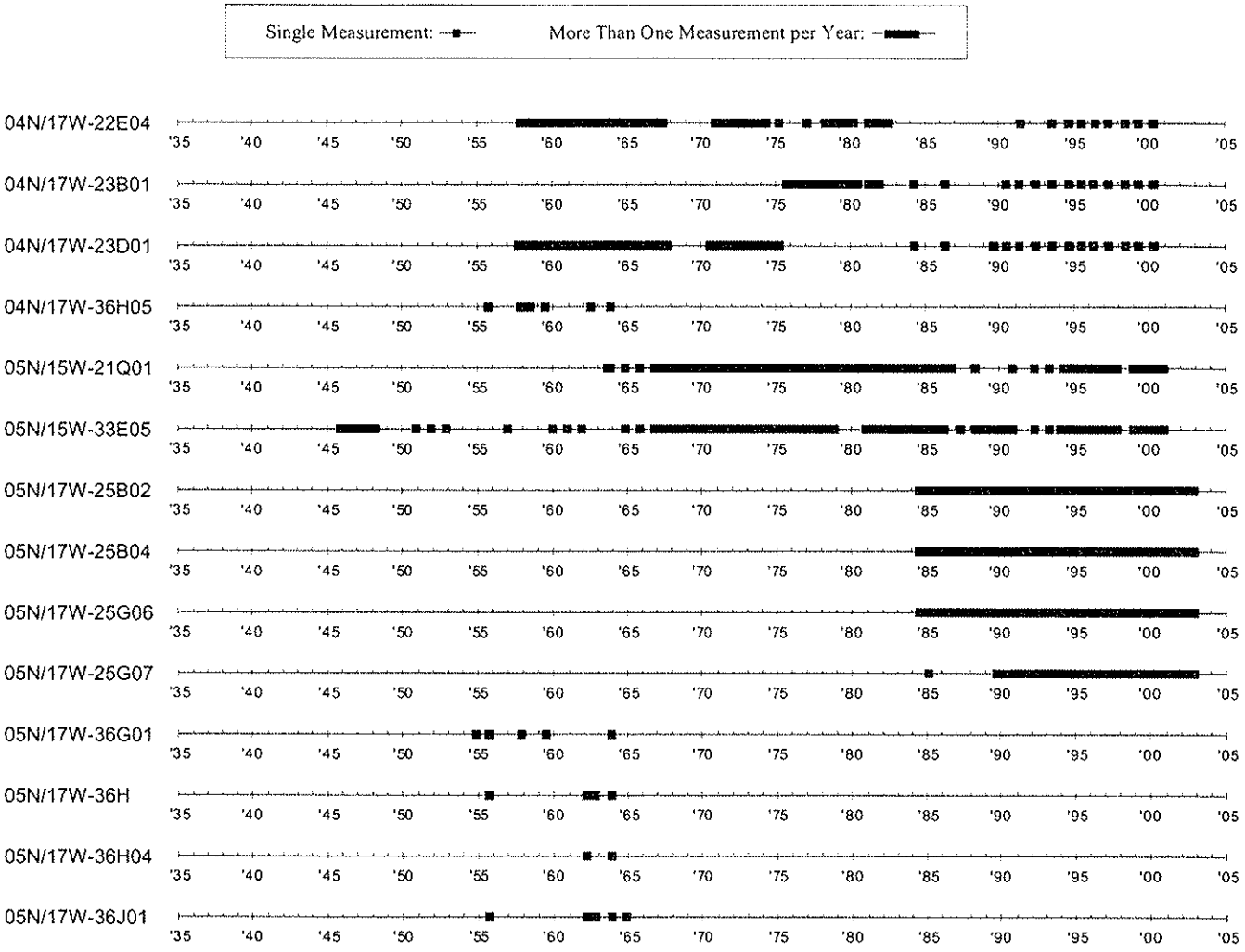

Table A1a
Dates of Historic Water Level Measurements in LACFCD Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin

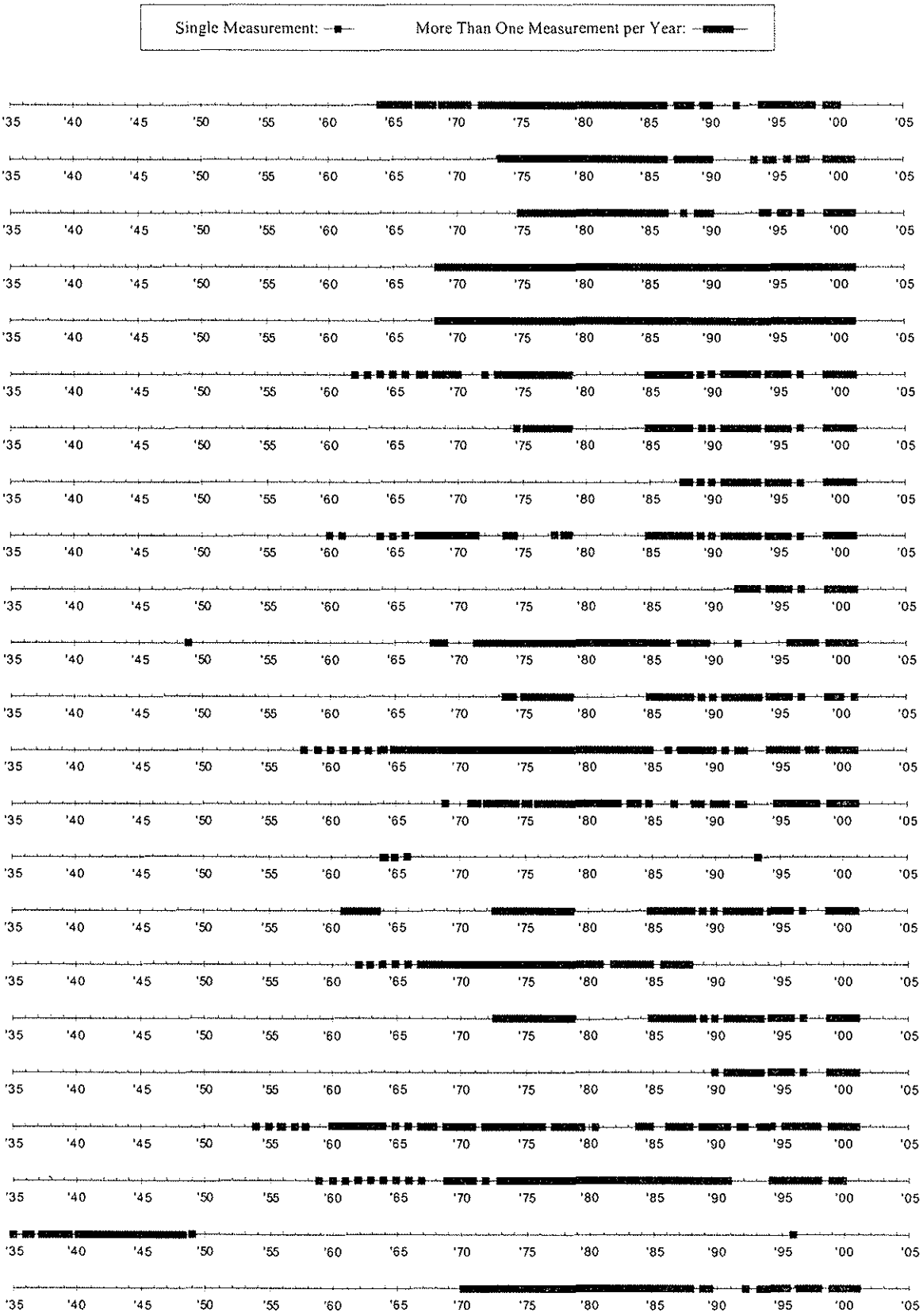

Table A1a - Continued
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Santa Clara River Valley Groundwater Basin, East Subbbasin

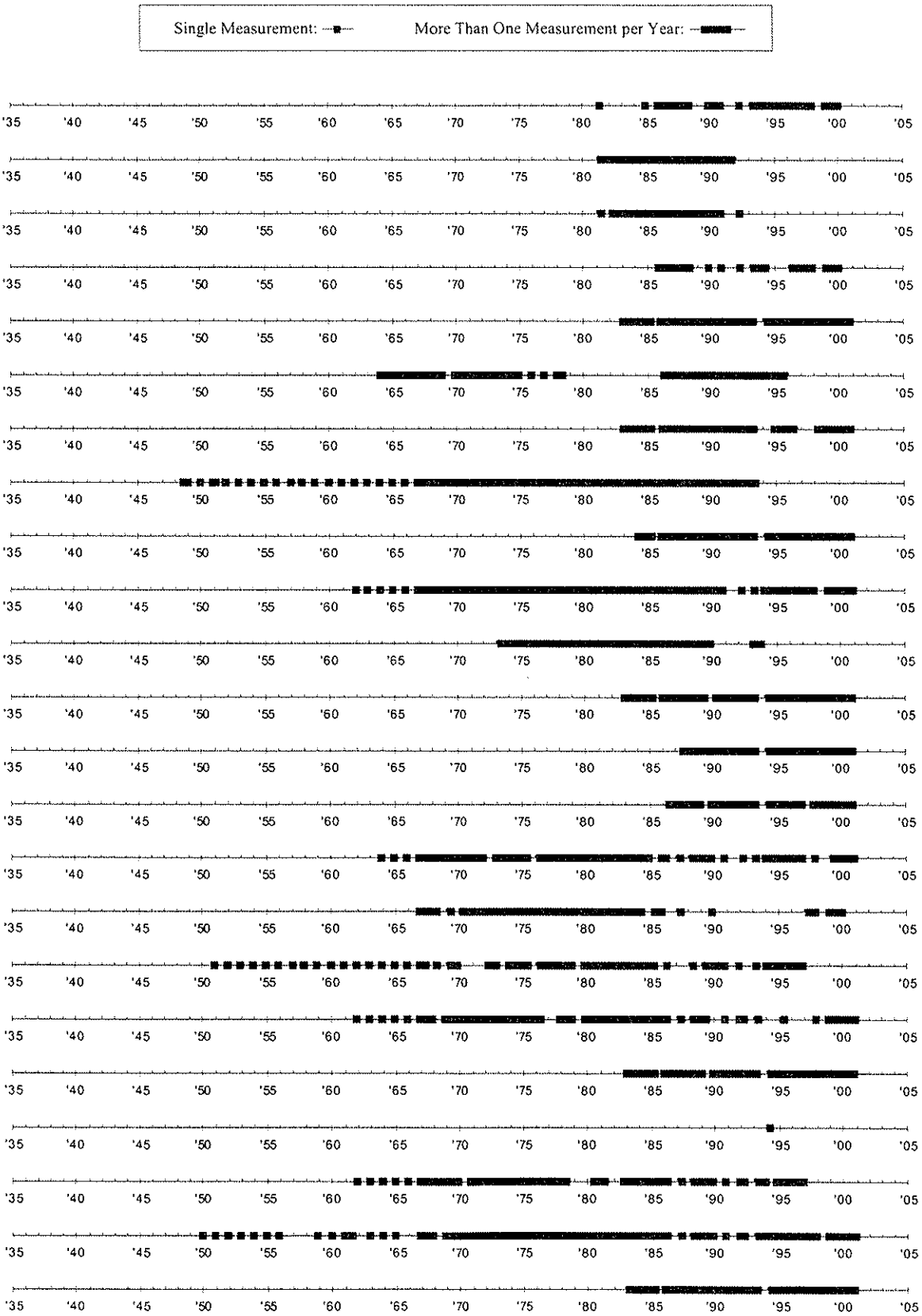

Table A1a - Continued
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Santa Clara River Valley Groundwater Basin, East Subbbasin

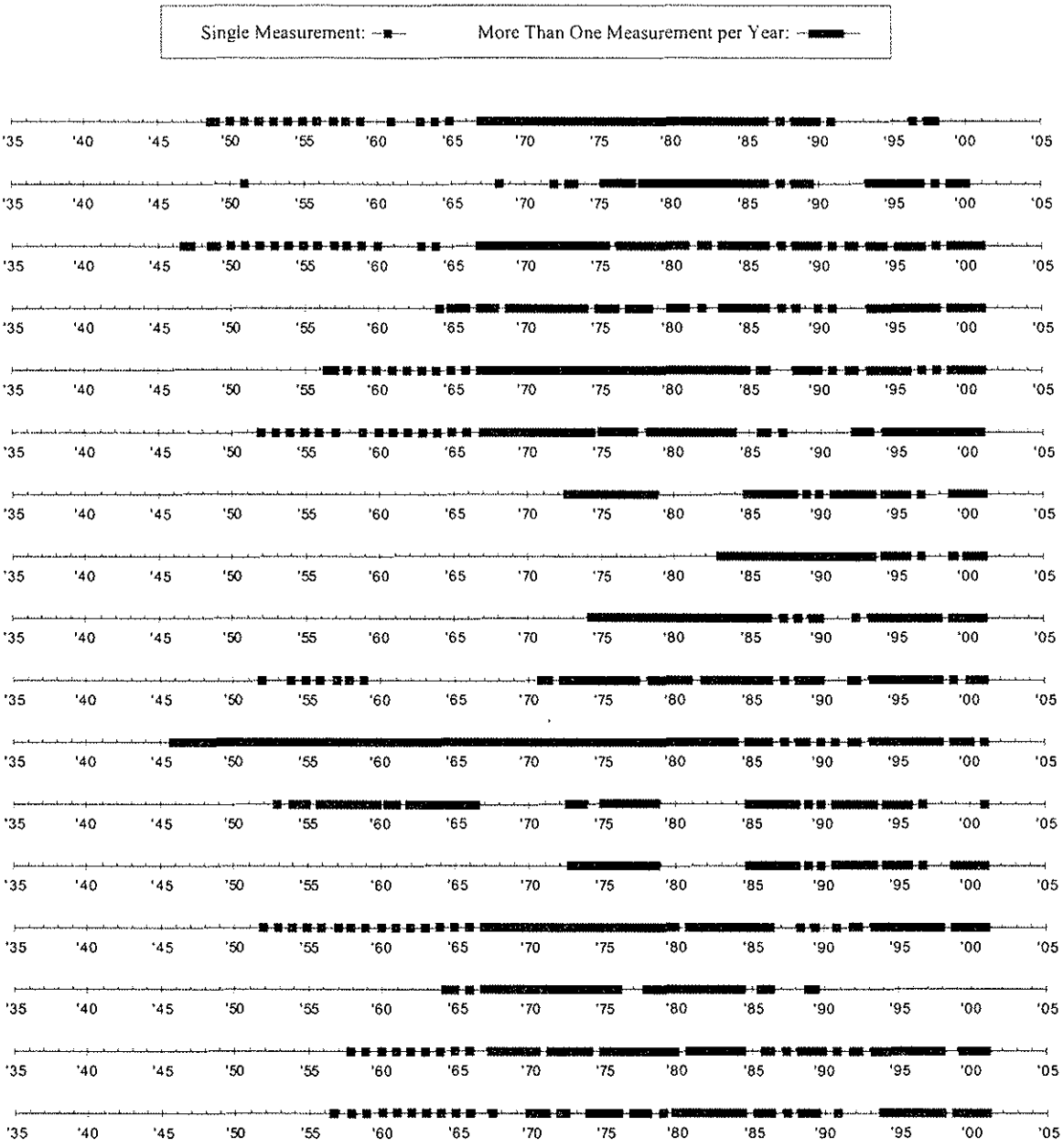


Table A2
Dates of Historic Water Level Measurements in Saugus Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin

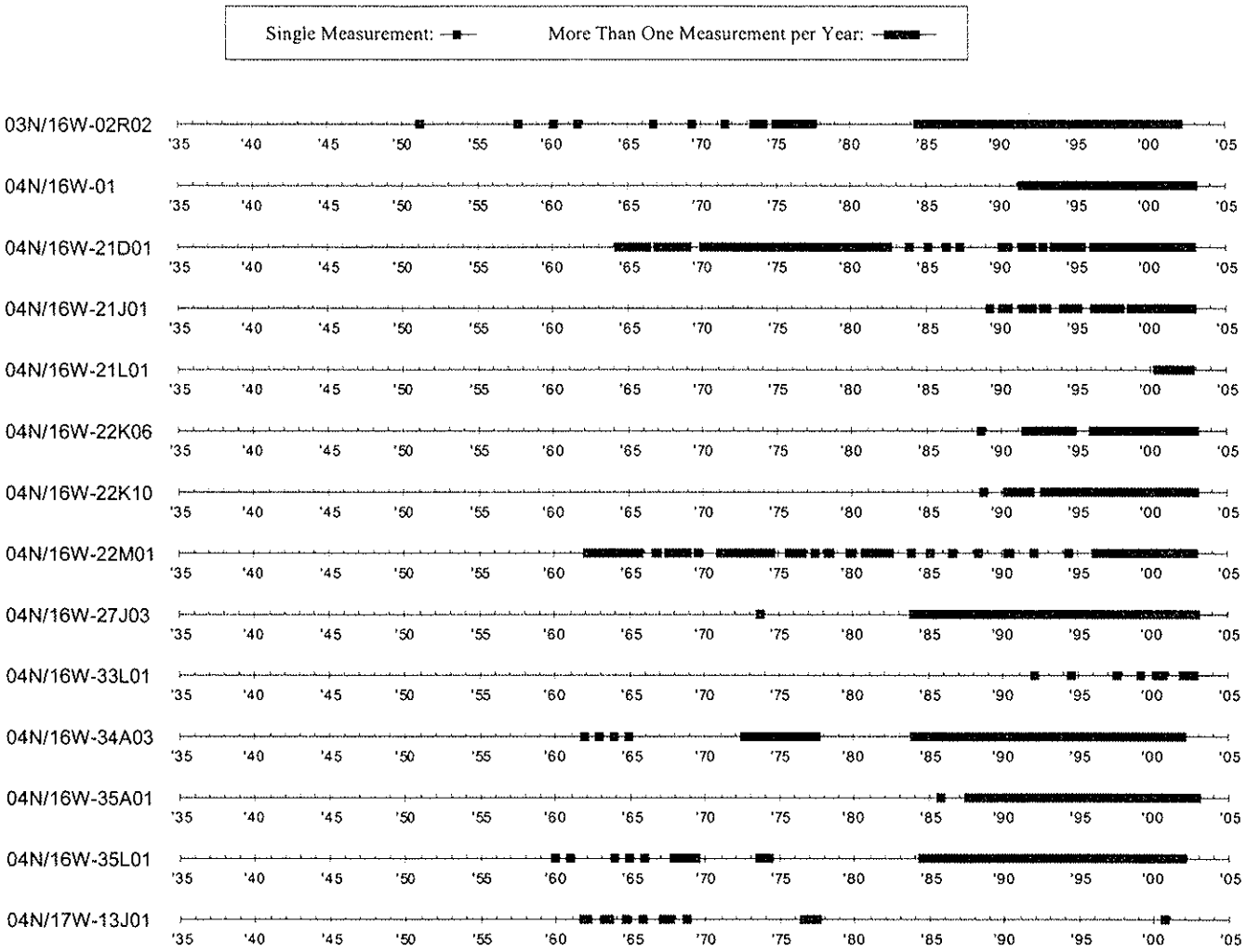


Table A3
Dates of Historic Water Quality Measurements (TDS) in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin

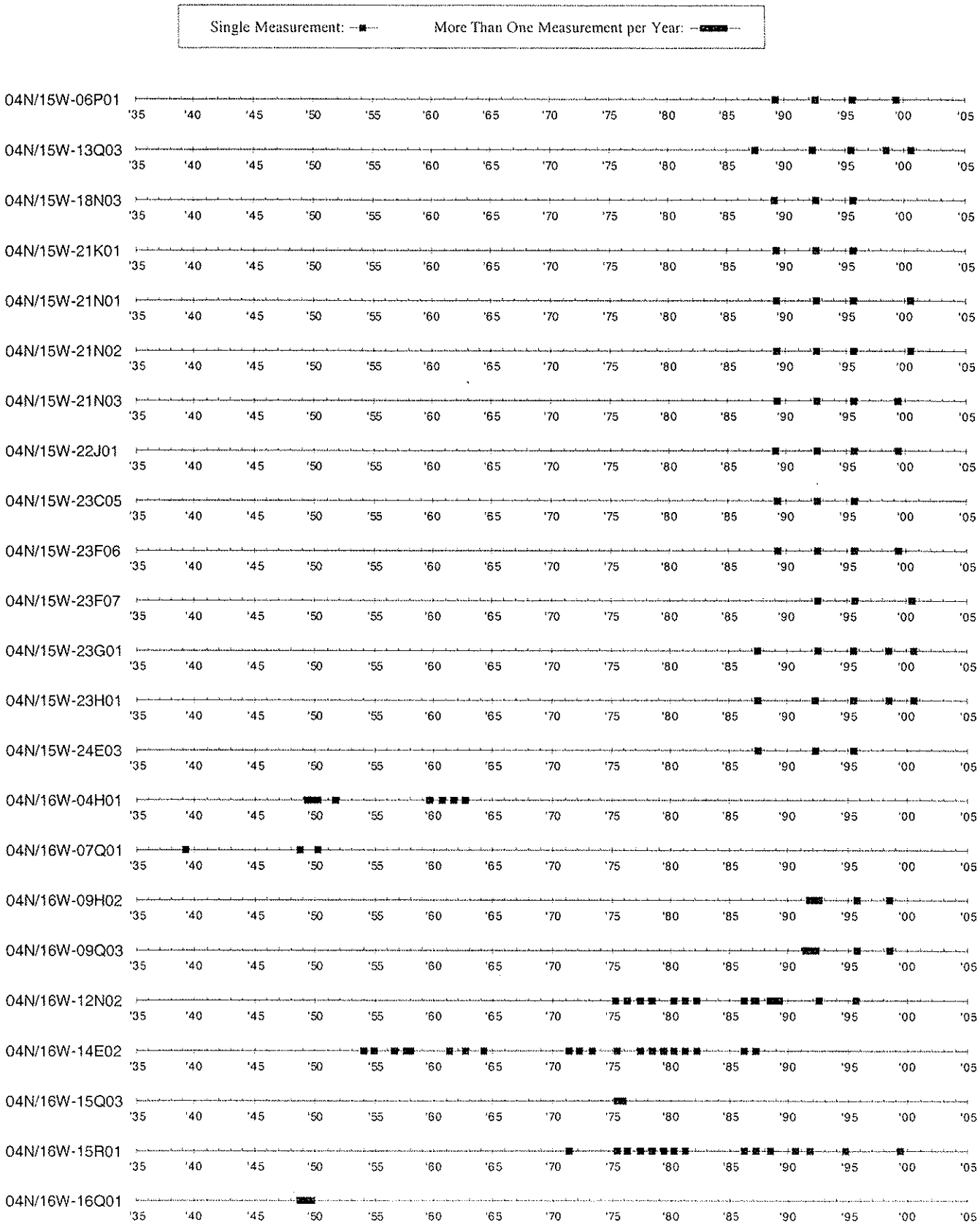
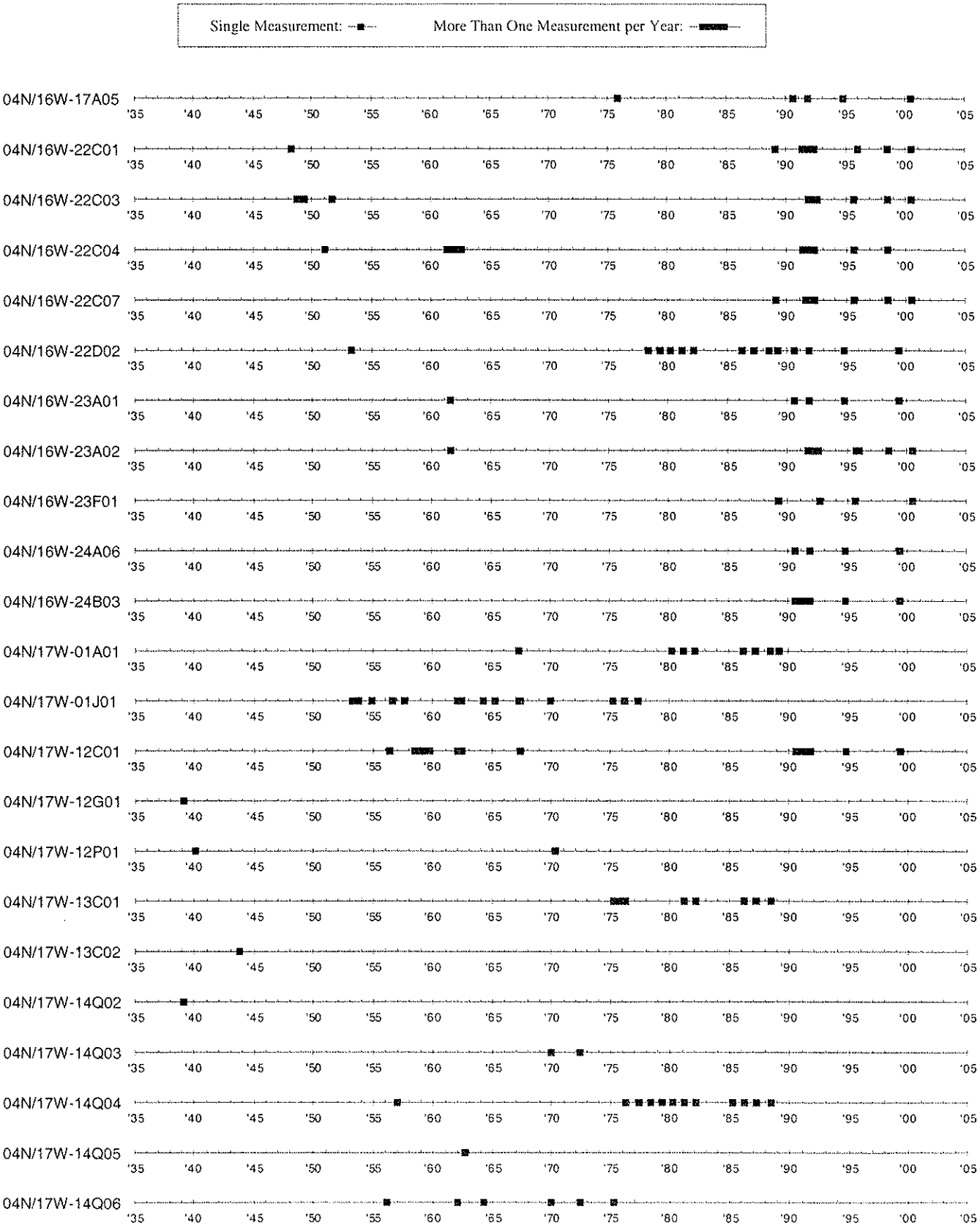


Table A3 - Continued
Dates of Historic Water Quality Measurements (TDS) in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin



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Santa Clara River Valley Groundwater Basin, East Subbbasin

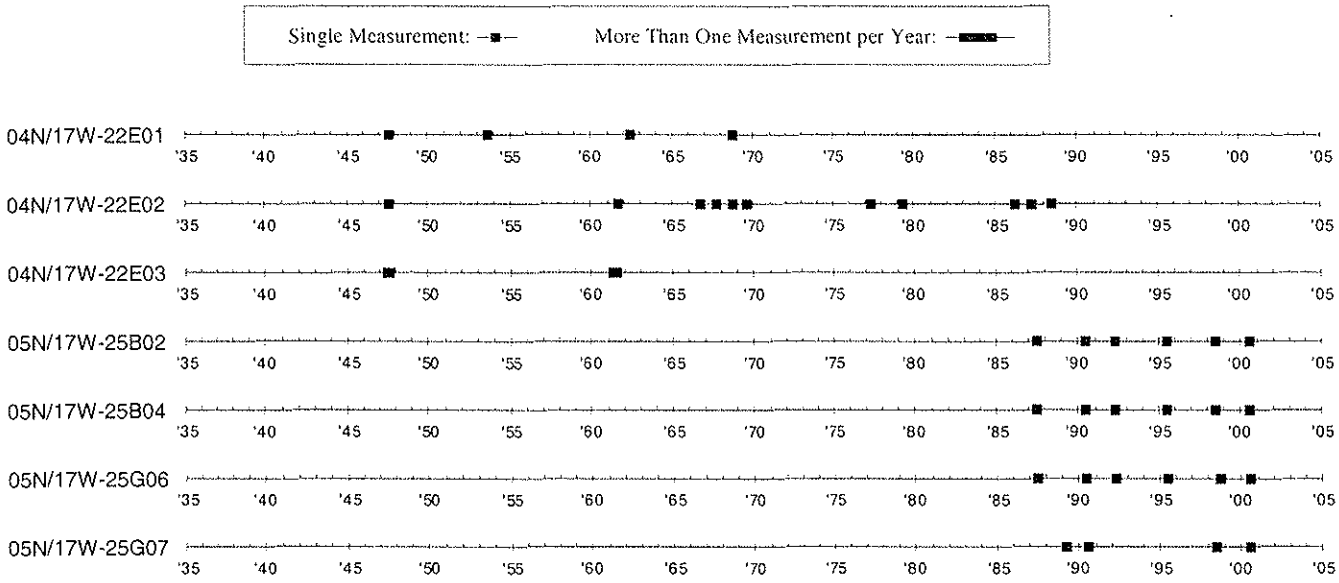
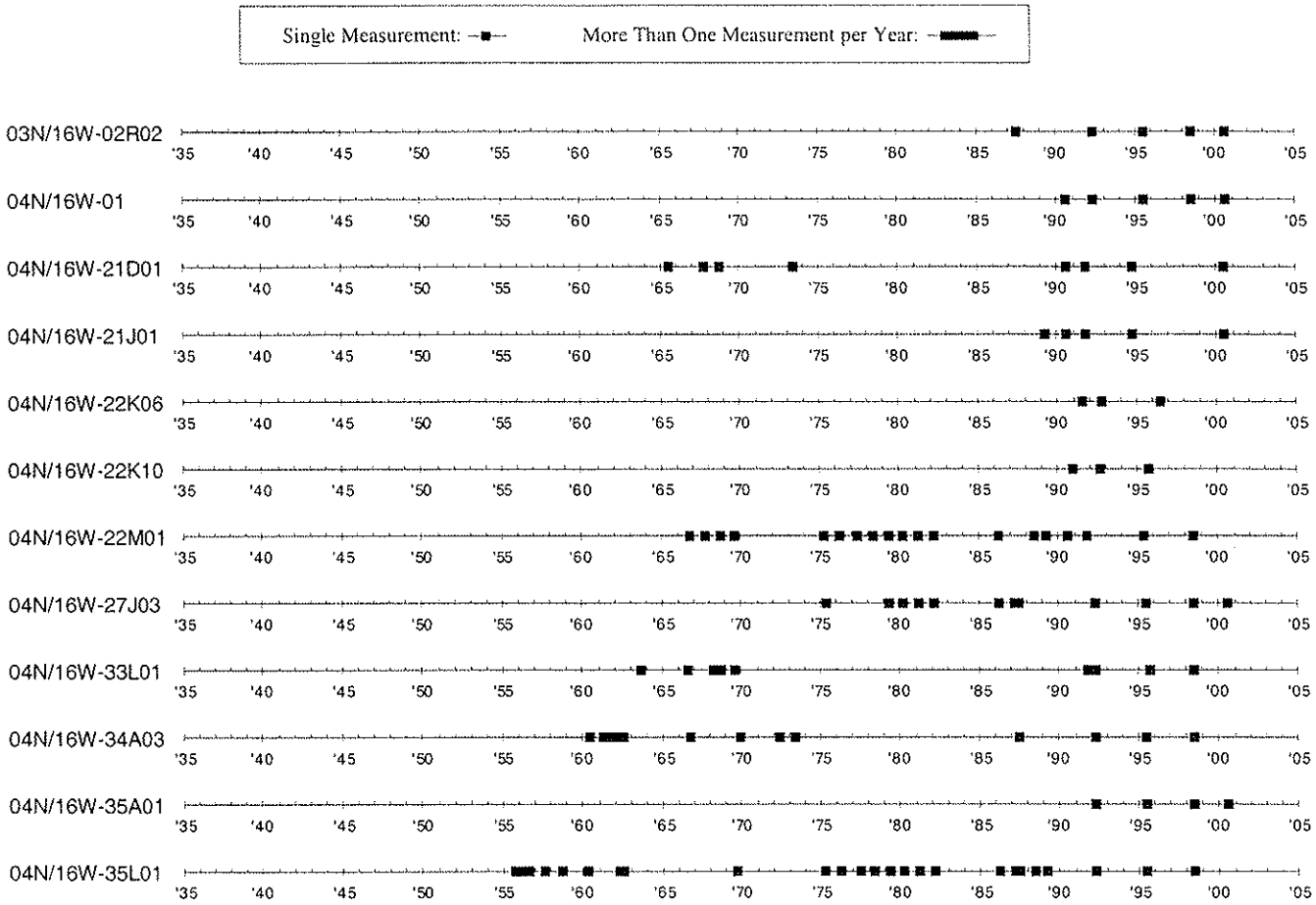
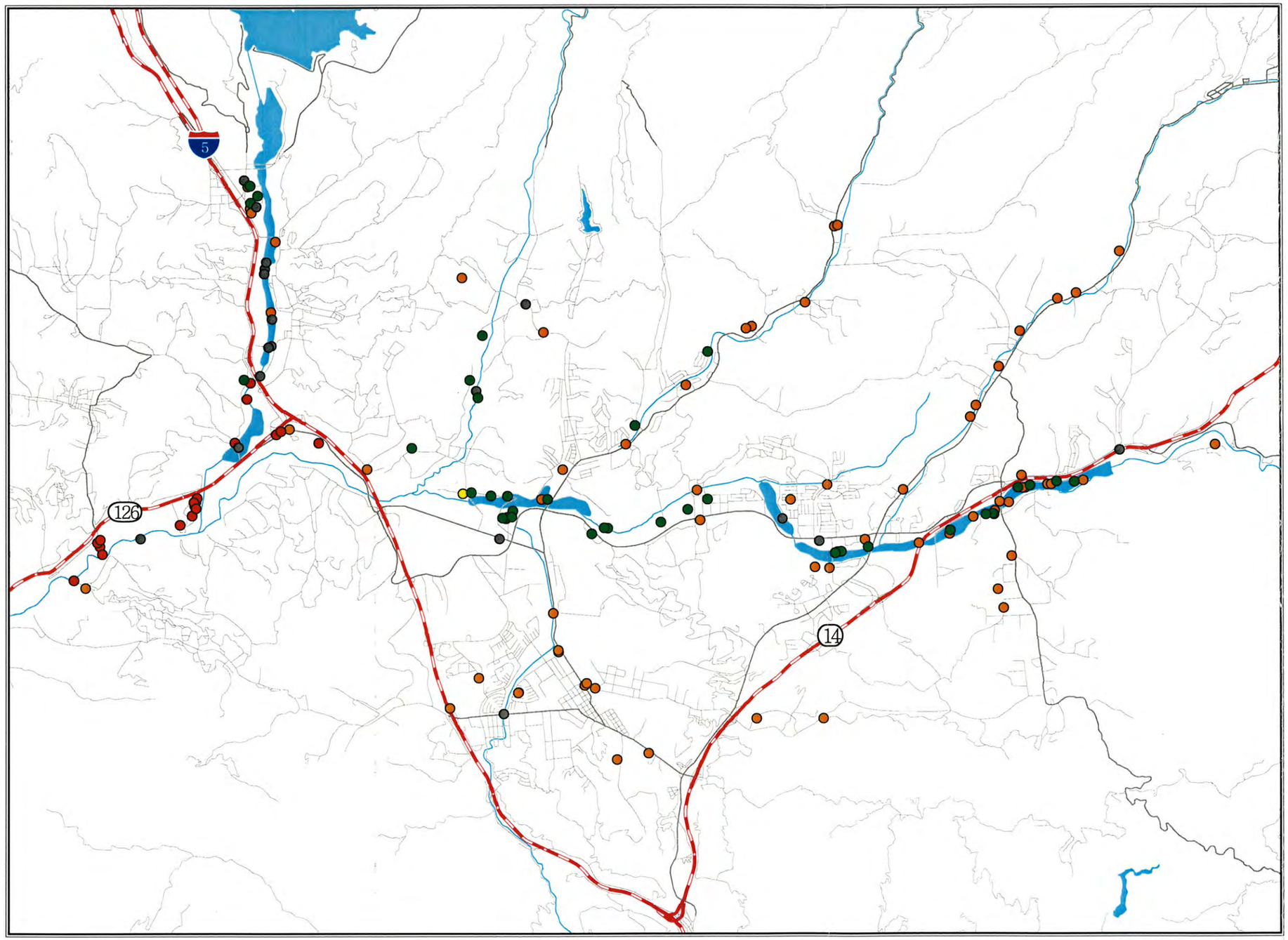


Table A4
Dates of Historic Water Quality Measurements (TDS) in Saugus Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin





LEGEND

- Monthly
- Quarterly
- Twice Yearly
- Yearly
- Unknown Status

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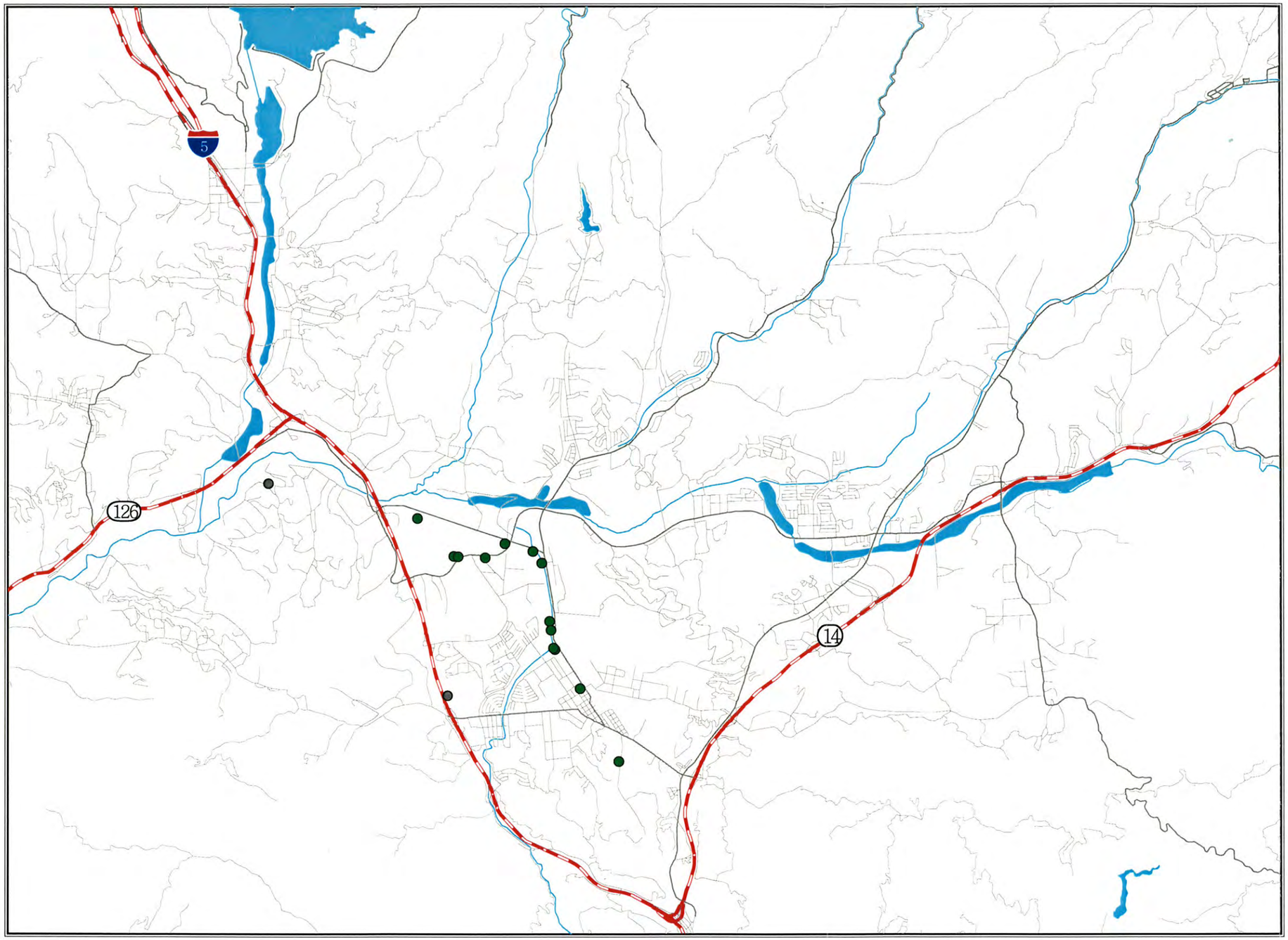
CONSULTING ENGINEERS

Figure A1
Frequency of Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin



LEGEND

- Monthly
- Unknown Status

N
W
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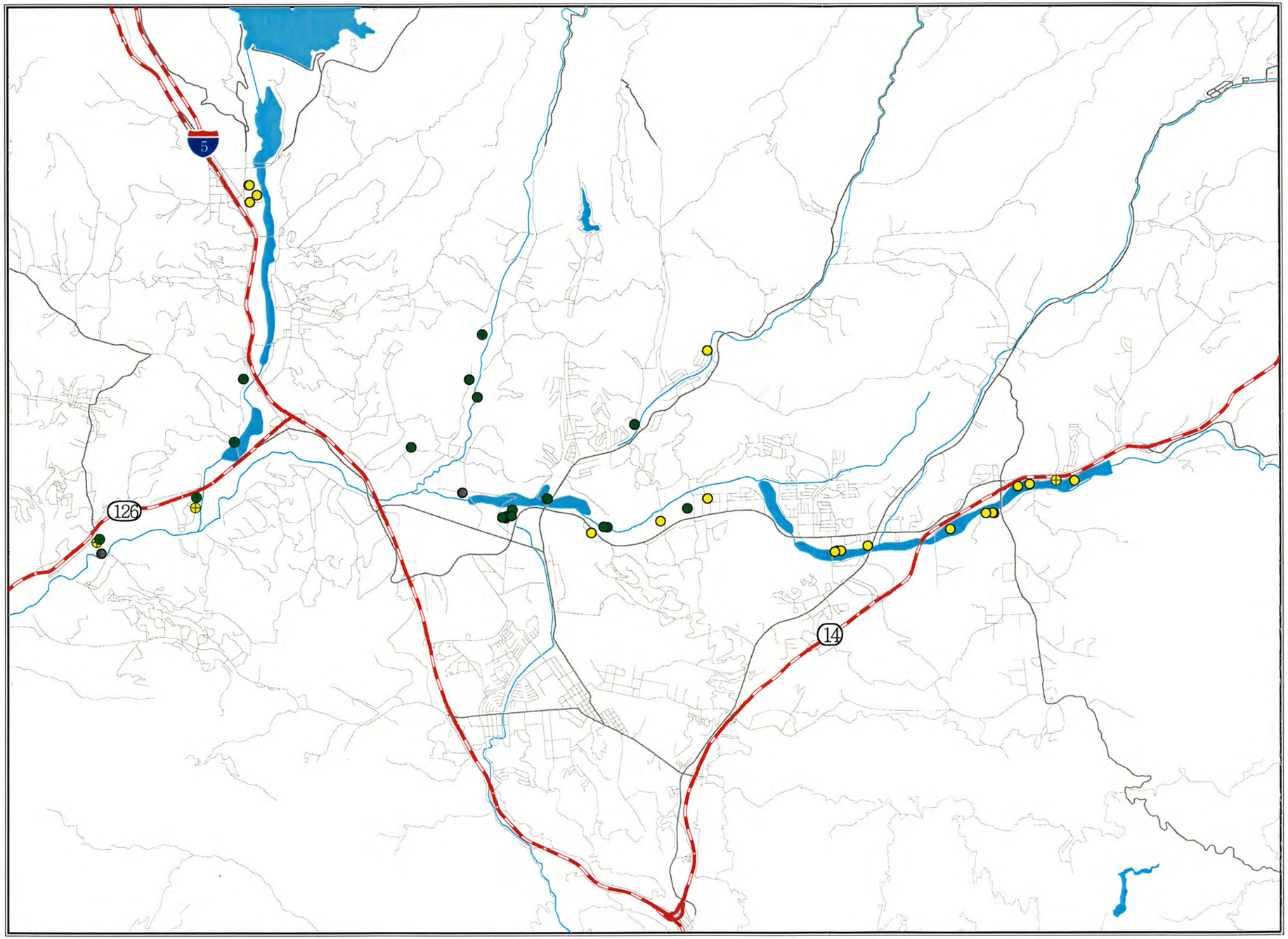
LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure A2
Frequency of Water Level Measurements in Saugus Wells
Santa Clara River Valley Groundwater Basin, East Subbasin



LEGEND

- Every 1 to 3 Years
- Every 1 to 3 Years (through 1988)
- Every 3 Years
- Every 3 Years (through 1988)
- Some Historic

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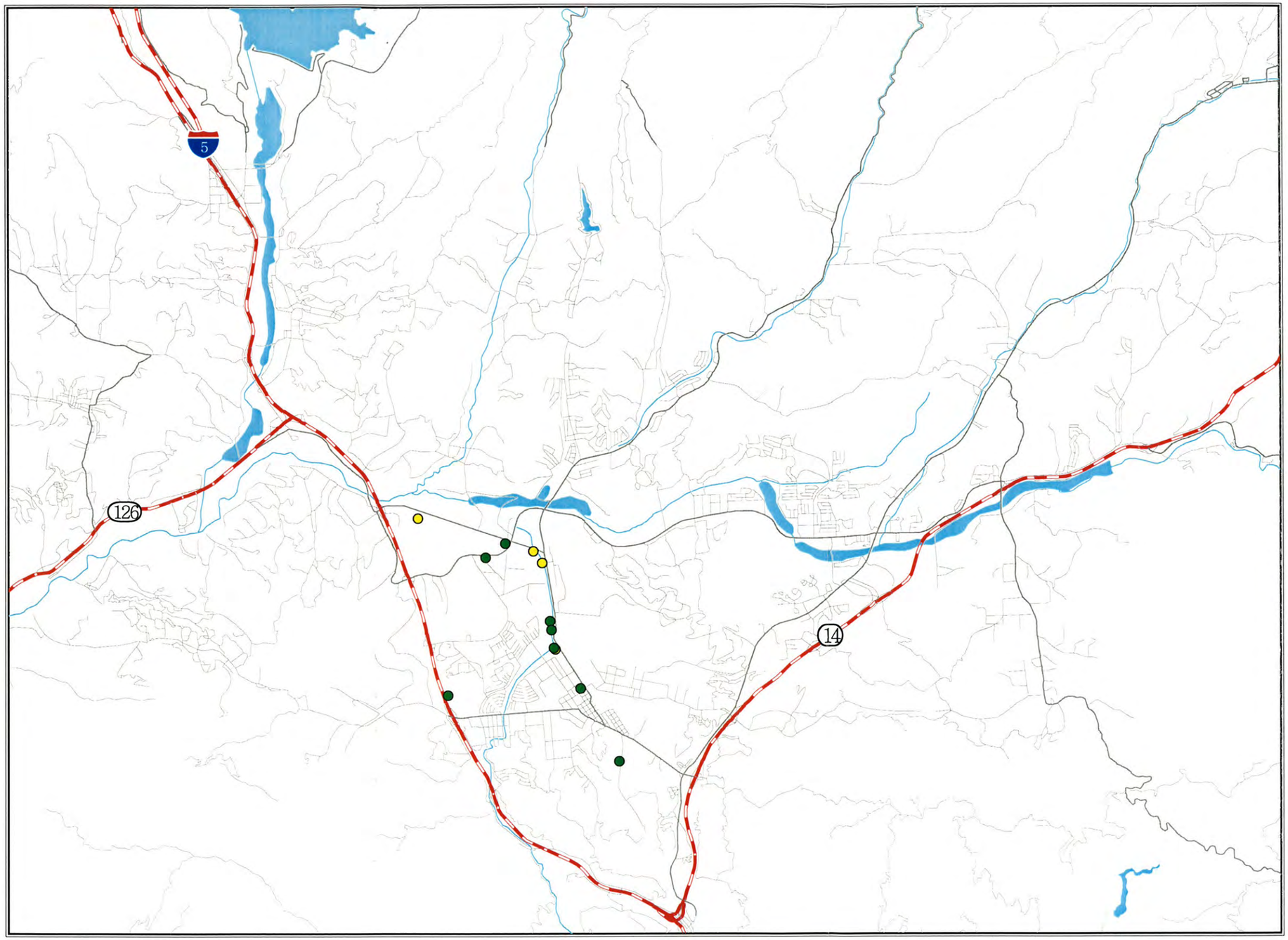
Figure A3
Frequency of Water Quality Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin



LEGEND

- Every 1 to 3 Years
- Every 3 Years

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LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure A4
Frequency of Water Quality Measurements in Saugus Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

Appendix II

Groundwater Management Plan
Public Comments

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
UWCD #5	Under Primary Element 2 related to surface flows, in addition to SWP water contributing to the increased flow of the Santa Clara River, other considerations should be noted (hydrologic cycle, Alluvial pumping).	Primary Element 2	As noted above, discussion of groundwater–related conditions is included in the Plan as a frame of reference for the Plan objectives and elements. Future interpretation and reporting will take such details as the impacts of the hydrologic cycle and Alluvial pumping into account.
Santa Clarita Organization for Planning and the Environment #1	Extensive pumping and lack of protection of recharge areas have resulted in almost complete elimination of surface flows and summer ponding necessary to wildlife as well as causing water level drops in wells that have resulted in water quality and availability problems for small users.	Section III (Groundwater Levels and Storage) and (Groundwater Quality) and Primary Elements 1, 2 and 3	See responses to SCOPE Comments 5, 6 and 9, Sand Canyon Comments 1 and 7, and Sierra Club Comment 3 regarding pumping within basin yield, avoidance of overdraft, preservation of recharge areas, and consideration of riparian conditions.
SCOPE #2	Concern that environmental organizations, small well owners, City of Santa Clarita, LA County, and others were not included on the Advisory Board.	Water Code Appendix § 103-15.1(e)(2)	CLWA legal counsel has confirmed that CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council. LA County was represented by LA Co. WWD #36 and LA County Sheriff's Department
SCOPE #3	The GWMP should include a timeline for completion of the plan components.	AB 3030[2] and AB 134[3]	AB 3030 and AB 134 do not require the inclusion of a timeline.
SCOPE #4	The GWMP is lacking in the review of land use plans and coordination with land use agencies. Land use issues should be given higher priority. This may include a wellhead protection plan.	Water Code § 10753.8(l); Primary Element 9 and Secondary Element 2	Primary Element 9 and Secondary Element 2 have been expanded to further address general preservation of recharge areas and appropriate review of land use plans to protect against potential groundwater contamination.
SCOPE #5	GWMP should address maintaining tributaries in a natural state to enhance water recharge and quality.	This is not explicitly required by AB 3030 but does relate to Secondary Element 2.	Secondary Element 2 has been expanded to address preservation of in-channel recharge areas in both the Santa Clara River and its tributaries.

[2] Stats. 1992, Ch. 947.
[3] Stats. 2001, Ch. 929.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
SCOPE #6	GWMP should find ways to increase water recharge. Water agencies should also coordinate to prevent paving of prime recharge areas.	This is not explicitly required by AB 3030 but relates to Primary Elements 3, 4 and 5 and Secondary Element 2.	Potentially increasing groundwater recharge will be part of Primary Elements 3, 4 and 5. Prevention of paving prime recharge areas is included in the expanded Secondary Element 2.
SCOPE #7	Number One Goal should not be "Development of Local Groundwater for Water Supply" because groundwater has many other important uses (recreational, biological, etc…)	This is not required by AB 3030 or AB 134. See Section II of GWMP.	The text of Section II, Management Objectives (Goals) for the Basin does not indicate a preference of any one objective over the others. The listing is not intended to indicate that any objective will not be attempted; all objectives are intended to be achieved.
SCOPE #8	Agricultural water usage in the GWMP is overestimated with the perennial yield (40,000 afy) estimate higher than that in a Richard Slade report; less agricultural runoff water is available for recharge today.	Section IV (Existing and Projected Water Supplies)	Reported historical agricultural pumping is consistent with all available records. A perennial yield of 40,000 afy is not included or implied in the GWMP. Rather, estimated ranges of 30,000 to 40,000 afy, depending on hydrologic conditions, are included as expected yield from the Alluvium. That range is consistent with historical reports, and with observations of actual Alluvial aquifer response to pumping in that range for at least the last 50 years.
SCOPE #9	Disappearance of year round Santa Clara River flow is indication of overdraft. "There are numerous records and observations by long-time residents indicating that surface flow usually occurred year round."	Section III (Areas of Concern and Identified Problems); Water Code § 10753.8(e).	Disappearance of year round stream flow does not necessarily indicate groundwater overdraft. In fact, stream flow west of Bouquet Canyon is now perennial. Part of implementing Primary Element 1 will be to obtain the "numerous records" of year round stream flow that are noted to have usually occurred.
SCOPE #10	GWMP should disclose the reduction in production capability because of perchlorate contamination.	Primary Element 8; § 10753.8(j).	The GWMP notes the inactivation of wells that have been impacted by perchlorate contamination.
Sand Canyon Area Well Owners Assoc. #1	Groundwater is extensively pumped and recharge areas are not adequately protected; water level in four wells has dropped from 12 ft in 1997 to 93 ft currently.	This relates to Primary Elements 1 and 3, and Secondary Element 2.	The noted groundwater level fluctuations are consistent with those described in Section III and illustrated in Figure 3-2 for the Sand Canyon area. Section III also describes and illustrates the historical recovery from such declines. Avoidance of overdraft, i.e. continuous lowering of water levels, and protection of recharge areas are included in Primary Element 3 and Secondary Element 2, respectively.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sand Canyon #2	Advisory board lacks representation by rural well owners.	Water Code Appendix § 103-15.1(e)(2)	CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council.
Sand Canyon #3	GWMP should include timelines for completing its phases.	AB 3030 and AB 134.	Timelines are not required by AB 3030 or AB 134.
Sand Canyon #4	GWMP is lacking in its review of land use plans and coordination with land use agencies.	Water Code §10753.8(l)	See response to SCOPE Comment 4 above.
Sand Canyon #5	Perennial yield estimates for the Santa Clara River are higher than that provided in a Richard Slade report. Agricultural runoff is no longer a factor; agricultural usage was not metered historically, and former recharge areas have been paved.	Section IV (Existing and Projected Water Supplies)	See response to SCOPE Comment 8 above.
Sand Canyon #6	Santa Clara River should not be defined in terms of percolating groundwater. GWMP should clarify relationship between river and Saugus formation.	Section III	The GWMP is not an appropriate document in which to define the legal classification of groundwater, whether in the Alluvium or the Saugus Formation; consequently, there is no expression in the GWMP to describe the legal classification of groundwater in the basin. The entire focus of the GWMP is management of groundwater toward long-term preservation of both the quantity and quality of the resource.
Sand Canyon #7	GWMP's assertions against existence of overdraft or other undesirable conditions are incorrect since water levels in wells have reached historic lows. In addition, riparian conditions on the Santa Clara River and tributaries show signs of water deprivation.	Section III (Areas of Concern and Identified Problems)	See response to Sand Canyon Comment 1. Further, intermittent fluctuations reaching the equivalent of historic low levels is not overdraft. Primary Elements 1 and 3 are included to monitor groundwater levels throughout the basin, and to operate in an ongoing manner to avoid overdraft. Finally, the statement that riparian conditions show signs of water deprivation is non-specific as to location and is otherwise unsubstantiated. Primary Elements 1 and 2 are included in the Plan to quantify the existence and extent of such conditions, if they occur; Primary Element 3 is included to avoid overdraft- related conditions of the type noted.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sand Canyon #8	GWMP should include reports regarding water contamination from Robinson Ranch. City of Santa Clarita had stipulated that water quality adjacent to the golf course be monitored with results published in a report.	Primary Element 1	See response to UWCD Comment 1 regarding extent of detail regarding occurrence of groundwater as framework for understanding the objectives and elements of the GWMP. As regards this comment, there is no documented groundwater contamination from Robinson Ranch, including that golf course. Required reports on Robinson Ranch have not shown any contamination as alleged in this comment. Monitoring in accordance with Primary Element 1 is intended to detect any groundwater contamination of the nature alleged in this comment.
Friends of the Santa Clara River #1	Disappointed that GWMP's primary goal is "Development of Local Groundwater for Water Supply" because other objectives should include protection of groundwater resources.	AB 3030 and AB 134. Section II of GWMP.	See response to SCOPE Comment 7 above regarding lack of priority for all management objectives, and lack of "primary" status for "Development of Local Groundwater for Water Supply".
Friends #2	GWMP should emphasize that paving of streams reduces recharge and should be avoided. Buffer zones around streams should be discussed.	This is not explicitly required by AB 3030 but relates to Primary Elements 3, 4 and 5 and Secondary Element 2.	See response to SCOPE Comments 4, 5 and 6. Further, given the importance of in-channel recharge to the yield of the Alluvium, a priority in implementation of the Plan can logically be expected to be avoidance of paving stream channels.
Friends #3	Advisory Board should include representatives from environmental groups and county agencies.	Water Code Appendix § 103-15.1(e)(2)	CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council.
Santa Clarita Sierra Club Group #1	GWMP should include timelines for completion of components.	AB 3030 and AB 134.	Timelines are not required by AB 3030 or AB 134

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sierra Club #2	GWMP does not account for loss of groundwater from perchlorate contamination. "The numbers do not adequately represent the real water supply."	Primary Element 8; Water Code §10753.8(j)	See response to SCOPE Comment 10 regarding the inactivation of wells impacted by perchlorate contamination. The inactivation of certain wells impacts pumping capacity until the wells can be reactivated, with treatment if necessary, or replaced. However, perchlorate contamination does not reduce the available yield of the aquifer system; hence, the numbers included in the GWMP accurately reflect the current state of water supply.
Sierra Club #3	Loss of groundwater due to development and pavement is not considered. GWMP must address coordination of land use with water necessities.	This is not explicitly required by AB 3030 but relates to Primary Elements 3, 4 and 5 and Secondary Element 2.	See responses to SCOPE Comments 4 and 6. Further, there has been no "loss" of groundwater due to development or pavement; groundwater conditions remain as generally described in Section III, with nearly constant water levels to the west and repetitive fluctuations to the east (see response to Sand Canyon Comment 1).
Sierra Club #4	Drought planning is inadequate as it fails to take account of loss of primary water sources and reclaimed water.	Primary Element 3, 4, 5 and 7.	Drought planning is embedded in the GWMP in that the Plan is intended to result in groundwater management that ensures adequacy of groundwater supplies through both wet and dry (drought) hydrologic cycles. While "drought planning", per se, relates more specifically to overall water supply planning, of which groundwater is only one component, this Plan is intended to manage groundwater in such a way that it will be a reliable component of overall water supply through dry periods without being overdrafted on a long-term basis, e.g. through wet/normal periods that follow dry periods. Primary Elements 3, 4, 5 and 7 in the Plan relate to drought planning as well as parts of groundwater management through long-term fluctuations in hydrologic conditions.
Sierra Club #5	GWMP does not adequately discuss maintaining river and tributary habitats. Sierra Club supports a citizen monitoring program for water quality.	This is not explicitly required by AB 3030 but does relate to Secondary Element 2.	See response to SCOPE Comment 5 and Friends Comment 2.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sierra Club #6	CLWA should involve the public and other government and private entities in its water supply planning.	Water Code Appendix § 103-15.1(e)(2)	CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council.
Ed & Joan Dunn #1	Concern because CLWA did not hold more public meetings before release of draft. Concern whether CLWA has regularly met with Advisory Board.	Water Code § 10753 et seq.	CLWA has complied with all requirements thus far regarding public meetings and gone beyond that legally required.
Dunn #2	Doubt regarding replenishment of water in the Alluvial Aquifer.	Primary Elements 3, 4 and 5	Fundamentally, as discussed in the Plan, the long-term objectives for the basin include utilizing groundwater for water supply while not overdrafting the basin. As also discussed in the Plan, historically, in the western part of the basin there has been sufficient water for recharge to maintain an essentially full basin throughout both wet and dry hydrologic periods. Part of the reference to "sustain recharge" relates to that historical condition. Whether or not additional artificial recharge will be implemented in other parts of the basin, and what water sources might be used for such recharge, are to be addressed via implementation of the Plan, particularly Primary Elements 3, 4 and 5.
Dunn #3	Doubt over Richard Slade's assertion as to Alluvial Aquifer capacity.	This challenges evidence which the GWMP cites.	The analysis and determination of the storage capacity of the Alluvium has been exhaustively described in Slade's reports. The comment conveys no specific aspect of its "question"; the commentors are referred to Slade's reports, which address the storage calculations in proper technical detail.
Dunn #4	GWMP should state that SWP water was interrupted for 6 months in 1991. Newspaper clipping is provided for this point.	Primary Elements 3, 4 and 5	Primary Elements 3, 4 and 5 are included in the GWMP to ensure the maximum reliability of local groundwater in order to endure any future drought-related impacts on SWP deliveries, such as occurred in 1991.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Dunn #5	Statement in GWMP that no wells exceeded DHS action level for perchlorate is false. Newspaper clippings provided.	Section III (Groundwater Quality)	The Plan has been revised to reflect that, while there remains no primary or secondary drinking water standard for perchlorate, and although only some of the detected concentrations of perchlorate in the Saugus wells exceeded the Action Level established by the State Department of Health Services at that time (18 ug/l), all those wells were inactivated by their respective owners after detection of perchlorate; those wells remain out of municipal water supply service since then.
Dunn #6	Statement that perchlorate contamination has not reduced groundwater capacity is misleading.	Primary Element 8	See response to SCOPE Comment 10 and Sierra Club Comment 2.
Dunn #7	The Urban Water Management Plan should not be referred to because it is under legal attack.	While it has been challenged, the UWMP is still a valid document.	While it has been challenged, the UWMP is still a valid document and represents the current plan for urban water supply through its 20 year planning horizon. The Kern County Superior Court in February 2003 ruled completely in favor of the water suppliers in their defense of the UWMP litigation. The remaining petitioners have appealed.
Dunn #8	The Saugus Formation does NOT underlie the entire CLWA service area.	Section I (Santa Clara River Valley Groundwater Basin)	The text of the Plan has been revised to reflect that the Saugus Formation underlies much of the CLWA service area.
Dunn #9	GWMP should state CLWA's inability to transport additional SWP to Santa Clarita Valley.	Section IV (Existing and Projected Water Supplies)	CLWA does not have an inability to transport additional SWP water to the Santa Clarita Valley. Fundamentally, the comment is erroneous since the State conveys SWP water to CLWA's diversion points from Castaic Lake; from there CLWA has sufficient treatment and conveyance capacity for its current water demands, and is in the process of designing additional treatment plant capacity to treat and distribute additional water to accommodate projected increased demand.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Dunn #10	CLWA's recycled water program is for private business only, not public agencies.	Primary Element 7	The recycled water program has no restrictions against use by public agencies. As described in Primary Element 7, the integration of recycled water to meet some non-potable demand is expected to decrease overall demand for potable water by up to 17,000 afy. As public agencies develop capabilities to utilize recycled water for non-potable uses, they are expected to reduce potable water demands by integrating recycled water into their overall water delivery systems. Finally, recycled water service to a specific user or area frees up potable water supplies for other users or areas, thus enhancing the reliability of the overall water supply of the Valley.
Dunn #11	Groundwater production from both the Alluvium and Saugus Formation is overstated.	Section IV (Existing and Projected Water Supplies)	The comment is unsubstantiated and includes no support in the form of records or other data to validate it. The historical use of groundwater reported in the Plan is based on a combination of metered pumping and indirect estimation of pumping based on metered power consumption and pump performance testing. There is no basis for claiming that reported groundwater production is "overstated".
Dunn #12	CLWA should develop an emergency plan.	Primary Elements 3, 4 and 5	Development of an emergency plan, presumably an emergency water supply plan, is beyond the scope of a GWMP. However, Primary Elements 3, 4 and 5 are intended to further develop both a regular and a dry year/emergency component of water supply from local groundwater.
Dunn #13	Chart depicting SWP water received in 1991 is erroneous. Newspaper clipping provided.	Figure 4-1	The final 1991 M&I allocation was 30% (October 1991). CLWA's M&I entitlement at that time was 41,500 af. The total amount made available to CLWA by DWR was 13,050 af. Since by October, CLWA and the retail purveyors had already instituted emergency operations, the entire amount was not used.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Dunn #14	Claim that CLWA meetings with retail water purveyors, the City, and UWCD have not occurred.	Primary Element 9	The Commentors' lack of knowledge of such meetings does not mean they have not occurred. Appropriate documentation of such meetings, including presentation materials, discussion topics, and resultant work assignments, are maintained by meeting participants.
Dunn #15	Secret meetings and secret reports related to Primary Element 10 should not be included as part of the GWMP.	Primary Element 10	The preparation of the annual Water Reports does not indicate that any secret meetings have taken place. Previous Water Reports have been prepared, and future Water Reports are envisioned to be prepared with few, if any, meetings of any type; both public and private meetings have been convened to present and discuss the findings of the various Water Reports, and such meetings are intended to occur in the future for the same purpose.
Dunn #16	CLWA should provide an accounting of water conserved.	N/A	Providing an accounting of water conserved is beyond the scope of the GWMP. More water sales are occurring through time due to increasing demand in the Valley. Water conservation measures result in water savings even though demand is increasing.
Diane Trautman (City Planning Commissioner) #1	What percentage of water demand will be drawn from local groundwater?	Primary Element 5	In terms of groundwater management planning, projected urban water demand (the 106,000 afy projected urban demand in 2020) does not represent total valley-wide demand; total projected demand is 113,100 afy, including both urban and agricultural. In that light, on an average basis, local groundwater is expected to be utilized to meet about 40 percent of total water demand.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #2	Will pumping of the Alluvial Aquifer reduce recharge of the Saugus Formation and reduce water that can be produced from the Saugus Formation during dry periods?	Primary Elements 3, 4 and 5	No. Since the Saugus Formation is recharged over a much larger area, beyond the spatial extent of the Alluvium, there is a limited relationship between Alluvial pumping and recharge to the Saugus Formation. The fundamental tenet of the GWMP is to utilize groundwater for water supply within its sustainable yield (see the Management Objectives, or Goals, for the Basin, GWMP Section II; see also the various GWMP Elements intended to achieve those objectives, GWMP Section V). In that light, it is expected and intended to operate in such a way that recharge to the Saugus Formation will not be "reduced" by pumping from the Alluvial Aquifer and that groundwater will be available in varying amounts, as needed depending on weather year-types, within the sustainable yields of the respective aquifers (i.e. without overdrafting them).
Trautman #3	Does CLWA have sufficient data regarding the Alluvial Aquifer and Saugus Formation; if not, how will it obtain such data?	Section III and Primary Element 1.	The reference to "useful amount of groundwater quality data" in the GWMP includes both Alluvial and Saugus data. However, due to the historically greater development and use of groundwater from the Alluvium (number and distribution of wells, volume of pumping), and due to the historically smaller development and use of the Saugus Formation (fewer wells, smaller geographical distribution of wells, smaller pumpage), there is comparatively limited ability to examine relationships among pumping, recharge, and quality in the Saugus Formation. CLWA and the other purveyors intend to expand the overall knowledge of the Saugus Formation as that resource is further explored and developed (number of wells, additional sampling as new wells are added, etc.). All that data will be included in ongoing implementation of GWMP Primary Element 1, Monitoring of Groundwater Levels, Quality and Production.
Trautman #4	The 2002 Water Report indicates that "there are limited Saugus (Formation) water level data." Does CLWA plan to collect more comprehensive data on the Saugus Formation?	Section III and Primary Element 1	The "limited nature of Saugus water level data" is a result of the same smaller extent of historical Saugus development described in the preceding answer. Acquisition of additional data on the Saugus Formation is planned as also described in the preceding answer.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #5	Is CLWA sharing detailed information with the City of Santa Clarita regarding contamination risks in relation to existing closed wells?	Primary Element 9	All publicly available information regarding the investigation of perchlorate contamination, its extent, its impact on water supply, and plans for cleanup, control of migration, etc. is available to the City. Representatives of CLWA and the purveyors meet routinely with City representatives to review the status of perchlorate cleanup and remediation activities. CLWA and the impacted water purveyors will continue to pursue control and cleanup of perchlorate contamination in order to restore impacted groundwater pumping capacity and to ensure the long-term quantity and quality of groundwater in accordance with the GWMP. As a practical matter, there are no surface contamination risks relating to perchlorate that would affect land use development adjacent to the impacted wells.
Trautman #6	Where is the Stadium Well located?	Section IV (Groundwater Quality)	The Stadium Well is located on the south side of the Santa Clara River, approximately two miles upstream (east) of its confluence with the South Fork tributary, or about 4,000 feet east of the Bouquet Canyon Road crossing of the Santa Clara River.
Trautman #7	Why isn't conservation a primary element (instead of secondary) since it may reduce water demand by 10%?	Secondary Element 1	The assignment of "primary" or "secondary" status to any GWMP element is discretionary and certainly not absolute. Secondary status is not intended to indicate that any element of the GWMP will not be implemented; all elements are intended to be implemented. Final status of all GWMP elements will be reviewed by the Advisory Council and the CLWA Board.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #8	How is CLWA delivering recycled water?	Primary Element 7	Recycled water is being delivered to the TPC golf course, the first customer of the system, via the dedicated, recycled water distribution system, which is also capable of delivering water to other non-potable water users, and which will be expanded in accordance with the Draft Recycled Water Master Plan. The costs and time frame for expanding recycled water distribution and use are included in the Draft Recycled Water Master Plan, which is complementary to, but beyond the scope of the Groundwater Management Plan. The intent is to develop 17,000 afy of recycled water use by 2020. The capital cost of the complete system is estimated to be $68 million, and will be funded through CLWA's connection fee program.
Trautman #9	How is recycled water reprocessed?	Primary Element 7	Recycled water is not "reprocessed" at points of use such at the TPC golf course. In general, recycled water is highly treated (tertiary treated) waste water. In the case of the Santa Clarita Valley, treatment already occurs at the Valencia Reclamation Plant operated by the Sanitation Districts of Los Angeles County. The treated water, ready for non-potable use, is distributed from the plant site in a dedicated transmission pipeline system to end users such as the TPC. Pesticide and fertilizer uses, as part of cultural practices at end-user locations such as golf courses, are discretionary actions of the respective end users of recycled water.
Trautman #10	What is the average per capita water usage?	N/A	Most water agencies no longer use "per capita" water use as a standard because it is not an accurate representation of actual per person water use, mainly due to the effects of landscape and commercial/industrial water use. (It is also expressed in "gallons per day," rather than "acre-feet per year," since it refers to individual water usage.) In general for the South Coast hydrologic region of California, water use is approximately 200 gallons per person per day (DWR Bulletin 160-98). Per capita use for the Santa Clarita Valley is slightly higher due to landscape irrigation demands caused by local climatic conditions.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #11	The Semitropic Water Bank/Transfer is not mentioned in discussion of the Supplemental (SWP) Surface Water on page 21. Is that because it is a relatively short-term water supply? Are any of the other water transfers – Kern Water Bank, Kern Delta Water, North Las Posas Water Bank – as listed on UWMP p. 2-16, of limited duration? And if the Semitropic Water Bank Transfer is short term, how can it be included in the 105,000 – 106,000 afy need projected for the next 20 years? What will take its place?	Section IV (Existing and Projected Supplies)	The SWP is referred to as "supplemental" water because that is the original purpose of the SWP: to serve as a supply that would "supplement" local supplies (whether groundwater or local surface water or both). The specific amounts referred to in the GWMP are from the contractual terms between CLWA and the California Department of Water Resources. The water banked in the Semitropic Water Storage Program during 2002 is a short-term, dry period supply. The program has a term of ten years (i.e., the water must be returned to CLWA for use in its service area within that time period). Thus it is not included as a supply for long-term needs. However, the other programs listed in the UWMP (most of which, by the way, are not water "transfers," but are instead groundwater banking programs) are long-term sources of supply. CLWA is in the process of designing and implementing a Long-Term Reliability Plan to begin bringing such long-term programs on line as a means to store water available in wet years, for use in later dry years. CEQA analysis, with its accompanying public comment opportunities, will be part of the long-term reliability program approval process.
Trautman #12	What specific efforts will be made to manage salinity?	Primary Element 6	Primary Element 6 – Long Term Salinity Management is included in the GWMP for the reasons presented in the text discussion of that element. The element recognizes the need to plan for salinity management but also recognizes that, to the present, there has been no extraordinary trend of salinity increase. Hence, there are no specific efforts currently in place to "manage" salinity. It is envisioned that specific efforts will be developed over time in response to implementation of the GWMP and, in particular, its Primary Element 6. CLWA is participating in efforts by the Sanitation Districts of Los Angeles County to address the Los Angeles Regional Water Quality Control Board's proposed TMDL standard for chloride in the Santa Clara River. This effort is separate from and beyond the scope of the Groundwater Management Plan.

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UNITED WATER CONSERVATION DISTRICT

"Conserving Water Since 1927"

August 7, 2003

Dan Masnada
Castaic Lake Water Agency
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Santa Clarita, CA 91350

Re: Response on Draft Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Sub-basin

Thank you for giving us the opportunity to review and comment on your *Draft Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Sub-basin*. United Water considers this plan as one piece of a broader effort at groundwater management that is being accomplished as part of the Memorandum of Understanding between United Water and water purveyors in the Santa Clarita area. We offer some specific comments and suggestions for your consideration.

Comments include:

Figure 3-2. The vertical and horizontal scales associated with the hydrographs are very difficult to read. The T4N/R17W, Section 22 well, in the western arm of the Alluvial Aquifer does not show data from approximately 1983 through 1991. In previous reports and analyses, the NLF #C5 well was used for this area. This well depicted variable groundwater levels for the period from the mid-1980s to the early 1990s. Because this is the discharge area of the Alluvial Aquifer to the Santa Clara River, we need to understand the response of the system to the onset of agricultural pumping in this area in the mid-1980s. The T4N/R17W, Section 22 well does not possess the data needed to show that response;

Page 15. The comment near the top of the page that "*over the last 35 years, groundwater quality in the Saugus has remained generally constant*" would be more supportable if it was accompanied by a groundwater quality map similar to Figure 3-3, with a few groundwater quality time-series specific to the Saugus Formation;

Figure 5-3. The average daily mean streamflow data appears to be shifted one year on the histogram graph. As an example to show the error, the histograms suggest that there were high flow years in 1968 and 1997. The high flow years were actually 1969 and 1998;

UNITED WATER CONSERVATION DISTRICT

Page 21. Local Groundwater. The planned production of 30,000 to 40,000 acre-feet per year from the Alluvial Aquifer and 7,500 to 15,000 acre-feet per year from the Saugus Formation, along with 10,000 to 20,000 acre-feet per year from the Saugus in dry years, has yet to be implemented. The current development of a regional transient groundwater flow model for the East Sub-basin is for the expressed purpose of evaluating the potential impacts to the basin and surface water outflow into Ventura County, to this increased pumping. Irrespective of the modeling results, only real groundwater and surrface water data can verify the influence of significantly increased pumping within the sub-basin; and

Page 26, Primary Element 2 – Monitoring and Management of Surface Water Flows and Quality. While imported SWP water no doubt contributes to the observed increased flow in the Santa Clara River at the Ventura County line, there exist additional explanations for a portion of the increased flow. Other considerations include:

1. Influence of the hydrologic cycle. The cumulative departure for precipitation was declining during the 1950s and first half of the 1960s. The cumulative departure improved significantly during the period of 1978 through 1986; and
2. The amount of Alluvial Aquifer pumping may influence flow at the Ventura County line. During the latter half of the 1960s and through the 1970s, groundwater pumping of the Alluvial Aquifer declined by 70%. Pumping during the 1980s was 30% lower than during the 1950s and early 1960s.

In this particular case, it would be very difficult to differentiate between the influence on streamflow from changes to groundwater pumping and the hydrologic changes.

If you have any questions about United Water's comments, please contact Steve Bachman at (805) 525-4431.

Sincerely,

Dana L. Wisehart

Dana L. Wisehart
General Manager

cc: BRRF
Lowell Preston, Ph.D., Ventura County Water Resources Division

File: Castaic Lake Water Agency
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SCOPE

Santa Clarita Organization for Planning and the Environment

TO PROMOTE, PROTECT AND PRESERVE THE ENVIRONMENT, ECOLOGY AND QUALITY OF LIFE IN THE SANTA CLARITA VALLEY

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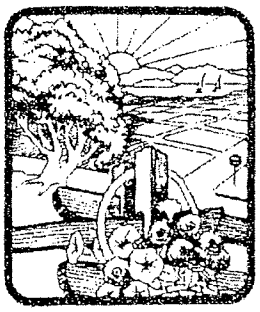

8-6-03

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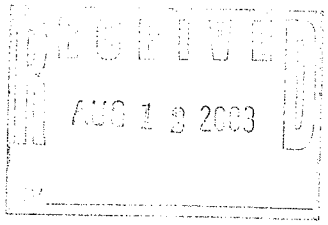
Santa Clarita, Ca. 91350
Faxed to 661 297 1611 Hard copy to follow via regular mail



Re: Comments on Ground Water Management Plan

Dear Sirs:

Thank-you for the opportunity to comment on your plan. We are pleased that your agency has begun a ground water management plan in response to the community's concerns over the excessive use of ground water. This extensive pumping and lack of protection of re-charge areas has resulted in almost complete elimination of surface flows and summer ponding necessary to wildlife as well as causing water level drops in wells that have resulted in water quality and availability problems for small users.

General Areas of Concern

We regret that environmental organizations, small well owners, the City of Santa Clarita, the County of Los Angeles (watershed and flood control divisions), Regional Water Quality Control and other members of the community interested in water issues in our valley were not included on your advisory board. We believe that inclusion of these groups early on would have helped resolved some of the issues with your plan at an earlier stage. Including only the water companies, Newhall Land and Robinson Ranch effectively excluded many of the groups and individuals that have voiced strong concerns over your present actions. The water agencies have consistently excluded these groups from all water planning, including water supply reports and the Urban Water Management Plan process. We strongly suggest that a more inclusive committee be formed to include representatives of the environmental community and rural well owners who are now being affected by overdraft of the Santa Clara River.

We also note that there are no timelines for completion of any of the components of the plan. Without such timelines, it would seem that there is little real intention or commitment to follow through on the various parts of the plan.

The Land Use/Wellhead Protection Component of the Groundwater Management Plan

Perhaps the most significant out come of a ground water management plan in the Santa Clarita Valley would be implementation of the portion of Section 10753 which requires review of land use plans and coordination with land use agencies. Your plan assigns this area to

"secondary element 2", an indication that you do not intend to pay much attention to this important component.

The coordination of land use and water planning has been sadly lacking in the Santa Clarita Valley. A simple wellhead protection plan would help decision makers understand the potentially polluting impacts of certain land uses such as gas stations, auto repair shops, etc. and how they could negatively affect our water supply. Instead, these uses are routinely permitted next to water supply wells.

Paving over of prime re-charge areas is allowed without a word of protest from the water agencies, even though such loss of recharge capacity will severely affect water availability. Recreational uses should be encouraged in recharge areas that will accommodate and perhaps even enhance water re-charge and thus increase water availability.

Newhall County Water District began a well head protection program and educational presentations with its ground water management plan in the mid 90's, but efforts to both educate the planners and protect re-charge and water supply wells have been stifled by the strong developer involvement with water agency decisions. This involvement has precluded advocacy of long term decisions that would protect water availability and water quality in favor of short term profits for development companies.

The ground water management plan should stress the importance of avoiding the concreting of tributaries when approving new land uses and require adequate set back from natural water courses to allow those blue line streams to remain in a natural state. This will enhance water re-charge (and thus, ensure water availability). It will also aid water quality because riparian vegetation absorbs many pollutants before they can enter the ground water system.

It is an indication of the myopic view of the water agencies that this plan states its number one goal to be "Development of Local Groundwater for Water Supply". There are many other uses of ground water and surface water which are important to the community. These include recreational and aesthetic values, biological value and the quality of the water supply. More pumping will result in diminution of all these other aspects of our ground water resource and ignore the strong protests and demands for their protection which are already being heard from many voices in the community.

Monitoring of Ground Water and Surface to Establish Safe Yield

Agricultural Water Usage is Overestimated

In its presentation, Luhdroff and Scalmanini revise the previous perennial yield estimate of the Santa Clara River by Richard Slade (perennial yield 32,000 AF, Hydrology of the Alluvial Sediments of the Santa Clara River, 1988, page 109) to approximately 40,000 AF. This revision is based in part on an average agricultural usage from the 1940s to the 1960s. We believe that these calculations are incorrect for three reasons.

1. No inclusion of recharge from agricultural run off was included in the usage calculations as was included in previous reports. Agricultural run-off was a substantial source of re-charge to the river that no longer exists, therefore not as much water is available for extraction.

2. Agricultural withdrawal was not metered, so water usage is merely an estimate based on crops and weather. It appears that estimates of withdrawals may have been over-stated.
3. Agricultural lands provided a source of re-charge during wet years. Urbanization has paved over most of this area, so re-charge is no longer occurring. This will reduce that amount of recharge to the river alluvium and thus reduce the amount available for extraction. (Slade, 1988, Hydrological Investigation of the Perennial Yield of the Alluvial Aquifer, page 88)

These evaluation errors have caused the water companies to believe that they can withdraw a higher amount of water than can actually occur without causing impacts to public trust matters and small well users

Monitoring and Managing Surface Water Flows

Visual Historical Evidence has been ignored

There are numerous records and observations by long-time residents indicating that surface flow usually occurred year round. Ponding that harbored fish and amphibians (many of which are listed as threatened or endangered) in areas that did not support year round flow has also been attested to by local residents. The disappearance of year-round flows and ponding is an indication of overdraft of the alluvial system. The impacts to riparian life and water quality are substantial. A goal of returning or replacing these summer surface waters should be incorporated in your plan. Such replacement may help to avoid potential future litigation brought to enforce the Endangered Species Act.

Water Quality Monitoring

Water Pollution

We appreciate that the water agencies have finally admitted that 5 municipal wells are closed and that there is a concern that the pollution plume is moving in a westerly direction (Plan at page 32). It is very regrettable that these facts were not disclosed to decision makers over the past several years and, further, were even denied by representatives of the water agencies.

However, we believe it is imperative that this plan additionally include a disclosure of the current reduction in production capability due to pollution of the Saugus and alluvial aquifer by ammonium perchlorate. Continued pumping may extend the pollution plume and increase clean-up costs. It is important that the extent of the problem be honestly outlined for the public so that alternative remedies may be devised and discussed. Failure to disclose the extent of the pollution problem and its real impact may lead to serious water quality problems if the Saugus aquifer is relied upon for drought supply.

Conclusion

We submit the following recommendations

1. We encourage CLWA to re-form its advisory committee to be inclusive of the community and other local agencies.

2. We suggest that the goals of the plan be re-ordered to place land use issues in a position of significance, and include recommendations from other agencies, organizations and individuals that might enhance water availability and water quality.
3. A time line must be established, financial commitment discussed and responsibility assigned so that the water management goals will actually be attained.

Sincerely

Pat Saletore

Pat Saletore

Cc: City of Santa Clarita
County of Los Angeles
Regional Water Quality Control Board
Local Newspapers

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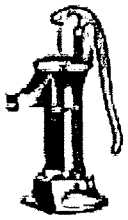

Sand Canyon Area Well Owners Association
c/o 27363 Sand Canyon Road
Santa Clarita, CA 91387-3632

August 8, 2003

Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350-2173

RE: Groundwater Management Plan ("AB 3030 Plan")

Gentlemen:

This letter is in response to your letter of June 16, 2003 which solicited comments about the above plan to ensure that the general public has had the opportunity to provide input on this local effort to manage our community's groundwater resources.

We are pleased to respond to your request for public participation. As well using residents of the Sand Canyon area who are affected by ground water use and plans for future use of it, we feel that our interests are very much at stake in determining how our river and ground water is to be used.

Our first and foremost concerns are that both river and ground water is being extensively pumped and that recharge areas are not being adequately protected. Surface flows and summer ponds have virtually vanished from our vicinity. In 1997, the water level in four wells adjacent to Sand Canyon Creek stood at twelve feet. As of last month, those same wells' water level now stands at ninety-three feet.

Other general concerns include the lack of representation on your advisory board by rural well owners. While water companies and the Robinson Ranch Golf Course have their own interests in how our community's water resources are used, many small well users have an equally valid interest in seeing that our area's water resources are managed in an equitable fashion that ensures no entity's use will result in the deprivation of others.

Also, none of we Sand Canyon area small well users have been consulted during the creation of water supply reports or the Urban Water Management Plan, despite the fact we are being affected by an increasingly serious overdraft of the Santa Clara River. Including members of our group in a groundwater management committee will bring important stakeholders to the planning process. We have important data to present.

It is disappointing to note that the ground water management plan specifies no timelines or dates for executing and completing its phases. We question whether there is sincere intent to carry out the plan given the lack of work plan.

On a broader scale, we are deeply concerned about the plan's land use and wellhead protection sections. Section 10753 calls for a review of land us plans and coordination with land use agencies, as stipulated in secondary element 2 of the plan. A critically important aspect of effective ground water management, such coordination has not taken place to any meaningful extent in the Santa Clarita Valley, and more specifically, in the Sand Canyon area. We have noted with dismay that vital recharge areas have been built upon and paved over with no comment from any water agencies, despite an obvious impact on water availability for all water users, particularly small well holders.

While intelligently planned development is meant to result in well designed, livable communities where all inhabitants are assured of fair access to resources, we note that ongoing strong developer involvement with water agency decisions has led to the potential compromise of water availability and quality in exchange for near term profits for developers and increased tax revenues for local governments.

In the draft plan's sections that deal with ground water monitoring to establish a safe yield, we believe that estimates of agricultural water consumption are not accurate. In Richard Slade's 1988 perennial yield estimate of the Santa Clara River, he stated on page 109 that it was approximately 32,000 acre-feet. Yet Luhdroff and Scalmanini raise this estimate to 40,000 acre-feet. They base their calculations on data measured for agricultural operations between the 1940's and 1960's.

Since our membership includes individuals who have farmed a large parcel in the Sand Canyon area from 1951, we feel qualified to comment on the above figures.

First, agricultural usage during the reference years was never metered. Usage during this period is estimated based on available crop reports (when they were recorded) and available weather data. A reading of withdrawal estimates raises a suspicion that they are overstated.

Second, the upward revision of Slade does not include agricultural runoff. Since agriculture in our area has virtually disappeared, it is no longer a contributing factor to aquifer recharge. Yet earlier estimates included agricultural runoff, a significant source of recharge.

Third, land in our area that previously was planted in both irrigated and dry land crops has now been paved over. During rainy years, farm fields were an important component of recharge, since rain soaked into them. Slade specifically mentions this reduction of extractable water on page 88 of his 1988 report.

Flawed calculations like these have caused water companies and other institutional users to think that they can extract more water than they can and should without adversely affecting small well users.

Primary element number two gives the appearance of an attempt to establish a commingled inter-relationship between the Saugus Formation and the Santa Clara River. With a clearly defined bed and banks, the Santa Clara River has historically behaved as a river, and despite severe depletion from over pumping, still exhibits the dynamics of a river during episodes of precipitation. With our members holding rights of diversion from the State Water Resources Board, we strongly feel that any attempt to define the river in terms of percolating groundwater defies logic and the laws of physics.

Also, in the "Existing and Projected Water Supplies" section, the draft report states that "...it is currently expected that ongoing utilization of local groundwater will continue to be in amounts that have historically been pumped, 30,000 to 40,000 afy from the Alluvium..."

As stated above, Slade's 1988 report clearly and unequivocally sets the upper pumping limit of the Santa Clara flow at 32,000 afy. By relying on generous overstatements and exaggerated potentials, a plan will go forward that will have serious negative impacts for small well users in the Sand Canyon area.

In primary element three, Determination of Basin Yield and Avoidance of Overdraft, we are concerned with the second paragraph's first sentence that states "...there has not been any widespread, steady degradation of groundwater conditions that might be indicative of overdraft..."

Again in Primary Element 4, the second sentence asserts..."Both ranges of numbers are consistent with recent historical pumping that has not resulted in any indication of overdraft or other undesirable conditions." And in Primary Element 5, the third sentence further posits that ..."Groundwater pumping has remained within a range that has not caused any evidence of overdraft, or associated undesirable impacts..."

It is the direct and incontrovertible evidence of water levels in our own wells that presents us with a clear contradiction to this assertion. Based on members' records that cover a fifty-year span, the current water levels in our wells have reached an unprecedented low. We are left with inescapable evidence that large users pumping from the Santa Clara River have contributed to a cone of depression that is negatively affecting our small wells.

In addition, riparian conditions along the tributaries and main channel of the Santa Clara River reflect highly stressed, water deprived environments. In areas away from river feeder creeks, some heritage California Coastal Oaks (Quericus Agrifolia) have begun showing signs of water deprivation.

In a related matter, the proposed plan calls for identification of potential sources of contamination to assure water quality. When Robinson Ranch Golf Course was granted permission to open and operate, the city stipulated that water quality adjacent to and on the golf course be monitored and that regular reports about it be published. These reports have not been included in the draft plan, despite the fact that Robinson Ranch is a participant on the advisory committee for this draft plan. Pesticide, insecticide, fertilizer, and other volatile organic compounds are all possible runoff and plume contaminants that may be leaching from the golf course.

As members of your advisory committee, we would be glad to share with others the data from five decades of small well usage. We believe that recent developments, specifically in our area, have seriously lowered both the alluvial water levels to historic levels.

While modeling, projection, and prediction can yield abstract theories, we small well users must live with the consequences of miscalculation, however unintentional or inadvertent.

Small well holders are franchised, integral, entitled members of the water using community, and as such, must be included in the planning process associated with any groundwater management plan that is to be implemented in the Santa Clarita Valley.

Primary element nine specifies a MOU (Memorandum of Understanding) executed between the United Water Conservation District in Ventura County as an example of..."a local agency relationship that has produced the beginnings of local groundwater management, now embodied in this comprehensive (sic) plan..." While we laud all attempts to widen the base of data and participation in the planning process for water resources, we are disappointed that as stakeholders in the Eastern Sub-basin of the Santa Clara River Valley, our interests are not being represented on the advisory committee that has been created to direct the groundwater management plan.

We ask to be included in the planning committee that is helping to shape the future of water use in our community.

Respectfully,

The Sand Canyon Area Well Owners Association
Robert and Jane Fleck
Eugene and Marylou Ruddell
Richard and Leslie Christensen
Shawn Clement
Joan Waldman

Friends of the Santa Clara River

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

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August 7, 2003

Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350

Board of Directors

Ron Bottorff
Chair
Barbara Wampole
Vice-Chair
Lynne Plambeck
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Jo Rogers
Secretary

Affiliated Organizations

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

Santa Clarita Organization for Planning the Environment (SCOPE)

Sierra Club
Angeles Chapter
Los Padres Chapter

Surfrider Foundation

Audubon Society
Ventura Chapter

Ventura County Environmental Coalition

Re: Groundwater Management Plan

Dear Sirs,

Friends of the Santa Clara River submits the following comments on the June 2003 Draft Groundwater Management Plan (Plan).

We are disappointed and dismayed that the Plan sets as its primary goal the "Development of Local Groundwater for Water Supply". While providing adequate water supplies is an important objective, it would seem to us that the primary goal should be the long-term protection of local groundwater resources, including groundwater quality. Groundwater resources provide many benefits to the community, including those related to the biological and environmental health of the river corridor. Long-term protection, if implemented, should curtail the over-pumping of local aquifers which is currently occuring.

We are also concerned that water agencies, in general, have failed to weigh-in on the paving over of recharge areas in the Santa Clarita Valley. Loss of recharge could have very substantial impacts on future water availability. The Plan should emphasize that concreting of ephemeral tributary streams reduces recharge, and thus should be avoided. Adequate setbacks, or buffer zones, around major streams should be stressed - an item that is rarely adequately addressed in development projects.

The Plan advisory board is too narrowly constituted. The Regional Water Quality Control Board should be represented, as should environmental groups and county agencies working on watershed protection.

Thank you for the opportunity to comment.

Sincerely,

Ron Bottorff

Ron Bottorff, Chair

Attention: CLWA Directors August 8, 2003

RE: Comments on Ground Water Management Plan

FAX: (661) – 297-1611

From: Henry Schultz
Phone: (661) 284-5613 or (805) 447-2863 (work) or FAX at (805) 480-1333
Email: hschultz@amgen.com, henry50@pacbell.net
Three pages total:

There follow 2 pages of comments on the water plan. If there are any questions I can be contacted at the above locations.

Henry Schultz
Chair, Santa Clarita Sierra Club Group

8/7/03

Castaic Lake Water Agency
272234 Bouquet Canyon Rd
Santa Clarita, CA 91350
FAX: 661-297-1611

RE: Ground Water Management Plan Comments

Dear Directors:

We appreciate the chance to comment on the ground water management plan. This plan has been a long time in the making. We hope that your response to concerned public input will make it a viable document. A few comments follow.

1. Based on the (too) long history of this plan, it is essential to include deadlines (with penalties for failure) for completion of the various components of the plan. Otherwise our water will just slip away.

2. There is no accounting for loss of groundwater from pollution such as perchlorates. As soon as the magnitude of the problem has been adequately determined, a realistic plan can then be implemented. As it stands right now, the numbers do not adequately represent the real water supply.

3. Loss of groundwater due to loss of percolation due to extensive development, which paves over permeable soil, is not considered. It is a continuous and cumulative impact on the water supply. More generally, the water plan must address coordination of land use with water necessities such as the preservation of water percolation basins and similar amenities.

4. Drought planning is inadequate in the plan. For example, if a water treatment plant is built, then a certain number of acre/ft of water can be reclaimed. Current planning would say that this is real water, which can be counted on. In a drought, not only do you lose primary water sources, but also the corresponding amount of reclaimed water, a double hit which must be accounted for in any realistic water plan.

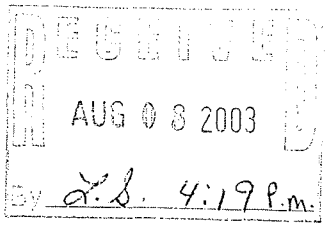
5. The Sierra Club strongly supports an active river-monitoring program so that potential and existing water quality issues can be addressed in a timely manner. This must be an integral part of the plan. In lieu of the water agency producing reliable data, a citizen-monitoring program will have to be undertaken to assure the quality of our water.

6. The plan does not adequately discuss maintaining river and tributary habitats such as the biological unhealthy zones created from the Rio Vista Plant's outflow into the Santa Clara River. While there are green plants growing in the area, UCLA researchers have shown that it is barren of many insects, which would normally be present in such an environment. This engenders a ripple effect in the biota.

7. Just as the City of Santa Clarita involves the public and other government and private agencies in its long range planning, CLWA should do the same with its water planning. People in the Santa Clarita Valley are just beginning to realize the importance and the fragility of their water supply. The time to start REAL planning is now.

Thanks for your kind attention.

Henry Schultz
Chair, Santa Clarita Sierra Club Group
21827 Parvin Dr.
Santa Clarita, CA 91350
Henry50@pacbell.net
661-284-5613



Ed & Joan Dunn
15414 Rhododendron Dr.
Canyon Country, CA 91387
August 8, 2003

Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350-2173

RE: Groundwater Management Plan (AB 3030)

Dear Sirs:

We are pleased to have the opportunity to comment on your draft AB 3030 Plan. Enclosed please find copies of individual pages of this plan and associated comments for these pages.

We are disappointed that the writing of this plan appears to be following the same path of the UWMP. We are also displeased there has not been an attempt to hold more public meetings prior to this draft release. As required in AB 134, when has the agency met regularly with the advisory council to consult on this plan? What was the frequency of the meetings and how many were there?

We are quite interested in an AB 3030 Plan and would appreciated this draft be made into an honest and truthful document, allowing it to go ahead on a timely schedule without challenges and delays.

Respectly submitted,

Ed and Joan Dunn

Enclosures: 3 Exhibits, 16 draft groundwater pages and 16 associated comment pages

Top of page:
Basin objective "manage groundwater levels and discharge to the Santa Clara River, at the west end of the basin"?
Wording should include "the entire basin".

Bottom paragraph, last sentence:
The plan is replenishing the aquifer with WHAT sufficient water?

and effects, e.g. chronic water level decline, loss of groundwater storage, onset of land subsidence, groundwater quality degradation, a corresponding basin objective is to manage groundwater levels and associated groundwater discharge to the Santa Clara River at the west end of the basin, and thus not adversely impact surface and groundwater discharges to the downstream basin(s).

3. Preservation of groundwater quality for beneficial use in the basin, and for beneficial use of surface water and groundwater discharges from the basin. Included in this management goal will be the active characterization and solution of any groundwater contamination problems, through cooperation with responsible parties or through independent action if timely action by responsible parties is not forthcoming and the preceding management objectives are thereby impacted or constrained.

4. Preservation of interrelated surface water resources. Included in this management goal will be the maintenance of appropriate surface water flows and non-degradation of surface water quality as a result of managing groundwater conditions to meet the other management goals for the basin.

Quantitatively, the preceding goals translate into general preservation of groundwater levels and quality in the Alluvial aquifer system consistent with the last 30 years, including fluctuations through seasonal demands and local hydrologic variations (wet and dry periods). As discussed in more detail in the next chapter, the hydrogeologic setting in the area has resulted in smaller Alluvial groundwater level fluctuations toward the western half of the basin (generally west of Bouquet Canyon), and larger fluctuations to the east. However, largely due in part to the importation of supplemental surface water over the last 20 years, and the integrated or conjunctive use of that supplemental water with local groundwater, there has been no chronic decline in groundwater levels or storage. A continuation of such basin conditions, possibly complemented by management actions to decrease the historical water level fluctuations in the eastern part of the basin, will accomplish the second basin objective, continued avoidance of overdraft as has been the ongoing historical condition in the basin, while continuing to utilize local groundwater to meet part of projected water requirements, the latter being the first management objective for the basin. Corresponding management actions to sustain recharge and not overdraft groundwater storage will accomplish the third basin objective by replenishing the aquifer system with sufficient water to sustain what has been generally consistent quality of groundwater on a long-term basis.

We question Slades 1986 and 2002 Report stating the alluvium has the capacity of 240,000 acre feet.

III. Groundwater Basin Conditions

Occurrence of Groundwater

Groundwater in the Santa Clara River Valley East groundwater subbasin occurs in two aquifer systems, the Alluvium associated with the Santa Clara River and its tributaries, and the Saugus Formation. There are also some scattered outcrops of Terrace deposits in the basin that likely have the capacity to contain limited amounts of groundwater; however, since these deposits are located in limited areas that are situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers and have consequently not been developed for water supply.

The Alluvial aquifer system, of Quaternary to Holocene (Recent) geologic age, consists primarily of stream channel and flood plain deposits of the Santa Clara River and its tributaries. The Alluvium is deepest along the center of the present river channel, with a maximum thickness of about 200 feet near the area known as Saugus. It thins toward the flanks of the adjoining hills and toward the eastern and western boundaries of the basin and, in the tributaries, becomes a mere veneer in their upper reaches. The spatial extent of the Alluvium throughout the basin is illustrated in Figure 3-1.

The Alluvium is the most permeable of the local aquifer units. Based on well yields and aquifer testing, transmissivity values in the range of 50,000 to 500,000 gallons per day per foot (gpd/ft) have been reported for the Alluvium, with the higher values where the Alluvium is thickest in the center of the valley and generally west of Bouquet Canyon (Slade 1986 & 2002). The amount of groundwater in storage can vary considerably because of the effects of recharge, discharge, and pumping from the aquifer. The maximum storage capacity of the Alluvium has been estimated to be about 240,000 acre-feet (af) (Slade, 1986 & 2002).

The Saugus Formation, of Pliocene to Pleistocene geologic age, has traditionally been divided into two stratigraphic units: the lowermost, geologically older Sunshine Ranch member, which is of mixed marine to terrestrial (non-marine) origin; and the overlying, of upper, portion of the Formation which is entirely terrestrial in origin. The Sunshine Ranch Member of the Saugus Formation has a maximum thickness of about 3,000 to 3,500 feet in the central part of the valley;

Top, bottom of first paragraph:
The plan states "the most significant period of Saugus pumpage was 1991 through 1994, when pumpage ranged from 10,600 afy to nearly 15,000 afy and averaged over 12,000 afy, during which time SWP water deliveries were reduced at the end of extended drought conditions".

It should be stated that the SWP water was INTERRUPTED for approximately 6 months. See Feb. 27,1991 Daily News newspaper article " Santa Clarita will turn to wells as state water supplies dry up". As stated in the article, the SWP water processing plant was shut down. Exhibit A.

"Officials say state's water delivery system inadequate". See Exhibit B

Since 1980, total pumpage from the Saugus Formation has ranged between about 3,850 afy and nearly 15,000 afy; average pumpage over that period has been about 6,900 afy. The great majority of pumpage from the Saugus is for municipal supply (nearly 6,300 afy, or 92 percent, on average). For comparison, although historical Saugus pumping records prior to 1980 are limited, there appears to have been essentially no pumping from the Saugus prior to 1960 (on the order of about 100 af in most years, beginning in 1948), and some increased pumping for agricultural water supply beginning in about 1962 (about 900 af). The largest amount of agricultural pumping from the Saugus was during the mid-1960's, when annual Saugus pumpage was about 3,000 af. Agricultural pumping from the Saugus declined to near zero by the late 1970's, but has been generally in the 500 to 1,000 afy range since 1982. There was no Saugus pumpage for municipal supply in the early 1960's; limited data suggests that municipal pumping from the Saugus began in the 1970's, and reached nearly 5,000 afy by 1980-81. The most significant period of Saugus pumpage was 1991 through 1994, when pumpage ranged from 10,600 afy to nearly 15,000 afy and averaged over 12,000 afy, during which time SWP water deliveries were reduced at the end of extended drought conditions.

Groundwater Monitoring Network and Program

There is no formal groundwater monitoring network of wells for groundwater level measurements and/or groundwater quality sampling in the basin. Consequently, one component of this Plan is to formalize both a network of wells for groundwater monitoring and a program for water level measurements, water quality sampling, and other pertinent groundwater data collection (Primary Plan Element 1). Despite the lack of an existing formal groundwater monitoring network and program, however, there is a significant amount of historical groundwater data, some of which dates back into the 1940's, on which to base reasonable assessments of groundwater conditions in the basin. For example, groundwater level measurements have been made over varying periods of record in a total of 154 wells, mostly alluvial wells, throughout the basin. Similarly, groundwater quality data, consisting of varying numbers of constituents analyzed, are available from some wells, but a much smaller number than is the case for groundwater level data. These data, along with direct measurements or indirect estimates of pumpage, primarily from high capacity municipal and agricultural wells, allow for analysis of groundwater basin conditions, as discussed in this Plan, and also provide the bases on which a groundwater model can be developed (Primary Plan Element 3) and on which various management criteria such as operational yield, baseline groundwater quality, etc. can be determined (Primary Plan Elements 3, 6 etc.).

Middle paragraph:
"Exceedence of action level of perchlorate".
Newhall County Water District perchlorate level was 19 micro-grams per liter and Santa Clarita Water Co. was 24 or more micro-grams per liter.
The statement that none (no wells) exceeded 18 micro-grams per liter is false. See Exhibit C

higher quality (low TDS) water and dry periods have resulted in the notable declines in water levels described above, with a corresponding increase in TDS (and individual component constituents) in the deeper parts of the Alluvium.

Due to a much more limited number of wells and the limited spatial extent of groundwater development in the Saugus Formation, long-term Saugus groundwater quality data are not sufficiently extensive to permit any sort of basin-wide analysis or assessment of pumping-related impacts on quality. Based on the most complete historical record, over the last 35 years, however, groundwater quality in the Saugus has remained generally constant, and the Saugus Formation is, on a groundwater quality basis, a viable agricultural and municipal water supply.

The most notable groundwater quality issue in the basin centers around the detection and impact of perchlorate on several Saugus wells and one Alluvial well in the central part of the basin near the location of the former Whittaker Bermite facility, which is immediately southeast of the confluence of the main Santa Clara River and its South Fork tributary. In 1997, routine water quality sampling detected the presence of perchlorate in four municipal wells completed in the Saugus Formation (CLWA Santa Clarita Water Division Saugus Wells 1 and 2, Newhall County Water District Well 11, and Valencia Water Company Well 157). While there remains no primary or secondary drinking water standard for perchlorate, and although the detected concentrations of perchlorate in the Saugus wells did not exceed the Action Level established by the State Department of Health Services at that time (18 ug/l), all those wells were inactivated by their respective owners after detection of perchlorate; those wells remain out of municipal water supply service to date.

More recently, in late 2002, routine water quality sampling of Alluvial wells detected perchlorate in one of them (CLWA Santa Clarita Water Division Stadium Well) at a concentration which slightly exceeds the current Action Level (4 ug/l). This well has also been voluntarily inactivated, and thus remains removed from municipal water supply service.

This Plan, notably through Primary Plan Elements 1, 6 and 8, is intended to incorporate both short-term and long-term groundwater quality considerations in the management of the groundwater basin in order to formalize groundwater quality monitoring and assessment, to investigate and correct groundwater contamination problems, and to preserve or improve groundwater quality for ongoing water supply as well as for avoiding adverse water quality impacts on interconnected surface waters.

Paragraph #2:
The statement of this paragraph is misleading. The correction should show "out of service wells significantly reduced groundwater capacity for existing groundwater supplies, so much so, that a substantial increase of state water use, has been initiated".

Areas of Concern and Identified Problems

A number of concerns have been expressed about groundwater conditions in the basin. While not all of the expressed concerns have been substantiated, they are listed and briefly discussed here, and they are addressed in the management objectives for the basin, intended to be achieved via implementation of the various primary and secondary elements in this Plan.

The most notable concern in the basin, at least at present, is the impact of perchlorate contamination on a number of municipal water supply wells, thus affecting the available pumping capacity from some municipal wells. While perchlorate impacts on a few wells do not preclude the ability to pump groundwater in accordance with existing water supply plans, activities to characterize the contamination, and ultimately to control it and treat it, have been initiated in order to return the impacted wells' pumping capacity to water supply service. Primary Element 8 is included in this Plan to formalize the addressing of groundwater contamination issues in the basin.

Concern has also been expressed that groundwater development in the basin will adversely impact the quantity and/or quality of surface flows leaving the basin via the Santa Clara River. Such concern extends to the potential impact on groundwater in the next downstream basin, the Piru Basin in Ventura County. While there are no established provisions regarding surface flows out of the Santa Clara River Valley East subbasin, Primary Element 2 is included in this Plan to formally address the monitoring and management of surface water flows and quality within, and flowing out of, the basin. Some work is already ongoing related to this area of concern via a Memorandum of Understanding (MOU) among CLWA, other purveyors within CLWA's service area, and United Water Conservation District, which manages surface water and groundwater in the downstream basins on the Santa Clara River in Ventura County. That cooperative effort, which is incorporated into this Plan via Primary Element 9, includes integration of databases, development of a numerical groundwater flow model, and interpretation and reporting on surface water and groundwater conditions.

A third expressed concern in the basin, although never substantiated, is that groundwater is already overdrafted. Associated with that expressed concern is a related issue that reliance on overdrafted groundwater results in an overstated water supply in the basin. As discussed earlier in this Section, long-term groundwater levels, storage, and quality all indicate a lack of overdraft. As also discussed above, the importation of supplemental surface water over the last 23 years,

References to the Urban Water Management Plan (UWMP).
The UWMP of 2000 contains incorrect information and is under legal attack for correction. The UWMP does not address the total interruption of the state water supply in the event of drought, earthquake, or Delta problems. It is suggested that the UWMP not be utilized or referred to until its contents have been corrected to reflect accurate and truthful information.

32,000 afy. The history and trend of municipal groundwater use in the basin are illustrated in Figure 4-1.

As noted above, until 1980, all water supply in the basin was from local groundwater. Imported surface water was first available from the State Water Project (SWP) in 1980, when a total of 1,125 af were imported into the basin. Since then, importations of SWP water have increased in two separate steady trends, interrupted by a notable decrease at the end of, and following, the 1987-1992 drought period: a steady increase beginning in 1980, to about 21,600 afy in each of 1989 and 1990, followed by a substantial decrease, to less than 8,000 af in 1991, and then a steady increase back to about 21,000 afy in 1997 and 1998, followed by further increases to about 35,000 af in 2001. The history and trends in importation of SWP water to the basin are illustrated in Figure 4-2, which also illustrates the historical trends in groundwater pumping and total water use in the basin since the importation of SWP water.

In the context of this groundwater management plan, the historical utilization of imported SWP water to augment local groundwater represents the initiation of conjunctive use of surface water and groundwater supplies, a groundwater management principle which is intended to be continued via adoption of Primary Element 5 of this plan.

Projected Water Requirements

Detailed projections of municipal water requirements were most recently completed as part of the Urban Water Management Plan prepared by CLWA and the municipal water purveyors (Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company) in 2000. Those projections, which are forecast for a 20 year period, also recognize an ongoing but decreasing agricultural water demand over the same period, from about 15,000 afy in 2005 to about 7,000 afy by 2020. The municipal water demand projections in the Urban Water Management Plan were derived from utilization and interpretation of multiple projection methods, including Per-Capita Water-Use applied to population projections; extrapolation of number of service connections (using two different projection techniques, an average rate and an accelerated rate projection) applied to the rate of service connection additions since 1990; and land use projections combined with unit water use factors on multiple land use categories (urban, including residential, commercial, industrial and recreational; irrigated agricultural; and vacant and open space). The water demand projections in the Urban Water Management Plan also considered weather effects (variations due to hot-dry years vs. cool-wet years) and conservation

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Top
"Local Groundwater" The statement is made: "That for all practical purposes the Saugus Aquifer underlies the entire CLWA service area". That statement is absolutely false! It does not!
Please correct.

Bottom paragraph:
Supplemental (SWP) Surface Water

CLWA's SWP Water Entitlement
The CLWA, indeed, has purchased water in addition to the original Table A entitlement, but cannot obtain contractual agreement to transport the additional water to the Santa Clarita Valley.

water and possibly some water supply derived from water transfers and desalination outside the basin.

Local Groundwater - Local groundwater has historically been developed from the two aquifers that comprise the groundwater basin, the Alluvium that underlies the Santa Clara River and its tributaries, and the Saugus Formation that underlies, for all practical purposes, the entire CLWA service area. Those two aquifers, and the groundwater basin they comprise, are the focus of this groundwater management plan. Based on historical experience and observation of groundwater conditions, it is currently expected that ongoing utilization of local groundwater will continue to be in amounts that are generally comparable to what has historically been pumped, 30,000 to 40,000 afy from the Alluvium and 7,500 to 15,000 afy from the Saugus Formation. It is also expected that there is some additional development potential in the Saugus Formation, in the range of 10,000 to 20,000 af which might be intermittently extracted during one or more dry years when supplemental imported water might be reduced. Ultimately, it is expected that local groundwater will continue to be a component of water supply, at appropriate production levels in both aquifers, in the basin. The intent of this groundwater management plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, i.e. avoidance of overdraft (Primary Plan Element 3), no degradation of quality (Primary Plan Element 6), no adverse impacts to surface waters (Primary Plan Element 2), all via continuation of conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Primary Plan Element 5) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Primary Plan Elements 1 and 2).

Supplemental (SWP) Surface Water - CLWA has a contractual Table A amount of 95,200 af of water from the SWP. CLWA's original contract, signed in 1963, was for 23,000 af; that Table A amount was later increased to 41,500 af. In 1988, CLWA purchased a Table A amount of 12,700 af from Devil's Den Water District, and it acquired another Table A amount of 41,000 af in 1999 from Kern County Water Agency and its member district, the Wheeler Ridge-Maricopa Water Storage District. There is ongoing CEQA-related litigation over the most recent acquisition of the additional SWP Table A amount, the 41,000 af acquired from Kern County Water Agency and Wheeler Ridge-Maricopa WSD. However, there has been no invalidation of the completed agreement to transfer the 41,000 af Table A amount to CLWA; and current water supply planning includes that Table A amount as CLWA corrects the CEQA technicality by preparing a new EIR to address the environmental consequences of the transfer.

Top:
Recycled Water

It should be noted CLWA's planned recycle water program is and has been for one private business only. No public agency is receiving or is planned to receive recycled water from CLWA.

Recycled Water - In 1993, CLWA prepared a draft Recycled Water System Master Plan that outlined a multi-phase program to integrate recycled water into the overall water supply system in the basin. Construction has begun on Phase I of that project, which will deliver approximately 1,700 afy, and deliveries are expected to begin in 2003. Overall, recycled water is expected to ultimately reclaim up to 17,000 afy of treated waste water suitable for irrigation use on golf courses, landscaping, and other non-potable uses.

Top:
Number 7 should read: Valleywide integration of recycled water.

Middle:
Secondary (Potential Elements) Item #2 Change to: involvement in land use planning per Water Code 10753.7 (l).

4. Development of Regular and Dry Year/Emergency Water Supply
5. Continuation of Conjunctive Use Operations
    - active and passive groundwater recharge
6. Long Term Salinity Management
7. Integration of Recycled Water
8. Identification and Mitigation of Soil and Groundwater Contamination
    - involvement with other local agencies in investigation, cleanup, and closure
9. Development and Continuation of Local, State and Federal Agency Relationships
10. Groundwater Management Reports

Secondary (Potential) Elements

1. Continuation of Public Education and Water Conservation Programs
2. Identification and Management of Recharge Areas and Wellhead Protection Areas
    - involvement in land use planning process
3. Identification of Well Construction Abandonment, and Destruction Policies
    - water quality protection
    - manage vertical distribution of pumpage
4. Provisions to Update the Groundwater Management Plan

Primary Element 1 - Monitoring of Groundwater Levels, Quality, and Production

Prior to 1980, all water supply in the Upper Santa Clara River Area was developed from local groundwater; since 1980, imported surface water has become an increasing component of overall water supply in the area, but groundwater continues to meet all agricultural water demand and a significant part of municipal water demand. As a result of the long term development and use of groundwater in the area, there is a fairly substantial amount of historical groundwater level data, and a useful amount of groundwater quality data, and groundwater pumping data that has been collected in the basin. All the available historical groundwater level, quality, and pumping data have been organized into a computerized data base for the Upper Santa Clara River Area. That data base, while separate, has been coordinated with an equivalent data base maintained by United Water Conservation District for the downstream basins on the Santa Clara River. The intent of database coordination has been to facilitate interpretation and reporting on groundwater and other water resource related issues by the respective agencies overlying the various basins along the River.

Bottom:
As stated earlier the UWMP is inacurate and under legal attack-and not certified by the courts.
Primary Element 4 – Development of Regular and Dry Year/Emergency Water Supply

40,000 acre feet from the aluvium and 15,000 a/f from the Saugus is optimistic.
We strongly suggest developing an emergency plan for an extended interruption of the state water project. How many times must we ask for such an obvious safeguard?

conditions (and associated fluctuations in recharge and pumping). Such fluctuations are typical of groundwater basin conditions in any conjunctive use setting, such as in this basin: groundwater is utilized from storage during dry years, or dry periods, and that storage is replenished during alternate wet years, or periods. The observation of these historical groundwater conditions, in combination with knowledge of pumpage from both the Alluvial and Saugus Aquifers, has led to current operational practices as well as general expectations regarding the approximate yield of the local groundwater system as discussed in this plan.

While historical operating experience, complemented by observed groundwater conditions, is an appropriate basis for generally planning for available groundwater supplies, it is possible and appropriate to more precisely analyze the basin to determine values or ranges of yield under varying hydrologic conditions, and to assess the impacts of various management actions that might be implemented in the basin. The MOU process described in Primary Element 9 of this Plan includes the development of a numerical groundwater flow model which is intended to be utilized for determination of the yield of the basin under existing land use and under existing groundwater and surface water development conditions. It is also expected to be used for implementation of this Plan Element in order to assess the yield of the basin under future land use conditions as well as future ranges of surface water importation, groundwater development, and recycled water use through varying hydrologic conditions, i.e. wet and dry periods that affect the availability of imported surface water.

The ultimate intent of this Plan Element is to develop an understanding and quantification of the yield of the basin, under varying hydrologic conditions and developing local cultural conditions, in order that groundwater development and use be managed in such a way to meet an appropriate fraction of total water demand while avoiding levels of groundwater use that would result in overdraft conditions. Thus, implementation of this Plan Element is essential to accomplishing the first and second management objectives (goals) for the basin.

Primary Element 4 - Development of Regular and Dry Year/Emergency Water Supply

The most recent updated Urban Water Management Plan (UWMP, December 2000) prepared by CLWA and the other purveyors in the basin (Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company) includes plans to develop 30,000 to 40,000 acre-feet per year (afy) from the Alluvial aquifer and 7,500 to 15,000 afy from the Saugus Formation in average/normal years. Both ranges of numbers are consistent with recent historical pumping that

The SWP water received in 1991 is erroneous. The chart indicates 8,000 a/f. It is incorrect. CLWA only received 10% of its then allocation 54, 200 a/f. The 10% was received in January and the plant shut down in March. See Exhibit A. It should be noted that this is a state water project interruption for months, not a reduction.

Historical and Projected Water Use
Upper Santa Clara Valley Groundwater Basin
East Subbasin

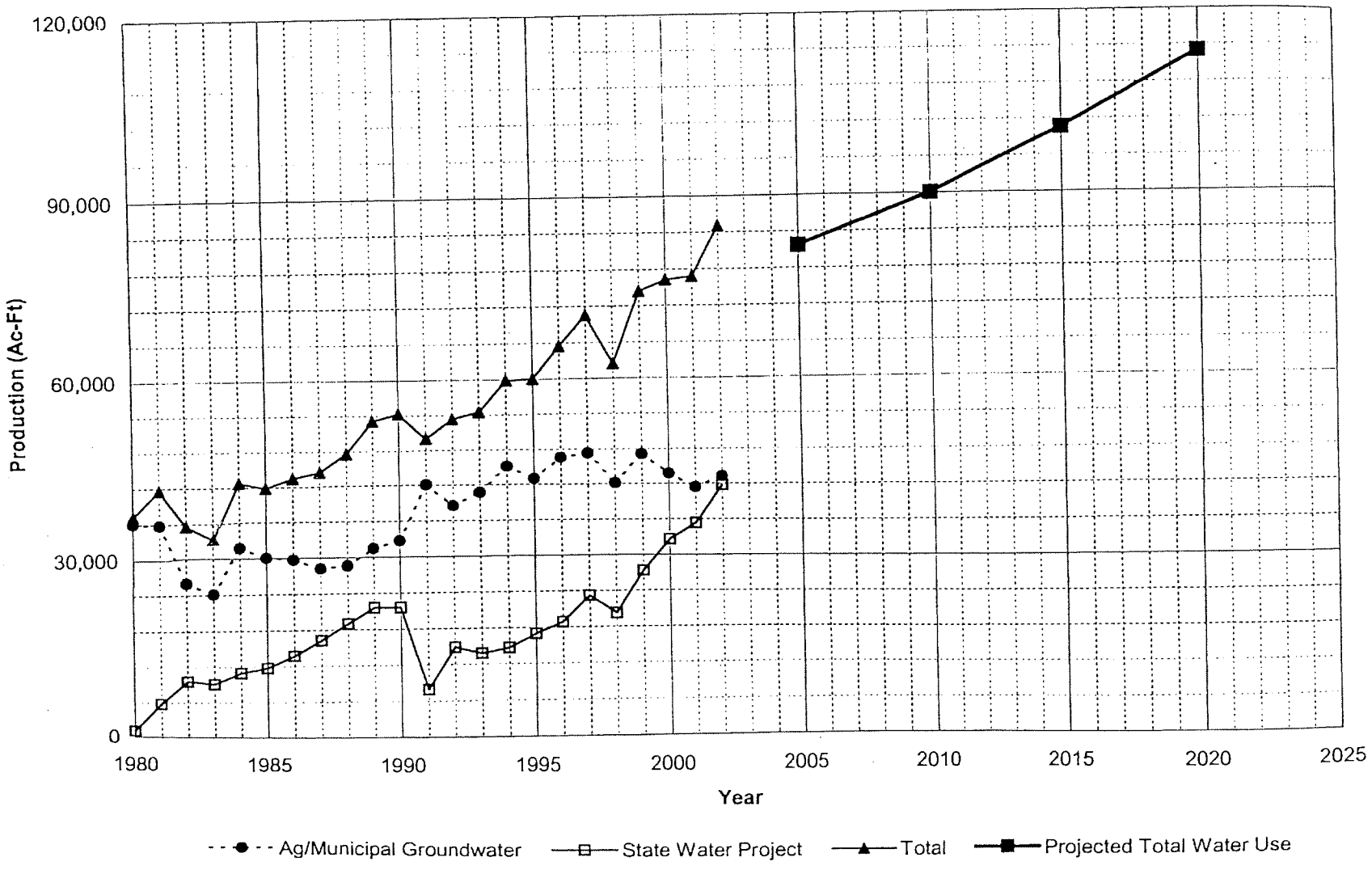


Figure 5-4

Plan, page #30 Dunn, page 13

Top paragraph:

There is no mention what the folks can do if groundwater cannot meet demand and the supplemental water is not there for an extended period of time. Please develop a plan to solve this most serious occurance.

Conjunctive use of local groundwater and imported surface water will continue to be a key element in meeting all the goals for the basin, most notably utilizing groundwater for water supply without overdrafting the basin. Historical experience with groundwater pumping and aquifer response to varying hydrologic conditions has shown that the groundwater basin can support notable variations in pumping during wet and dry periods, but it cannot support continuous pumping at rates high enough to meet total local water demand. Thus, utilization of imported surface water in conjunction with local groundwater will be essential to the management of groundwater for water supply without overdrafting that resource.

As part of conjunctively using surface water and groundwater, it is recognized that, particularly when the surface water supply is imported from the State Water Project, there will be variations in the amount of available surface water supply from year to year. Similarly, there are expected to be variations in local groundwater conditions as a function of local hydrologic conditions which affect, among other things, the natural recharge to the groundwater basin from year to year. In the case of this basin, local (Southern California) hydrology which affects local groundwater conditions may not necessarily be the same as the hydrology in a distant (Northern California) location that directly affects the availability of supplemental, imported surface water in any given year. Thus, conjunctive use management is challenging, but is notably important to ensure that the groundwater basin is maintained to meet a regular component of water supply and to also be able to meet a larger component of water supply during "dry periods" that affect supplemental surface water availability. Conjunctive use management is similarly important to ensure that local groundwater can be replenished, via reduced pumping and/or as a result of wetter local hydrologic conditions, during periods of wet/normal surface water availability. In light of all the preceding, implementation of this Plan Element is essential to accomplishing all the management objectives (goals) for the basin.

Primary Element 6 - Long Term Salinity Management

In general, groundwater quality in the basin is such that groundwater supplies meet standards for beneficial use in the basin, most of which now is for municipal (domestic) use but some of which remains for agricultural and some other irrigation (non-domestic) use. There also have been no notable historical trends of groundwater quality degradation in the basin over time. However, a number of geologic and hydrologic factors suggest that observations and interpretation of groundwater quality warrant some focus to ensure long-term preservation of groundwater quality. Notable among those geologic and hydrologic factors are: 1) the largely "closed" geologic nature

Bottom of page:

Is appears the entire paragraph is false. There is no knowledge of such meetings occurring.

Newhall County Water District, Los Angeles County Waterworks District No. 36, Valencia Water Company, and its own Santa Clarita Water Division. As such, CLWA has a historical and ongoing working relationship with all those local agencies, as well as with other local groundwater pumpers, to manage water supplies in order to effectively meet water demands within the available yields of imported surface water and local groundwater. In fact, the Advisory Council convened to assist in the preparation of this Plan is comprised representatives of all the local water purveyors and significant groundwater pumpers.

A local MOU process among CLWA, other purveyors within CLWA's service area, and United Water Conservation District in neighboring Ventura County is a classic illustration of a local agency relationship that has produced the beginnings of local groundwater management, now embodied in this comprehensive plan, most notably in Primary Elements 1 through 5. In 2001, out of a willingness to seek opportunities to work together and develop programs that mutually benefit the region as well as their individual communities, those agencies prepared and executed a Memorandum of Understanding (the MOU) that initiated a collaborative and integrated approach to several of the aspects of water resource management that are now included in this Plan. United WCD manages surface water and groundwater resources in seven groundwater basins, all located in Ventura County, downstream of the East Subbasin of the Santa Clara River Valley that is the focus of this Plan. United is thus a logical partner in the cooperation of management efforts to accomplish the objectives (goals) for this basin, particularly as they relate to preservation of surface water resources that flow through the respective basins. As a result of that MOU, the cooperating agencies have integrated their database management efforts (part of Primary Elements 1 and 2 of this Plan), have initiated the development of a numerical groundwater flow model (for utilization in Primary Elements 3, 4 and 5 of this Plan), and are continuing to prepare reports on the status of basin conditions, as well as on geologic and hydrologic aspects of the overall stream-aquifer system.

A local extension of the interaction among CLWA, the retail water purveyors, and United is an ongoing working relationship with the City of Santa Clarita. CLWA and the municipal purveyors meet regularly with City staff and also present water supply conditions via study sessions with the City Council on a regular basis. It is expected that the implementation of this Plan will result in the availability of a broader range of information transfer with the City relative to the existing and future water supply to its residents. OH?

This Primary Element is included in this Plan to formalize the historical local and state agency

Middle:

Primary Element 10-Groundwater Management Reports
These secretly created reports contain erroneous numbers to overstate supply and understate demand. The creators meet secretly, allow no public participation or oversight and meet without authority or sanction from any public agency. The meetings are held secretly and without benefit of the Brown Act. Since these reports are created with no public oversight, do not appear to have credibility, and usually are not signed by anyone, they should not be included as part of an AB3030 groundwater management plan. It is time to form an official joint powers authority between the purveyors and other participating parties.

working relationships as part of comprehensively managing local groundwater, in concert with imported surface water and local recycled water, to accomplish all the management objectives (goals) for the basin.

Primary Element 10 - Groundwater Management Reports

As briefly described in the Introduction of this Plan, local groundwater management planning already includes, among several other activities, analysis of groundwater conditions and preparation of annual reports on groundwater and all other aspects of water resources and water supplies in the Santa Clara River Valley East ground water basin. In addition, recently formalized cooperative work with neighboring United Water Conservation District includes both regular reporting on the status of groundwater conditions and specific reporting on geologic and hydrologic aspects of the overall stream-aquifer system. For example, documentation of the numerical groundwater modeling work currently in progress is expected to be the first of the latter reports in the next year.

Beginning in 1998, CLWA and the retail water purveyors in the basin have prepared a series of annual reports, known locally as the Water Report, to describe all aspects of water supply and water resource conditions in the basin. That report provides current information to local City and County land use agencies, and to other interested parties, about current water requirements, use of groundwater and treated imported surface water to meet those water requirements, groundwater conditions (pumping, groundwater levels and quality, etc.), local surface water conditions, the status of imported surface water supplies including details of delivered SWP water in the reported year as well as an up-to-date summary of available imported SWP water for the next year, a short-term projection of water requirements in the next year, and other appropriate details about water requirements and supplies such as, for example, the status of introducing recycled water as a component of non-potable water supply.

In light of the frequency and comprehensive nature of the annual Water Reports, and also in light of the planned preparation of more detailed technical reports on various aspects of the basin as appropriate, the continued preparation of those reports will serve as regular and complete reporting on all aspects of this groundwater management plan.

(Not much truth on this page.) CLWA constantly preaches conservation but continually sells more and more water. CLWA should provide the public with an accounting of the water CLWA is conserving.

Secondary Element 1 - Continuation of Public Education and Water Conservation Programs

CLWA has provided water conservation and public education programs that will continue and expand as a complement to and an element of this groundwater management plan. The expansion of water conservation will largely stem from CLWA's having signed the "Memorandum of Understanding Regarding Water Conservation in California" (Urban MOU) in 2001, which made CLWA a wholesaler member of the California Urban Water Conservation Council. CLWA has thus committed to implementation of cost-effective water conservation measures known as Best Management Practices (BMPs) that are included in the Urban MOU and are intended to reduce California's long-term urban water demands. The BMPs have been incorporated into the water demand management measures section of the Urban Water Management Planning Act.

Water conservation and related public education measures have generally been developed in California to achieve the following goals:

- meet legal mandates
- reduce average annual potable water demands
- reduce sewer flows
- reduce water demands during peak seasons
- meet drought restrictions.

As a wholesaler of imported surface water CLWA has implemented the following BMPs for several years prior to signing the MOU:

- distribution system water audits, leak detection and repair
- public information
- school education
- wholesale agency assistance ?
- conservation pricing ?
- conservation coordinator. ?

Top:

(Not much truth here either.) Mostly deception. The UWMP doesn't exist for the reasons mentioned earlier. The UWMP must not be considered here.

As a signatory to the MOU, CLWA's water conservation and public education program will expand to include the following BMPs found to be locally cost-effective, as detailed in the 2000 Urban Water Management Plan for CLWA and the Santa Clarita Valley retail purveyors.

- water survey programs for single-family residential and multi-family residential programs
- residential plumbing retrofits
- metering with commodity rates for all new connections and retrofit of existing connections
- large landscape conservation programs and incentives
- high-efficiency washing machine rebate programs (when also provided by local energy providers or wastewater utilities)
- conservation programs for commercial, industrial, and institutional accounts
- wholesale agency programs to financially or otherwise support water conservation efforts by retailers (this measure will be expanded)
- residential ultra-low-flow toilet replacement program.

This Primary Element, while identical to independent CLWA efforts in water conservation and public education, is incorporated in this Plan to complement other Plan elements, and to move toward accomplishment of all management objectives (goals) for the groundwater basin.

Secondary Element 2 - Identification and Management of Recharge Areas and Wellhead Protection Areas

The 1986 Amendments to the federal Safe Drinking Water Act (SDWA) established a new Wellhead Protection Program (WPP) to protect groundwater that supplies drinking water wells for public water systems. Each state was required to prepare a WPP and submit it to the USEPA by June 19, 1989. However, California did not develop an active state-wide Wellhead Protection Program at that time. Subsequently, in 1996, reauthorization of the SDWA established a related program called the Source Water Assessment Program. In 1999, the California Department of Health Services (DHS) Division of Drinking Water and Environmental Management developed its Drinking Water Source Assessment Program (DWSAP), and EPA approved it. The overall objective of the DWSAP is to ensure that the quality of drinking water sources is protected.

As discussed in Section 1 of this Plan, the potential groundwater management plan component

EXHIBIT A

Suppliers driven into the ground

Drought forces area to rely on well water

2-27-91

By Kimberly Heinrichs
Daily News Staff Writer

SANTA CLARITA — The state is expected to stop water deliveries March 15 to the Santa Clarita Valley, forcing the area to rely on ground water as California's worst drought on record continues, officials said Tuesday.

The Castaic Lake Water Agency, which treats, stores and distributes state water to local purveyors, will close its plant after the last of the imported water arrives, agency General Manager Robert Sagehorn said.

Related story:
■ Conservation law gets OK.
Page 4

"For all substantial purposes we're shutting the plant down on March 15," he said, adding, "No one's going to go bone dry over this."

Local water suppliers still will pump water from the Santa Clarita Valley's extensive network of wells, he said.

The state Department of Water Resources told Sagehorn on Saturday that the expected cut of 50 percent of the agency's water supply has been increased to 90 percent as the drought continues its fifth year. The agency will have received 10 percent of this year's water allocation by the middle of March, Sagehorn said.

Of the four purveyors receiving state water from the Castaic Lake agency, only the Los Angeles County Waterworks District No. 36 — which serves Val Verde

See WATER / Pg. 2

Santa Clarita will turn to wells as state water supplies dry up

2-27-91 D.N.

WATER / From Page 1

and Hasley Canyon — does not have a ground-water supply.

The county agency has drilled a well about 1,000 feet northwest of the intersection of Hasley Canyon and Del Valle roads that it had planned on using in about a year after building a 250,000-gallon storage tank, Assistant Deputy Director Gary Hartley said. However, with the new cutback, the county is hurriedly seeking permission from several property owners to run a temporary pipeline from that well to customers, Hartley said.

County officials hope to have the pipeline operating in about six weeks, he said. Meanwhile, the county is working on agreements with the three other purveyors in the valley — the public Newhall County Water District and the private Valencia Water Co. and Santa Clarita Water Co., Hartley said.

If the county cannot set aside enough well water from the other purveyors, there is a chance the state would send emergency supplies through the Castaic agency, he said.

While the city considers a law that would restrict wasteful practices in the hopes of achieving a 25 percent reduction in water use, Hartley said that county water officials are drafting a conservation proposal that would require different levels of participation in different areas. Because of the severity of the water cuts in the Val Verde and Hasley Canyon areas, he said he would expect a 20 percent to 30 percent mandatory cutback in water use.

Although the plant near Castaic Lake will be closed, the agency most likely will lay off just a temporary maintenance worker, Sagehorn said. The worker was hired when one of the two permanent maintenance workers was on medical leave and was kept on.

FOR PG. 17 + FIG. 5-4

EXHIBIT B

Officials say state's water delivery system inadequate

By Laura Myers
Associated Press

MONTEREY, Calif. — The tap has run dry too often and for too many years in California because of an inadequate water delivery system, representatives of the three main groups vying for the precious commodity complained Thursday.

The 5-year-old drought that saw everybody suffer when supplies were drastically cut only magnified the problem this year, said representatives of the urban, agriculture and wildlife interests.

"The biggest problem we have is that the reliability of the water supply is grossly inadequate," said Tim Quinn, conservation director for the urban Metropolitan Water District of Southern California. "The way the system works now, you just can't count on a steady water supply because the water delivery system just doesn't work like it should."

Quinn's comments came at the annual spring conference of the California Association of Water Agencies, which attracted more than 2,000 of the state's top water officials.

Stephen Hall, representing agriculture, and Charles Hanson, representing wildlife and the environment, agreed with Quinn that the State Water Project and the federal Central Valley Water Project can't satisfy competing supply needs.

All three men presented dire pictures of what would happen if they weren't the first in line for water if the drought continues — the quality of urban life will decline, farms will go under, workers will be jobless and wildlife will dwindle, with some species becoming extinct.

But beyond the growing instant competition for scarce supplies, they said water officials must improve the delivery and storage system that essentially hasn't developed for decades.

"We shouldn't have to continue to fight one another for resources," said Hall, executive director of the California Farm Water Coalition.

The Sacramento-San Joaquin Delta, the cornerstone of the delivery system, is a bottleneck even in non-drought years, Quinn and Hall said.

Part of the problem, according to Hanson, who has an environmental consulting business, is the growing importance on protecting endangered and threatened species while making water transfers in the delta.

The winter-run chinook salmon already is listed by state and federal wildlife officials as threatened and the delta smelt also is expected to make the U.S. Fish and Wildlife Service list soon.

Certain water flow rates from the river must be met when those fish spawn, under wildlife protection rules, he said.

"We need to manage the allocations to provide adequate water throughout the year," Hanson said.

PG. 12

EXHIBIT C

A boost for toxic cleanup in state

Feds back state on perchlorate

By Heather MacDonald
Staff Writer 8-8-03 D.N.

SANTA CLARITA — The Department of Defense agreed Thursday to obey California's drinking water standards for perchlorate and not try to avoid paying for cleanup of the toxic rocket fuel byproduct.

The agreement, announced by U.S. Sen. Barbara Boxer and Pentagon officials during a visit to a contaminated site in Rialto, could help speed the cleanup of the defunct Bermite explosives factory in the center of Santa Clarita, and dozens of other polluted sites all over California, officials said.

"This is an important breakthrough," said Boxer, a California Democrat. "Defense Department activities have been a major source of perchlorate contamination in California. This kind of active cooperation will help us find and fix perchlorate problems throughout the state."

The agreement also appeared to put to rest concerns expressed by Santa Clarita leaders that legislation introduced by President George W. Bush would exempt some defense contractors from having to pay for environmental cleanups in the name of military readiness.

The Newhall County Water District Board of Directors was afraid the language of the bill could be used to let Whittaker Corp., which operated the site until 1987 and has recently begun studying the best ways to clean up the pollution, off the hook.

"The well-being of millions of Californians depends on this agreement," Boxer said.

More than 7 million Californians drink water with at least traces of perchlorate, which can damage the thyroid gland and be risky for pregnant women, whose fetuses can be affected, according to the U.S. Environmental Protection Agency.

A provisional standard set by the EPA recommends that drinking water have no more than 1 part per billion of perchlorate. The old standard considered water with 32 parts per billion of perchlorate safe.

Although the EPA is not expected to set a final standard

See WATER / Page 2

Help on the way for toxic cleanups

8-8-03 D.N.

WATER / From Page 1

until at least 2008, Boxer has called for the agency to act next year because of the threat perchlorate poses to California residents.

Five wells in Santa Clarita have been shut down because of high levels of perchlorate, with tests showing as much as 40 parts per billion of the toxin in the water, officials said. The wells draw on the Saugus Aquifer, which serves as a backup water supply for the Santa Clarita Valley in times of drought.

State officials believe the pollution is coming from the Bermite property near the Santa Clarita Metrolink Station on Soledad Canyon Road. From World War II to the end of the Cold War, several companies manufactured and tested munitions and explosives for the U.S. military on the 996-acre site.

While the California Department of Health Services requires that wells with more than 4 parts per billion of perchlorate be shut down, the state Office of Environmental Health Hazard Assessment has found that water with as much as 6 parts per billion is safe to drink.

Heather MacDonald, (661) 257-5257
heather.macdonald@dailynews.com

FOR PG. 15

-----Original Message-----
From: Diane Trautman [mailto:dianetrautman@comcast.net]
Sent: Friday, August 08, 2003 2:41 PM
To: Dan Masnada
Cc: Marsha McLean; Vince Bertoni
Subject: Draft Groundwater Management Plan

TO: Dan Masnada

RE: Draft Groundwater Management Plan

Following are my questions and comments related to the Agency's Draft Groundwater Management Plan:

1. What percentage of the 106,000 afy (needed over the next 20 years) will be drawn from local groundwater sources? Does the Agency expect to maintain roughly the same 60% SWP/40% local groundwater mix in most years?

2. If the Saugus Formation absorbs recharge much more slowly than the Alluvial Aquifer, won't pumping of the Alluvial Aquifer at the high end of the scale over a sustained period of time reduce recharge of the Formation and reduce the amount of potable water that can be drawn from the Formation in dry periods?

3. Both this report (p. 15) and the 2002 Water Report (p. 19) state that the Agency does not have sufficient groundwater quality data on the Saugus Formation to perform an analysis of "pumping related inpacts on quality." On page 25 of this report under Primary Element 1, the Agency states that it has "a useful amount of groundwater quality data." Is the latter in reference only to the Alluvial and not the Saugus? And if the Agency does not have sufficient data on quality of water from the Saugus Formation, how does the agency propose to collect that data to ensure quality in order to maintain the current pumpage level and to increase the yield as proposed on page 21?

4. Looking back at the 2002 Water Report, the Agency indicates (on page 19) that "there are limited Saugus (Formation) water level data." Does the Agency plan to collect more comprehensive data on the Saugus Formation general groundwater stability to determine reliability of projected yields and "artificial groundwater recharge" (p. 27) capacity?

5. Regarding Secondary Element 2,the Agency states: "The results of the DWSAPs can be used as a planning tool to guide land use development in the vicinity of water sources." Is the Agency currently sharing more recent, detailed information with the City regarding contamination risks in relation to the existing closed wells?

6. Where is the SCWC Stadium Well located?

7. Why is "Continuation of Public Education and Water Conservation listed as a Secondary (Potential) Element" when increased conservation savings are projected to reduce water demand by 10%? Shouldn't conservation be one of the primary elements of water management?

8. How is the Agency delivering recycled water to the TPC? Is it being run through a parallel piping system? Is so, what is the estimated cost and time frame for constructing such a system to carry the estimated 17,000afy? And how does the Agency propose to pay for this system?

9. How is the recycled water in locations, such as the golf course, reprocessed to remove pesticides and fertilizers?

10. What is the current average per capita water usage in afy?

11. The Semitropic Water Bank/Transfer is not mentioned in discussion of the Supplemental (SWP) Surface Water on page 21. Is that because it is a relatively short-term water supply? Are any of the other water transfers – Kern Water Bank, Kern Delta Water, North Las Posas Water Bank – as listed on UWMP p. 2-16, of limited duration? And if the Semitropic Water Bank Transfer is short term, how can it be included in the 105,000-106,000 afy need projected for the next 20 years? What will take its place?

12. What specific efforts will be made to manage salinity?

Thank you for giving me an opportunity to respond.

Diane Trautman

Responses to Trautman

1. In terms of groundwater management planning, projected urban water demand (the 106,000 afy projected urban demand in 2020) does not represent total valley-wide demand; total projected demand is 113,100 afy, including both urban and agricultural. In that light, on an average basis, local ground water is expected to be utilized to meet about 40 percent of total water demand.

   In regards to maintaining "roughly the same 60% SWP/40% local groundwater mix in most years", please refer to page 20 of the draft GWMP for a more complete response to your question. For example, about 54 percent of water demand in 2001 was supplied by local groundwater, and about 46 percent was supplied by imported SWP water. Also please refer to Table II-5 in the 2002 Santa Clarita Valley Water Report, which displays the build up of SWP water use through time, and the relative percentages of groundwater and SWP water used in a given year. As noted above, it is expected that, over time, again on an average basis, the annual amount of local groundwater pumping will not appreciably change but its fraction of total water supply will decrease. Conversely, over time, and once again on an average basis, both the annual volume of imported SWP water and its fraction of total water supply will increase.

2. No. Since the Saugus Formation is recharged over a much larger area, beyond the spatial extent of the Alluvium. There is a limited relationship between Alluvial pumping and recharge to the Saugus Formation.

   The fundamental tenet of the GWMP is to utilize groundwater for water supply within its sustainable yield (see the Management Objectives, or Goals, for the Basin, GWMP Section II; see also the various GWMP Elements intended to achieve those objectives, GWMP Section V). In that light, it is expected and intended to operate in such a way that recharge to the Saugus Formation will not be "reduced" by pumping from the Alluvial Aquifer and that groundwater will be available in varying amounts, as needed depending on weather year-types, within the sustainable yields of the respective aquifers (i.e. without overdrafting them).

3. The reference to "useful amount of groundwater quality data" in the GWMP includes both Alluvial and Saugus data. However, due to the historically greater development and use of groundwater from the Alluvium (number and distribution of wells, volume of pumping), and due to the historically smaller development and use of the Saugus Formation (fewer wells, smaller geographical distribution of wells, smaller pumpage), there is a comparatively limited ability to examine relationships among pumping, recharge, and quality in the Saugus. CLWA and the other purveyors intend to expand the overall knowledge of the Saugus Formation as that resource is further explored and

developed (number of wells, additional sampling as new wells are added, etc.). All that data will be included in ongoing implementation of GWMP Primary Element 1, Monitoring of Groundwater Levels, Quality, and Production.

4. The "limited nature of Saugus water level data" is a result of the same smaller extent of historical Saugus development described in the preceding answer. Acquisition of additional data on the Saugus Formation is planned as also described in the preceding answer.

5. All publicly available information regarding the investigation of perchlorate contamination, its extent, its impact on water supply, and plans for cleanup, control of migration, etc. is available to the City. Representatives of CLWA and the purveyors meet routinely with City representatives to review the status of perchlorate cleanup and remediation activities. CLWA and the impacted water purveyors will continue to pursue control and cleanup of perchlorate contamination in order to restore impacted groundwater pumping capacity and to ensure the long-term quantity and quality of groundwater in accordance with the GWMP. As a practical matter, there are no surface contamination risks relating to perchlorate that would affect land use development adjacent to the wells.

6. The stadium well is located on the south side of the Santa Clara River, approximately two miles upstream (east) of its confluence with the South Fork tributary, or about 4,000 feet east of the Bouquet Canyon Road crossing of the Santa Clara River.

7. The assignment of "primary" or "secondary" status to any GWMP element is discretionary and certainly not absolute. Secondary status is not intended to indicate that any element of the GWMP will not be implemented; all elements are intended to be implemented. Final status of all GWMP elements will be reviewed by the Advisory Council and decided by the CLWA Board.

8. Recycled water is being delivered to the TPC via the dedicated, recycled water distribution system, which is also capable of delivering water to other non-potable water users, and which will be expanded in accordance with the Draft Recycled Water Master Plan. The costs and time frame for expanding recycled water distribution and use are included in the Draft Recycled Water Master Plan, which is complementary to, but beyond the scope of the Groundwater Management Plan. The intent is to develop the 17,000 AFY of use by 2020. The capital cost of the complete system is estimated to be $68 million, and will be funded through CLWA's connection fee program.

9. Recycled water is not "reprocessed" at points of use such as the TPC golf course. In general, recycled water is highly treated (tertiary treated) waste water. In the case of the Santa Clarita Valley, treatment already occurs at the Valencia Reclamation Plant operated by the Sanitation Districts of Los Angeles County. The treated water, ready for non-potable use, is distributed from the plant site in a dedicated transmission pipeline system to end users such as the TPC. Pesticide and fertilizer uses, as part of cultural practices at end-user locations such as golf courses, are discretionary actions of the respective end users of recycled water.

10. Most water agencies no longer use "per capita" water use as a standard because it is not an accurate representation of actual per person water use, mainly due to the effects of landscape and commercial/industrial water use. (It is also expressed in "gallons per day," rather than "acre-feet per year, since it refers to individual water usage.") In general for the South Coast hydrologic region of California, water use is approximately 200 gallons per person per day (DWR Bulletin 160-98). Per capita use for the Santa Clarita Valley is slightly higher than this due to landscape irrigation demands caused by local climatic conditions.

11. The SWP is referred to as "supplemental" water because that is the original purpose of the SWP: to serve as a supply that would "supplement" local supplies (whether groundwater or local surface water or both). The specific amounts referred to in the GWMP are from the contractual terms between CLWA and the California Department of Water Resources.

    The water banked in the Semitropic Water Storage Program during 2002 is a short-term, dry period supply. The program has a term of ten years (i.e., the water must be returned to CLWA for use in its service area within that time period). Thus it is not included as a supply for long-term needs. However, the other programs listed in the UWMP (most of which, by the way, are not water "transfers," but are instead groundwater banking programs) are long-term sources of supply. As of this writing, the Agency is in the process of designing and implementing a Long-Term Reliability Plan to begin bringing such long-term programs on line as a means to store water available in wet years, for use in later dry years. CEQA analysis, with its accompanying public comment opportunities, will be part of the long-term reliability program approval process.

12. Primary Element 6 – Long Term Salinity Management is included in the GWMP for the reasons presented in the text discussion of that element. The element recognizes the need to plan for salinity management but also recognizes that, to the present, there has been no extraordinary trend of salinity increase. Hence, there are no specific efforts currently in place to "manage" salinity. It is envisioned that specific efforts will be developed over

time in response to implementation of the GWMP and, in particular, its Primary Element 6.

CLWA is participating in efforts by the Sanitation Districts of Los Angeles County to address the Los Angeles Regional Water Quality Control Board's proposed TMDL standard for chloride in the Santa Clara River. This effort is separate from and beyond the scope of the Groundwater Management Plan.

Additional Comments

Ed and Joan Dunn
15414 Rhododendron Dr.
Canyon Country, CA 91387
November 25, 2003

Castaic Lake Water Agency
President Peter Kavounas and Board of Directors
27234 Bouquet Canyon Road
Santa Clarita, CA 91350-2173

Re: Groundwater Management Plan (AB 3030) Nov. 2003 Draft

Dear President Kavounas and Directors:

We would like to comment on some statements of your new draft plan. On page 38 there is a bullet - Conservation pricing. Since we have never seen any conservation pricing locally, this should be explained or removed. We seriously question this being presently implemented.

On page 41, we ask why you are stating that only the eastern portion of the alluvium has experienced historical fluctuations in groundwater levels. How can there be constant groundwater levels in the western portion of the basin, when the western basin is supposed to receive its re-charge primarily from the eastern portion of the river? You imply that tributaries in the Bouquet Canyon area are the source of water in that area. We believe you are avoiding the real source of water to the area. That source appears to be the large amount of effluent from Sanitation District #26, and is maintaining the water level. Why is this not explained?

As usual, there is no explanation for a total extended interrupt of the state wholesale water system or the CLWA facilities!

We are disappointed that of the numerous comments of August 8, 2003 that we supplied, only a few were considered. We spent our time and efforts to supply comments and suggestions to make the water plan a good plan. So much for that!

Sincerely,

Ed and Joan Dunn

November 25, 2003

Mary Lou Cotton
Water Resources Manager
CLWA
via fax only

Subject: November 25, 2003 Groundwater Management Plan Protest Hearing

I will not be attending the protest hearing this evening, but I do have three comments on the materials you provided to me.

First, I commented previously on the proposed network of monitoring wells and the public availability of data. The monitoring wells in figures 5-1 and 5-2 appear to cover a wide range of the valley. However, the text on p. 27 states the network will be "mostly as illustrated in figures 5-1 and 5-2, but possibly expanded...." I hope the final network is extensive and covers all areas of the valley. Further expansion of the network would add valuable data points and should be encouraged.

I did not see any indication of whether the collected monitoring data would be publicly available. I have heard comments from others that some well data is not being released to the public, even upon request. I think that concerned citizens and groups should be allowed access to the monitoring database.

Second, I have one new comment on the wording on page 34, regarding perchlorate cleanup. The last paragraph states "the proposed pumping would be combined with approved wellhead treatment to render the treated water suitable for municipal supply." This may be a wording issue, but my understanding is that wellhead treatment is not always approved or allowed by the permitting agencies. This wording implies that wellhead treatment is already an approved scenario, while it may be determined that treatment followed by re-injection or non-potable usage makes more sense. I think it would be more accurate to not specify the final treatment scenario until the plume characterization is complete and the pilot studies are finished and accepted.

Finally, the plan is clearly an overview that will have to be expanded upon with supporting policies and target dates. Some commenters requested this information go in the groundwater plan. If the agency does not add implementation strategies and target dates to the plan, they should be prepared separately, updated annually, and made available to the public upon request.

I understand the time for commenting may have past, but if you are able to address these concerns in the final draft it would be appreciated.

Sincerely

Maria Gutzeit
24463 Shadeland Dr
Newhall, CA 91321

Appendix H

Historical Imported Supply Deliveries by Purveyor
(Expanded Table 3-3 from Section 3)

APPENDIX H
HISTORICAL IMPORTED SUPPLY DELIVERIES BY PURVEYOR (AF)
(Expanded Table 3-3 from Section 3 Water Resources)

Santa Clarita Water Division

Year	SWP Deliveries to Service Area[a]	Withdrawals from Out-of-Service Area Storage[b]	Other Imported Deliveries to Service Area[c]	Total Imported Supplies to Service Area
1980	1,210	0	0	1,210
1981	4,558	0	0	4,558
1982	6,358	0	0	6,358
1983	5,379	0	0	5,379
1984	6,905	0	0	6,905
1985	7,248	0	0	7,248
1986	8,469	0	0	8,469
1987	9,642	0	0	9,642
1988	11,353	0	0	11,353
1989	12,850	0	0	12,850
1990	12,784	0	0	12,784
1991	5,686	0	0	5,686
1992	6,313	0	0	6,313
1993	3,417	0	0	3,417
1994	5,127	0	0	5,127
1995	8,304	0	0	8,304
1996	9,174	625	0	9,798
1997	9,410	0	0	9,410
1998	8,681	0	0	8,681
1999	11,368	0	0	11,368
2000	13,119	1,093	0	14,212
2001	15,764	0	0	15,764
2002	19,062	179	0	19,241
2003	24,072	0	0	24,072
2004	22,165	0	0	22,165
2005	15,954	0	0	15,954
2006	16,714	0	0	16,714
2007	15,921	0	5,015	20,937
2008	14,216	0	4,905	19,121
2009	12,009	759	5,062	17,830

Los Angeles County Waterworks District 36

Year	SWP Deliveries to Service Area[a]	Withdrawals from Out-of-Service Area Storage[b]	Other Imported Deliveries to Service Area[c]	Total Imported Supplies to Service Area
1980	0	0	0	0
1981	0	0	0	0
1982	143	0	0	143
1983	214	0	0	214
1984	250	0	0	250
1985	285	0	0	285
1986	346	0	0	346
1987	358	0	0	358
1988	431	0	0	431
1989	459	0	0	459
1990	525	0	0	525
1991	402	0	0	402
1992	419	0	0	419
1993	463	0	0	463
1994	460	0	0	460
1995	498	0	0	498
1996	521	35	0	556
1997	730	0	0	730
1998	564	0	0	564
1999	690	0	0	690
2000	763	64	0	827
2001	914	0	0	914
2002	1,077	10	0	1,087
2003	1,369	0	0	1,369
2004	859	0	0	859
2005	828	0	0	828
2006	1,257	0	0	1,257
2007	1,083	0	341	1,424
2008	1,035	0	357	1,392
2009	842	53	355	1,250

Newhall County Water District

Year	SWP Deliveries to Service Area[a]	Withdrawals from Out-of-Service Area Storage[b]	Other Imported Deliveries to Service Area[c]	Total Imported Supplies to Service Area
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	0	0	0	0
1984	0	0	0	0
1985	0	0	0	0
1986	0	0	0	0
1987	22	0	0	22
1988	141	0	0	141
1989	430	0	0	430
1990	815	0	0	815
1991	623	0	0	623
1992	797	0	0	797
1993	1,071	0	0	1,071
1994	919	0	0	919
1995	1,362	0	0	1,362
1996	1,186	81	0	1,266
1997	1,231	0	0	1,231
1998	1,727	0	0	1,727
1999	5,329	0	0	5,329
2000	5,747	479	0	6,226
2001	5,493	0	0	5,493
2002	6,031	57	0	6,087
2003	7,654	0	0	7,654
2004	5,928	0	0	5,928
2005	5,731	0	0	5,731
2006	5,749	0	0	5,749
2007	4,990	0	1,572	6,562
2008	4,149	0	1,432	5,581
2009	3,271	207	1,379	4,857

Valencia Water Company

Year	SWP Deliveries to Service Area[a]	Withdrawals from Out-of-Service Area Storage[b]	Other Imported Deliveries to Service Area[c]	Total Imported Supplies to Service Area
1980	0	0	0	0
1981	1,203	0	0	1,203
1982	3,015	0	0	3,015
1983	3,883	0	0	3,883
1984	4,321	0	0	4,321
1985	4,868	0	0	4,868
1986	5,113	0	0	5,113
1987	6,145	0	0	6,145
1988	6,979	0	0	6,979
1989	7,980	0	0	7,980
1990	8,014	0	0	8,014
1991	646	0	0	646
1992	6,301	0	0	6,301
1993	8,394	0	0	8,394
1994	8,097	0	0	8,097
1995	7,577	0	0	7,577
1996	6,805	463	0	7,269
1997	9,223	0	0	9,223
1998	8,799	0	0	8,799
1999	11,404	0	0	11,404
2000	11,452	954	0	12,406
2001	13,461	0	0	13,461
2002	15,910	149	0	16,059
2003	18,640	0	0	18,640
2004	18,511	0	0	18,511
2005	14,233	0	0	14,233
2006	15,902	0	0	15,902
2007	12,925	0	4,071	16,996
2008	12,478	0	4,306	16,784
2009	9,974	631	4,204	14,809

Los Angeles County Honor Farm

Year	SWP Deliveries to Service Area[(a)]	Withdrawals from Out-of-Service Area Storage[(b)]	Other Imported Deliveries to Service Area[(c)]	Total Imported Supplies to Service Area
1980	0	0	0	0
1981	0	0	0	0
1982	0	0	0	0
1983	0	0	0	0
1984	0	0	0	0
1985	0	0	0	0
1986	0	0	0	0
1987	0	0	0	0
1988	0	0	0	0
1989	0	0	0	0
1990	0	0	0	0
1991	0	0	0	0
1992	981	0	0	981
1993	441	0	0	441
1994	316	0	0	316
1995	6	0	0	6
1996	762	52	0	814
1997	992	0	0	992
1998	12	0	0	12
1999	21	0	0	21
2000	3	0	0	3
2001	0	0	0	0
2002	0	0	0	0
2003	0	0	0	0
2004	0	0	0	0
2005	0	0	0	0
2006	0	0	0	0
2007	0	0	0	0
2008	0	0	0	0
2009	0	1,650	0	38,746

Source: DWR Bulletin 132, Management of the California State Water Project; and DWR delivery files.

Notes:

(a) Includes deliveries of Table A supplies, carryover water, Article 21 water, Turnback Pool water, local supply (from West Branch reservoirs) and water purchased through DWR.

(b) Out-of-service area storage includes flexible storage in Castaic Lake, the Semitropic Banking Program and the Rosedale-Rio Bravo Banking Program.

(c) Deliveries from Buena Vista-Rosedale.

Appendix I

Perchlorate Contamination and Impact on Groundwater Supplies in the Santa Clarita Valley

Appendix I

Perchlorate Contamination and Impact on Groundwater Supplies in the Santa Clarita Valley

Introduction

The detection of perchlorate in Santa Clarita Valley groundwater supplies has raised concerns over the reliability of those supplies, in particular the Saugus Formation where six wells have been impacted as a result of perchlorate. As discussed below, planning and implementation of remediation of the perchlorate, and restoration of impacted well capacity, have been substantially undertaken. While that work continues, non-impacted production facilities can be relied upon for the quantities of water projected to be available from the Alluvial Aquifer and Saugus Formation during the time necessary to fully restore perchlorate-impacted wells. CLWA, the local retail water purveyors, the California Department of Toxic Substances Control (DTSC) and the U.S. Army Corps of Engineers (ACOE) continue to work closely on the perchlorate contamination issue, which reasonably ensures a prompt response to any significant changes in conditions.

The following is a discussion of pertinent events related to perchlorate contamination. It illustrates that work toward the ultimate remediation of the perchlorate contamination, including the reactivation of impacted groundwater supply wells, has progressed on several integrated fronts over the last ten years. The following discussion is organized into several sections that focus on various aspects of the offsite impacts of perchlorate on water supply wells and the ongoing activities to remediate that problem and restore the impacted well capacity.

On-Site Investigations and Clean-up

On-site investigation and clean-up have continued at the former Whittaker-Bermite facility. The on-site investigation and clean-up activities at the source of the contamination are under the regulatory authority and control of DTSC.

Background

The Whittaker-Bermite site is located in the center of the Santa Clarita Valley and was operated as an explosives and munitions manufacturing, testing and storage facility since the late 1930's. It was first owned by the Los Angeles Powder Company and later by Golden State Fireworks, the Halifax Explosives Company, the Bermite Powder Company and the Whittaker Corporation (Whittaker), which assumed ownership of the site in 1967. Under contracts with the U.S. Department of Defense, Whittaker Corporation used perchlorate in the manufacture of solid propellants for rockets and missiles until operations ceased in 1987. There was a long history of perchlorate use and other chemical use at the site, and surface and subsurface investigations at the site revealed the presence of perchlorate and other contaminants in soil and groundwater.

The contaminants found in the soil that require clean-up are perchlorate and volatile organic compounds (VOCs). These chemicals were used in the manufacturing and testing of fireworks, dynamite, oil-field explosives, and munitions. The site encompasses 996 acres, with actual production facilities occupying approximately 50 acres. The property is characterized by chaparral covering the undisturbed portions of the site, fire breaks, dirt roads and remnants of facility foundations and buildings. The surrounding areas include commercial, light industrial and residential land uses. The facility was closed in 1987 and most of the structures on the property were removed at or about that time.

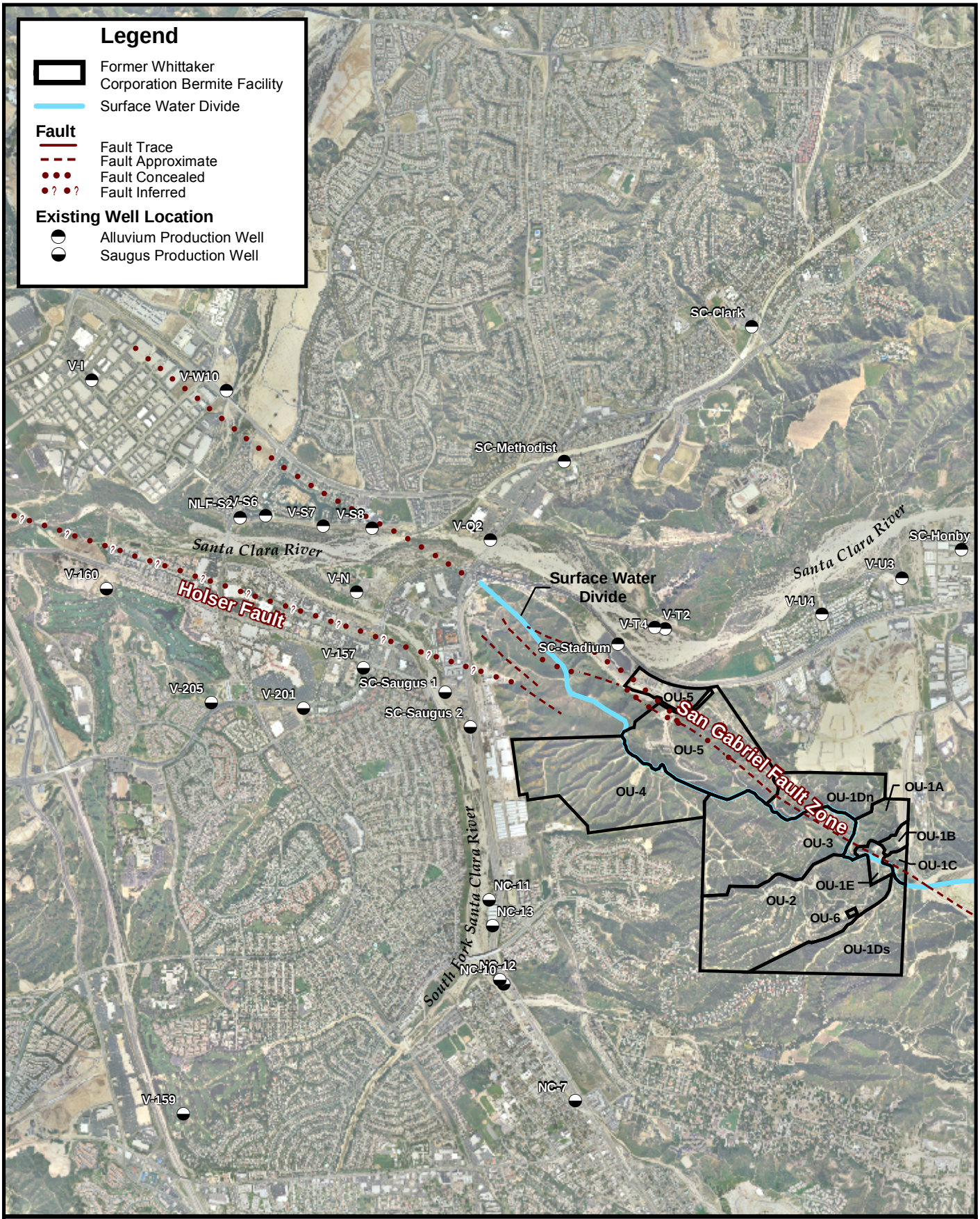
Between 1987 and 1998, Whittaker conducted environmental investigations and clean-up activities under the supervision of DTSC and its predecessor agency. In 1994, Whittaker entered into an enforceable agreement with DTSC to conduct a comprehensive site-wide investigation of areas of concern. In early 1997, with the remedial investigations under way, DTSC informed Whittaker that the soils, groundwater and surface runoff would have to be reassessed for the presence of perchlorate

In 1998, Whittaker sold the property to Santa Clarita LLC, a brownfield development company. In addition to assuming all clean-up responsibilities, Santa Clarita LLC acquired the right to develop the property contingent upon the full clean-up and certification of the property's reuse by DTSC. Between 1999 and 2001, Santa Clarita LLC expanded the site investigation and clean-up programs that had been initiated by Whittaker under the 1994 agreement. In 2002, however, with Santa Clarita LLC unable to fund additional site work due to financial difficulties, DTSC initiated negotiations with Whittaker to resume site investigation and clean-up work. In November 2002, DTSC issued an Order that required Whittaker to complete the site investigations and feasibility studies for all contaminants of concern under a tight time schedule.

Perchlorate Impacted Water Purveyor Wells

Perchlorate was initially detected in four Saugus Formation production wells operating near the former Whittaker-Bermite site in 1997. These wells – CLWA Santa Clarita Water Division's (SCWD) Wells Saugus 1 and Saugus 2, Newhall County Water District's (NCWD) Well NC-11 and Valencia Water Company's (VWC) Well V-157 – were removed from service. In 2002, perchlorate was detected in the SCWD Stadium well located directly adjacent to the Whittaker-Bermite site. This Alluvial well was also removed from service and subsequently capped in 2009. It was replaced with a new well, the SCWD Santa Clara well, also in 2009. Locations of the impacted wells and other nearby non-impacted wells, relative to the Whittaker-Bermite site are shown on Figure I-1. The restoration and/or replacement of these wells to service is discussed below.

Since the initial detection of perchlorate and resultant inactivation of impacted wells, the retail water purveyors have continued to conduct regular monitoring of active wells near the Whittaker-Bermite site. In late March 2005, that monitoring detected the presence of perchlorate in VWC's Well Q2, an Alluvial well located immediately northwest of the confluence of Bouquet Creek and the Santa Clara River.



CH2MHILL

Figure I-1
Site Location
Former Whittaker-Bermite Facility

As a result of the detection and confirmation of perchlorate in its Well Q2, VWC removed the well from active service and immediately pursued permitting and installation of wellhead treatment. The well was returned to water supply service in October 2005.

In 2006, Saugus well NCWD Well NC-13 had detectable concentrations of perchlorate below drinking water standards; it has remained in active water supply service.

Most recently, in August 2010, VWC's water sample tests, taken from August 2010 through April 2011, confirmed the presence of perchlorate above the regulatory standard at VWC's Saugus Well 201, located downgradient from the Whittaker Bermite site and downgradient from the initially impacted Saugus 1 and 2 and V-157 wells. VWC immediately took the well out of service and notified the California Department of Public Health (DPH). VWC continues to monitor the inactive well on a monthly basis. The most recent sample confirmed that perchlorate is still present and that remediation is needed as outlined by the 2007 Whittaker-Bermite Litigation Settlement Agreement (Settlement Agreement; discussed below in the section entitled "Water Supplier Litigation and Settlement Agreements").

VWC is currently evaluating remediation alternatives and intends to pursue restoration of the well's capacity through such means as wellhead treatment as provided for in the Settlement Agreement. This and several other wells were identified as being potentially threatened by perchlorate in the Settlement Agreement. Therefore, provisions were made in the Settlement Agreement to provide for treatment for any additional wells that may be impacted by perchlorate.

Analysis of the planned program for restoration of originally impacted wells using the basin groundwater model estimated that perchlorate-contaminated groundwater would be contained and captured by pumping Saugus 1 and 2. Ultimately, however, the combination of litigation, settlement, permitting and construction constrained actual implementation of the containment program until 2010, six years after the impact of the containment program on perchlorate migration in groundwater was analyzed. That time, combined with the preceding seven years since perchlorate first impacted water supply wells, resulted in a greater risk of downgradient migration of perchlorate in the Saugus Formation, and is interpreted to be the primary reason for the recent detection of perchlorate in VWC Well 201. However, as mentioned above, that possibility was addressed in the Settlement Agreement as it includes provisions for providing treatment to wells that are impacted by perchlorate not contained or captured by the original containment program.

Regulatory Standards for Perchlorate

Perchlorate is a chemical salt and is very soluble in water. It is also very mobile in water and is persistent (i.e., does not degrade) under typical environmental conditions. The maximum contaminant level (MCL) for perchlorate of 6 micrograms per liter (ug/L) was established by DPH in October 2007. MCLs are based on health protection, technical treatment feasibility, analytical detection limits and costs.

Water Supplier Litigation and Settlement Agreements

On November 29, 2000, CLWA and the local retail water purveyors filed suit against the current and prior owners of the Whittaker-Bermite facility. The lawsuit included causes of action relating to payment of all necessary costs of response, removal of the perchlorate contamination, payment of remediation action costs and compensation for other damages associated with the perchlorate contamination. CLWA and the local retail water purveyors had incurred substantial response costs and other expenses as a result of production lost on account of the contamination

In late summer 2003, CLWA, the local retail water purveyors, Whittaker and Remediation Financial, Inc. (RFI) and Santa Clarita LLC (SCLLC) entered into an interim settlement agreement, in which the parties agreed to work cooperatively for a minimum of one year to further define long-term costs and possibly achieve a long-term settlement. The interim settlement agreement specified that Whittaker, RFI and SCLLC and/or their insurers would reimburse certain past costs as well as fund studies and prepare cost estimates for the clean-up plan to restore water production and capacity of the impacted wells and protect other wells from future contamination. The interim settlement provided for a one-year stay of the lawsuit between the parties and was subsequently amended to extend the stay through January 31, 2005. This allowed the parties to focus on the final elements of the clean-up plan, which was submitted to the regulatory agencies in early 2005 and approved in 2007.

In May 2007, a comprehensive settlement was executed by CLWA, the retail purveyors and Whittaker, RFI and SCLLC (Settlement Agreement). The water suppliers were reimbursed certain costs incurred as a result of the perchlorate contamination and funds were deposited in escrow to pay for the costs of restoration of wells and construction of treatment facilities and related pipelines. The Settlement Agreement also provides funds to pay for operation and maintenance costs for the treatment system for up to 30 years, which the agencies estimate to cost as much as $50,000,000.

Approximately $31,000,000 has been reimbursed to the agencies for past expenditures pursuant to the Perchlorate Contamination Settlement. Another $5,000,000 to $10,000,000 will be used to construct wells and pipelines to supply water that will replace capacity lost from impacted wells. An additional $10,000,000 is available to allow the water suppliers to immediately treat any additional wells that could become impacted by perchlorate in the future (i.e., the “Rapid Response Fund”).

DTSC/CLWA/Purveyor Environmental Oversight Agreement

In February 2003, DTSC and CLWA, NCWD, SCWD, and VWC entered into an Environmental Oversight Agreement (Agreement) whereby DTSC provides review and oversight of the response activities being undertaken by CLWA and the local retail water purveyors relating to the detection of perchlorate in the initially impacted wells.

The significance of the Agreement lies in the response actions to be undertaken in its “Scope of Work” (Exhibit B to the Agreement). Under the Scope of Work, CLWA and the retail water purveyors prepared (1) Well Characterization Reports, (2) a Health-Based Risk Assessment,

(3) a Regional Groundwater Flow Model and (4) a Treatment Technology Evaluation Report. The regional groundwater flow model and the treatment technology evaluation were key inputs to the permitting for restoring the impacted wells by returning them to water supply service as described below. Both were completed and utilized in conjunction to control contamination migration and restore impacted water supply well capacity. Most important, under the Scope of Work, CLWA and the retail water purveyors prepared and implemented a Remedial Action Plan (RAP) that is being used in connection with water treatment programs and/or well relocation. The RAP remains important to the retail water purveyors, who have been working cooperatively with DTSC to implement the groundwater clean-up.

Treatment Technology

A number of full scale perchlorate treatment systems were evaluated by a technical group to ensure the most efficient and cost-effective process to remove perchlorate was selected. The technical group was comprised of representatives from CLWA, the retail water purveyors and consultants retained by Whittaker-Bermite. It initially agreed to solicit competitive bids for the design, construction and operation of two treatment systems – ion exchange and biological.

After thorough evaluation of several bids, the technical group determined that ion exchange was the preferred technology based upon treatment performance, ease of regulatory compliance and comparison of costs associated with construction and operations and maintenance.

The preferred single-pass ion exchange treatment technology does not generate a concentrated perchlorate waste stream that would require additional treatment before discharge to a sanitary sewer or a brine line (if one is available). This technology incorporates an active resin (a material that attracts perchlorate molecules) that safely removes the perchlorate from water. The resin is contained in pressure vessels and the water is pumped through the vessel. The resin is eventually replaced with new resin after a period of time. The old resin is removed and transported by truck to an approved waste disposal site where it is safely destroyed. This technology is robust and reliable for use in drinking water systems.

DPH has approved operation of the perchlorate treatment plants currently in operation at the following locations:

- La Puente Valley Water District (2,500 gpm)
- San Gabriel Valley Water Company, El Monte (7,800 gpm)
- California Domestic Water Company, Whittier (5,000 gpm)
- City of Riverside (2,000 gpm)
- West San Bernardino Water District, Rialto (2,000 gpm)
- City of Rialto (2,000 gpm)
- City of Colton (3,500 gpm)
- Fontana Union WC (5,000 gpm)
- City of Pomona (10,000 gpm)
- Valencia Water Company (1,700 gpm)
- CLWA Santa Clarita Water Division (2,400 gpm)

Based on (1) the results of CLWA's investigation of perchlorate removal technologies, (2) the technical group's evaluation and (3) DPH's approval of single-pass ion exchange for treatment in other settings, CLWA and the local retail water purveyors selected and installed single-pass ion exchange as the treatment technology for restoration of impacted capacity (wells). The perchlorate treatment facility includes an ion exchange process located at the Rio Vista Intake Pump Station. The same single-pass ion exchange wellhead treatment is being considered for installation at the recently impacted VWC Well 201 to restore that impacted Saugus well capacity. This same treatment also was successfully implemented at VWC Well Q2 in 2007.

Restoration of Perchlorate Impacted Water Supply

Since the detection of perchlorate in the four Saugus wells in 1997, CLWA and the retail water purveyors recognized that one element of an overall remediation program would include pumping from impacted wells, or from other wells in the immediate area, to establish hydraulic conditions that would control the migration of contamination from further impacting the aquifer in a downgradient (westerly) direction. Thus, CLWA and the retail water purveyors expected that the overall perchlorate remediation program could include dedicated pumping from some or all of the impacted wells, with appropriate treatment, such that two desirable objectives could both be achieved. The first objective is control of subsurface flow and protection of downgradient wells and the second is restoration of some or all of the contaminated water supply. Not all of the initially impacted pumping capacity is required for control of groundwater flow. Some of the remaining capacity has been replaced by construction of replacement wells at other nonimpacted locations; and some capacity remains to be replaced by future new wells.

In cooperation with state regulatory agencies and investigators working for Whittaker-Bermite, CLWA and the local retail water purveyors developed an off-site plan that focuses on the above concepts of groundwater flow control and restored pumping capacity and is compatible with onsite and possibly other off-site remediation activities. Specifically relating to water supply, the plan includes the following:

- Constructing and operating a water treatment process that removes perchlorate from two impacted wells such that the produced water can be used for municipal supply
- Hydraulically containing the perchlorate contamination moving from the Whittaker-Bermite site toward the impacted wells by pumping the wells at rates that will capture water from all directions around them
- Protecting the downgradient non-impacted wells through the same hydraulic containment that results from pumping two of the impacted wells
- Restoring the annual volumes of water that were pumped from the impacted wells before they were inactivated, and also restoring the wells' total capacity to produce water in a manner consistent with the retail water purveyor's operational plan for groundwater supply.

An extended test of the wells that were eventually returned to service was performed as part of restoring a portion of the impacted well capacity and controlling the migration of perchlorate in the aquifer. Concurrent with the testing of the wells, several specific ion exchange resins were also tested to evaluate their performance and longevity.

The Final Interim Remedial Action Plan for containment and extraction of perchlorate was completed and approved by DTSC in January 2006. Construction of the perchlorate treatment facility and related distribution system, the main components of the "pump and treat program," began in November 2007 and was completed in May 2010. In combination with start-up of the treatment system, the SCWD Saugus 1 and 2 wells (two of the four wells that were taken out of service in 1997) were returned to service in January 2011 after DPH issued an amendment to CLWA's Operating Permit in December 2010 (see discussion of "Compliance with DPH Policy Memo 97-005" below). After consideration of groundwater modeling results and engineering analysis, the parties to the Settlement Agreement agreed to operate the Saugus 1 and 2 wells at 1,100 gallons per minute (gpm) each (2,200 gpm total) in order to optimize both the contaminant plume containment and well production.

Additionally, VWC well 157 that was taken out of service in 1997 was replaced by Well 206 in 2005.

In light of the preceding, with regard to the adequacy of groundwater as the local component of water supply in this UWMP, the impacted capacity of the previously out of service wells (not including VWC Well 201) is being restored by a combination of treatment (i.e., Saugus 1 and 2) and new wells in non-impacted areas (all funded by the Settlement Agreement), providing well capacity that is sufficient to meet near-term normal and dry-year water requirements. Achievement of the full range of normal and multiple dry-year groundwater supply as provided in the groundwater operating plan will require additional new well construction, as well as restoration of the recently impacted VWC Well 201.

Compliance with DPH Policy Memo 97-005

Returning contaminated wells to municipal water supply service by installing treatment requires issuance of permit from DPH before the water can be considered potable and safe for delivery to customers. The permit requirements are contained in DPH Policy Memo 97-005 for direct domestic use of impaired water sources. Before issuing a permit to a water utility for use of an impaired source as part of the utility's overall water supply permit, DPH requires that studies and engineering work be performed to demonstrate that pumping the wells and treating the water will be protective of public health for users of the water. The Policy Memo requires that DPH review the local retail water purveyor's plan, establish appropriate permit conditions for the wells and treatment system and provide overall approval of returning the impacted wells to service for potable use. Ultimately, CLWA and the local retail water purveyors' plan and the DPH requirements are intended to ensure that the water introduced to the potable water distribution system has no detectable concentration of perchlorate.

The DPH 97-005 Policy Memo requires, among other things, the completion of a source water assessment for the impacted wells intended to be returned to service. The purpose of the assessment is to determine the extent to which the aquifer is vulnerable to continued migration of perchlorate and other contaminants of interest from the Whittaker-Bermite site. The assessment includes the following:

- Delineation of the groundwater capture zone caused by operating the impacted wells

- Identification of contaminants found in the groundwater at or near the impacted wells
- Identification of chemicals or contaminants used or generated at the Whittaker-Bermite facility
- Determination of the vulnerability of pumping the impacted wells to these contaminant sources

CLWA worked directly with the retail water purveyors and its consultants on the development of the DPH 97-005 Policy Memo permit application. Drafts of all six elements of the 97-005 Policy Memo were submitted to DPH and the retail purveyors for review, including the Source Water Assessment, Raw Water Quality Characterization, Source Protection Plan, Effective Monitoring and Treatment Evaluation, Human Health Risk Assessment and the Alternatives Sources Evaluation. The Engineer's Report, which summarizes these six elements for the 97-005 process, was completed in 2005.

As noted above, CLWA and the local retail water purveyors recognized the need for some form of pumping in or near the impacted wells to extract contamination and protect downgradient non-impacted wells. As part of the permitting for use of impacted wells with treatment, DPH 97-005 Policy Memo requires an analysis to demonstrate contaminant capture and protection of other nearby water supply wells. The development and calibration of a numerical groundwater flow model of the entire basin was initiated as a result of a 2001 Memorandum of Understanding among the Upper Basin Water Purveyors (CLWA, CLWA SCWD, LACWWD #36, NCWD and VWC) and the United Water Conservation District in Ventura County.

The basin-wide groundwater model was initially intended for use in analyzing the yield and sustainability of groundwater in the Basin. That model, and the current updated model, was used to develop the sustainable groundwater pumping rates reflected in Section 3 of this UWMP. The model was also used to analyze both the sustainability of groundwater under an operational scenario that includes full restoration of perchlorate-contaminated supply and the containment of perchlorate near the Whittaker-Bermite property (i.e., by pumping some of the contaminated wells), including preventing movement of perchlorate contamination to other portions of the aquifer system. DTSC reviewed and approved the construction and calibration of the regional model as described in the final model report "Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration" (CH2M Hill, April 2004).

After DTSC's approval of the model, it was used to simulate the capture and control of perchlorate by restoring impacted wells, with treatment, as described above. The results of that work were summarized in a second report "Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California" (CH2M Hill, December 2004).

The modeling analysis indicated that the pumping of impacted wells Saugus 1 and Saugus 2 at a rate of 1,200 gpm each on a nearly continual basis would effectively contain perchlorate migrating westward in the Saugus Formation from the Whittaker-Bermite property (as previously noted, subsequent technical analysis resulted in the selection of a pumping rate of 1,100 gpm for each well). The analysis also indicates that (1) no new production wells are needed in the Saugus Formation to meet the perchlorate containment objective, (2) impacted well NCWD-11 is not a required component of the containment program and (3) pumping at Saugus 1 and 2 is

necessary to prevent continued migration of perchlorate to other portions of the Saugus Formation. The modeling report also includes the general design of a sentinel groundwater monitoring network and program required by DPH as part of its 97-005 Policy Memo permitting. The perchlorate containment report was approved by DTSC in November 2004. With that approval, the model was then used to support the source water assessment and the remainder of the permitting process required by DPH under its 97-005 Policy Memo.

Conclusions Regarding VWC Well 201

As noted above and in Section 3, perchlorate was detected in VWC Well 201 in the August 2010. This well was taken out of service and its capacity is not included in active groundwater sources delineated in Table 3-9 of this UWMP. VWC plans to actively seek remediation under the settlement agreement and rapidly restore the impacted well capacity. Given its experience of (1) bringing its Q2 well back into production, (2) actions under the DPH 97-005 Policy Memo, (3) participating in bringing treatment facilities on line for the Saugus 1 and Saugus 2 wells and (4) replacing capacity for its Well 157, VWC has determined that it could either install wellhead treatment to bring the well back into service or replace the capacity with a new well within two years.

Appendix 5.21F

2013 Santa Clarita Valley Water Report

Luhdorff & Scalmanini Consulting Engineers

June 2014

2013
Santa Clarita Valley
Water Report

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Los Angeles County Waterworks District 36
Newhall County Water District
Valencia Water Company

June, 2014

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

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CONSULTING ENGINEERS

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EXECUTIVE SUMMARY

This annual report, which is the sixteenth in a series that began to describe water supply conditions in 1998, provides current information about the water requirements and water supplies of the Santa Clarita Valley. The report was prepared for the imported water wholesaler, Castaic Lake Water Agency (CLWA), and for the four local retail water Purveyors that serve the Valley: CLWA Santa Clarita Water Division, Los Angeles County Waterworks District 36, Newhall County Water District, and Valencia Water Company. These entities and representatives from the City of Santa Clarita and the County of Los Angeles Department of Regional Planning meet as required as the Santa Clarita Valley Water Committee to coordinate the management of imported water with local groundwater and recycled water to meet water requirements in the Valley.

This report provides information about local groundwater resources, State Water Project (SWP) and other imported water supplies, water conservation, and recycled water. The report reviews the sufficiency and reliability of supplies in the context of existing water demand, with focus on actual conditions in 2013, and it provides a short-term outlook of water supply and demand for 2014.

ES.1 2013 Water Requirements and Supplies

In 2013, total water requirements in the Santa Clarita Valley were about 89,600 acre-feet (af), of which about 73,500 af (82 percent) were for municipal use and the remainder (16,100 af) was for agricultural and other (miscellaneous) uses, including individual domestic uses. Total demand in 2013 was about five percent higher than 2012; slightly above what was estimated in the 2012 Water Report and the average projection in the 2010 Urban Water Management Plan (UWMP). Total water requirements in 2013 were met by a combination of about 45,900 af from local groundwater resources (about 26,600 af for municipal and about 16,200 af for agricultural and other uses), about 43,300 af of SWP and other imported water, and about 400 af of recycled water.

Of the 45,900 af of total groundwater pumping in the Valley in 2013, about 36,900 af were pumped from the Alluvium and about 9,000 af were pumped from the underlying, deeper Saugus Formation. Alluvial pumping in 2013 represented about a 3,800 af decrease from 2012, and Saugus pumping was slightly higher than in 2012, by about 300 af. Neither pumping volume resulted in any notable long term, overall change in groundwater conditions (water levels, water quality, etc.) in either aquifer system. Imported water deliveries to the Purveyors increased by about 7,700 af from the previous year. Water uses and supplies in 2013 are summarized in the following Table ES-1.

Table ES-1
Santa Clarita Valley
Summary of 2013 Water Supplies and Uses
(acre-feet)

Municipal		
SWP and other Imported		43,281
Groundwater (Total)		29,779
Alluvium	*21,431*	
Saugus	*8,348*	
Recycled Water		400
Subtotal		**73,460**
Agriculture/Miscellaneous		
SWP and other Imported		-
Groundwater (Total)		16,151
Alluvium	*15,461*	
Saugus	*690*	
Subtotal		**15,151**
Total		***89,611***

In accordance with the California Urban Water Management Planning Act, the Valley-wide UWMP was updated in 2010 and adopted in 2011 (2010 UWMP) to extend projected water demands through projected buildout of the Valley in 2050, and to describe the combination of local groundwater, imported water supplies from the State Water Project and other sources, local recycled water supplies, and other water supplies planned to meet those projected water demands in the Valley. The 2010 UWMP describes the reliability of local groundwater resources and the adequacy of groundwater supplies to meet groundwater demand. The 2010 UWMP also describes the recently completed work for integrated control of perchlorate migration and restoration of perchlorate-impacted groundwater supply.

Notable details about each component of water supply in the Valley, and about the water supply outlook for 2014, include the following.

ES.2 Alluvial Aquifer

Based on an updated evaluation of groundwater basin yield, completed in 2009, the groundwater operating plan in the 2010 UWMP includes Alluvial pumping in the range of 30,000 to 40,000 acre-feet per year (afy) following wet/normal years, and slightly reduced pumping (30,000 to 35,000 afy) following dry years. Pumping from the Alluvium in 2013 was about 36,900 af, which is slightly above the middle of the operating plan range for the Alluvium during wet/normal years and slightly above the range following dry years. There were no adverse

effects on groundwater levels and storage in the basin that have not normally occurred during previous dry periods in the basin. On average, pumping from the Alluvium has been about 33,200 afy since supplemental imported water became available in 1980. That average rate remains near the lower end of the range of operational yield for a wet/normal year and about mid-range for a dry period.

On a long-term basis, continuing through 2013, there is no evidence of any historic or recent trend toward permanent water level or storage decline. In general, throughout a large part of the basin, Alluvial groundwater levels have generally remained near historic highs during the last 35 years with short-term declines during dry periods followed by rapid recoveries during wet periods. Above-average precipitation in late 2004 and 2005, and more recently in 2010 and early-2011, resulted in significant water level recovery in the eastern part of the basin despite the recent multi-year dry period (2006-2009, 2011-2013), when water levels declined to the low end of the historic range of groundwater levels. This continues the overall trend of fluctuating groundwater levels within a generally constant range over the last 35 years. These ongoing data indicate that the Alluvium remains in good operating condition and can continue to support pumping in the operating range included in the 2010 UWMP, or slightly higher, without adverse results (e.g., long-term water level decline or degradation of groundwater quality.)

Based on an integration of water quality records from multiple wells completed in the Alluvium, there have been historical fluctuations in groundwater quality, typically associated with variations in precipitation and streamflow. However, like groundwater levels, there has been no long-term trend toward groundwater quality degradation; groundwater produced from the Alluvial aquifer remains a viable municipal and agricultural water supply.

In 2002, as part of ongoing monitoring of wells for perchlorate contamination, perchlorate was detected in one Alluvial well (the SCWD Stadium Well) located near the former Whittaker-Bermite facility. The detected concentration was slightly below the then-applicable Notification Level for perchlorate (6 µg/l, which was subsequently established as the Maximum Contaminant Level for perchlorate in October 2007), and the well has now been replaced to restore that component of municipal water supply that was impacted by perchlorate. In early 2005, perchlorate was detected in a second Alluvial well, VWCôs Well Q2. After an interim period of wellhead treatment, that well has now been returned to regular water supply service. All other Alluvial wells operated by the Purveyors continue to be used for municipal water supply service; all Alluvial municipal wells are sampled in accordance with drinking water regulations and perchlorate has not been detected. The 2005 UWMP specifically addressed the adequacy of groundwater supply in light of the inactivation of the impacted Alluvial wells; and it addressed the plan and schedule for restoration of perchlorate-impacted wells, including the protection of existing non-impacted wells. As summarized in the 2010 UWMP, the replacement and

reactivation of the formerly impacted wells now adds to the overall ability to meet the groundwater component of total water supply in the Valley.

The ongoing characterization and plan for control and cleanup of perchlorate in the Valley has focused on the Saugus Formation. In addition, however, on-site cleanup and control activities that began in 2006, and continued through 2013, include continuation of soil cleanup on the Whittaker-Bermite site, and continuation of pumping and treatment in the Northern Alluvium on the Whittaker-Bermite site. Expanded pumping and treatment, intended to effect perchlorate containment in the Northern Alluvium, became operational in October 2007. Under the direction of the State Department of Toxic Substances Control (DTSC), Whittaker has submitted a comprehensive site-wide remediation plan for the contaminants of concern in soil and groundwater detected on the site. A Draft Remedial Action Plan for Operable Units 2 through 6, focused on soil remediation, was submitted to DTSC in 2009. DTSC approved the Remedial Action Plan for contaminated soils in Operable Units 2 through 6 on December 6, 2010 and Preparation of the Remedial Design documents are underway. Whittaker also completed a Draft Feasibility Study for Operable Unit 7 to identify and select treatment technologies for both on-site and off-site groundwater. A work plan for Pilot Remediation of Saugus Aquifer Containment and Remediation was approved by DTSC on December 31, 2008 and the first phase of the work plan was completed in 2013.

ES.3 Saugus Formation

The groundwater operating plan in the 2010 UWMP includes pumping from the Saugus in the range of 7,500 to 15,000 afy in normal years; it also includes planned dry-year pumping from the Saugus of 21,000 to 35,000 afy for one to three consecutive dry years. As with the operation plan for the Alluvium, the ranges of Saugus pumping are based on the updated evaluation of groundwater basin yield, completed in 2009, which found those ranges of pumping to be sustainable on a long-term basis.

Pumping from the Saugus Formation was about 9,000 af in 2013; this included about 3,100 af that were pumped from CLWAôs Saugus 1 and Saugus 2 Wells as part of the perchlorate pump and treat program. On average, Saugus pumping has been about 7,000 afy since 1980. Both the 2013 amount and the long-term average rates remain near the lower end of the ranges included in the groundwater operating plan and in the UWMP. As a result of long-term relatively low pumping from the Saugus Formation, groundwater levels in that aquifer have remained generally constant to slightly increasing over the last 40 to 45 year time horizon. On a short-term time frame, there have been declining trends in groundwater elevations in the Saugus Formation since 2006 that likely reflect the generally dry climatic conditions that have existed during that time with the exception of 2010 and the early part of 2011 which were generally wet.

In 1997, ammonium perchlorate was discovered in four wells (Saugus 1, Saugus 2, V157 and NC-11) completed in the Saugus Formation in the vicinity of the former Whittaker-Bermite facility located generally toward the east, on the south side of the basin. In 2006, a very low level of perchlorate was detected in another Saugus municipal well (NC-13). And in 2010, it was detected further downgradient in a sixth Saugus well (V201). To date, one of the impacted wells has been destroyed and replaced, three have remained in or been returned to service with treatment as required, one remains out of service with its capacity replaced by an alternate source, and the most recently impacted well remains out of service with plans in development for restoration. As part of regular operation, those wells that remain in service are sampled in accordance with drinking water regulations. All other Saugus Formation wells owned and operated by the Purveyors remain available for municipal water supply service.

Work toward the remediation of perchlorate contamination, including the restoration of impacted groundwater supply was continued in 2013, with a focus on the implementation of a jointly developed plan to ñpump and treatò contaminated water from two of the originally impacted wells to stop migration of the contaminant plume, and to deliver treated water for municipal supply to partially replace impacted well capacity. Environmental review of the project was completed with adoption of a Mitigated Negative Declaration in September 2005. The Final Interim Remedial Action Plan was completed and approved by DTSC in January 2006. Construction of facilities and pipelines necessary to implement the pump and treat program and to also restore inactivated well capacity began in November 2007. Construction was completed in May 2010, DPH issued an amendment to CLWAôs Operating Permit in December 2010, and two of the originally impacted Saugus Formation wells (Saugus 1 and 2) were placed back into water supply service in January 2011. Through this reactivation, Castaic Lake Water Agencyôs Saugus Perchlorate Treatment Facility (SPTF) is online and numerous monitoring tests are performed each week in order to ensure the safety of the water leaving the SPTF. In 2013, 3,108 af of groundwater were pumped from Saugus 1 and 2. After treatment for perchlorate removal, the groundwater is blended with treated imported water and delivered to the Purveyors through the CLWA distribution system. With this additional production at Saugus 1 and 2, the Purveyors continue to have sufficient pumping capacity to meet the planned normal range of Saugus pumping as described in the 2010 UWMP. Restoration of Valencia Water Companyôs Well V201 to service by 2015 will also increase available production capacity from the Saugus Formation.

ES.4 Imported Water

Historically comprised of only its SWP Table A Amount, CLWAôs imported water supplies now consist of a combination of SWP water and water acquired from the Buena Vista Water Storage District in Kern County. CLWAôs contractual Table A Amount is 95,200 af of water from the SWP. Under the 2007 Water Acquisition Agreement with the Buena Vista Water Storage District (Buena Vista) and the Rosedale-Rio Bravo Water Storage District (RRBWSD), Buena

Vistaôs high flow Kern River entitlements (and other acquired waters that may become available) are captured and recharged within the RRBWSD service area on an ongoing basis. CLWA will receive 11,000 af of these supplies annually through either exchange of Buena Vistaôs and Rosedale-Rio Bravoôs SWP supplies or through direct delivery of water to the California Aqueduct via the Cross Valley Canal.

CLWAôs final allocation of SWP water for 2013 was 35 percent of its Table A Amount, or 33,320 af. The total available imported water supply in 2013 was 94,236 af, comprised of the 33,320 af of Table A supply, 11,000 af purchased from Buena Vista/RRBWSD, and 49,916 af of 2012 carryover available in 2013. CLWA deliveries to the Purveyors were 43,281 af. Following disposition of available water supplies in 2013, carryover of 21,482 af from 2013 is available for 2014 water supply. No water was contributed to or withdrawn from banking programs in 2013.

CLWA has two groundwater banking agreements with the Semitropic Water Storage District in Kern County. In accordance with those amended agreements, over a twenty-year period (until 2022/2024), CLWA could withdraw up to 50,870 af of its Table A water that was stored in 2002 and 2003 to meet future Valley demands when needed. Following the withdrawal of 4,950 af in 2009, that balance is 45,920 af. In addition to the banking in Semitropic, CLWA finalized an agreement with the Rosedale-Rio Bravo Water Storage District in 2005 to bank up to 100,000 afy of surplus Table A Amount in that Districtôs Water Banking and Exchange Program. In addition to 20,000 af previously banked in both 2005 and 2006, CLWA banked 8,200 af of water in 2007, 33,668 af of water in 2010, 1,006 af of water in 2011, and 6,031 af of water in 2012. In accordance with the provisions of that agreement, CLWA can withdraw up to a total of 78,000 af of that water, at a rate up to 20,000 afy, to meet Valley water demands when needed. Additionally, as part of the Buena Vista Water Acquisition Agreement, CLWA is entitled to 22,000 af of water that was stored in the Rosedale Rio-Bravo Water Banking and Exchange Program in 2005 and 2006 on CLWAôs behalf. As of 2013, CLWA maintains a recoverable total of 100,000 af in the Rosedale Rio-Bravo Water Banking and Exchange Program.

Since SWP water deliveries are subject to reduction when dry conditions occur in Northern California, the 2010 UWMP includes programs, like the Semitropic and Rosedale-Rio Bravo programs, for enhancing water supply reliability during such occurrences. A capital improvement program funded by CLWA has been established to provide facilities and additional water supplies needed to firm up SWP water supplies during times of drought.

ES.5 Recycled Water

Recycled water service was initiated in July 2003 in accordance with CLWAôs Draft Reclaimed Water System Master Plan (2002). The amount of recycled water used for irrigation purposes, at a golf course and in roadway median strips, was approximately 400 af in 2013. CLWA and the

Purveyors completed programmatic CEQA analysis in early 2007 for full implementation of the recycled water system as outlined in the Master Plan. CLWA and the Purveyors are preparing the design of the second phase of the Recycled Water Master Plan (Phase 2A) that will take water from the Saugus Water Reclamation plant and distribute it to identified users to the north, across the Santa Clara River and then to the west and the east, which will include service to Santa Clarita Central Park. The environmental documentation for this phase was completed in July 2011. Another new phase of the recycled water system (Phase 2C) is in design to extend the system southward from the intersection of Valencia Boulevard and The Old Road, south along Rockwell Canyon Road to the intersection of Orchard Village Road and Lyons Avenue, serving large irrigation customers along its proposed alignment. Collectively, these phases will have design capacity to increase recycled water deliveries by about 500 afy.

ES.6 2014 Water Supply Outlook

In 2014, total water demands are expected to be about 89,000 af, about the same use as last year, and consistent with the range of water demand projections in the 2010 UWMP. It is expected that water demands in 2014 will continue to be met with a generally mix of water supplies that is primarily comprised of local groundwater, SWP carryover supplies and other imported water, and recycled water. Conservation programs initiated by the Purveyors are expected to reduce demands on water supplies in 2014.

Announced on April 18, 2014, the latest allocation of water from the SWP in 2014 is 5 percent of CLWAôs Table A Amount, or 4,670 af. Combined with local groundwater from the two aquifer systems (50,000 af), total Flexible Storage Account (6,060 af), net carryover of SWP Table A allocation from 2013 used in 2014 (21,482 af), annual acquisition through the Buena Vista Water/Rosedale Rio-Bravo Water Acquisition Agreement (11,000 af), Yuba Accord water (342 af), water recovered from banking and exchange programs with Semitropic, Rosedale-Rio Bravo, and West Kern (12,350af), and recycled water (400 af), the total available water supplies for 2014 is over 106,000 af. As a result, CLWA and the Purveyors anticipate having more than adequate supplies to meet all water demands in 2014.

In August 2007, a federal court ruled that certain operational changes were required of the SWP in order to protect the endangered Delta smelt. With the objective of protecting endangered fish such as the Delta smelt and spring-run salmon, the court order resulted in the preparation of new Biological Opinions (BO) requiring DWR to implement mitigation requirements with resultant impacts on SWP water supply reliability. The current SWP Draft Delivery Reliability Report 2013, issued in December 2013, maintains the restrictions on SWP operations according to the Biological Opinions of the U.S. Fish and Wildlife Service and the National Marine Fishery Service issued on December 15, 2008 and June 4, 2009, respectively. In December 2010, a federal judge overruled most of the 2008 federal biological opinion and invalidated several of the criteria that reduced SWPôs water supply. These matters were appealed to the U.S. Court of

Appeals for the Ninth Circuit. The Ninth Circuit ruling upheld the Biological Opinions of the federal agencies. Therefore, the operational rules defined in these BOs continue to be legally required and were used by DWR in the analyses supporting its 2013 Draft Delivery Reliability Report. The current SWP Draft Delivery Reliability Report 2013 also considers the impacts on SWP delivery reliability due to climate change, sea level rise, and vulnerability of the Deltaôs conveyance system and structure due to floods and earthquakes. With these factors, the Reliability Report projects that long-term reliability will be slightly less than the 2011 estimate of 60 percent during normal year hydrology. Specifically, under existing conditions, the average annual delivery of Table A water is estimated at 1% more than the 2011 report; under future conditions, the average annual delivery is estimated at 2% less than the 2011 report. CLWA staff has assessed the impact of the current SWP Delivery Reliability Report on the CLWA reliability analysis contained in the Agencyôs 2010 UWMP that current and anticipated supplies are available to meet anticipated water supply needs through the year 2050.

CLWA, the retail water Purveyors, Los Angeles County and the City of Santa Clarita have formed the Santa Clarita Valley Water Committee. The specific purpose of the Committee is to work collaboratively to ensure the progressive implementation of water use efficiency programs and manage the conjunctive use of the water supplies in the Santa Clarita Valley. In terms of short-term water supply availability, the Committee has determined that, while current operational changes of the SWP are in effect, there are sufficient supplemental water supplies, even with the limited amount of SWP water allocated in 2014, to augment local groundwater and other water supplies such that overall water supplies will be sufficient to meet projected 2014 water requirements as reflected herein.

In any given year, SWP supplies may be reduced due to dry weather conditions or regulatory factors. During such an occurrence, the remaining water demands are planned to be met by a combination of alternate supplies such as returning water from CLWAôs accounts in the Semitropic Groundwater Storage Program and the Rosedale-Rio Bravo Water Banking and Exchange Program, deliveries from CLWAôs flexible storage account in Castaic Lake Reservoir, local groundwater pumping, short-term water exchanges, and participation in DWR dry-year water purchase programs. Following the recovery of 9,900 af (with delivery of 1,650 af in 2009, 3,300 af in 2010, and 4,950 af in 2014), the banked excess 2002 and 2003 SWP Table A water in Semitropic represents nearly 36,000 af of recoverable water for drought water supply. In addition, the banked excess SWP Table A water in 2005 and 2006, augmented by banked water acquired through the Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement in 2005, 2006, 2007, 2010, 2011, and 2012, along with a recovery of 5,400 af anticipated for 2014 represent a total of 94,600 af of recoverable water for drought water supply from the Rosedale-Rio Bravo Banking and Exchange Program. And most recently, the new water 2-for-1 exchange programs that were initiated in 2011 provide an additional 10,000 af of dry-year supply which accounts for an anticipated recovery of 2,000 af from the West Kern Water District program in

2014. The total recoverable water in all the Kern County storage banks is now almost 141,000 af.

Drought periods may affect available water supplies in any single year and even for a duration that spans multiple consecutive years. It is important to note that hydrologic conditions vary from region to region throughout the state. Dry conditions in Northern California affecting SWP supply may not affect local groundwater and other supplies in Southern California, and the reverse situation can also occur (as it did in 2002 and 2003). For this reason, CLWA and the retail water suppliers have emphasized developing a water supply portfolio that is diverse, especially in dry years along with water conservations programs. Diversity of supply is considered a key element of reliability, giving Valley water Purveyors the ability to draw on multiple sources of supply to ensure reliable service during dry years, as well as during normal and wet years.

1. INTRODUCTION

1.1 Background

For most residents of the Santa Clarita Valley (Valley), domestic water service is provided by four retail water Purveyors: Castaic Lake Water Agencyôs Santa Clarita Water Division (SCWD), Los Angeles County Waterworks District 36 (LACWWD36), Newhall County Water District (NCWD), and Valencia Water Company (VWC). Together, the Purveyors provide water to about 71,550 service connections. As a State Water Project (SWP) contractor, Castaic Lake Water Agency (CLWA) contracts for SWP water delivered from Castaic Lake, after which it is treated, filtered, and disinfected at two CLWA treatment plants before distribution to the Purveyors. Staff of CLWA and the four retail water purveyors meet regularly to coordinate the supply of water in the Valley. Their respective service areas are shown in Figure 1-1.

While municipal water supply has grown to become the largest category of water use in the Valley, there remains an agricultural and other small private water demand that is dependent on local groundwater for its water supply. Accordingly, ongoing agricultural water requirements and the use of local groundwater to meet those requirements are considered in analyses of water requirements and supplies as reported herein. Also, in addition to municipal and agricultural water uses in the Valley, water supply for a small fraction of Valley residents is provided by individual private water supply wells. The locations, construction details, annual pumping and other information about these private wells are not currently available. In the absence of detailed information about private wells and associated water use, pumping as reported herein necessarily includes an estimate of groundwater pumped from private wells; it is intended that this estimate will be refined in the future as more information about the private wells is obtained.

For more than 30 years, CLWA and the Purveyors have reviewed and reported on the availability of water supplies to meet all water requirements in the Valley. Those reports have also addressed local water resources, most notably groundwater, in the region. Past studies have assessed the condition of local groundwater aquifers, their hydrogeologic characteristics, aquifer storage capacity, operational yield and recharge rate, groundwater quality and contamination, and the ongoing conjunctive use of groundwater and imported water resources.

Other efforts have included developing drought contingency plans, coordinating emergency response procedures and implementing Valley-wide conservation programs. In 1985, NCWD, on behalf of the retail water purveyors, prepared the areaôs first report on urban water supplies and water management. Beginning in 1995, formalized versions of Urban Water Management Plans (UWMP) have been developed and have included CLWA. Information in the plans was coordinated among CLWA and the Purveyors to provide accurate, comprehensive and consistent

water supply and demand information for long term planning purposes. In accordance with the California Urban Water Management Planning Act, the UWMP was most recently updated (2010 UWMP) and issued by CLWA and the Purveyors in 2011. The 2010 UWMP includes water demand projections through projected build out of the Valley in 2050, and describes the combination of local groundwater, imported water supplies from the SWP and other sources, local recycled water supplies, and other planned water supplies to meet the existing and projected water demands in the Valley. The 2010 UWMP describes the reliability of local groundwater resources and the adequacy of groundwater supplies to meet that component of overall water supply; and it also describes the mitigation of perchlorate contamination which had impacted several municipal water supply wells, and the implementation of integrated control of perchlorate migration and full restoration of perchlorate-impacted groundwater supply.

In 2009, primarily in preparation of the 2010 UWMP, an updated analysis of groundwater basin yield was completed to guide the ongoing use of groundwater and the associated distribution of pumping to maintain groundwater use at a sustainable rate while also addressing localized issues such as restoration of groundwater contamination which has impacted local groundwater supplies since 1997. The results of the updated groundwater basin analysis are summarized in the groundwater basin yield discussion (Section 3.1) of this Water Report.

1.2 Purpose and Scope of the Report

The purpose of this report, which is the sixteenth in a series of annual water reports that began to describe water supply conditions in 1998, is to provide current information about water requirements and available water supplies to meet those demands in the Santa Clarita Valley. CLWA and the Purveyors began preparation of this series of reports in response to a request made by the Los Angeles County Board of Supervisors in 1998. Over the last several years, this series of reports has also served as an annual summary of groundwater conditions in the Valley in fulfillment of the commitment in the Santa Clarita Valley Groundwater Management Plan, adopted in 2003, to regularly report on implementation of that Plan.

This report was prepared for CLWA, SCWD, LACWWD36, NCWD, and VWC. It continues a format for providing information regarding water uses and the availability of water supplies on an annual basis. It is intended to be a helpful resource for use by water planners and local land use planning agencies. This report is complemented by the 2010 UWMP for the area, which provides longer-term water supply planning over a 40-year period, and by a number of other technical reports, some of which are specifically referenced herein.

1.3 Santa Clarita Valley Water Purveyors

As introduced above, four retail water Purveyors provide water service to most residents of the Santa Clarita Valley. Brief summary descriptions of those four Purveyors are as follows.

Castaic Lake Water Agency Santa Clarita Water Division has a service area that includes a portion of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Saugus, Canyon Country, and Newhall. Water is supplied from both groundwater and CLWA turnouts to about 29,700 service connections.

Los Angeles County Waterworks District 36 has a service area that encompasses approximately 6,600 acres in the Hasley Canyon area and the unincorporated community of Val Verde. LACWWD 36 has about 1,350 service connections. Prior to 2012, LACWWD 36 obtained its full water supply from a connection to the CLWAôs Castaic Conduit; however, beginning in 2012, that supply was reduced to about one-third of the overall water supply with the remainder obtained from groundwater pumped from the Saugus Formation.

Newhall County Water District's service area includes portions of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Newhall, Canyon Country, Valencia, and Castaic. NCWD supplies water from both groundwater and CLWA turnouts to about 9,700 service connections.

Valencia Water Company's service area serves almost 30,800 service connections in a portion of the City of Santa Clarita and in the unincorporated communities of Castaic, Newhall, Saugus, Stevenson Ranch, and Valencia. VWC supplies water from both groundwater and CLWA turnouts; VWC also delivers recycled water for a small amount of non-potable use.

1.4 The Upper Santa Clara River Hydrologic Area and East Groundwater Subbasin

The Upper Santa Clara River Hydrologic Area (HA), as defined by the California Department of Water Resources (DWR), is located almost entirely in northwestern Los Angeles County (**Figure 1-2**). The area encompasses about 654 square miles comprised of flat valley land (about 6 percent of the total area) and hills and mountains (about 94 percent of the total area) that border the valley area. The mountains include the Santa Susana and San Gabriel Mountains to the south, and the Sierra Pelona and Leibre-Sawmill Mountains to the north. Elevations range from about 800 feet on the valley floor to about 6,500 feet in the San Gabriel Mountains. The headwaters of the Santa Clara River are at an elevation of about 3,200 feet at the divide separating this hydrologic area from the Mojave Desert.

The Santa Clara River and its tributaries flow intermittently from Lang Station westward about 35 miles to Blue Cut, just west of the Los Angeles-Ventura County line, where the River is the outlet from the Upper Santa Clara River Hydrologic Area. The principal tributaries of the River in the Santa Clarita Valley are Castaic Creek, San Francisquito Creek, Bouquet Creek, and the South Fork of the Santa Clara River. In addition to tributary inflow, the Santa Clara River receives treated wastewater discharge from the Saugus and Valencia Water Reclamation Plants, which are operated by the Santa Clarita Valley Sanitation District of Los Angeles County. The Santa Clara River continues westward through Ventura County to its mouth near Oxnard. Along that route, the River traverses all subbasins of the Santa Clara River Valley Groundwater Basin. There are a total of seven subbasins that span across Los Angeles and Ventura counties: the Santa Clara River Valley East Subbasin, beneath the Santa Clarita Valley and the source of essentially all local groundwater used for water supply in the Santa Clarita Valley, Piru, Fillmore, Santa Paula, Oxnard Forebay, Oxnard Plain, and Mound subbasins as shown in **Figure 1-3**.

There are two primary precipitation gages in the Santa Clarita Valley that have long-term records, the Newhall-Soledad 32c gage and the Newhall County Water District gage; a third gage, #204 Santa Clarita, that was established in 2006 (**Figure 1-4**). The National Climatic Data Center (NCDC) and Los Angeles County Department of Public Works (LADPW) have maintained records for the Newhall-Soledad 32c gage since 1931. Newhall County Water District has maintained records for the NCWD gage since 1979. The cumulative records from these two gages correlate very closely, with the NCWD gage historically recording approximately 30 percent more precipitation than the Newhall-Soledad 32c gage over the entire period of record. During dry periods, this relative difference is greater, and there is closer to 40% more rainfall at the NCWD gage relative to the Newhall-Soledad 32c gage. The overall offset is likely due to the differences in location between the two gages, with the NCWD gage situated farther south in the hills rimming the southern edge of the Santa Clarita Valley at an elevation of about 1,390 feet, while the Newhall-Soledad 32c gage is located northwest of the NCWD gage and further away from the hills at an elevation of about 1,330 feet.

The third gage, #204 Santa Clarita, was established in December 2006 near the Rio Vista Treatment Plant (elevation 1,410ô) near the main Santa Clara River channel and on the north side of the Valley (**Figure 1-4**). This gage is operated by CLWA and is part of the California Irrigation Management Information System (CIMIS) managed by the Department of Water Resources (DWR). Daily precipitation data at this location are available beginning in January 2008, and these data correlate well with the other two precipitation gages in the Valley over the period of 2008 through 2013 with the exception of data for the month of December 2010. Comparison of historical data collected from all three gages between 2008 through 2013 indicates that the CIMIS gage located in the central part of the Valley near the river receives aabout 65% of the rainfall of the 32c gage and about 45% of the NCWD gage.

The Santa Clarita Valley is characterized as having an arid climate. Historically, intermittent periods of below-average precipitation have typically been followed by periods of above-average precipitation in a cyclical pattern, with each above average or below average period typically lasting from one to five years. The longer-term precipitation records for the Newhall-Soledad 32c gage are illustrated in **Figure 1-5**. Long-term annual (calendar year) average precipitation at that gage is 17.5 inches calculated for the 1931 through 2013 period. **Figure 1-5** also shows the cumulative departure from mean annual precipitation which shows periods of above average rainfall (increasing slope or trend) and below average rainfall (declining trend or slope). In general, periods of below-average precipitation have been longer and more moderate than periods of above average precipitation. Historically, the periods from 1947 to 1951, 1959 to 1964, 1971 to 1976, 1984 to 1991 and 1999 to 2003 have generally been drier than average; the periods from 1938 to 1946, 1965 to 1970, 1977 to 1983, 1992 to 1996, and 2004 to 2005 have been wetter than average. Recently, the dry or below average period that began in 2006, has generally persisted through 2013 with all but two of those years (2008 and 2010) having below average rainfall totals. The last two years, 2012 and 2013, have been significantly below average with about 9.0 and 3.7 inches, respectively. 2013 experienced the lowest amount of precipitation that has been recorded since 1931. Early year precipitation in 2014 has been below average through March; these conditions combined with other water supply considerations, discussed in Chapter 4, are expected to result in 2014 water requirements being about the same as water requirements in 2013.

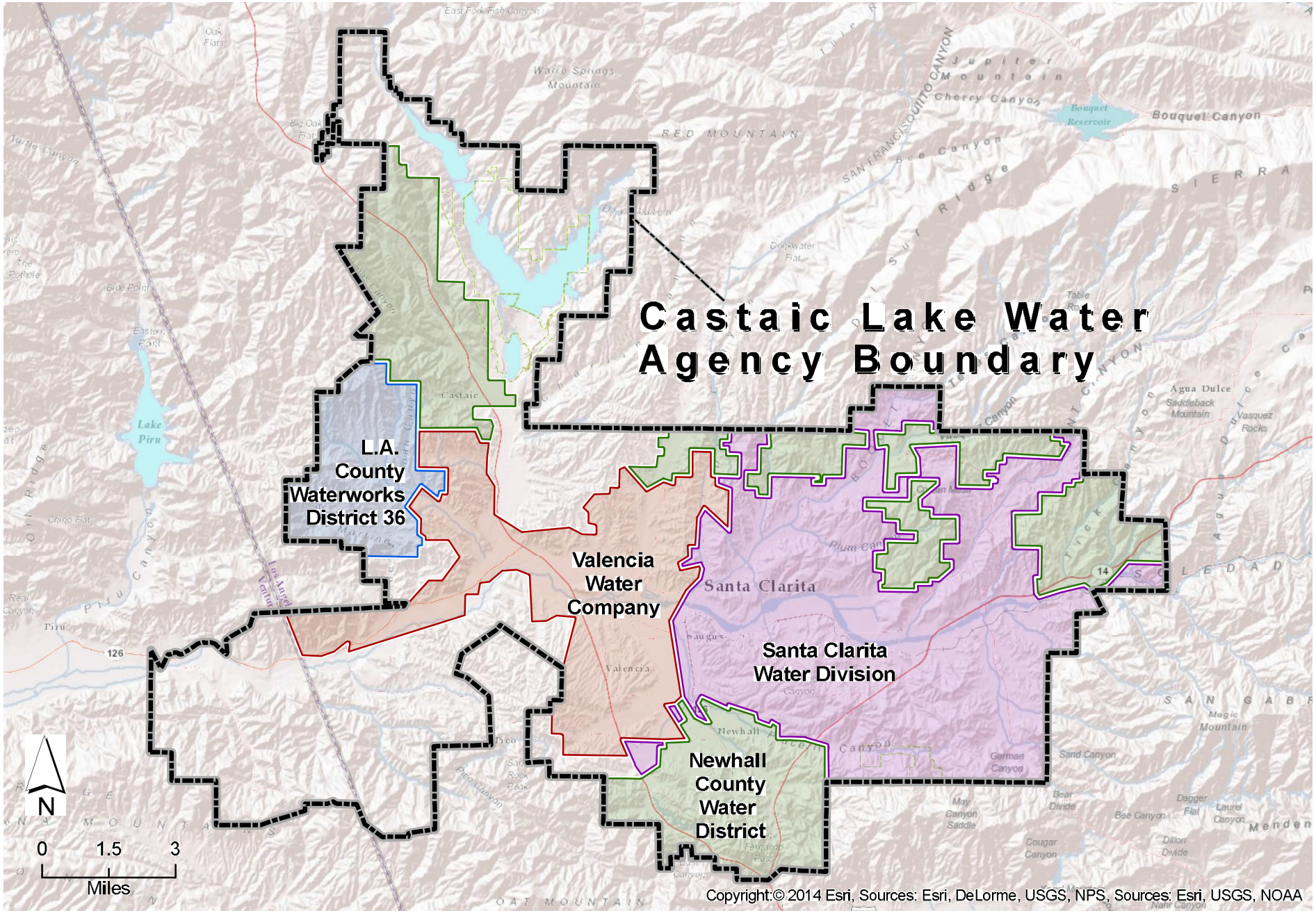

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Figure 1-1
CLWA and Purveyor Service Areas
Santa Clarita Valley Water Report

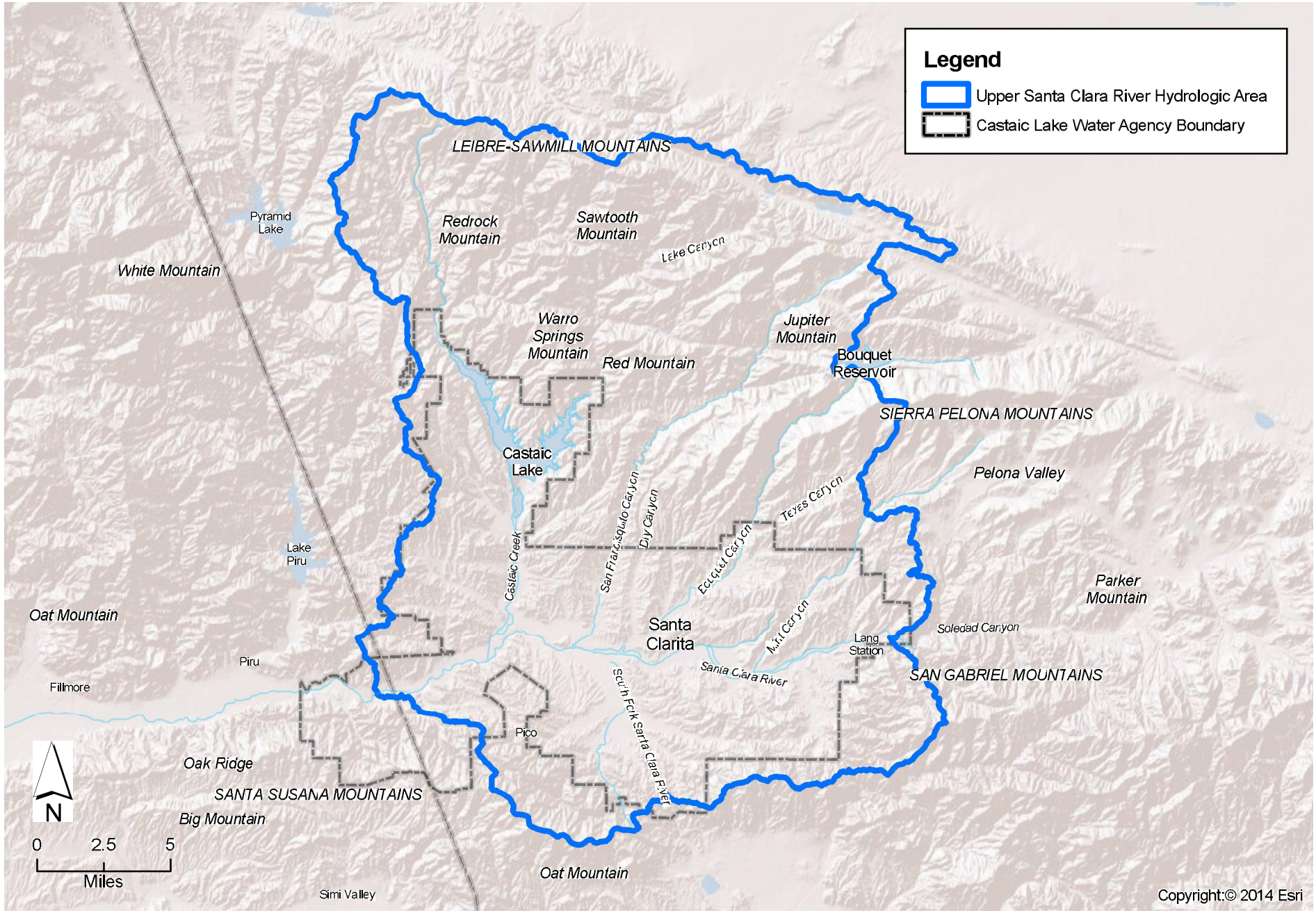

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Figure 1-2
Upper Santa Clara River Hydrologic Area
Santa Clarita Valley Water Report

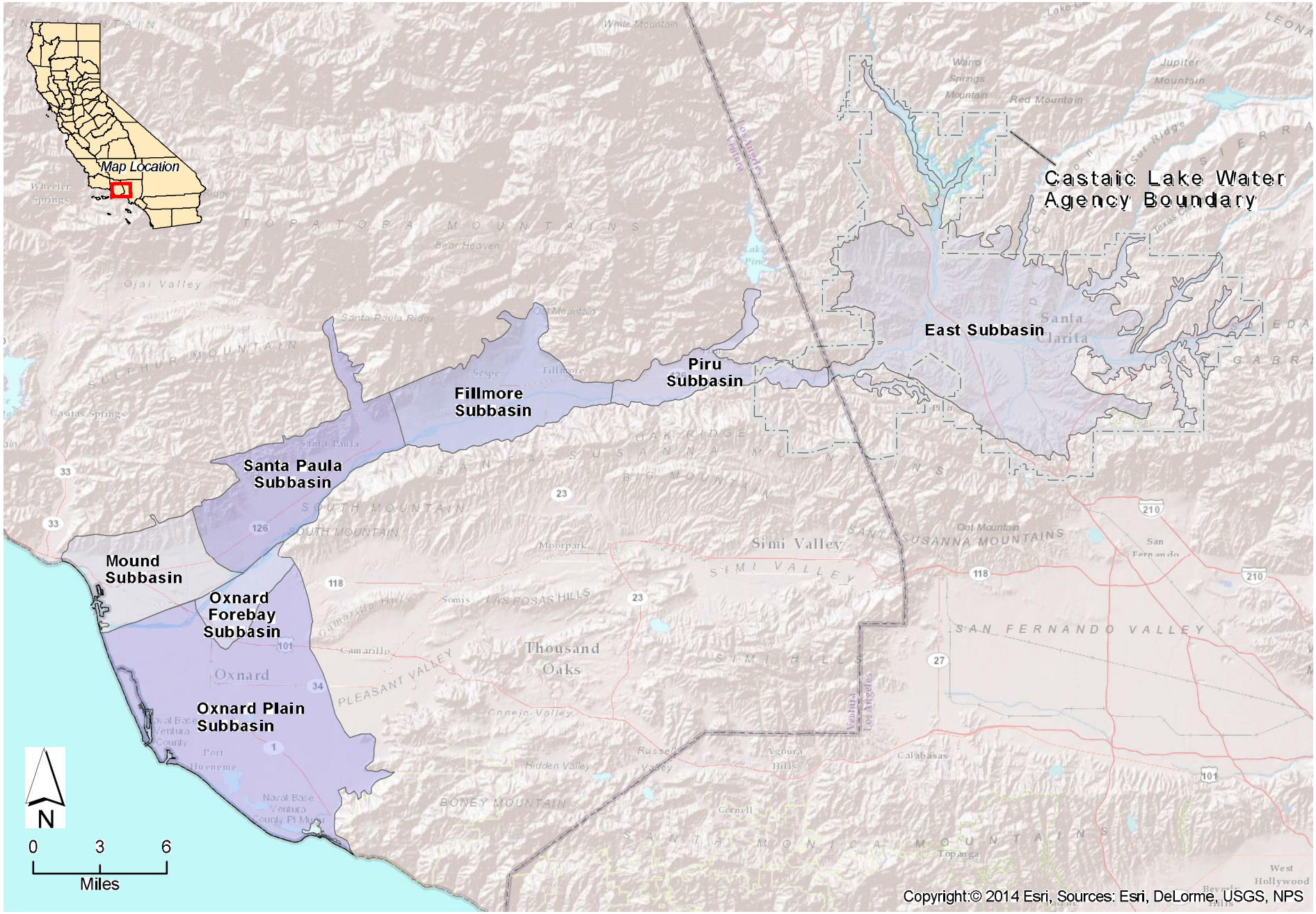

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Figure 1-3
Santa Clara River Valley Groundwater Basin and Subbasins
Santa Clarita Valley Water Report

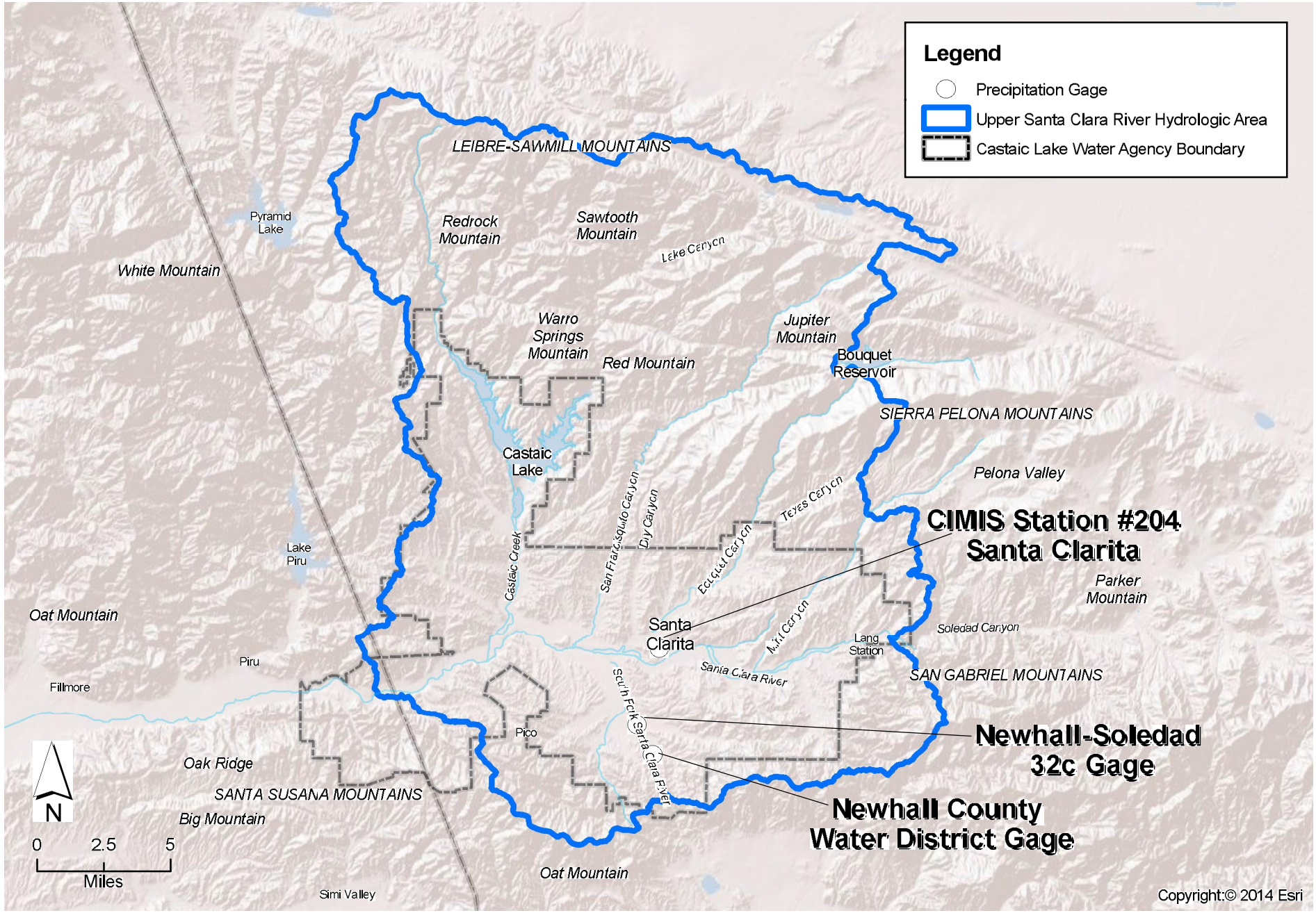

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Figure 1-4
Precipitation Gage Locations
Santa Clarita Valley Water Report

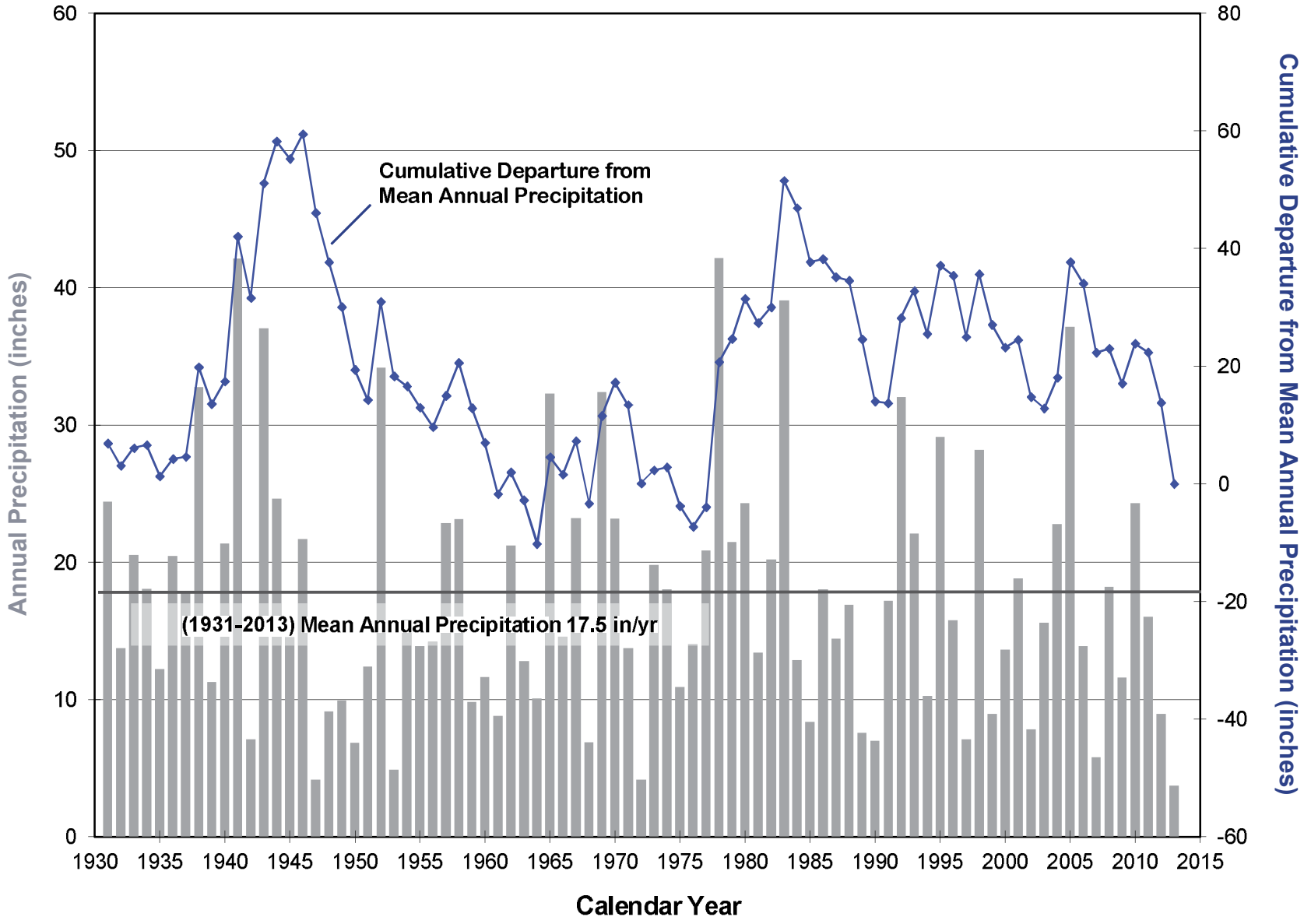

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Figure 1-5
Annual Precipitation and Cumulative Departure from Mean Annual Precipitation at Newhall-Soledad 32c Gage
Santa Clarita Valley Water Report

2. 2013 WATER REQUIREMENTS AND SUPPLIES

Total water use in the Santa Clarita Valley was 89,600 acre feet (af) in 2013. Of the total, 73,500 af (about 82 percent) were for municipal use (**Table 2-1**) and the remaining 16,100 af (18 percent) were for agricultural and other (miscellaneous) uses (**Table 2-2**), including estimated individual domestic uses. Total water use was met by a combination of about 45,900 af from local groundwater resources (about 26,600 af for municipal supply and 16,200 af for agricultural and other uses), 43,300 af from SWP and other imported water sources, and about 400 af from recycled water (**Table 2-3**).

Compared to 2012, total water use in the Santa Clarita Valley in 2013 was about five percent higher and slightly above the short-term projected water requirement estimated in last yearôs Annual Water Report. The increase in water use in 2013 is primarily attributed to below average rainfall and above normal temperatures in early 2013. There was about a one percent growth in service connections in 2013 as compared to 2012, with the largest number of additional service connections occurring in the SCWD (about 350 new connections) and VWC (almost 400 new connections) service areas. There were about 750 new service connections in 2013 compared to about 200 to 500 new annual connections in the 2009 through 2012 period. The number of new annual service connections in 2013 is still less than the number and rate of new annual connections in the late 1990s through 2008 period. In addition, the Purveyors and the local community continue to be aware of recent drought conditions and potential water supply shortages. Although water use increased five percent in 2013 as compared to 2012, 2013 water demand is similar to 2008 levels even though there are about 2,200 more service connections in 2013 as compared to 2008. The water demand in 2013 most likely reflects a combination of ongoing water conservation efforts, continued dry conditions, and an increased rate of economic growth.

The uses of local groundwater, augmented by water supplies purchased from CLWA (imported SWP and non-SWP water supplies and treated Saugus Formation groundwater), and also slightly augmented by the use of recycled water, are summarized in **Table 2-1**. Municipal water requirements in 2013 (73,300 af) were slightly above (by about 300 af in 2013) the projections in the 2010 UWMP without conservation, and about 4,900 af greater than the projections with conservation.

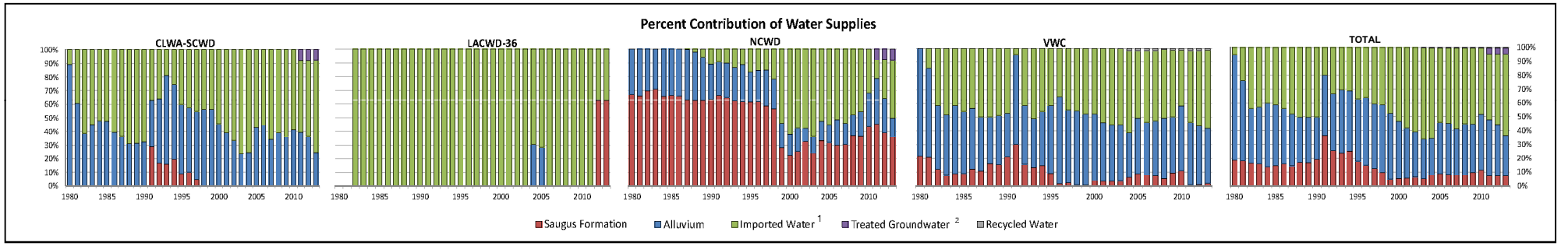
Water supply utilization for all agricultural and other non-municipal uses is summarized in **Table 2-2**. The category of Small Private Domestic, Irrigation and Golf Course Uses in **Table 2-2** includes an estimated 500 af of small individual private pumping from the Alluvium. Annual water supply utilization for all agricultural and other non-municipal uses has generally remained stable and has averaged about 15,500 af since the mid-1990s and was about 16,100 af in 2013.

Water supply utilization for all uses in the Santa Clarita Valley, again for the period 1980 to present, is summarized in **Table 2-3**. The trends in utilization of local groundwater and imported water, complemented by the addition of recycled water, are graphically illustrated in **Figure 2-1**. As can be seen by inspection of **Table 2-3** and **Figure 2-1**, total water use in the Valley was nearly linearly increasing from the early 1980ôs through 2007, with some climatic-related fluctuations in certain years. As discussed above, total water use progressively declined from 2007 through 2010, followed by an increase in water use in 2012 and 2013 that offset some of the decline, from a peak slightly above 92,000 af in 2007 down to a low of 80,200 af in 2010, and currently back up to 89,600 af in 2013. Total water use in 2010 was the lowest in nearly a decade (since 2001). However, 2011 was then the first year since 2008 that had not seen a decline in demand from the previous year, and water use in 2012 and 2013 increased six and five percent, respectively, over prior year totals. Overall, since the inception of supplemental SWP importation, total annual water use has increased from about 37,000 af in 1980 to the mid-80,000 af per year range through 2000-2005, to the short-term peak in the low-90,000 af per year range in 2006 through 2008, and currently 89,600 af in 2013 (**Table 2-3** and **Figure 2-1**).

As can also be seen by inspection of **Table 2-3** and **Figure 2-1**, most of the historical increase in water demand from 1980 through 2007 has been met with generally greater proportions of imported SWP water, complemented by other imported water sources. Recent variations in water demand (from 2007 through 2012) have been met with a corresponding increase or decrease in the use of imported water while groundwater use has generally remained unchanged, ranging from about 46,000 to 49,000 acre-feet per year. In 2013, the 5 percent increase in water demand over 2012 was primarily met with a 22 percent increase in imported water and about an 8 percent decrease in groundwater use (from 46,500 af to 42,800 af).

Table 2-1
Water Supply Utilization by Municipal Purveyors
Santa Clarita Valley Water Report
(Acre-Feet)

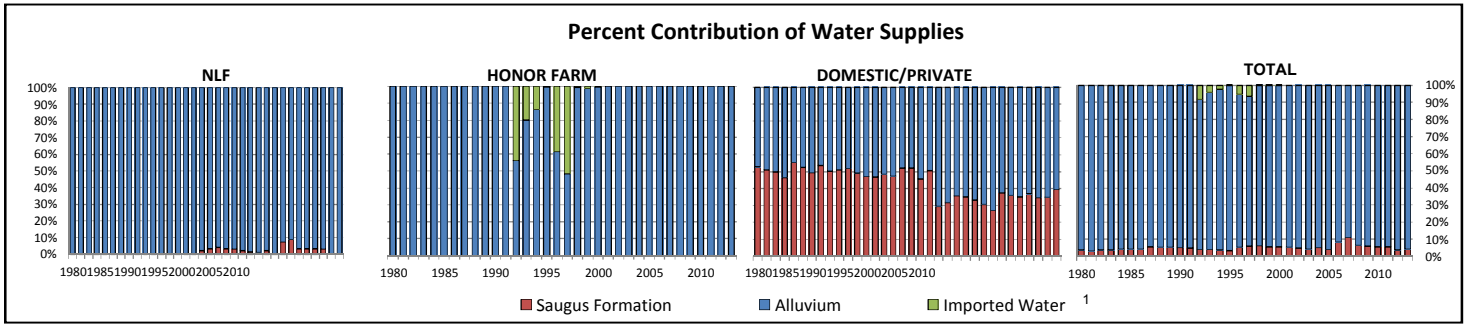
	CLWA Santa Clarita Water Division					Los Angeles County Waterworks District 36				Newhall County Water District					Valencia Water Company					All Municipal Purveyors					
	Purchased from CLWA		Local Production			Purchased from CLWA	Local Production			Purchased from CLWA		Local Production			Purchased from CLWA	Local Production		Other		Purchased from CLWA		Local Production		Other	
Year	*Imported Water*[1]	*Treated Groundwater*[2]	*Alluvium*	*Saugus Formation*	**Total**	*Imported Water*[1]	*Alluvium*[3]	*Saugus Formation*[4]	**Total**	*Imported Water*[1]	*Treated Groundwater*[2]	*Alluvium*	*Saugus Formation*	**Total**	*Imported Water*[1]	*Alluvium*	*Saugus Formation*	*Recycled Water*[5]	**Total**	*Imported Water*[1]	*Treated Groundwater*[2]	*Alluvium*	*Saugus Formation*	*Recycled Water*	**Total**
1980	1,126	-	9,467	0	**10,593**	0	-	-	**0**	0	-	1,170	2,363	**3,533**	0	5,995	1,644	-	**7,639**	1,126	-	16,632	4,007	-	**21,765**
1981	4,603	-	7,106	0	**11,709**	0	-	-	**0**	0	-	1,350	2,621	**3,971**	1,214	5,597	1,808	-	**8,619**	5,817	-	14,053	4,429	-	**24,299**
1982	6,454	-	4,091	0	**10,545**	145	-	-	**145**	0	-	1,178	2,672	**3,850**	3,060	3,415	897	-	**7,372**	9,659	-	8,684	3,569	-	**21,912**
1983	5,214	-	4,269	0	**9,483**	207	-	-	**207**	0	-	1,147	2,787	**3,934**	3,764	3,387	611	-	**7,762**	9,185	-	8,803	3,398	-	**21,386**
1984	6,616	-	6,057	0	**12,673**	240	-	-	**240**	0	-	1,549	2,955	**4,504**	4,140	4,975	854	-	**9,969**	10,996	-	12,581	3,809	-	**27,386**
1985	6,910	-	6,242	0	**13,152**	272	-	-	**272**	0	-	1,644	3,255	**4,899**	4,641	4,633	885	-	**10,159**	11,823	-	12,519	4,140	-	**28,482**
1986	8,366	-	5,409	0	**13,775**	342	-	-	**342**	0	-	1,842	3,548	**5,390**	5,051	5,167	1,427	-	**11,645**	13,759	-	12,418	4,975	-	**31,152**
1987	9,712	-	5,582	0	**15,294**	361	-	-	**361**	22	-	2,127	3,657	**5,806**	6,190	4,921	1,305	-	**12,416**	16,285	-	12,630	4,962	-	**33,877**
1988	11,430	-	5,079	63	**16,572**	434	-	-	**434**	142	-	2,283	4,041	**6,466**	7,027	4,835	2,300	-	**14,162**	19,033	-	12,197	6,404	-	**37,634**
1989	12,790	-	5,785	0	**18,575**	457	-	-	**457**	428	-	2,367	4,688	**7,483**	7,943	5,826	2,529	-	**16,298**	21,618	-	13,978	7,217	-	**42,813**
1990	12,480	-	5,983	40	**18,503**	513	-	-	**513**	796	-	1,936	4,746	**7,478**	7,824	5,232	3,516	-	**16,572**	21,613	-	13,151	8,302	-	**43,066**
1991	6,158	-	5,593	4,781	**16,532**	435	-	-	**435**	675	-	1,864	4,994	**7,533**	700	9,951	4,642	-	**15,293**	7,968	-	17,408	14,417	-	**39,793**
1992	6,350	-	8,288	2,913	**17,551**	421	-	-	**421**	802	-	1,994	5,160	**7,956**	6,338	6,615	2,385	-	**15,338**	13,911	-	16,897	10,458	-	**41,266**
1993	3,429	-	12,016	2,901	**18,346**	465	-	-	**465**	1,075	-	1,977	5,068	**8,120**	8,424	5,815	2,182	-	**16,421**	13,393	-	19,808	10,151	-	**43,352**
1994	5,052	-	10,996	3,863	**19,911**	453	-	-	**453**	906	-	2,225	5,103	**8,234**	7,978	6,847	2,565	-	**17,390**	14,389	-	20,068	11,531	-	**45,988**
1995	7,955	-	10,217	1,726	**19,898**	477	-	-	**477**	1,305	-	1,675	4,775	**7,755**	7,259	8,698	1,586	-	**17,543**	16,996	-	20,590	8,087	-	**45,673**
1996	9,385	-	10,445	2,176	**22,006**	533	-	-	**533**	1,213	-	1,803	4,871	**7,887**	6,962	12,433	326	-	**19,721**	18,093	-	24,681	7,373	-	**50,147**
1997	10,120	-	11,268	1,068	**22,456**	785	-	-	**785**	1,324	-	2,309	5,168	**8,801**	9,919	11,696	516	-	**22,131**	22,148	-	25,273	6,752	-	**54,173**
1998	8,893	-	11,426	0	**20,319**	578	-	-	**578**	1,769	-	1,761	4,557	**8,087**	9,014	10,711	149	-	**19,874**	20,254	-	23,898	4,706	-	**48,858**
1999	10,772	-	13,741	0	**24,513**	654	-	-	**654**	5,050	-	1,676	2,622	**9,348**	10,806	11,823	106	-	**22,735**	27,282	-	27,240	2,728	-	**57,250**
2000	13,751	-	11,529	0	**25,280**	800	-	-	**800**	6,024	-	1,508	2,186	**9,718**	12,004	12,179	1,007	-	**25,190**	32,579	-	25,216	3,193	-	**60,988**
2001	15,648	-	9,941	0	**25,589**	907	-	-	**907**	5,452	-	1,641	2,432	**9,525**	13,362	10,518	835	-	**24,715**	35,369	-	22,100	3,267	-	**60,736**
2002	18,916	-	9,513	0	**28,429**	1,069	-	-	**1,069**	5,986	-	981	3,395	**10,362**	15,792	11,603	965	-	**28,360**	41,763	-	22,097	4,360	-	**68,220**
2003	20,665	-	6,424	0	**27,089**	1,175	-	-	**1,175**	6,572	-	1,266	2,513	**10,351**	16,004	11,707	1,068	50	**28,829**	44,416	-	19,397	3,581	50	**67,444**
2004	22,045	-	7,146	0	**29,191**	854	380	-	**1,234**	5,896	-	1,582	3,739	**11,217**	18,410	9,862	1,962	420	**30,654**	47,205	-	18,970	5,701	420	**72,296**
2005	16,476	-	12,408	0	**28,884**	857	343	-	**1,200**	5,932	-	1,389	3,435	**10,756**	14,732	12,228	2,513	418	**29,891**	37,997	-	26,368	5,948	418	**70,731**
2006	16,548	-	13,156	0	**29,704**	1,289	-	-	**1,289**	5,898	-	2,149	3,423	**11,470**	16,313	11,884	2,449	419	**31,065**	40,048	-	27,189	5,872	419	**73,528**
2007	20,488	-	10,686	0	**31,174**	1,406	-	-	**1,406**	6,478	-	1,806	3,691	**11,975**	16,779	13,140	2,367	470	**32,756**	45,151	-	25,632	6,058	470	**77,311**
2008	18,598	-	11,878	0	**30,476**	1,354	-	-	**1,354**	5,428	-	1,717	4,195	**11,340**	16,325	14,324	1,770	311	**32,730**	41,705	-	27,919	5,965	311	**75,900**
2009	17,739	-	10,077	0	**27,816**	1,243	-	-	**1,243**	4,832	-	1,860	3,868	**10,559**	14,732	12,459	2,836	328	**30,355**	38,546	-	24,396	6,704	328	**69,974**
2010	15,188	-	10,607	0	**25,795**	1,141	-	-	**1,141**	3,035	-	2,323	4,173	**9,531**	11,214	13,054	2,995	336	**27,599**	30,578	-	25,984	7,168	336	**64,066**
2011	13,593	2,038	10,195	0	**25,826**	1,172	-	-	**1,172**	1,325	746	3,216	4,389	**9,676**	14,718	12,775	265	373	**28,131**	30,808	2,784	26,186	4,654	373	**64,805**
2012	15,600	2,164	10,192	0	**27,956**	471	-	794	**1,265**	2,965	792	2,631	4,081	**10,469**	16,522	12,770	302	428	**30,022**	35,558	2,956	25,593	5,177	428	**69,712**
2013	20,059	2,275	7,262	0	**29,596**	485	-	811	**1,296**	4,488	833	1,405	3,835	**10,561**	18,249	12,764	594	400	**32,007**	43,281	3,108	21,431	5,240	400	**73,460**



1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.
2. In January 2011, CLWA began operation of its Saugus groundwater containment project as part of municipal water supply. After treatment for perchlorate removal, that water was blended with treated imported water and delivered to the Purveyors through the CLWA distribution system. The amounts of treated groundwater from Saugus 1 and 2 utilized by each Purveyor reflect the estimated distribution to each Purveyor consistent with the proportions in the December, 2006 MOU that establishes amounts to be delivered and sold by CLWA to SCWD and NCWD at a reduced rate. Although the MOU and the CLWA subsidized rate structure indicates all the treated Saugus 1 and 2 water is delivered to NCWD and SCWD, a minor, unquantifiable amount of the water may have been delivered to the other purveyors as a result of varying distribution system operations.
3.Groundwater purchased from LA County Honor Farm.
4.Groundwater production began at a new LA County Waterworks District 36 Saugus well in December 2011.
5. Recycled water totals for 2012 and 2013 are estimates based on the water treament plant production meter; estimates were necessary due to customer meter failure.

Table 2-2
Individual Water Supply Utilization by Agricultural and Other Users
Santa Clarita Valley Water Report
(Acre-Feet)

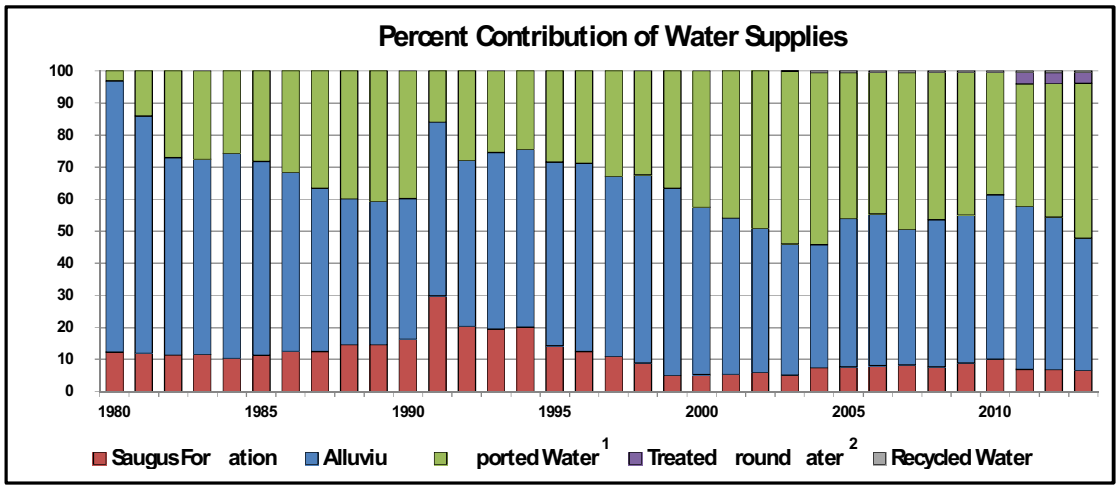
	Newhall Land and Farming			Los Angeles County Honor Farm			Small Private Domestic, Irrigation, and Golf Course Uses			All Agricultural and Other Users			
	Local Production		Total	Purchased from CLWA	Local Production	Total	Local Production		Total	Purchased from CLWA	Local Production		Total
Year	*Alluvium*	*Saugus Formation*		*Imported Water*[1]	*Alluvium*		*Alluvium*[2]	*Saugus Formation*[3]		*Imported Water*[1]	*Alluvium*	*Saugus Formation*	
1980	11,331	20	**11,351**	0	3,000	**3,000**	500	562	**1,062**	0	14,831	582	**15,413**
1981	13,237	20	**13,257**	0	3,000	**3,000**	500	521	**1,021**	0	16,737	541	**17,278**
1982	9,684	20	**9,704**	0	3,000	**3,000**	500	501	**1,001**	0	13,184	521	**13,705**
1983	7,983	20	**8,003**	0	3,000	**3,000**	500	434	**934**	0	11,483	454	**11,937**
1984	11,237	20	**11,257**	0	3,000	**3,000**	500	620	**1,120**	0	14,737	640	**15,377**
1985	9,328	20	**9,348**	0	3,000	**3,000**	500	555	**1,055**	0	12,828	575	**13,403**
1986	8,287	20	**8,307**	0	3,000	**3,000**	500	490	**990**	0	11,787	510	**12,297**
1987	6,512	20	**6,532**	0	3,000	**3,000**	500	579	**1,079**	0	10,012	599	**10,611**
1988	5,951	20	**5,971**	0	3,000	**3,000**	500	504	**1,004**	0	9,451	524	**9,975**
1989	6,243	20	**6,263**	0	3,000	**3,000**	500	522	**1,022**	0	9,743	542	**10,285**
1990	8,225	20	**8,245**	0	2,000	**2,000**	500	539	**1,039**	0	10,725	559	**11,284**
1991	7,039	20	**7,059**	0	2,240	**2,240**	500	480	**980**	0	9,779	500	**10,279**
1992	8,938	20	**8,958**	987	1,256	**2,243**	500	446	**946**	987	10,694	466	**12,147**
1993	8,020	20	**8,040**	443	1,798	**2,241**	500	439	**939**	443	10,318	459	**11,220**
1994	10,606	20	**10,626**	311	1,959	**2,270**	500	474	**974**	311	13,065	494	**13,870**
1995	11,174	20	**11,194**	6	2,200	**2,206**	500	453	**953**	6	13,874	473	**14,353**
1996	12,020	266	**12,286**	780	1,237	**2,017**	500	547	**1,047**	780	13,757	813	**15,350**
1997	12,826	445	**13,271**	1,067	1,000	**2,067**	500	548	**1,048**	1,067	14,326	993	**16,386**
1998	10,250	426	**10,676**	12	2,000	**2,012**	500	423	**923**	12	12,750	849	**13,611**
1999	13,824	479	**14,303**	20	1,842	**1,862**	500	509	**1,009**	20	16,166	988	**17,174**
2000	11,857	374	**12,231**	3	1,644	**1,647**	1,220	513	**1,733**	3	14,721	887	**15,611**
2001	12,661	300	**12,961**	0	1,604	**1,604**	1,224	573	**1,797**	0	15,489	873	**16,362**
2002	13,514	211	**13,725**	0	1,602	**1,602**	1,063	589	**1,652**	0	16,179	800	**16,979**
2003	10,999	122	**11,121**	0	2,273	**2,273**	931	504	**1,435**	0	14,203	626	**14,829**
2004	10,991	268	**11,259**	0	2,725	**2,725**	1,071	535	**1,606**	0	14,787	803	**15,590**
2005	8,648	6	**8,654**	0	2,499	**2,499**	1,133	499	**1,632**	0	12,280	505	**12,785**
2006	11,477	934	**12,411**	0	3,026	**3,026**	1,369	506	**1,875**	0	15,872	1,440	**17,312**
2007	9,968	971	**10,939**	0	2,085	**2,085**	1,088	656	**1,744**	0	13,141	1,627	**14,768**
2008	9,191	330	**9,521**	0	3,506	**3,506**	1,100	623	**1,723**	0	13,797	953	**14,750**
2009	11,061	379	**11,440**	0	3,432	**3,432**	1,097	595	**1,692**	0	15,590	974	**16,564**
2010	10,772	366	**11,138**	0	3,446	**3,446**	957	558	**1,515**	0	15,175	924	**16,099**
2011	10,323	344	**10,667**	0	3,226	**3,226**	1,013	533	**1,546**	0	14,562	877	**15,439**
2012	11,296	0	**11,296**	0	2,722	**2,722**	1,090	586	**1,676**	0	15,108	586	**15,694**
2013	12,091	0	**12,091**	0	2,309	**2,309**	1,061	690	**1,751**	0	15,461	690	**16,151**



1. *Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.*
2. *Robinson Ranch Golf Course irrigation and estimated private pumping.*
3. *Valencia Country Club and Vista Valencia Golf Course irrigation.*

Table 2-3
Total Water Supply Utilization for Municipal, Agricultural and Other Uses
Santa Clarita Valley Water Report
(Acre-Feet)

ear	Purchased fro CLWA		Local Production		Other	Total
	ported Water [1]	Treated round ater [2]	Alluviu	Saugus For ation	Recycled Water	
1980	1,126	-	31,463	4,589	-	37,178
1981	5,817	-	30,790	4,970	-	41,577
1982	9,659	-	21,868	4,090	-	35,617
1983	9,185	-	20,286	3,852	-	33,323
1984	10,996	-	27,318	4,449	-	42,763
1985	11,823	-	25,347	4,715	-	41,885
1986	13,759	-	24,205	5,485	-	43,449
1987	16,285	-	22,642	5,561	-	44,488
1988	19,033	-	21,648	6,928	-	47,609
1989	21,618	-	23,721	7,759	-	53,098
1990	21,613	-	23,876	8,861	-	54,350
1991	7,968	-	27,187	14,917	-	50,072
1992	14,898	-	27,591	10,924	-	53,413
1993	13,836	-	30,126	10,610	-	54,572
1994	14,700	-	33,133	12,025	-	59,858
1995	17,002	-	34,464	8,560	-	60,026
1996	18,873	-	38,438	8,186	-	65,497
1997	23,215	-	39,599	7,745	-	70,559
1998	20,266	-	36,648	5,555	-	62,469
1999	27,302	-	43,406	3,716	-	74,424
2000	32,582	-	39,937	4,080	-	76,599
2001	35,369	-	37,589	4,140	-	77,098
2002	41,763	-	38,276	5,160	-	85,199
2003	44,416	-	33,599	4,207	50	82,273
2004	47,205	-	33,757	6,503	420	87,885
2005	37,997	-	38,648	6,453	418	83,516
2006	40,048	-	43,061	7,312	419	90,840
2007	45,151	-	38,773	7,685	470	92,079
2008	41,705	-	41,716	6,918	311	90,650
2009	38,546	-	39,986	7,678	328	86,538
2010	30,578	-	41,159	8,092	336	80,165
2011	30,808	2,784	40,748	5,531	373	80,244
2012	35,558	2,956	40,701	5,763	428	85,406
2013	43,281	3,108	36,892	5,930	400	89,611



1 Reflects State Water Pro ect through 2006 includes i ported ater fro State Water Pro ect and uena Vista WS Agree ent beginning in 2007

2 n anuary 2011, CLWA began operation of its Saugus For ation ground ater contain ent pro ect After treat ent for perchlorate re oval, that ater as blended ith treated i ported ater and delivered to the Purveyors through the CLWA distribution syste

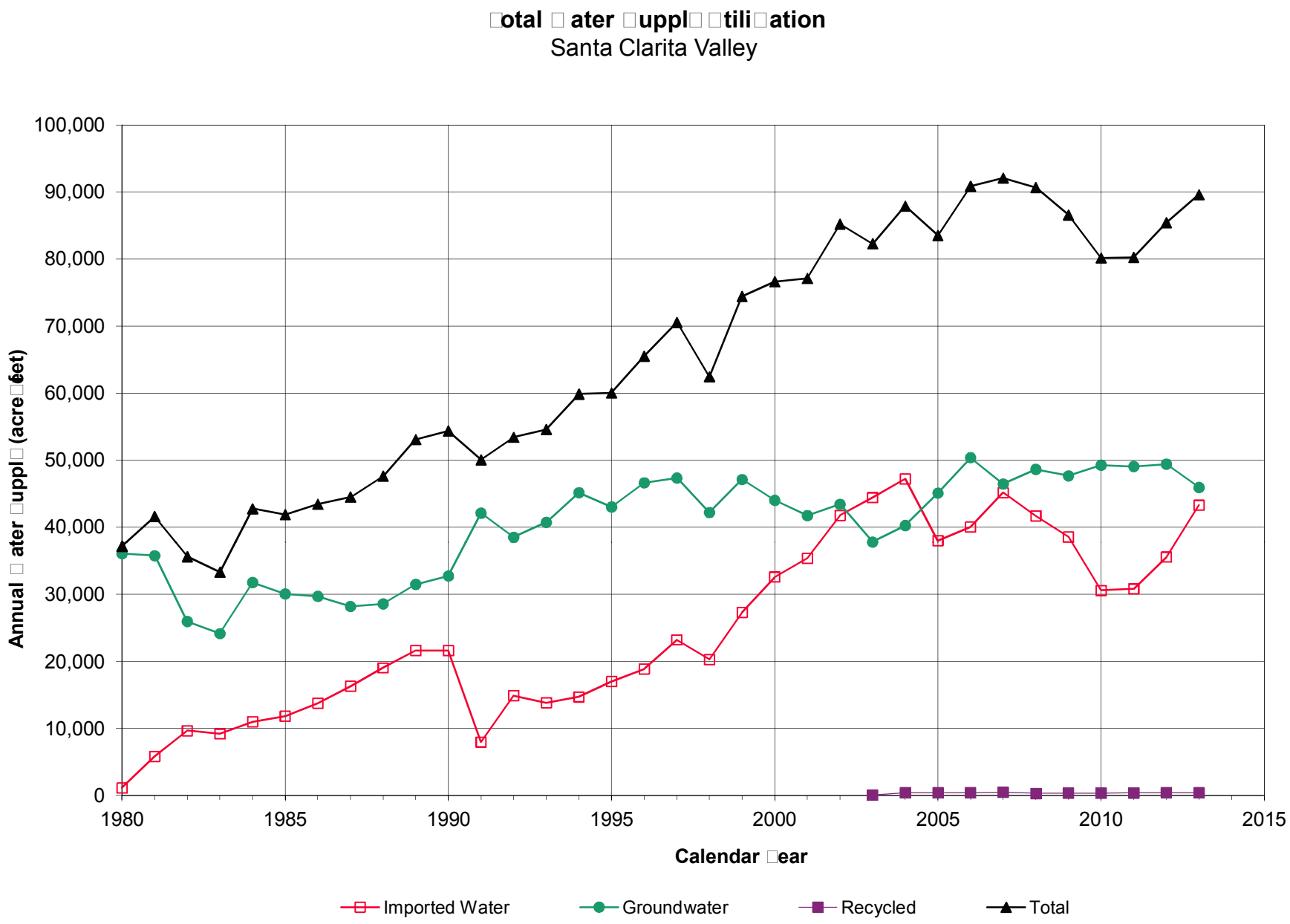


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Figure 2-1
Total Water Supply Utilization
Santa Clarita Valley Water Report

3. WATER SUPPLIES

Prior to 1980, local groundwater extracted from the Alluvium and the Saugus Formation was the sole source of water supply in the Santa Clarita Valley. Since 1980, local groundwater supplies have been supplemented with imported SWP water supplies, augmented in 2007 by acquisition of additional supplemental water imported from the Buena Vista Water Storage District, and Yuba Accord water in 2008. Those water supplies have also been slightly augmented by deliveries from CLWAôs recycled water program since 2003. This section describes the groundwater resources of the Santa Clarita Valley, SWP and other imported water supplies, and the recycled water program in the Valley.

3.1 Groundwater Basin Yield

The groundwater basin generally beneath the Santa Clarita Valley, identified in the State Department of Water Resourcesô Bulletin 118 as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), is comprised of two aquifer systems, the Alluvium and Saugus Formation. The Alluvium generally underlies the Santa Clara River and its several tributaries, and the Saugus Formation underlies practically the entire Upper Santa Clara River area. The mapped extent of the Santa Clara River Valley East Groundwater Subbasin in DWR Bulletin 118 and its relationship to the extent of the CLWA service area are illustrated in **Figure 3-1**. The mapped subbasin boundary approximately coincides with the outer extent of the Alluvium and Saugus Formation.

The most recent report on both the Alluvium and Saugus Formation (2001 Update Report) was prepared in 2002 (Slade, 2002), which updated analyses and interpretation of hydrogeologic conditions from earlier reports (Slade, 1986 and 1988). The 2001 Update Report included extensive detail on major aspects of the groundwater basin. Notable parts of the report relative to groundwater supply included the following findings.

- Analysis of historical groundwater levels and production indicates that there have been no conditions that would be illustrative of groundwater overdraft.

- The utilization of operational yield (as opposed to perennial yield) as a basis for managing groundwater production would be more applicable in this basin to reflect the fluctuating utilization of groundwater in conjunction with imported SWP water.

- The operational yield of the Alluvium would typically be 30,000 to 40,000 acre feet per year (afy) for wet and normal rainfall years, with an expected reduction into the range of 30,000 to 35,000 afy in dry years.

- The operational yield of the Saugus Formation would typically be in the range of 7,500 to 15,000 afy on a long-term basis, with possible short-term increases during dry periods into a range of 15,000 to 25,000 afy, and to 35,000 afy if dry conditions continue.

Following on the 2001 Update Report (Slade, 2002), the groundwater component of overall water supply in the Valley derives from a groundwater operating plan to meet water requirements (municipal, agricultural and other non-municipal, and small individual domestic) while maintaining the basin in a sustainable condition (i.e., no long-term depletion of groundwater or interrelated surface water). That operating plan also addresses groundwater contamination issues in the basin, all consistent with the Groundwater Management Plan adopted in 2003. The groundwater operating plan is based on the concept that pumping can vary from year to year to generally rely on increased groundwater use in dry periods and increased recharge during locally wet periods, and to collectively assure that the groundwater basin is adequately replenished through various wet/dry cycles.

The groundwater operating plan, summarized in **Table 3-1**, is as follows:

Alluvium ï Pumping from the Alluvial Aquifer in a given year is related to local hydrologic conditions in the eastern Santa Clara River watershed. Pumping is expected to typically range between 30,000 and 40,000 afy following normal and above-normal rainfall years. Due to hydrogeologic constraints in the eastern part of the basin, pumping is expected to be typically reduced to between 30,000 and 35,000 afy following multiple locally dry years.

Saugus Formation ï Pumping from the Saugus Formation in a given year is related to the availability of imported water supplies, particularly from the SWP. During average-year conditions within the SWP system, Saugus pumping is expected to typically range between 7,500 and 15,000 afy. Planned dry-year pumping from the Saugus Formation is expected to range between 15,000 and 25,000 afy during a drought year and can increase to between 21,000 and 25,000 afy if SWP deliveries are reduced for two consecutive years. For three or more consecutive years of reduced SWP deliveries, pumping from the Saugus Formation can range between 21,000 and 35,000 afy. Such high pumping is expected to typically be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 afy, to enhance the effectiveness of natural recharge processes that would cause groundwater levels and storage volumes to recover after the higher pumping during dry years.

Table 3-1
Groundwater Operating Plan for the Santa Clarita Valley

Aquifer	Groundwater Production (af)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

In 2004, as part of analyzing the restoration of perchlorate-impacted groundwater supply in the Valley, a numerical groundwater flow model was developed and calibrated for use in analyzing the response of the groundwater basin to long-term operation at the operational yields noted above, with focus on perchlorate extraction and the control of perchlorate migration in the basin. That groundwater flow model was then utilized in 2005 to specifically analyze the sustainability of groundwater supplies in both the Alluvium and the Saugus Formation through a long-term (78 year) hydrologic period that was selected to examine groundwater basin response to variations in pumping in accordance with the operating plan. Resultant projections of groundwater levels, groundwater storage, and surface water flows showed the basin to respond in a long-term sustainable manner, with no chronic depletion of groundwater levels, storage, or stream flows. The analysis of groundwater sustainability was summarized in a Basin Yield Report (CH2M Hill and LSCE, 2005), which included the following findings listed below.

- The groundwater basin has historically been, and continues to be, in good operating condition and not in overdraft, as indicated by historical data.

- The groundwater plan is sustainable over varying hydrologic conditions, because it is feasible to intermittently exceed a long-term average yield for one or more years without creating long-term adverse impacts to the groundwater system and the Santa Clara River.

- The groundwater operating plan for the Alluvium and the Saugus Formation can be used for long-term water supply planning purposes. In particular, although increased pumping from the Saugus Formation during dry periods can be expected to cause short-term declines in groundwater levels, it is not projected to cause permanent declines in groundwater discharges or streamflow. Saugus groundwater levels can be expected to recover to pre-drought conditions when pumping is reduced in subsequent wet to normal years.

- The strategy around which the groundwater operating plan was designed (maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, while limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus pumping during years when SWP supplies are significantly reduced because of drought conditions) is viable on a long-term basis.

- Together, the historical observations of basin conditions and the model simulations together support the historical and ongoing confidence that groundwater can continue to be a sustainable source of water supply under the groundwater operating plan.

In 2008, partly in preparation for the 2010 UWMP, and in part because of events that can be expected to impact the future reliability of the supplemental water supply from the State Water Project, the Purveyors initiated an updated analysis to further assess groundwater development potential and possible augmentation of the groundwater operating plan. A further consideration in conducting an updated analysis of the basin was that global climate change could alter local rainfall and associated recharge patterns, thus affecting local groundwater supplies, i.e. the yield of the basin. Finally, the Los Angeles County Flood Control District (LACFCD) was planning a number of small flood control projects in the Santa Clarita Valley; estimated amounts of conservation/groundwater recharge potential were being included for each of the individual projects in the overall LACFCD planning, and the Purveyors had interest in whether that potential could appreciably augment the yield of the basin.

The updated basin yield analysis (LSCE and GSI, 2009), completed in August 2009, had the following conclusions.

- The 2008 Operating Plan, with currently envisioned pumping rates and distribution comparable to the Operating Plan described above, will not cause detrimental short- or long-term effects to the groundwater and surface water resources in the Valley and is, therefore, sustainable. Further, local conditions in the Alluvium in the eastern end of the basin can be expected to repeat historical groundwater level declines during dry periods, necessitating a reduction in desired Alluvial aquifer pumping due to decreased well yield and associated actual pumping capacity during those periods. However, those reductions in pumping from the Alluvial aquifer can be made up by an equivalent amount of increased pumping in other parts of the basin without disrupting basin-wide sustainability or local pumping capacity in those other areas. For the Saugus Formation, the modeling analysis indicated that it can sustain the pumping that is embedded in the 2008 Operating Plan.

- A Potential Operating Plan (Alluvial pumping between 41,500 and 47,500 afy) would result in lower Alluvial groundwater levels, failure of the basin to fully recover (during wet hydrologic cycles) from depressed storage that would occur during dry periods, and generally declining trends in groundwater levels and storage. Long-term lowering of groundwater levels would also occur in the Saugus Formation (pumping between about 16,000 and nearly 40,000 afy) with only partial water level recovery occurring in the Saugus. Thus, the Potential Operating Plan would not be sustainable over a long-term period.

- Several climate change models were examined to estimate the potential impacts on local hydrology in the Santa Clarita Valley. The range of potential climate change impacts extends from a possible wet trend to a possible dry trend over the long term. The trends that range from an approximate continuation of historical average precipitation, to something wetter than that, would appear to result in continued sustainability of the 2008 Operating Plan, again with intermittent constraints on full pumping in the eastern part of the basin. The potential long-term dry trend arising out of climate change would be expected to decrease local recharge to the point that lower and declining groundwater levels would render the 2008 Operating Plan unsustainable. Ultimately it was recognized that a wide range of potential global climate change produces a range of non-unique results with respect to local hydrologic conditions and associated sustainable groundwater supply. Notable in the wide range of possibilities, however, was the output that, over a 20 to 25-year planning horizon of the 2005 UWMP, the range of relatively wet to relatively dry hydrologic conditions would be expected to produce sustainable groundwater conditions under the 2008 Groundwater Operating Plan.

Based on the preceding conclusions, groundwater utilization continues in accordance with the 2008 Operating Plan; and the Potential Operating Plan is not being considered for implementation.

3.2 Alluvium – General

The spatial extent of the aquifers used for groundwater supply in the Valley, the Alluvium and the Saugus Formation, are illustrated in **Figure 3-1**. Geologic descriptions and hydrogeologic details related to both aquifers are included in several technical reports including Slade (1986, 1988, and 2002), CH2M Hill (2005) and LSCE (2005), the 2005 UWMP and the 2010 UWMP.

Consistent with the 2001 Update Report (Slade, 2002), the 2005 Basin Yield Report (CH2M Hill and LSCE, 2005), the 2005 UWMP, the 2009 Updated Basin Yield Report (LSCE and GSI, 2009), and the 2010 UWMP, the management practice of the Purveyors continues to be to rely on groundwater from the Alluvium for part of the overall municipal water supply, whereby total

pumping from the Alluvium (by municipal, agricultural, and small private pumpers) is in accordance with the 2008 groundwater Operating Plan, 30,000 to 40,000 afy in wet and normal years, with possible reduction to 30,000 to 35,000 afy during multiple dry years. Such operation will maximize use of the Alluvium because of the aquiferôs ability to store and produce good quality water on a sustainable basis, and because the Alluvium is capable of rapid recovery of groundwater storage in wet periods. As with many groundwater basins, it is possible to intermittently exceed a long-term average yield for one or more years without long-term adverse effects. Higher pumping for short periods may temporarily lower groundwater storage and related water levels, as has been the case in the Alluvium several times since the 1930's. However, subsequent decreases in pumping limit the amount of water level decline. Normal to wet-period recharge results in a rapid return of groundwater levels to historic highs. Historical groundwater data collected from the Alluvium over numerous hydrologic cycles continue to provide assurance that groundwater elevations, if locally lowered during dry periods, recover in subsequent average or wet years. Such water level response to rainfall is a significant characteristic of permeable, porous, alluvial aquifer systems that occur within large watersheds. In light of these historical observations, complemented by the long-term sustainability analysis using the numerical groundwater flow model, there is ongoing confidence that groundwater will continue to be a sustainable source of water supply at the rates of pumping as described in the 2009 Updated Basin Yield Report, and incorporated in the 2010 UWMP.

Long-term adverse impacts to the Alluvium could occur if the amount of water extracted from the aquifer were to exceed the amount of water that recharges the aquifer over an extended period. However, the quantity and quality of water in the Alluvium and all significant pumping from the Alluvium are routinely monitored, and no long-term adverse impacts have ever been evident. Ultimately, the Purveyors have identified cooperative measures to be taken, if needed, to ensure sustained use of the aquifer. Such measures include but are not limited to the continuation of conjunctive use of SWP and other imported supplemental water with local groundwater, artificial recharge of the aquifer with local runoff or other surface water supplies, financial incentives discouraging extractions above a selected limit, expanded use of other water supplies such as recycled water, and expanded implementation of demand-side management, including conservation.

3.2.1 Alluvium Historical and Current Conditions

Total pumping from the Alluvium in 2013 was about 36,900 af, a decrease of about 3,800 af from the preceding year. Total Alluvial pumping was slightly above the upper end of the groundwater Operating Plan range for a dry year. Groundwater level response to that amount of pumping has remained consistent with historically observed conditions, with no negative changes that might indicate pumping in excess of a sustainable amount; overall, the combination of 2013 pumping and groundwater level response suggest that the Operating Plan range does not

reflect absolute groundwater pumping limits. Of the total Alluvial pumping in 2013, about 21,400 af (58 percent) was for municipal water supply, and the balance, about 15,500 af (42 percent), was for agriculture and other smaller uses, including individual domestic uses. In a longer-term context, there has been a change in municipal/agricultural pumping distribution since SWP deliveries began in 1980, toward a higher fraction for municipal water supply (from about 50 percent to more than 65 percent of Alluvial pumpage), which reflects the general land use changes in the area. Ultimately, on a long-term average basis since the beginning of imported water deliveries from the SWP, total Alluvial pumping has been about 33,200 afy, which is at the lower end of the range of operational yield of the Alluvium during wet/normal years and in the middle of the range for dry years. That average has been higher over the last decade, about 39,500 afy, which remains within the range of operational yield of the Alluvium. The overall historic record of Alluvial pumping is illustrated in **Figure 3-2**.

Groundwater levels in various parts of the basin have historically exhibited different responses to both pumpage and climatic fluctuations. During the last 20 to 30 years, depending on location, Alluvial groundwater levels have remained nearly constant (generally toward the western end of the subbasin), or have fluctuated from near the ground surface when the subbasin is full, to as much as 100 feet lower during intermittent dry periods of reduced recharge (generally toward the eastern end of the subbasin). For illustration of the various groundwater level conditions in the subbasin, the Alluvial wells have been grouped into areas with similar groundwater level patterns, as shown in **Figure 3-3**. The groundwater level records have been organized into hydrograph form (groundwater elevation vs. time) as illustrated in **Figures 3-4 and 3-5**. Also shown on these plots is a marker indicating whether any year had a below-average amount of rainfall. The wells shown on these plots are representative of the respective areas, showing the range of values (highest to lowest groundwater elevation) through each area, and containing a sufficiently long-term record to illustrate trends over time.

Situated along the upstream end of the Santa Clara River Channel, the Mint Canyon area, located at the far eastern end of the groundwater subbasin, and the nearby Above Saugus WRP area generally exhibit similar groundwater level responses (**Figure 3-4**) to hydrologic and pumping conditions. The wells located in the Mint Canyon area generally show a more pronounced rebound in groundwater elevations during wet periods compared to wells located in the Above Saugus WRP area. These eastern parts of the Valley have historically experienced a number of alternating wet and dry hydrologic conditions during which groundwater level declines have been followed by returns to high or mid-range historic levels. When water levels are low, well yields and pumping capacities in this and other eastern areas can be impacted. The affected Purveyors typically respond by decreasing pumping in the Alluvium and increasing use of Saugus Formation and imported (SWP and other) supplies, as shown in **Table 2-3**. The Purveyors also shift a fraction of the Alluvial pumping that would normally be supplied by the eastern areas to areas further west, where well yields and pumping capacities remain fairly

constant because of smaller groundwater level fluctuations in response to wet and dry hydrologic periods. Long-term pumping in the Mint Canyon area has averaged about 8,000 afy. However, since a high of over 12,000 afy in 2006, pumping in the Mint Canyon area has since generally declined and in 2013 pumping was about 5,500 af. Recent wet and dry periods illustrate the groundwater level response to managed Alluvial pumping. The five-year period of 2006 through 2010 saw water level declines on the order of 50 to 60 feet; pumping was gradually reduced by about 40 percent over that period (from 12,000 af in 2006 to 6,900 in 2010) and water levels stopped declining (**Figure 3-6).** Subsequent wet conditions in late 2010, continuing into 2011, resulted in a nearly full recovery of groundwater levels and aquifer storage. With such high groundwater levels, pumping increased by about 1,500 afy over 2010 levels in 2011 (8,400 af) and 2012 (8,600 af). Following the wet conditions in late 2010 and 2011, dry conditions resumed in 2012 and 2013, resulting in a general groundwater level decline that is similar to low levels observed in the historical long-term record.

Just below the Mint Canyon area, the Above Saugus WRP area has shown similar water level trends. While the pumping trends since 2004 have been inversely proportional to those of the Mint Canyon area, pumping here has been less by about half with a long-term average, as shown in **Figure 3-6**, of about 3,700 afy. Groundwater level response is similar to the Mint Canyon area in that groundwater levels are sensitive to variations in rainfall. Groundwater levels have exhibited a decline since 2005 and 2006 with a slight increase in levels in 2010 and 2011 in response to the above normal rainfall in late 2010 and 2011. Currently, groundwater levels are at levels representative of recent dry periods in the early 1990s and mid 2000ôs.

In the Bouquet Canyon area, groundwater levels, as represented by the Guida and Clark wells in **Figure 3-4**, are influenced by a number of factors, including groundwater pumping and recharge from rainfall, natural streamflow in Bouquet Creek and releases from Bouquet Reservoir into Bouquet Creek. Groundwater pumping has ranged from 500 to 2,500 afy since 1985 and has declined slightly since 2007 from about 2,200 af to about 1,500 af in 2013, similar to the early 1990s. Although groundwater pumping has gradually declined since 2007, groundwater elevations during this period do not appear to be changing in response to the declining pumping trend. Rather they appear to be influenced more by variations in rainfall and changes in Bouquet Reservoir releases into Bouquet Creek and resultant groundwater recharge. Groundwater elevations had increased in varying degrees over the past 10 years in response to a wet rainfall year in 2005 and to elevated releases of water from Bouquet Reservoir to Bouquet Creek that occurred in 2009 through 2011. However, during the past two years, with the dry conditions and smaller releases from Bouquet Reservoir[1], groundwater elevations have either been stable or declining, but they remain within the historical range of levels for each well.

[1] Flow in Bouquet Creek is regulated by releases from Bouquet Reservoir, which is operated by Los Angeles Department of Water and Power. Per an agreement with United Water Conservation District, minimum releases

In the western parts and lower elevations of the subbasin, groundwater levels in the Alluvium respond to pumping and precipitation in a similar manner, but to an attenuated or limited extent compared to those situated in the eastern, higher elevation areas. As shown in the group of hydrographs in **Figure 3-5** that represent Alluvial groundwater conditions in the western portion of the subbasin, specifically the Below Saugus WRP and San Francisquito Canyon areas, groundwater level fluctuations in the subbasin become more subtle in the westward and lower portion of the Valley. Wells located in the Below Saugus WRP area in **Figure 3-5** (VWCôs I and Q2 wells), along the Santa Clara River immediately downstream of the Saugus Water Reclamation Plant generally show either stable or slightly declining groundwater levels since 2006 through 2013, but remain within the historical range of levels. Although the groundwater levels in the Below Saugus WRP area are relatively low, the water levels are still at or substantially above well screen intake sections and higher than historic lows in the 1960s. With the exception of a couple of years, pumping has been generally constant at about 6,000 afy since the mid 1990ôs in the Below Saugus WRP area.

Wells located in the San Francisquito Canyon area and presented in **Figure 3-5** (W5, W9 and W11 wells) generally exhibit fairly stable groundwater level trends that respond slightly to variations in rainfall, similar in nature to other areas in the middle and western portions of the subbasin. In this middle part of the basin, historical groundwater levels were lower in the 1950's and 60's than current levels. Groundwater levels in this area notably recovered as pumping declined through the 1960's and 1970's. They have subsequently sustained generally high levels for much of the last 30 years, with four dry-period exceptions: mid-1970's, late 1980's to early 1990's, late 1990ôs to early 2000ôs and late 2000ôs. Recoveries to previous high groundwater levels have followed all of the short dry-period declines in the 1970's, 1990's, and early 2000ôs. More recently, groundwater levels recovered significantly to historic highs, following a wetter-than-average year in 2010 and early 2011; since 2011 they have declined about 25 feet but remain within mid-range historic levels. In 2013, pumping in the San Francisquito Canyon area was about 2,500 af, or almost 20 percent less than in 2012.

The Castaic Valley area is located along Castaic Creek below Castaic Lake. Below that and along the Santa Clara River, downstream of the Valencia Water Reclamation Plant, is the Below Valencia WRP area, where discharges of treated effluent from the Valencia WRP to the Santa Clara River contribute to groundwater recharge. In the Castaic Valley area, groundwater levels continue to remain fairly constant over the last several decades, with slight responses to climatic

from Bouquet Reservoir are specified. These releases had been maintained until a series of storms in 2005 created substantial runoff and altered the streambed so that even small amounts of flow spills out of the creek and onto Bouquet Canyon Road. Efforts to prevent flow onto the road while maintaining specified releases have not been completely successful, and therefore releases from Bouquet Reservoir have continued to be reduced by about 8 cubic feet per second from March through October since 2006.

and other fluctuations, since the 1950ôs (**Figure 3-5**) ranging from 20 to 30 feet. Over the last three years, groundwater levels have declined approximately 20 feet from long term high levels. In the Castaic Valley area, pumping has remained relatively constant over the last 28 years at about 5,300 afy, with a recent decline since 2012 to about 4,000 af in 2013. Recent changes in groundwater levels are consistent with other short-term historical fluctuations around the Valley, but in the long-term, a generally constant trend remained through 2013.

In the Below Valencia WRP area, pumping notably increased through the 1990ôs but has since increased at a much lower rate since the early 2000ôs, and is currently about 13,000 afy (**Figure 3-6**). Long term groundwater levels in this area have generally been stable and have exhibited slight, if any, response to either pumping or climatic fluctuations, although in the last decade there has been a slight decline of about 10 feet observed in the C and E designated wells in this area. These slight declines may be attributed to generally dry conditions present since 2005 (**Figure 3-5**).

In summary, depending on the period of available data, all the history of groundwater levels in the Alluvium shows the same general picture: recent (last 30 years) groundwater levels have exhibited historic highs; in some locations, there are intermittent dry-period declines (resulting from use of some groundwater from storage) followed by wet-period recoveries (and associated refilling of storage space). On a long-term basis, whether over the last 30 years since importation of supplemental SWP water, or over the last 40 to 50 years (since the 1950's - 60's), the Alluvium shows no chronic trend toward decreasing water levels and storage, and thus shows no symptoms of water level-related overdraft. Consequently, pumping from the Alluvium has been and continues to be sustainable, well within the operational yield of that aquifer on a long-term average basis.

3.3 Saugus Formation – General

Saugus wells operated by the Purveyors and CLWA are located in the southern portion of the basin, primarily south of the Santa Clara River (one well is located north of the river) (**Figure 3-7**). Consistent with the 2001 Update Report (Slade, 2002), the 2005 Basin Yield Report (CH2M Hill and LSCE, 2005), and the 2009 Updated Basin Yield Report (LSCE and GSI, 2009), the Purveyors have utilized the Saugus in accordance with the original (and the 2008) groundwater Operating Plan, in the range of 7,500 to 15,000 afy in average/normal years, with planned dry-year pumping of 15,000 to 35,000 afy for one to three consecutive dry years, when shortages to CLWAôs SWP water supplies could occur. Such high pumping would be followed by periods of lower pumping in order to allow recharge to recover water levels and storage in the Saugus Formation. Maintaining the substantial volume of water in the Saugus Formation remains an important strategy to help maintain water supplies in the Santa Clarita Valley during drought periods.

3.3.1 Saugus Formation Historical and Current Conditions

Total pumping from the Saugus in 2013 was about 9,000 af, or about 300 af more than in the preceding year. This included about 3,100 af that were pumped from CLWA's Saugus 1 and Saugus 2 Wells as part of the perchlorate pump and treat program as described herein. Of the total Saugus pumping in 2013, most (about 8,300 af) was for municipal water supply, and the balance (600 af) was for agricultural and other irrigation uses. Historically, groundwater pumping from the Saugus peaked in the early 1990's and then steadily declined through the remainder of that decade. Since then, Saugus pumping has been trending upward from about 4,000 in the early 2000's to above 9,000 afy last year, with the recent 5-year average at about 8,400 af per year. On a long-term basis since the importation of SWP water, total pumping from the Saugus Formation has ranged between a low of about 3,700 afy (in 1999) and a high of nearly 15,000 afy (in 1991); average pumping from 1980 to present has been about 7,000 afy. These pumping rates remain well within, and generally at the lower end of the range of Operating Yield of the Saugus Formation. The overall historic record of Saugus pumping is illustrated in **Figure 3-8**.

Unlike the Alluvium, which has an abundance of wells with extensive water level records, the water level data for the Saugus Formation are limited by both the geographic distribution of the wells in that Formation and the periods of water level records. The wells that do have an historical water level record that exists prior to the initiation of SWP deliveries in 1980 indicate that groundwater levels in the Saugus Formation were highest in the mid-1980's and are currently similar to what they were in the mid-1960's (**Figure 3-9**). Since 2006, there has been a downward trend in groundwater elevations observed in the Saugus Formation wells. However, there is no evidence the recent decline in groundwater levels are representative of a permanent water level or storage decline. There continues to be fluctuations in groundwater levels attributed to seasonal and climatic fluctuations along with pumpage, but the prevalent long-term trend is one of general stability.

Consistent with the 2001 Update Report (Slade, 2002), the 2005 Basin Yield Report (CH2M Hill and LSCE, 2005), the 2005 UWMP, the 2009 Updated Basin Yield Report (LSCE and GSI, 2009), and the 2010 UWMP, the Purveyors continue to maintain groundwater storage and associated water levels in the Saugus Formation so that supply is available during drought periods, when Alluvial pumping might be reduced and/or SWP or other supplemental supplies also decreased. The period of increased pumping during the early 1990's is a good example of this management strategy. Most notably, in 1991, when SWP deliveries were substantially reduced, increased pumping from the Saugus made up almost half of the decrease in SWP deliveries. The increased Saugus pumping over several consecutive dry years (1991-1994) resulted in short-term declining groundwater levels, reflecting the use of water from storage. However, groundwater levels subsequently recovered when pumping declined in the late 1990s

to early 2000s to around 4,000 afy, reflecting recovery of groundwater storage in the Saugus Formation.

3.4 Imported Water

CLWA obtains the majority of its imported water supplies from the State Water Project (SWP), which is owned and operated by the California Department of Water Resources (DWR). CLWA is one of 29 contractors holding long-term SWP contracts with DWR. SWP water originates as rainfall and snowmelt in the Feather River watershed in northern California. Runoff from the watershed is stored in Lake Oroville, which is the SWPôs largest storage facility. The water is then released from Lake Oroville down the Feather River to the Sacramento River and through the Sacramento-San Joaquin Delta. Water is diverted from the Delta into the Clifton Court Forebay, and then pumped into the 444-mile long California Aqueduct. SWP water delivered to southern California is temporarily stored in San Luis Reservoir, which is jointly operated by DWR and the U.S. Bureau of Reclamation. Prior to delivery to CLWA, SWP supplies are stored in Castaic Lake, a terminal reservoir located at the end of the West Branch of the California Aqueduct.

CLWAôs service area covers approximately 195 square miles (124,800 acres), including the City of Santa Clarita and surrounding unincorporated communities. SWP and other imported water from Castaic Lake is treated, filtered and disinfected at CLWAôs Earl Schmidt Filtration Plant and Rio Vista Water Treatment Plant, which have a combined treatment capacity of 122 million gallons per day. Treated water is delivered from the treatment plants to each of the four Purveyors through a distribution network of pipelines and turnouts. At present, CLWA delivers water to the four Purveyors through 26 potable turnouts as schematically illustrated in **Figure 3-10**.

In 2013, CLWA fulfilled the following major accomplishments in order to enhance, preserve, and strengthen the quality and reliability of existing and future supplies:

- continued participation in long-term water banking programs with Rosedale-Rio Bravo Water Storage District and the Semitropic Water Storage District.
- continued to participate in two-for-one exchange programs with Rosedale-Rio Bravo Water Storage District and West Kern Water District,
- completed water sales of 22,000 af to west Kern County agricultural water districts providing revenue to CLWA,
- completed water sales of 6,000 af to the San Luis Water District providing revenue to CLWA,
- continued implementation of the AB 3030 Groundwater Management Plan,

- continued implementation of the water conservation Best Management Practices, including measures in the Santa Clarita Valley Water Use Efficiency Plan,
- continued participation in the Santa Clarita Valley Water Committee,
- pumped and treated about 3,100 af from the Saugus 1 and 2 wells in 2013 as part of the remediation of the Saugus Formation groundwater perchlorate contamination,
- continued cooperative effort with the U.S. Army Corps of Engineers for characterization studies of the former Whittaker-Bermite site and in a task force effort with the City of Santa Clarita, local legislators, and state agencies to effect the cleanup and remediation of all aspects of the former Whittaker-Bermite site, including perchlorate contamination of local groundwater, and
- continued recycled water service.

3.4.1 State Water Project Table A Supplies

Each SWP contractor has a specified water supply amount shown in Table A of its contract that currently totals approximately 4.1 million af. The term of the CLWA contract is through 2038 and is renewable after that year. Although the SWP has not been fully completed, the SWP can deliver nearly all 4.1 million af of Table A Amounts during certain wet years.

CLWA has a contractual Table A Amount of 95,200 af per year of water from SWP. On November 29, 2012, the initial allocation for 2013 was announced as 30 percent. The allocation was increased to 40 percent on December 21, 2012, and finally decreased to 35 percent on March 22, 2013. The allocation was not subsequently changed. CLWAôs final allocation of Table A Amount for 2013 was thus 35 percent, or 33,320 af. CLWA was also able to use 28,434 af of the total available carryover (49,916 af) from 2012.

In addition to its Table A Amount, CLWA has access to 4,684 af of ñflexible storageò in Castaic Lake. In 2005, CLWA negotiated an agreement with the Ventura County SWP contractors to allow CLWA to utilize its flexible storage account of 1,376 af. CLWA may withdraw water from flexible storage on an as-needed basis; however any water withdrawn from this storage must be replaced within five years. In combination, this provides total flexible storage of 6,060 af, which is maintained in Castaic Lake for use in a future dry period or an emergency. This amount was available in 2013, but was not utilized due to other available supplies.
Also in 2005, CLWA completed an agreement to participate in a long-term water banking program with Rosedale-Rio Bravo Water Storage District (RRBWSD) in Kern County. CLWA delivered 20,000 af of its excess Table A water into storage in both 2005 and 2006. In 2007, pursuant to the Water Acquisition Agreement with Buena Vista Water Storage District (BVWSD) and RRBWSD as described below, CLWA was also back-credited a total of 22,000 af for 2005 and 2006. CLWA delivered 8,200 af and another 33,668 af of SWP and BVWSD/RRBWSD water to the bank in 2007 and 2010, respectively. In 2011, CLWA

delivered 1,006 af into storage and in 2012, delivered another 6,031 af into storage. The recoverable storage in the program after groundwater and other losses are factored in is 100,000 af stored in the bank at this time. This long-term program will allow storage of up to 100,000 af at any one time, and provides significant dry year reliability for the Santa Clarita Valley. No water was withdrawn from or contributed to the bank in 2013.

In 2011, CLWA executed a water 2-for-1 exchange program with RRBWSD where CLWA can recover one acre-foot of water for each two acre-feet delivered (less losses). In 2011, CLWA delivered 15,602 af to the program, delivered another 3,969 af in 2012 and, after program losses, has 9,509 af of recoverable water. This program is also at capacity. CLWA also has a two-for-one exchange program with the West Kern Water District in Kern County and delivered 5,000 af in 2011, resulting in a recoverable total of 2,500 af. No water was withdrawn from or contributed to the exchange programs in 2013.

The other banking component of CLWA's imported water supply reliability program comprises two agreements with Semitropic Water Storage District whereby CLWA banked surplus Table A water supply in 2002 and 2003. Notable in 2009 was the first recovery of water from the 2002 account; of 4,950 af withdrawn in 2009, 1,650 af was delivered for water supply in the Valley in 2009, and the 3,300 af balance was delivered in 2010. No water was withdrawn from the Semitropic Water Banking Program in 2013.

As delineated in **Table 3-2**, with the 35 percent Table A allocation and other imported water supplies, including 49,916 af of carryover from 2012, CLWA had total available supply of 94,236 af in 2013, the largest part of which was delivered to the Purveyors (43,281 af), sold to west Kern County agricultural water districts (22,000 af), and sold to the San Luis Water District (6,000 af), and delivered to Devil's Den (628 af), leaving 21,482 af of Table A Amount available for carryover to 2014.

3.4.2 Other Imported Water Supplies

In early 2007, CLWA finalized a Water Acquisition Agreement with the BVWSD and the RRBWSD in Kern County. Under this Program, Buena Vista's high flow Kern River entitlements (and other acquired waters that may become available) are captured and recharged within Rosedale-Rio Bravo's service area on an ongoing basis. CLWA receives 11,000 af of these supplies annually through either exchange of Buena Vista's and Rosedale-Rio Bravo's SWP supplies or through direct delivery of water to the California Aqueduct via the Cross Valley Canal. In 2013, CLWA received 11,000 af of water from this Program and sold this water as part of the 22,000 af sale to west Kern County Agricultural water districts.

Table 3-2
2013 CLWA Imported Water Supply and Disposition
(acre-feet)

Supply		
Net 2012 SWP Carryover to 2013 [1]		49,916
Buena Vista/Rosedale Rio-Bravo		11,000
Yuba County Accord Water		0
2013 SWP Article 21 Water		0
2013 Final SWP Table A Allocation [2]		33,320
Total 2013 Imported Water Supply		**94,236**
Disposition		
Purveyor Deliveries		43,281
CLWA SCWD	*20,059*	
Valencia Water Company	*18,249*	
Newhall County Water District	*4,488*	
Los Angeles County WWD 36	*485*	
Deliveries to Devilôs Den		628
CLWA/DWR/Purveyor Metering[3]		845
Rosedale ï Rio Bravo Water Banking and Exchange Program		0
Rosedale ï Rio Bravo Water Two-for-One Exchange Program		0
West Kern Water District Two-for-One Exchange Program		0
West Kern County Agricultural Water Districts Sale[4]		22,000
San Luis Water District Sale[5]		6,000
2013 Table A Carryover to 2014[6]		21,482
Total 2013 Imported Water Disposition		**94,236**

1. Total 2012 carryover available in 2013 was 49,916 af; of that amount 28,434 af was used by CLWA, based on final DWR delivery accounting, and the difference remains available for future use.

2. Final 2013 allocation was 35% of contractual Table A amount of 95,200 acre-feet, which progressed as follows:

Initial allocation, November 29, 2012	30%
Allocation increase, December 21, 2012	40%
Allocation decrease, March 22, 2013	35%
Final allocation, (no change)	35%

3. Reflects meter reading differences.

4. Sale of 11,000 af of Buena Vista/Rosedale-Rio Bravo water, 7,177 af of SWP Table A and 3,823 af of carryover water to West Kern County agricultural water districts.

5. Sale of 6,000 af of banked Buena Vista/Rosedale-Rio Bravo water in the Rosedale-Rio Bravo Water Banking and Exchange

6. Total 2013 Table A and previous yearsô carryover to 2014.

In 2008, CLWA entered into the Yuba Accord Agreement, which allows for the purchase of water from the Yuba County Water Agency through the Department of Water Resources to 21 State Water Project contractors (including CLWA) and the San Luis and Delta-Mendota Water Authority. Up to 850 af of non-SWP supply is available to CLWA in critically dry years. Under certain hydrologic conditions, additional water may be available to CLWA from this program. CLWA chose not to purchase any water from this source in 2013.

3.4.3 Imported Water Supply Reliability

The current SWP Draft Delivery Reliability Report 2013, issued in December 2013, maintains the restrictions on SWP operations according to the Biological Opinions of the U.S. Fish and Wildlife Service and the National Marine Fishery Service issued on December 15, 2008 and June 4, 2009, respectively. In December 2010, a federal judge overruled most of the 2008 federal biological opinion and invalidated several of the criteria that reduced SWPôs water supply. These matters were appealed to the U.S. Court of Appeals for the Ninth Circuit. The Ninth Circuit ruling upheld the Biological Opinions of the federal agencies. Therefore, the operational rules defined in these BOs continue to be legally required and were used by DWR in the analyses supporting its 2013 Draft Delivery Reliability Report. The SWP Draft Delivery Reliability Report 2013 also considers the impacts on SWP delivery reliability due to climate change, sea level rise, and vulnerability of the Deltaôs conveyance system and structure due to floods and earthquakes. With these factors, the Reliability Report projects that long-term reliability under future 2033 conditions will decrease relative to the 2011 estimate of 60 percent to 58 percent during normal year hydrology. Specifically, under existing conditions (2013), the average annual delivery of Table A water is estimated at 1% more than the 2011 report; under future conditions, the average annual delivery is estimated at 2% less than the 2011 report. CLWA staff has assessed the impact of the current Reliability Report on the CLWA water supply and concluded that the 2010 UWMPôs statement that current and future supplies are available to meet anticipated water supply needs through the year 2050 remains correct.

Groundwater banking and conjunctive use offer significant opportunities to improve water supply reliability for CLWA. Groundwater banking is the process of storing available supplies of water in groundwater basins during wet years or when supplemental water is otherwise available. During dry periods, or when imported water supply availability is reduced, banked water can be recovered from groundwater storage to replace, or firm up, the imported water supply deliveries.

As described herein, CLWA has entered into four groundwater banking and water exchange programs and has, in aggregate, almost 158,000 af of recoverable water outside the local groundwater basin. The first component of CLWAôs overall groundwater banking program is the result of two 10-year agreements between CLWA and Semitropic Water Storage District

whereby, over the terms of the two agreements, CLWA can withdraw up to 45,920 af of SWP Table A water that it stored in Semitropic to meet Valley demands when needed in dry years (45,920 af is the net recoverable balance after originally banking 24,000 af in 2002 and 32,522 af in 2003, and withdrawing 4,950 af in 2009 for delivery in 2009 and 2010). In April 2011, Semitropic and CLWA extended the original agreements by 10 years to 2022/2024. The second component of the program, the long-term RRBWSD Water Banking and Exchange Program in Kern County, has a recoverable total of 100,000 acre-feet in storage. The third and fourth components are the two-for-one banking programs that CLWA initiated with RRBWSD and West Kern Water District in 2011 that now have a total of 12,009 af of recoverable water.

Conjunctive use is the purposeful integrated use of surface water and groundwater supplies to maximize water supply from the two sources. CLWA and the Purveyors have been conjunctively utilizing local groundwater and imported surface water since the initial importation of SWP water in 1980. The groundwater banking programs described above allow CLWA to firm up the imported water component of conjunctive use in the Valley by storing surplus SWP and other water, in wet years, in groundwater basins outside the Valley. This allows recovery and importation of that water as needed in dry years to maintain a greater overall amount of imported surface water to be used conjunctively with local groundwater, further supporting the sustainable use of local groundwater at the rates in the groundwater operating plan.

3.5 Water Quality – General

Water delivered by the Purveyors consistently meets drinking water standards set by the Environmental Protection Agency (EPA) and the California Department of Public Health (DPH). An annual Water Quality Report is provided prior to July 1st to all Santa Clarita Valley residents who receive water from one of the four water retailers. There is detailed information in that report about the results of quality testing of the groundwater and treated SWP water supplied to the residents of the Santa Clarita Valley. Several constituents of particular local interest are discussed in more detail below.

Total Trihalomethanes

In December 2005, the United States Environmental Protection Agency (USEPA) implemented the Stage 2 Disinfectants and Disinfection Byproducts Rule. In part, this rule did not change the existing Maximum Contaminant Level (MCL) of 80 µg/l for Total Trihalomethanes (TTHM), however, it requires water systems to apply that MCL at each compliance monitoring location (instead of as a system-wide average as in previous rules). TTHMs are byproducts created when chlorine is used as a means for disinfection. CLWA, NCWD, and SCWD implemented an alternative method of disinfection, chloramination, in 2005 to maintain compliance with the new rule and future regulations relating to disinfection byproducts. TTHM concentrations have remained significantly below the MCL since implementation of alternative disinfection. VWC

continues to use chlorination (using free chlorine) to disinfect groundwater and has been in compliance with the USEPAôs Disinfection Byproducts Rule.

Perchlorate

Perchlorate is a regulated chemical in drinking water. In October 2007, DPH established an MCL for perchlorate of 6 µg/l. Perchlorate has been a water quality concern in the Valley since 1997 when it was originally detected in four wells operated by the Purveyors in the eastern part of the Saugus Formation, near the former Whittaker-Bermite facility. In late 2002, perchlorate was detected in a fifth municipal well, in this case an Alluvial well (SCWDôs Stadium Well), also located near the former Whittaker-Bermite site. Currently, two of those wells (VWCôs Well 157 and SCWDôs Stadium Well) have been sealed and replaced by new wells, and two wells (CLWAôs Saugus 1 and 2 Wells) were returned to service in January 2011 as described below. NCWDôs Well NC-11 has remained out of service with a portion of its capacity replaced by a combination of imported water from CLWA and treated water from CLWAôs Saugus Perchlorate Treatment Facility (described further below) through a SWP turnout. In early 2005, perchlorate was detected in a second Alluvial well (VWCôs Well Q2) near the former Whittaker-Bermite site; following the installation of wellhead treatment for the removal of perchlorate in the same year, the well was returned to regular water supply service. After two years of subsequent operation with no detections of perchlorate, the wellhead treatment was removed and the well has since remained in active water supply service. In 2006, perchlorate was detected in low concentrations below the Detection Limit for Reporting (<4.0 µg/l) in another Saugus well (NCWDôs Well NC-13), near one of the originally impacted wells. Saugus Well NC-13 has remained in service with regular sampling per DPH requirements and no subsequent detections of perchlorate. In August 2010, perchlorate was detected further down gradient in an eighth well, Valenciaôs Saugus Well 201. While the initial detection was below the MCL, the well was immediately taken out of active supply service. VWC is currently pursuing restoration alternatives at Saugus Well 201 that are expected to involve methodologies already employed at other previously impacted wells. Pending regulatory approval by the California Department of Public Health (CDPH) in 2014, it is planned that the approved CDPH restoration alternative will be implemented in 2015, resulting in the return of VWCôs Well 201 to service. Following the detection of perchlorate in Well 201 in 2010, VWC elected to minimize pumping from Saugus Well 205 through 2011 and since 2011 the well was voluntarily taken out of service entirely when perchlorate was detected in low concentrations below the Detection Limit for Reporting (<4.0 µg/l) in April 2012. This well is planned to resume service as part of the implementation of the restoration and containment program at Saugus Well 201. As described in the 2010 UWMP, the replacement and reactivation of the impacted wells, augmented by planned and funded replacement wells, adds to the overall ability to meet the groundwater component of total water supply in the Valley.

In February 2003, DTSC and the impacted Purveyors entered into a voluntary cleanup agreement entitled *Environmental Oversight Agreement* (amended 2012). Under the Agreement, DTSC is providing review and oversight of the response activities being undertaken by the Purveyors related to the detection of perchlorate in the impacted wells. Under the Agreementôs Scope of Work, the impacted Purveyors prepared a Work Plan for sampling the production wells, a report on the results and findings of the production well sampling, a draft Human Health Risk Assessment, a draft Remedial Action Workplan, an evaluation of treatment technologies and an analysis showing the integrated effectiveness of a project to restore impacted pumping capacity, extract perchlorate-impacted groundwater from two Saugus wells for treatment, and control the migration of perchlorate in the Saugus Formation. Environmental review of that project was completed in 2005 with adoption of a mitigated Negative Declaration. The Final Interim Remedial Action Plan for containment and extraction of perchlorate was completed and approved by DTSC in January 2006. Design and construction of the treatment facilities and pipelines to implement the pump and treat program and to also restore inactivated municipal well capacity was completed in May 2010. Water from Saugus 1 and Saugus 2 was initially treated and discharged into the Santa Clara River. DPH issued an amendment to CLWAôs Operating Permit in December 2010, and the wells were placed back in water supply service on January 25, 2011.

As part of the operation of CLWAôs Saugus Perchlorate Treatment Facility (SPTF), numerous monitoring tests are performed on a continuous basis in order to ensure the safety of the treated water leaving the SPTF. Perchlorate samples are collected semi-weekly at several locations, including at the Saugus 1 and Saugus 2 wells, both at the influent and effluent water points, at the lead and lag vessels, and at several distribution locations. The samples are analyzed at different frequencies for numerous other constituents, including chlorate, perchlorate, chloride, nitrate, nitrite and sulfate. In addition, samples are analyzed for microbiological growth, radiological and volatile organic compounds. In 2013, 3,108 af of groundwater were pumped from Saugus 1 and Saugus 2. After treatment for perchlorate removal, the groundwater was blended with treated imported water and delivered to the Purveyors through the CLWA distribution system. In October 2011, Saugus 2 experienced a failure in its casing/screen assembly and associated damage to its pump, causing the well to be taken out of service for mechanical rehabilitation and pump replacement. An inner liner assembly was installed in the well, followed by installation of a new pump. The well was returned to service in April 2012.

Since 2007, the impacted Purveyors (SCWD, NCWD, and VWC) and CLWA continued working toward the now-implemented plan that combines pumping from two of the impacted wells (Saugus 1 and 2) and a water treatment process (the SPTF) to restore the impacted pumping capacity and control the migration of contamination in the aquifer. The development and implementation of a cleanup plan for the Whittaker-Bermite site and the impacted groundwater is being coordinated among CLWA, the impacted Purveyors, Whittaker Corporation, the State

DTSC, and U.S. Army Corps of Engineers. DTSC is the lead agency responsible for regulatory oversight of the Whittaker-Bermite site.

Under the direction of DTSC, Whittaker has submitted a comprehensive site-wide remediation plan for the contaminants of concern in soil and groundwater detected on the property. A Draft Remedial Action Plan for Operable Units 2 through 6 that is focused on soil remediation was submitted to DTSC in 2009. The plan contains a number of recommended technologies to remove contaminants from the soil, in addition to a proposed clean-up schedule for the site. DTSC approved the Remedial Action Plan for contaminated soils in Operable Units 2 through 6 on December 6, 2010 and preparation of the Remedial Design documents are underway. Whittaker has also completed a Draft Operable Unit 7 Feasibility Study to identify and select treatment technologies for both on-site and off-site groundwater. The work plan for Pilot Remediation of Saugus Aquifer Containment and Remediation in Operable Unit 7 was approved by DTSC on December 31, 2008 and the first phase of the plan was completed in 2013.

Hardness

In 2008, the Valencia Water Company (VWC) began a demonstration project delivering pre-softened groundwater from one of its wells to approximately 420 residents located in the Copperhill Community of Valencia. Hard water is the primary complaint from VWC customers, and it is estimated that more than 50 percent have installed individual water softening units at their homes. In addition to having high operating costs, many of these units are designed to discharge a brine (salt) solution to the sanitary sewer system that is eventually discharged to the Santa Clara River, or is part of the recycled water supply. The environmental impact of such discharges was the subject of a major Chloride Total Maximum Daily Load investigation which concluded with a commitment by the Purveyors to achieve surface water quality goals for in-stream discharge from the basin. VWC's project is aimed at improving the quality of water for its customers to eliminate the need for home softening devices and to achieve the environmental benefits of reduced chloride discharge to the river.

The demonstration project utilizes softening technology that removes calcium and produces small calcium carbonate pellets which can be reused in a variety of industries. The demonstration project has now been operated for over five years and provides the water company with customer feedback and technical/financial information to assess potential future expansion of treatment to other well sites. For much of 2011 and 2012, the project was offline while upgrades and modifications to equipment were conducted. The project resumed operation in December 2012 and was operated periodically in 2013 with additional upgrades to various components. The plant is expected to resume normal operations during 2014.

3.5.1 Groundwater Quality Alluvium

Groundwater quality is, of course, a key factor in assessing the Alluvial aquifer as a municipal and agricultural water supply. Groundwater quality details and long-term conditions, examined by integration of individual records from several wells completed in the same aquifer materials and in close proximity to each other, have been discussed in previous annual Water Reports and in the 2010 UWMP. Historical groundwater quality, including 2013 data, is illustrated in **Figures 3-11 and 3-12**. These graphs show historical specific conductance (which is a measure of the salinity or amount of dissolved minerals) values for representative wells in the Valley with the CDPH Secondary Maximum Levels (ñRecommended Levelò and ñUpper Levelò) included for reference. Over the last 10 years, specific conductance values generally respond to wet periods by exhibiting a downward trend, followed by an increasing trend. In the Mint Canyon and Above Saugus WRP areas (**Figure 3-11**), specific conductance values increased in the early 2000s, followed by a downward trend in the mid-2000s, a result of the 2004 and 2005 wet period. This downward trend was followed by an upward trend in the late 2000s and another downward trend in 2010 through 2011 (Wells T7 and Pinetree 1) or through 2013 (Well U4). There was only one well (Clark) that was sampled in the Bouquet Canyon area in 2013. Specific conductance data for 2013 was similar to the 2001 value and lower than the values observed in 2004, 2007, and 2010. Specific conductance values in the western areas of the Valley exhibited similar patterns and responses of specific conductance values to wet and dry periods as those observed in the eastern portions of the Valley. For the most part, 2013 values were similar to or lower than previous recent results, with the exception of Well S8, which had an increase in specific conductance relative to the 2012 sample result. In summary, water quality in the Alluvium exhibits no long-term overall trends and, most notably, no change in Alluvial groundwater quality that exceeds historical conditions. There have been periodic fluctuations in some parts of the basin, where groundwater quality has generally inversely varied with precipitation and streamflow. The fluctuations occur during dry and wet periods when low streamflow and recharge during dry periods results in increased mineral concentrations and high streamflow and recharge during wet periods results in decreased mineral concentrations.

The presence of long-term consistent water quality patterns, although intermittently affected by wet and dry cycles, supports the conclusion that the Alluvial aquifer remains a viable ongoing water supply source in terms of groundwater quality.

3.5.2 Groundwater Quality Saugus Formation

As discussed above for the Alluvium, groundwater quality is a key factor in also assessing the Saugus Formation as a municipal and agricultural water supply. As with groundwater level data, long-term Saugus groundwater quality data are not sufficiently extensive to permit any sort of basin-wide analysis or assessment of pumping-related impacts on quality. However, integration

of individual records from several wells has been used to examine general water quality trends. Based on those records, water quality in the Saugus Formation has not historically exhibited the precipitation-related fluctuations seen in the Alluvium. Based on available data over the last 50 years, groundwater quality in the Saugus has exhibited a slight overall increase in dissolved mineral content as illustrated in **Figure 3-13**. Since 2000, several wells within the Saugus Formation have exhibited an additional increase in dissolved mineral content, similar to short-term changes in the Alluvium, possibly as a result of recharge to the Saugus Formation from the Alluvium. Since 2005, however, these levels have been steadily dropping or remaining within the recent 10-year range. Dissolved mineral concentrations in the Saugus Formation remain below the Secondary (aesthetic) Upper Maximum Contaminant Level. Groundwater quality within the Saugus will continue to be monitored to ensure that degradation to the long-term viability of the Saugus as a component of overall water supply does not occur.

3.5.3 Imported Water Quality

CLWA operates two surface water treatment plants, the Earl Schmidt Filtration Plant located near Castaic Lake and the Rio Vista Water Treatment Plant located in Saugus. CLWA produces water that meets drinking water standards set by the U.S. EPA and DPH. SWP water has different aesthetic characteristics than groundwater with lower dissolved mineral concentrations (total dissolved solids) of approximately 250 to 300 mg/l, and lower hardness (as calcium carbonate) of about 105 to 135 mg/l.

Historically, the SWP delivered only surface water from the Sacramento-San Joaquin River Delta. However, CLWA and other SWP users, in anticipation of drought, many years ago began ñwater bankingò programs where SWP water could be stored or exchanged during wet years and withdrawn in dry years. During the dry-year periods, a greater portion of water in the SWP has been this ñpumped-inò water. The ñpumped-inò water has met all water quality standards established by DWR under its anti-degradation policy for the SWP.

3.6 Recycled Water

Recycled water is available from two water reclamation plants operated by the Santa Clarita Valley Sanitation District. In 1993, CLWA prepared a draft Reclaimed Water System Master Plan that outlined a multi-phase program to deliver recycled water in the Valley. CLWA previously completed Phase I of the project, which will ultimately deliver 1,700 afy of recycled water. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips. In 2013, recycled water deliveries were about 400 af, generally consistent with recycled water deliveries that have ranged between about 310 and nearly 500 afy over the past ten years.

Surveys conducted by CLWA indicate an interest for recycled water by existing water users as well as by future development as recycled water becomes available. In 2002, CLWA produced an updated Draft Recycled Water Master Plan (Kennedy/Jenks Consultants, 2002). Overall, the program is expected to ultimately recycle up to 17,400 af of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping and other non-potable uses, as set forth in the UWMP. This is in addition to an expected recycled water use of approximately 4,800 af per year in the Newhall Ranch Specific Plan development using recycled water from the proposed Newhall Ranch Water Reclamation Plant.

In 2007, CLWA and the Purveyors completed California Environmental Quality Act (CEQA) analysis of the Recycled Water Master Plan (2002). This analysis consisted of a Program Environmental Impact Report (PEIR) covering the various options for a recycled water system as outlined in the Master Plan. The PEIR was certified by the CLWA Board in March 2007.

CLWA and the Purveyors prepared the preliminary design of the second phase of the Recycled Water Master Plan (Phase 2A) that will take water from the Saugus Water Reclamation plant and distribute it to identified users to the north, across the Santa Clara River and then to the west and the east, which will include service to Santa Clarita Central Park. The environmental documentation for this phase was completed in July 2011. This phase will have design capacity to increase recycled water deliveries by about 500 afy. CLWA and the retail water suppliers continue to explore opportunities to increase recycled water use consistent with the objectives presented in the 2010 UWMP.

3.7 Santa Clara River

The Memorandum of Understanding (MOU) between the Santa Clarita Valley Purveyors and the United Water Conservation District, which manages surface and groundwater resources in seven groundwater subbasins in the Lower Santa Clara River Valley Area, was a significant accomplishment when it was prepared and executed in 2001. The MOU initiated a collaborative and integrated approach to data collection; database management; groundwater flow modeling; assessment of groundwater basin conditions, including determination of basin yield amounts; and preparation and presentation of reports, including continued annual reports such as this one for current planning and consideration of development proposals, and also including more technically detailed reports on geologic and hydrologic aspects of the overall stream-aquifer system. Meetings of the MOU participants have continued, and coordination of the Upper (Santa Clarita Valley) and Lower (United WCD) Santa Clara River databases has been accomplished. As discussed above, a numerical groundwater flow model of the entire Santa Clarita groundwater basin was developed and calibrated in 2002-2004. Subsequent to its initial use in 2004 for assessing the effectiveness of various operating scenarios to restore pumping capacity impacted by perchlorate contamination (by pumping and treating groundwater for water supply while

simultaneously controlling the migration of contaminated groundwater), the model was used in 2005 for evaluation of basin yield under varying management actions and hydrologic conditions. The results completed the determination of sustainable operating yield values for both the Alluvium and the Saugus Formation, which were incorporated in the 2005 UWMP. The updated analysis of basin yield, completed in 2009, indicates that the 2008 Operating Plan will maintain river flows at higher levels than occurred prior to urbanization of the Valley; the resultant operating yield values for both the Alluvium and the Saugus Formation are now incorporated in the 2010 UWMP.

On occasion, issues have been raised about whether use and management of groundwater in the Santa Clarita Valley have adversely impacted surface water flows into Ventura County. Part of the groundwater modeling work has addressed the surface water flow question as well as groundwater levels and storage. While the sustainability of groundwater has logically derived primarily from projected long-term stability of groundwater levels and storage, it has also derived in part from modeled simulations of surface water flows and the lack of streamflow depletion by groundwater pumping. In addition, the long-term history of groundwater levels in the western and central part of the basin, as illustrated in **Figures 3-4 and 3-5**, supports the modeled analysis and suggests that groundwater has not been lowered in such a way as to induce infiltration from the river and thus impact surface water flows.

Historical annual streamflow in the Santa Clara River, into and out of the Santa Clarita Valley has been monitored at an upstream gage at Santa Clara River above Lang Railroad Station (Lang gage) and two downstream gages (County Line and SCR at Piru) **(Figure 3-14)**. The Lang gage was reinstated in 2002 and shows a wide range of average annual streamflow into the basin; however the data from the gage has not always been very accurate. In 2010, Los Angeles County Department of Public Works (LADPW) removed the transducer which previously collected streamflow data due to operational problems with the transducer and the location of the gage not being adequate to allow for accurate streamflow measurements. Between 2010 and 2012, LADPW have conducted manual measurements of streamflow, however, the measurements were not frequent enough to account for the range of streamflows that likely occurred. In 2013, CLWA had discussions with LADPW regarding the reinstallation or relocation of the Lang gage to a more suitable location and by June 2013, the gage was moved and operational to a nearby location on the Santa Clara River. The downstream gage (County Line gage) was moved in 1996 to its present location near Piru (SCR at Piru), about two miles downriver. The combined record (1953-2013) of these two downstream gages indicates an annual stream discharge of about 47,000 afy (**Figure 3-15**). These data gaged near the County line show notably higher flows from the Santa Clarita Valley into the uppermost downstream subbasin, the Piru subbasin, over the last 35 to 40 years.

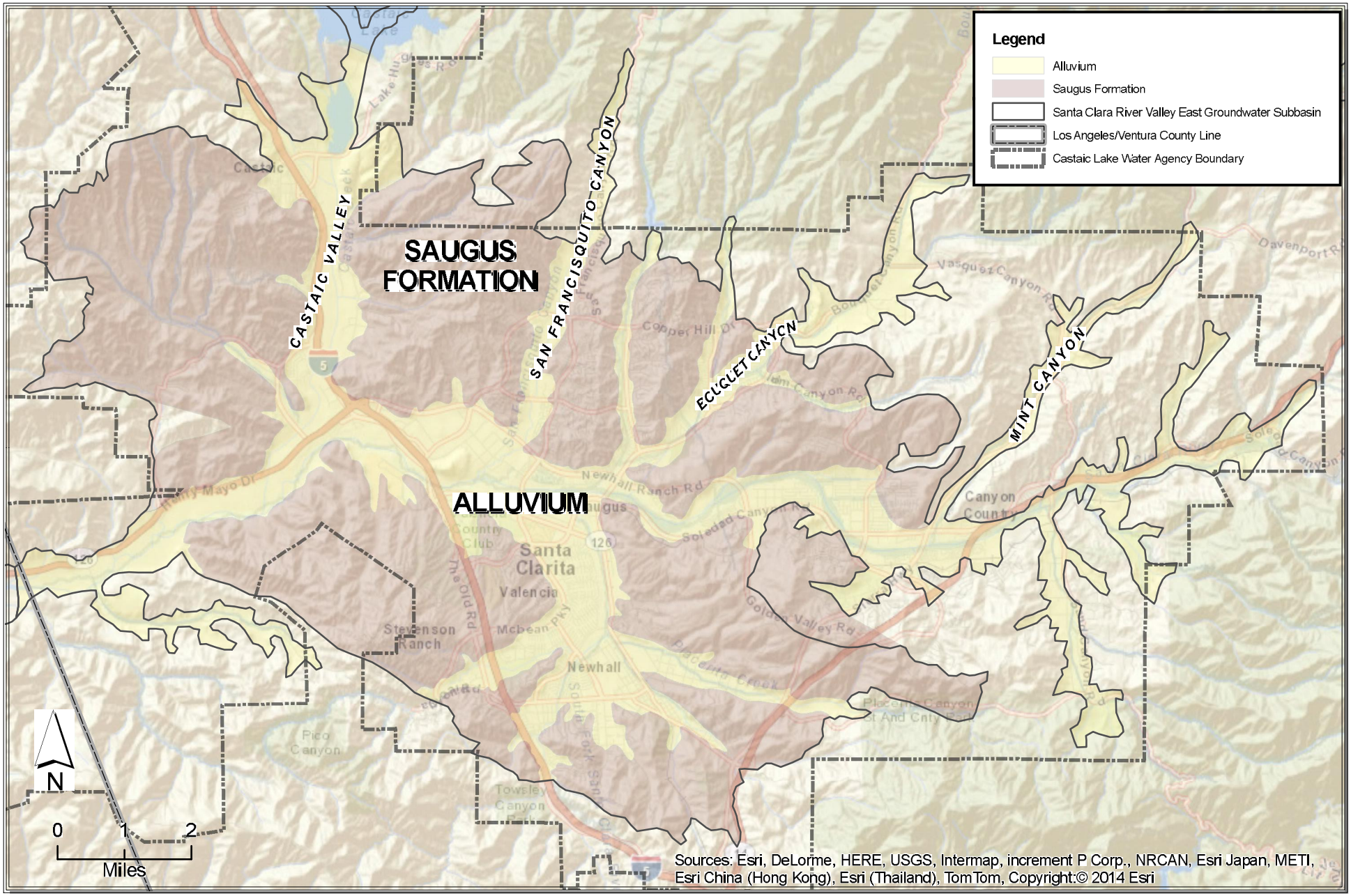

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Figure 3-1
Alluvium and Saugus Formation
Santa Clarita Valley Water Report

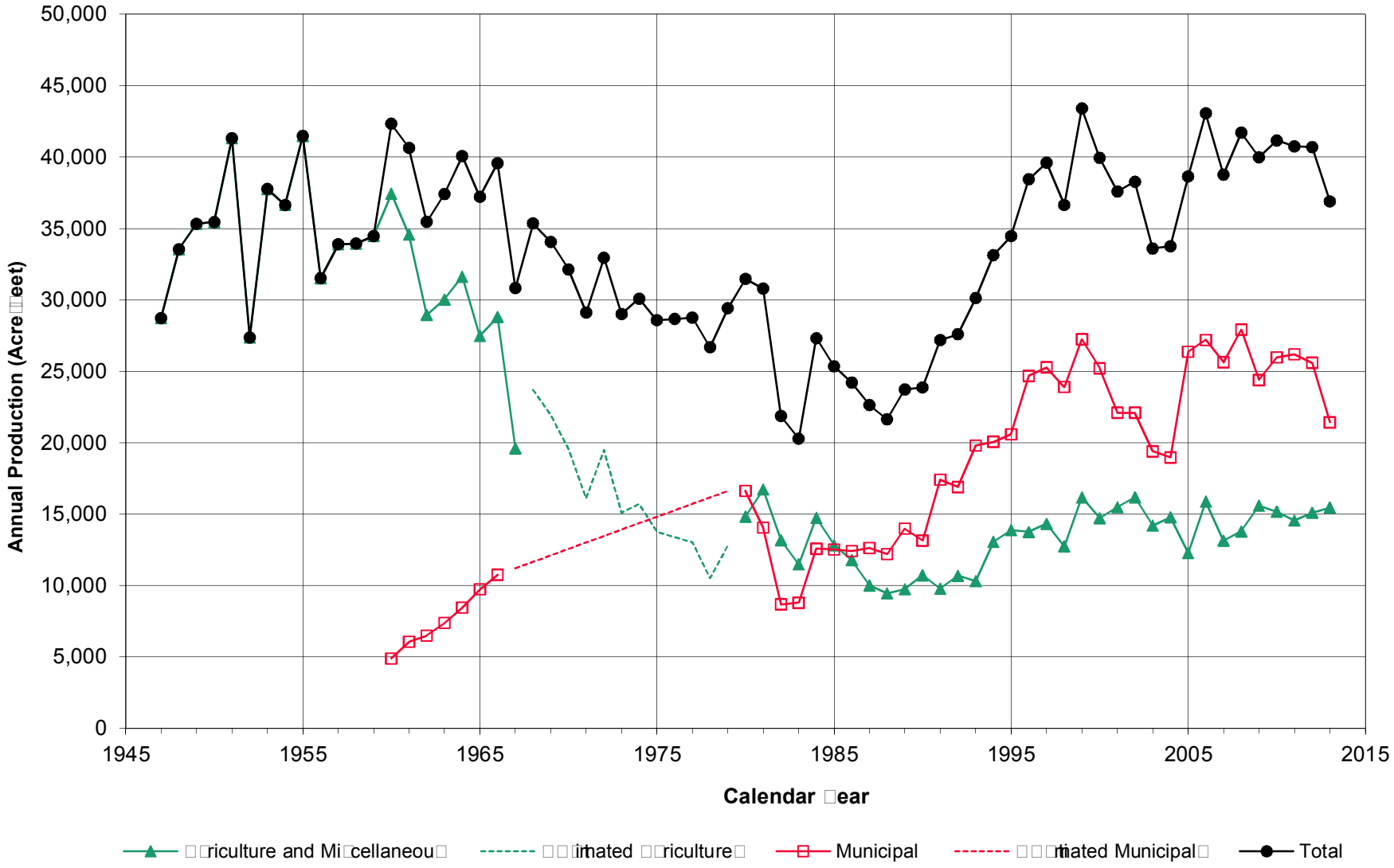

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Figure -2
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Santa Clarita Valley Water Report

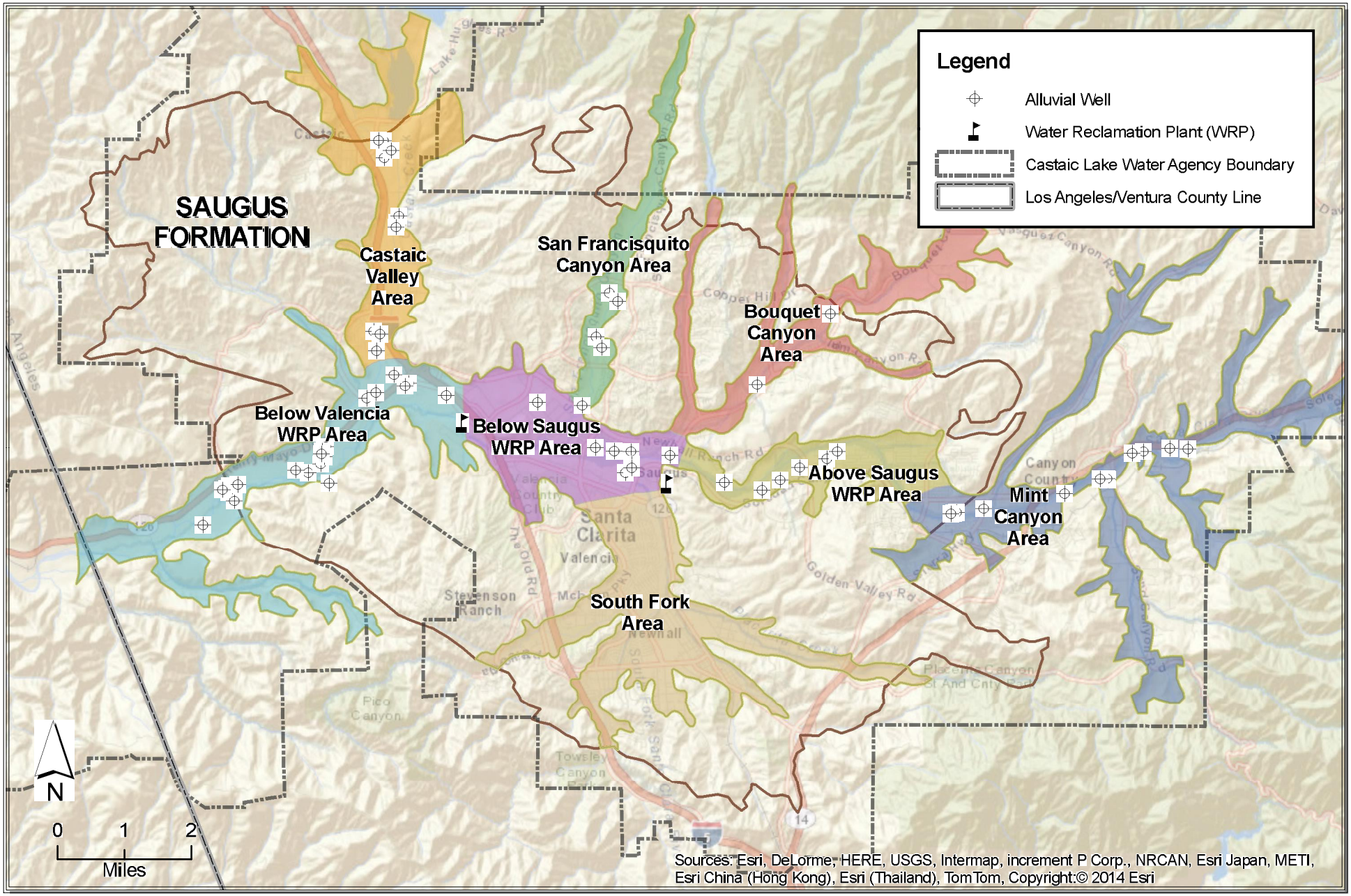

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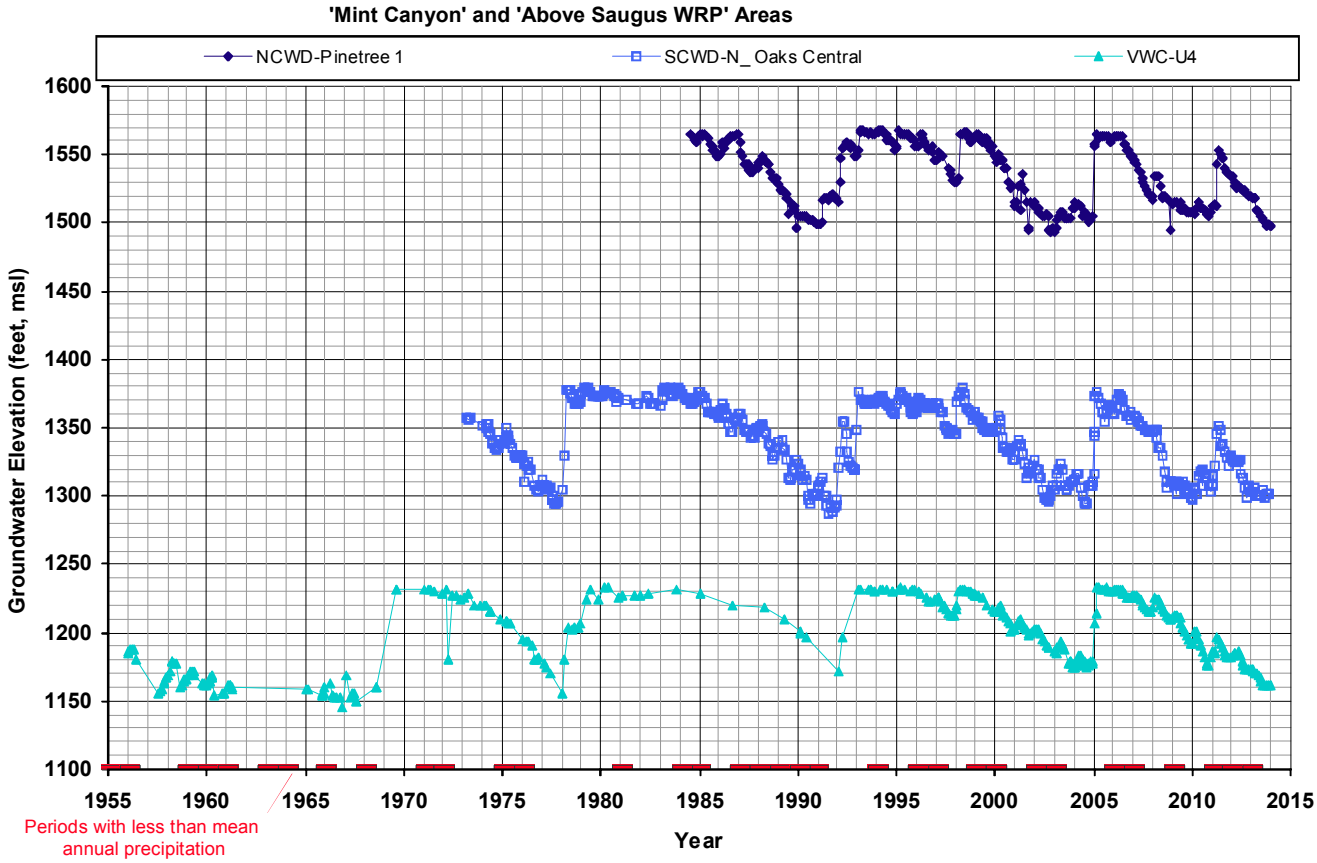
Figure 3-3
Alluvial Well Locations By Area
Santa Clarita Valley Water Report



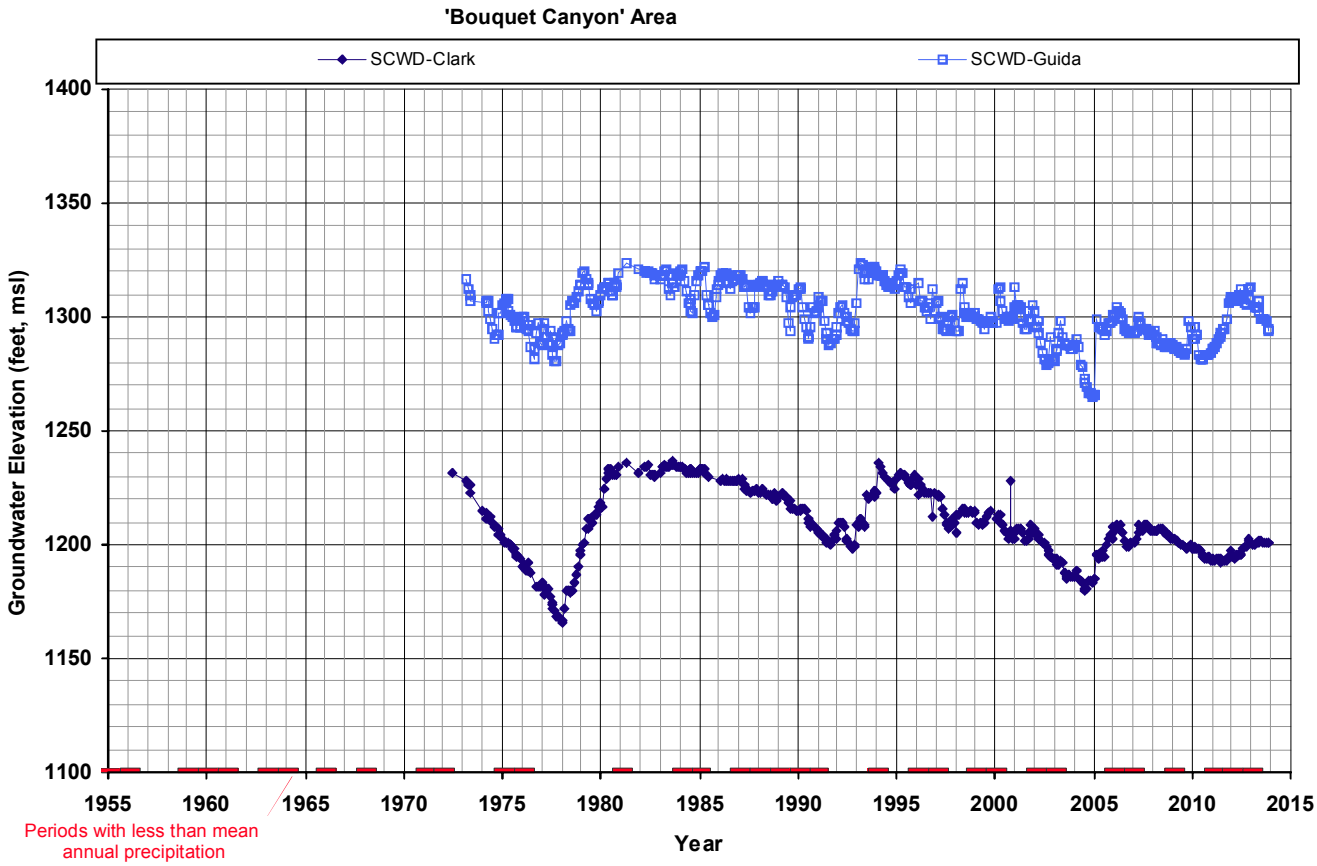


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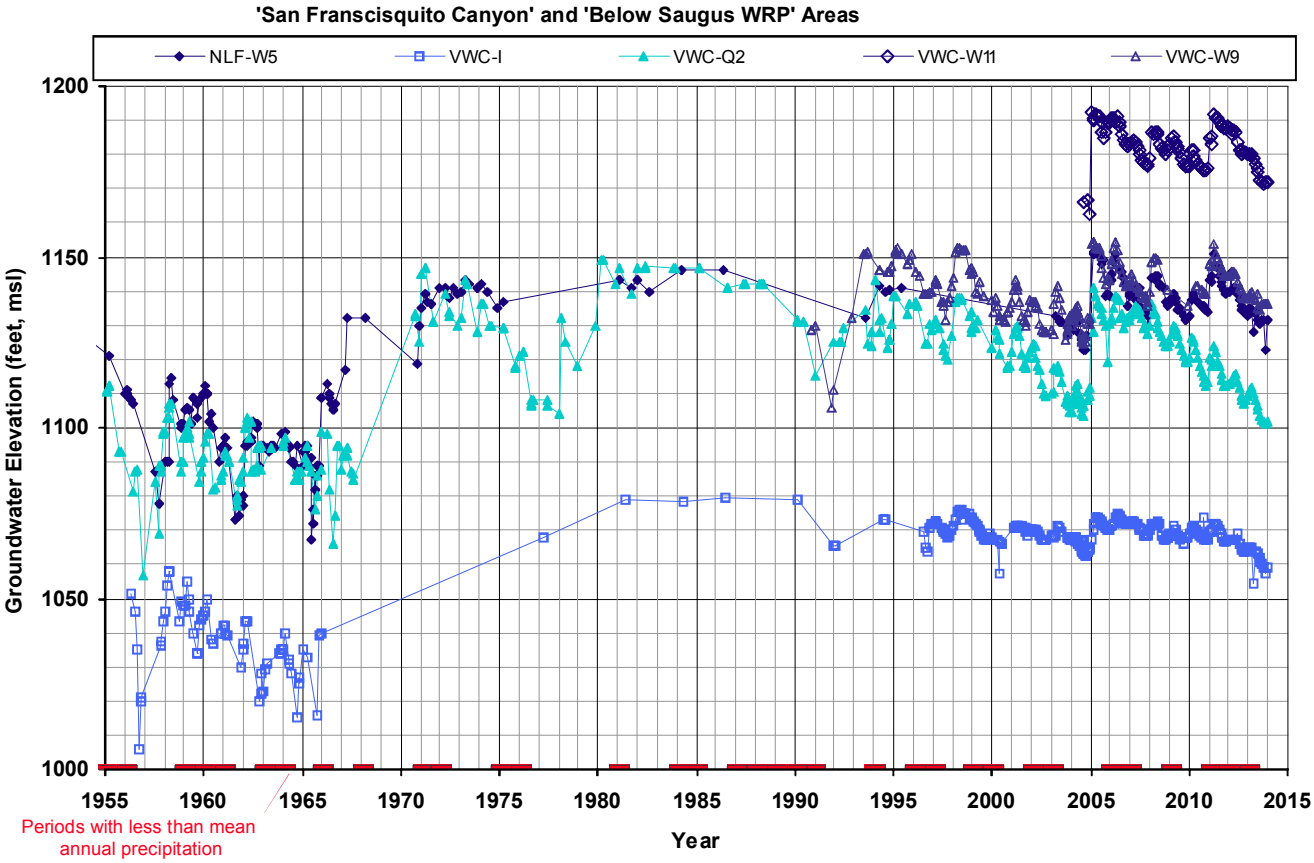
Figure 3-4
Groundwater Elevations in Eastern Santa Clarita Valley Alluvial Wells
Santa Clarita Valley Water Report



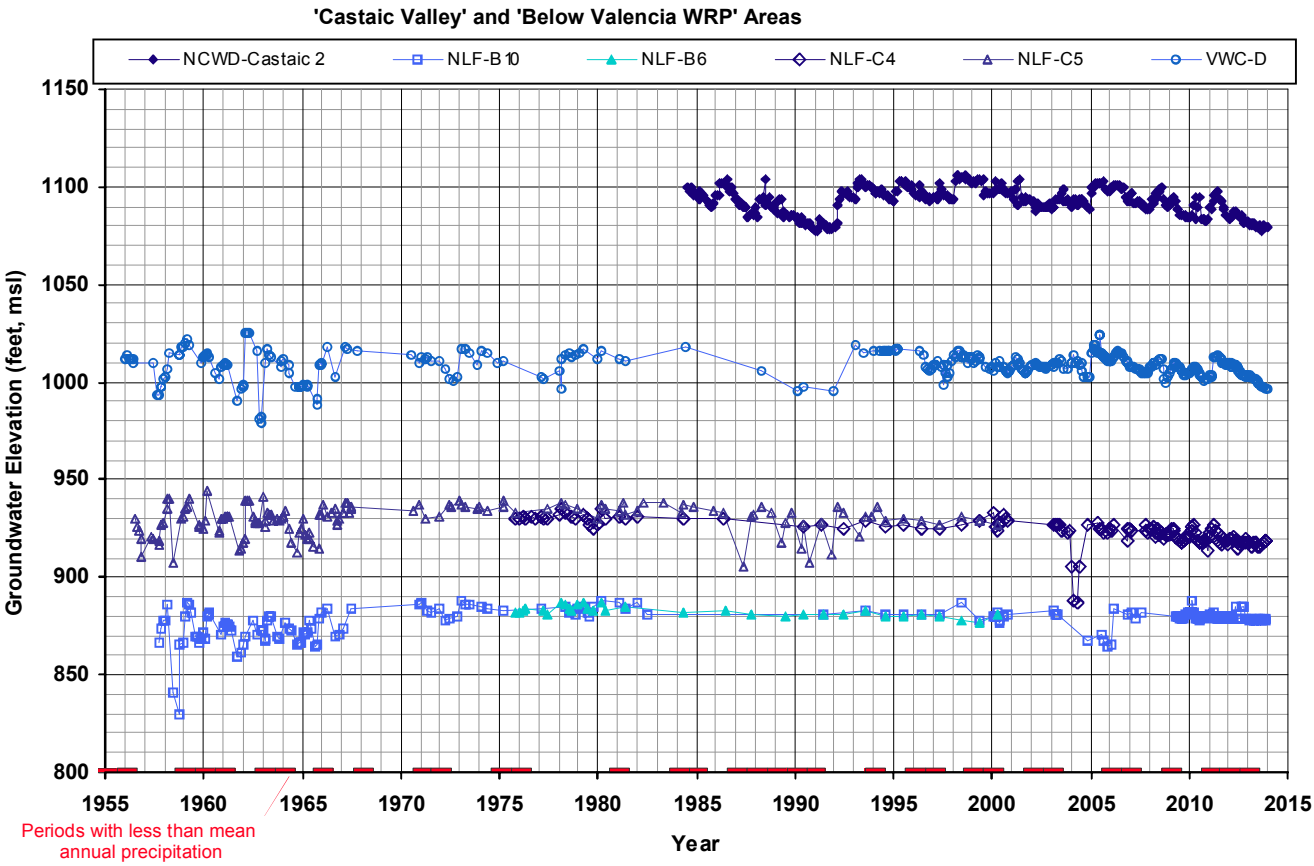


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Figure 3-5
Groundwater Elevations in Western Santa Clarita Valley Alluvial Wells
Santa Clarita Valley Water Report

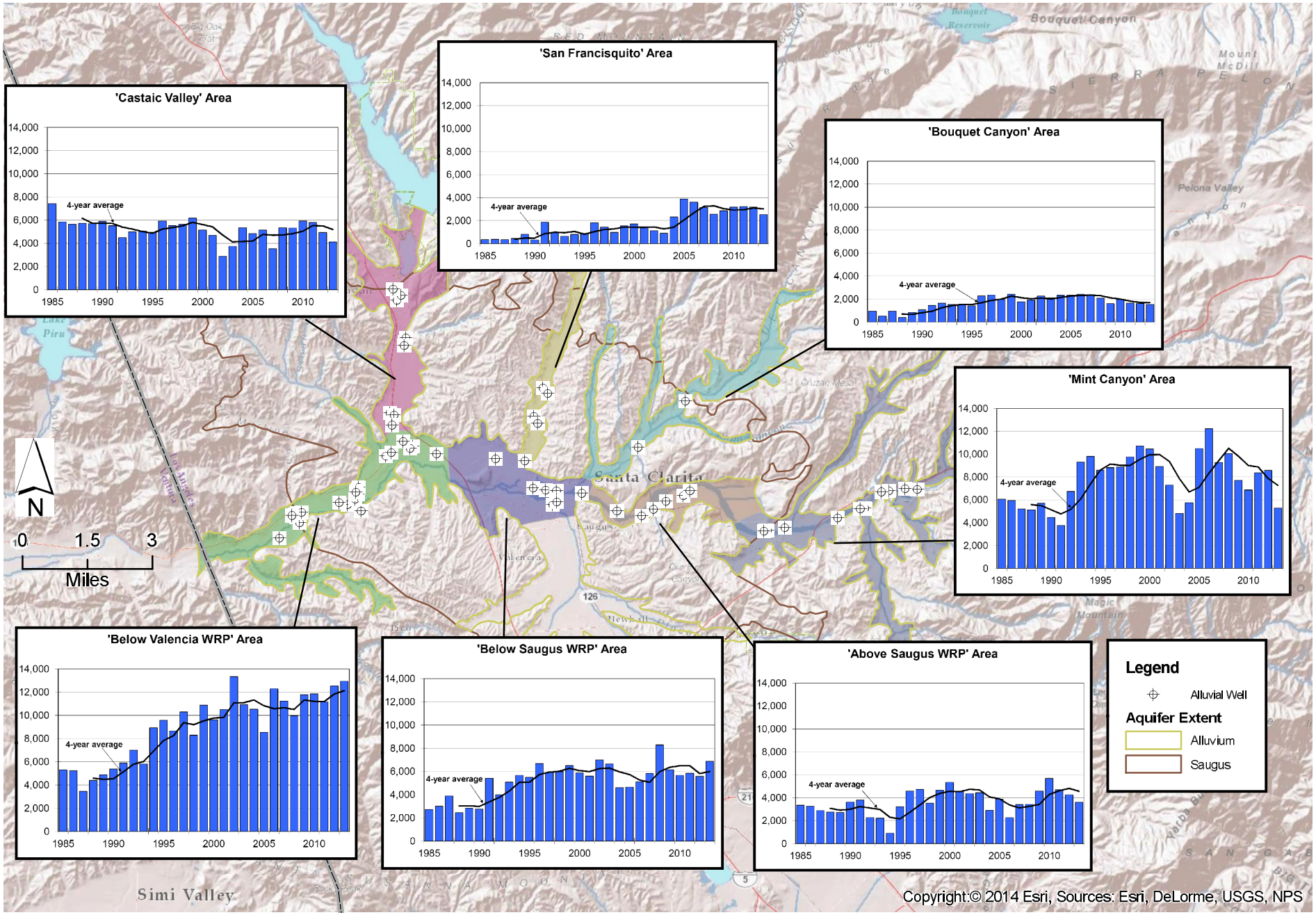

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Figure 3-6
Annual Groundwater Production from Alluvium by Area (Acre-feet)
Santa Clarita Valley Water Report

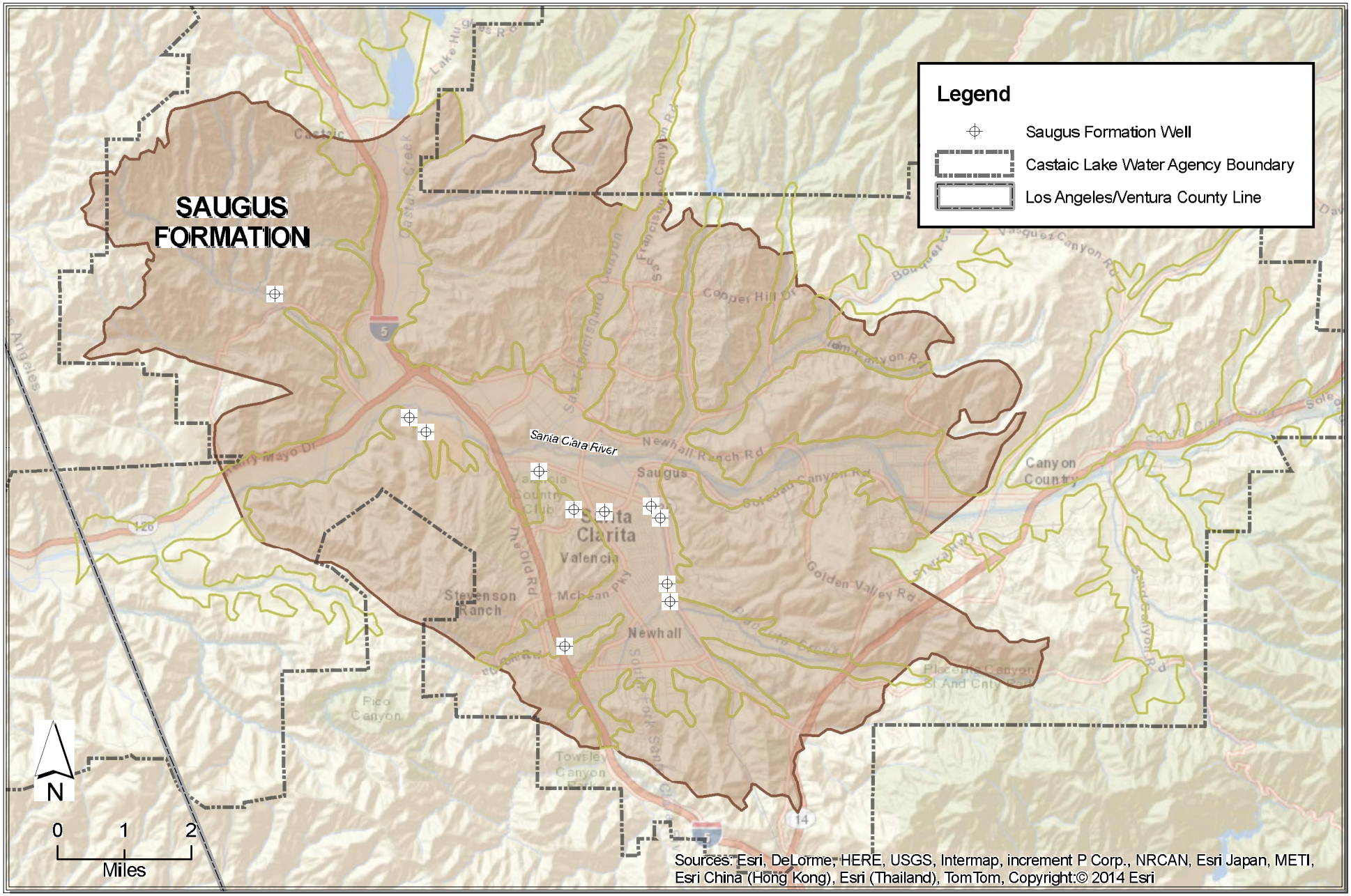

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Figure 3-7
Saugus Formation Well Locations
Santa Clarita Valley Water Report

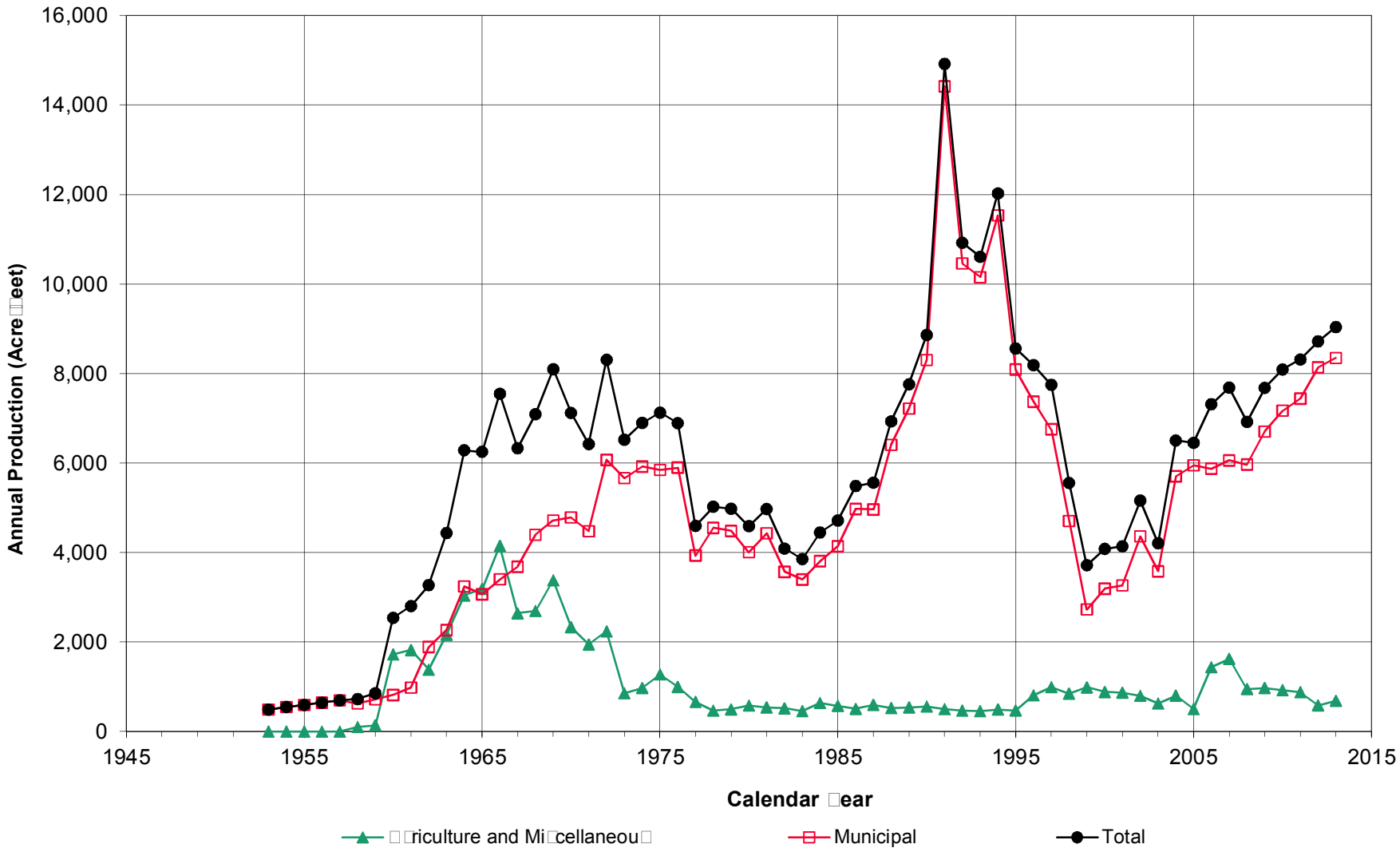

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Figure -
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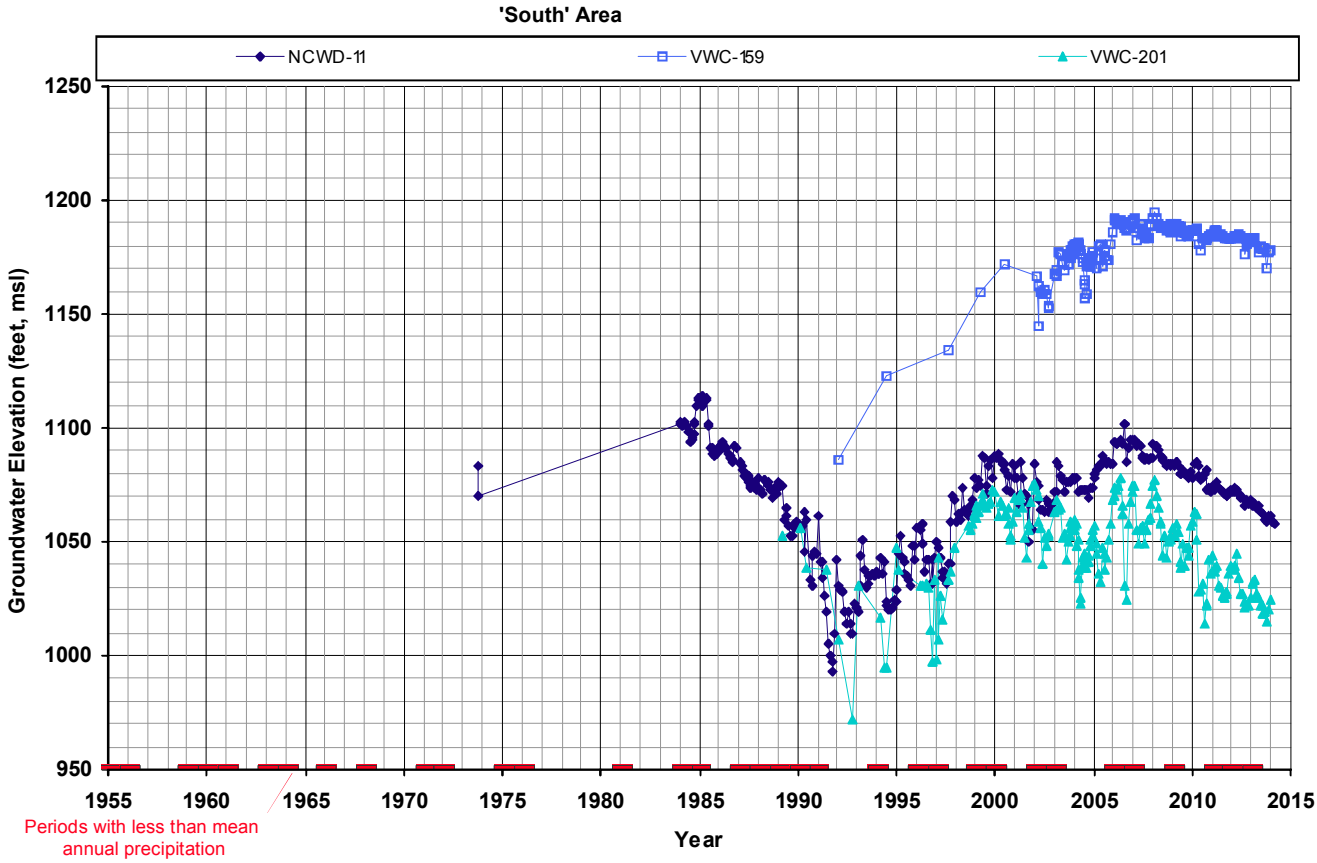
Santa Clarita Valley Water Report



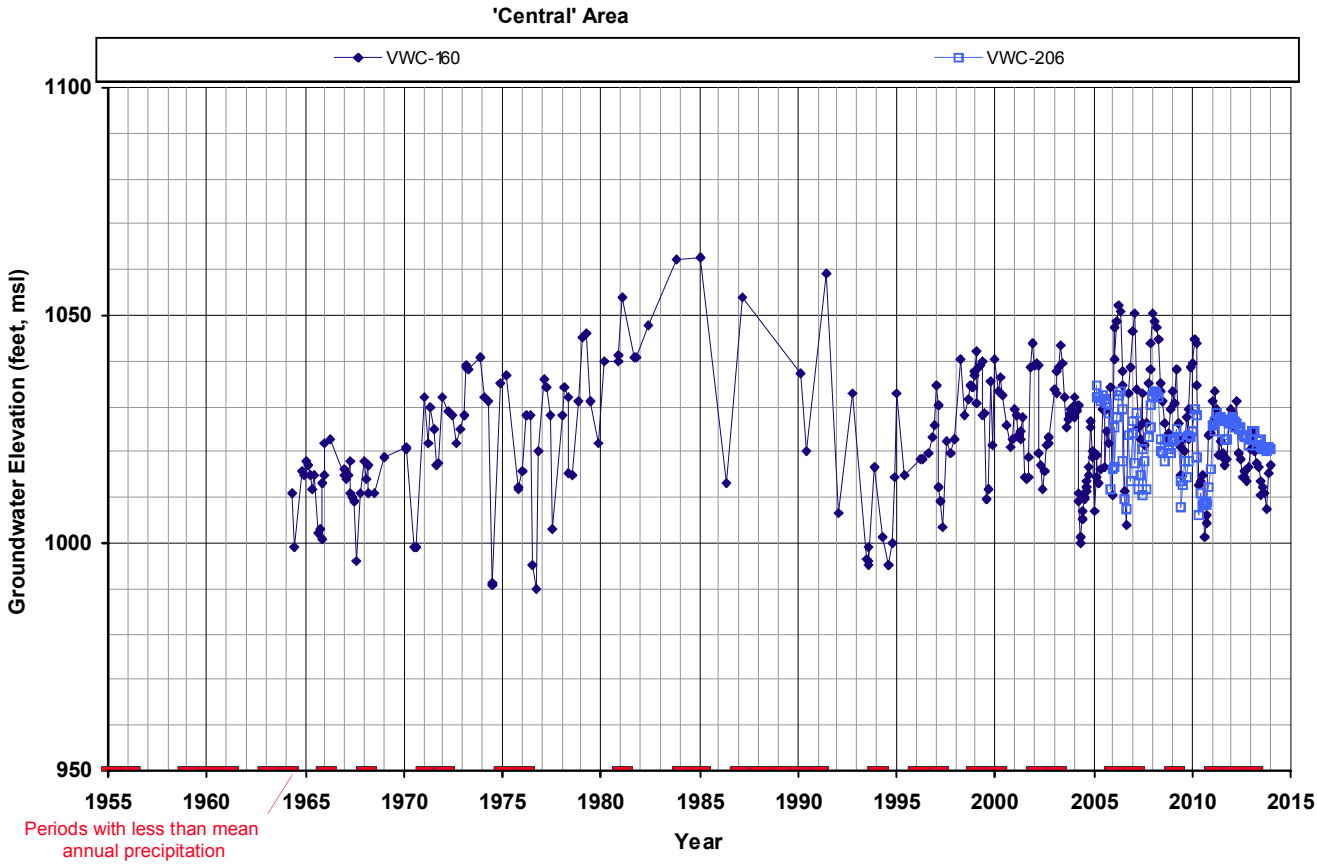


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Figure 3-9
Groundwater Elevations in Saugus Wells

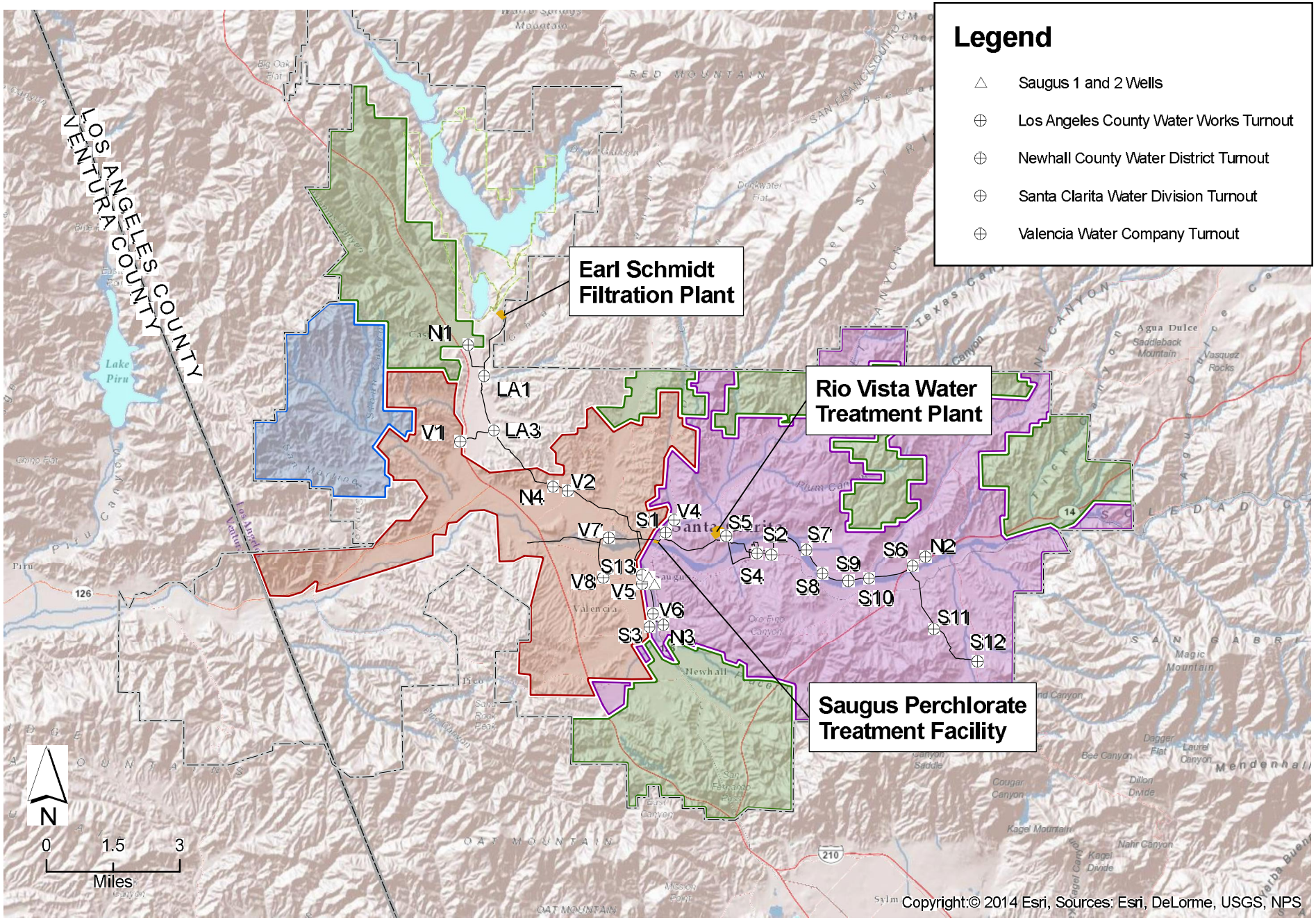

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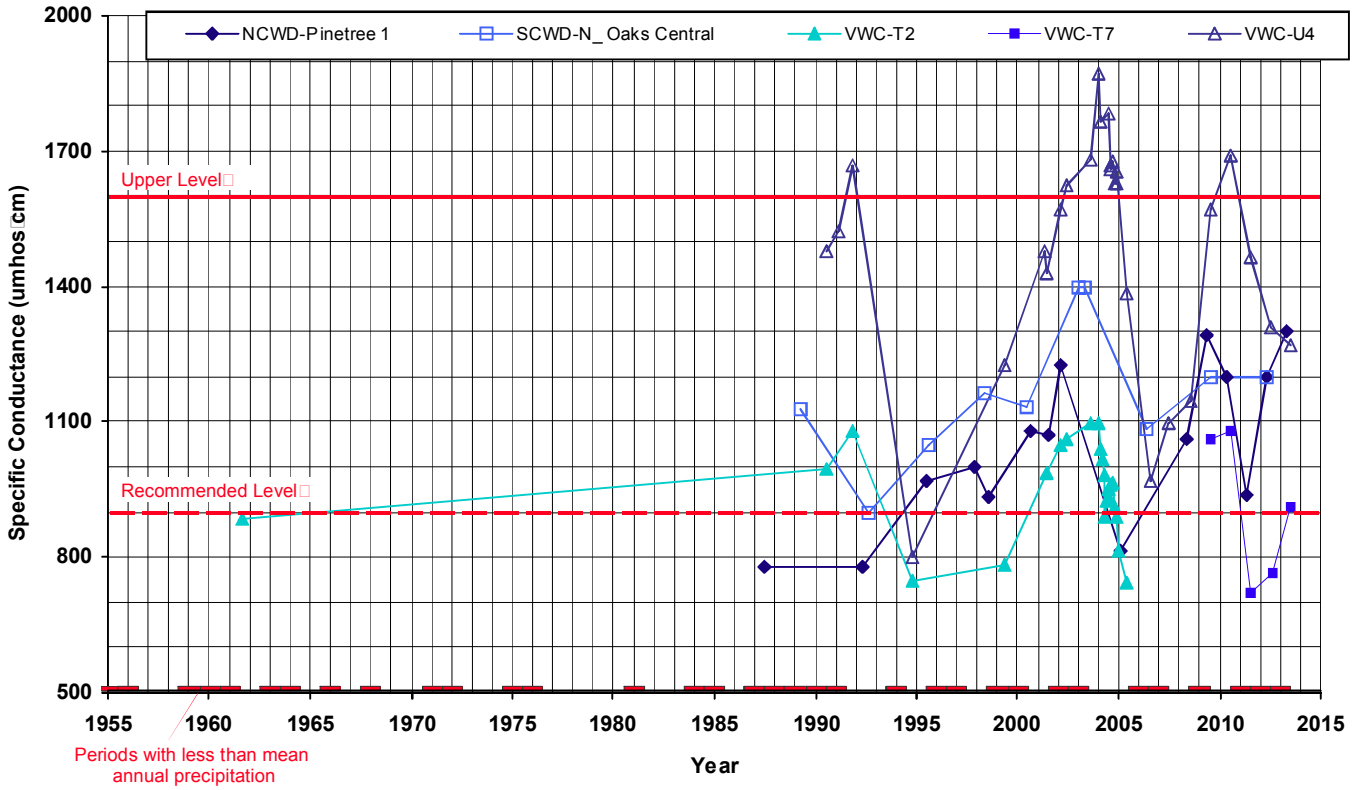
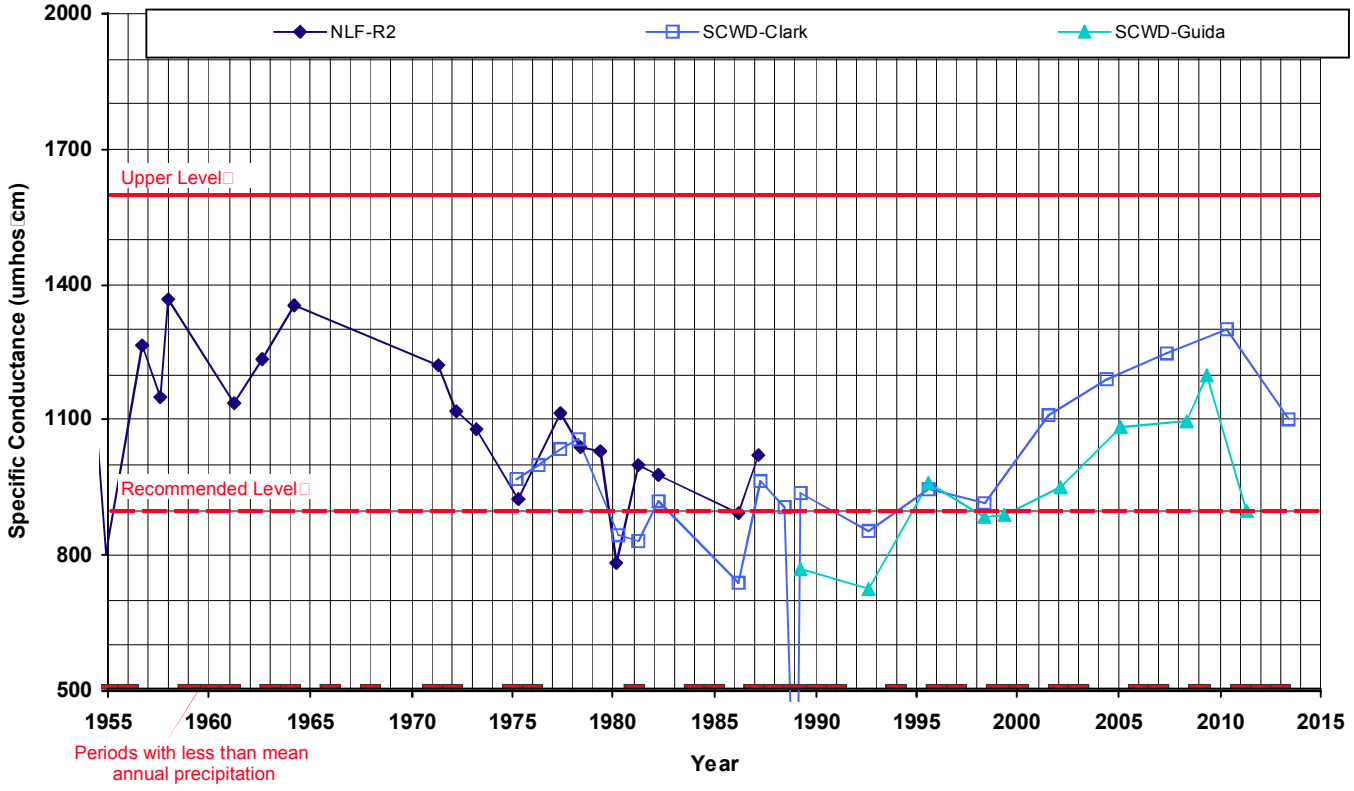
Figure 3-10
Treated Water Distribution System
Castaic Lake Water Agency
Santa Clarita Valley Water Report

'Mint Canyon' and 'Above Saugus WRP' Area Alluvial Wells (representative selection for area shown)



'Bouquet Canyon' Area Alluvial Wells (representative selection for area shown)



California Department of Public Health Secondary Maximum Contaminant Level

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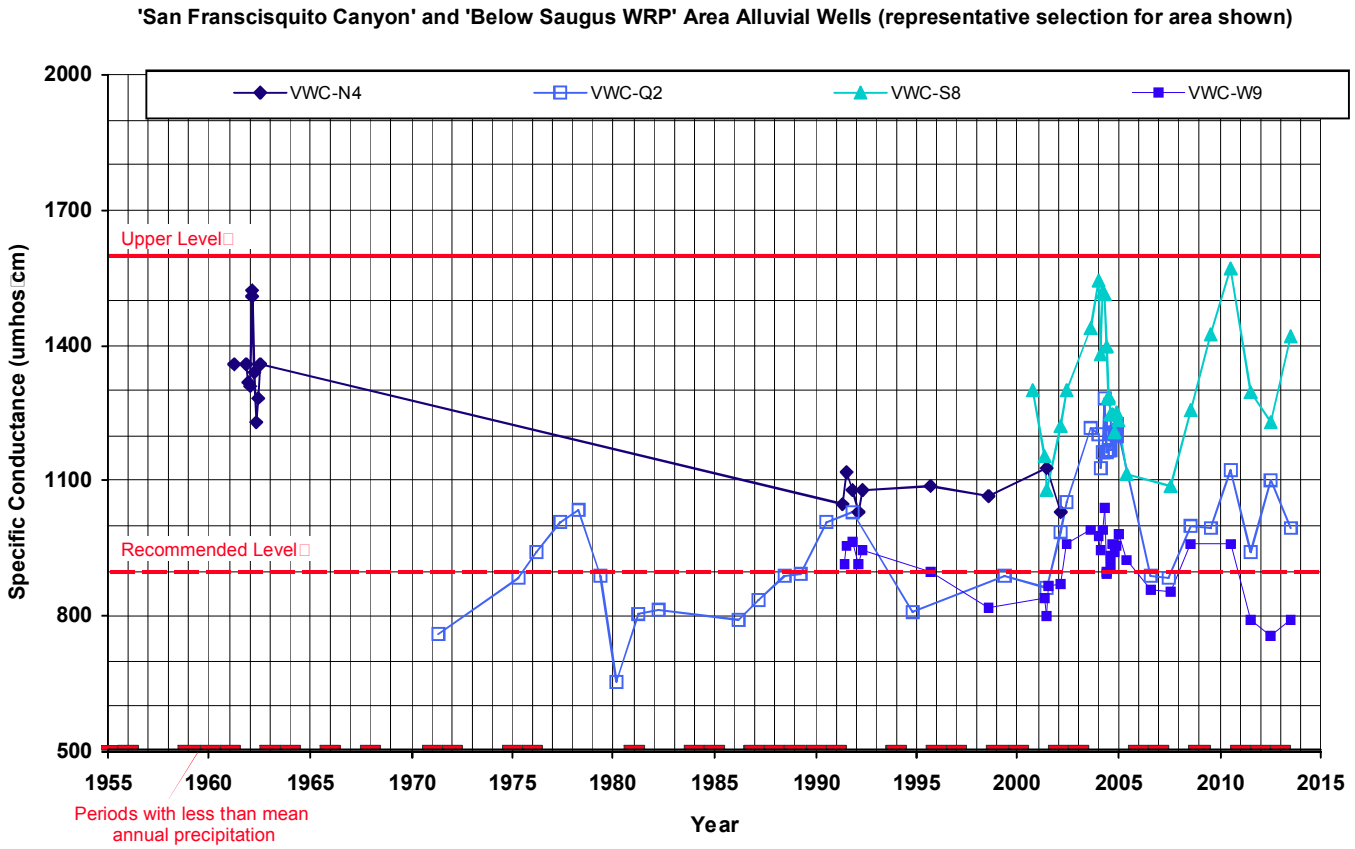
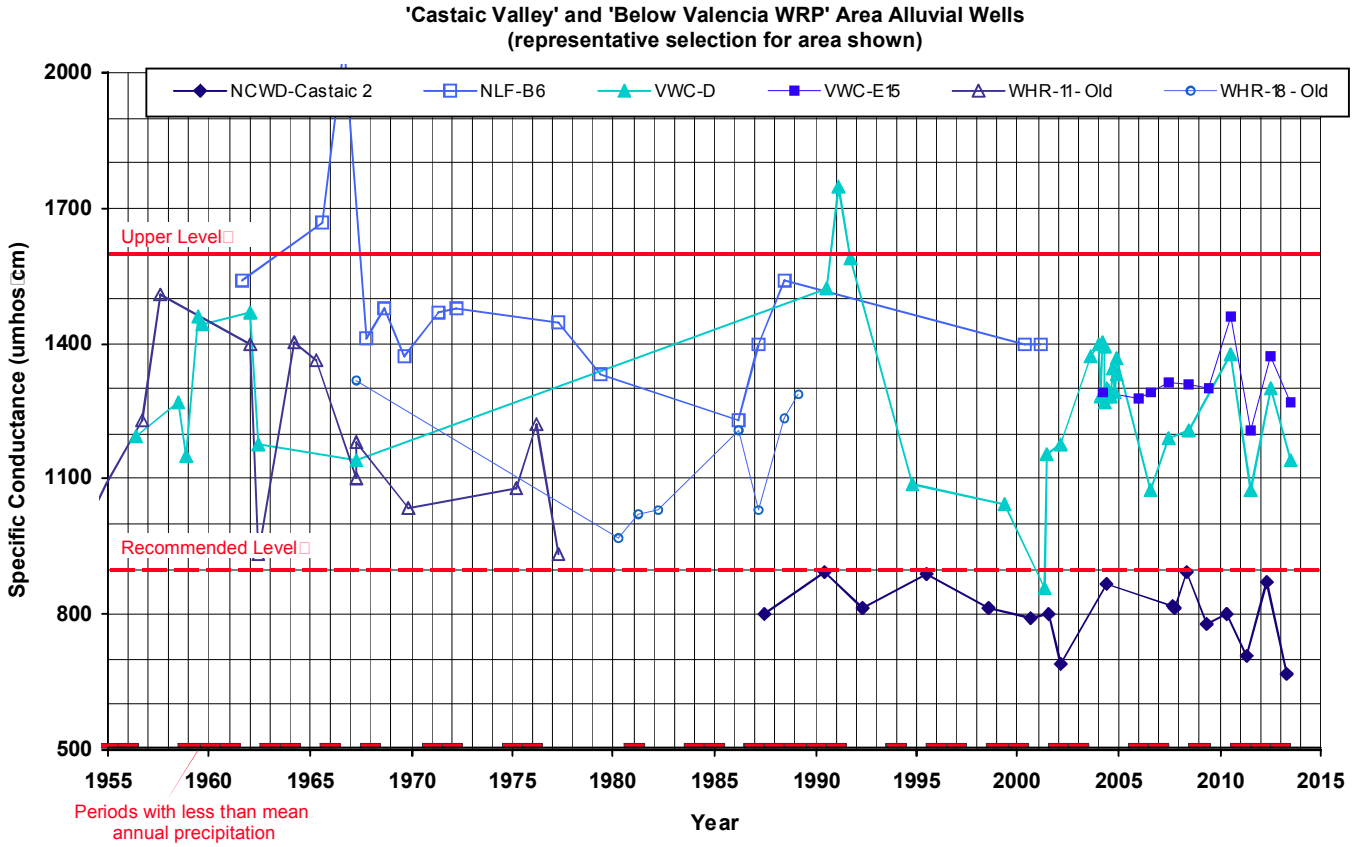
Figure 3-11
Groundwater Quality in Eastern Santa Clarita Valley Alluvial Wells





California Department of Public Health Secondary Maximum Contaminant Level

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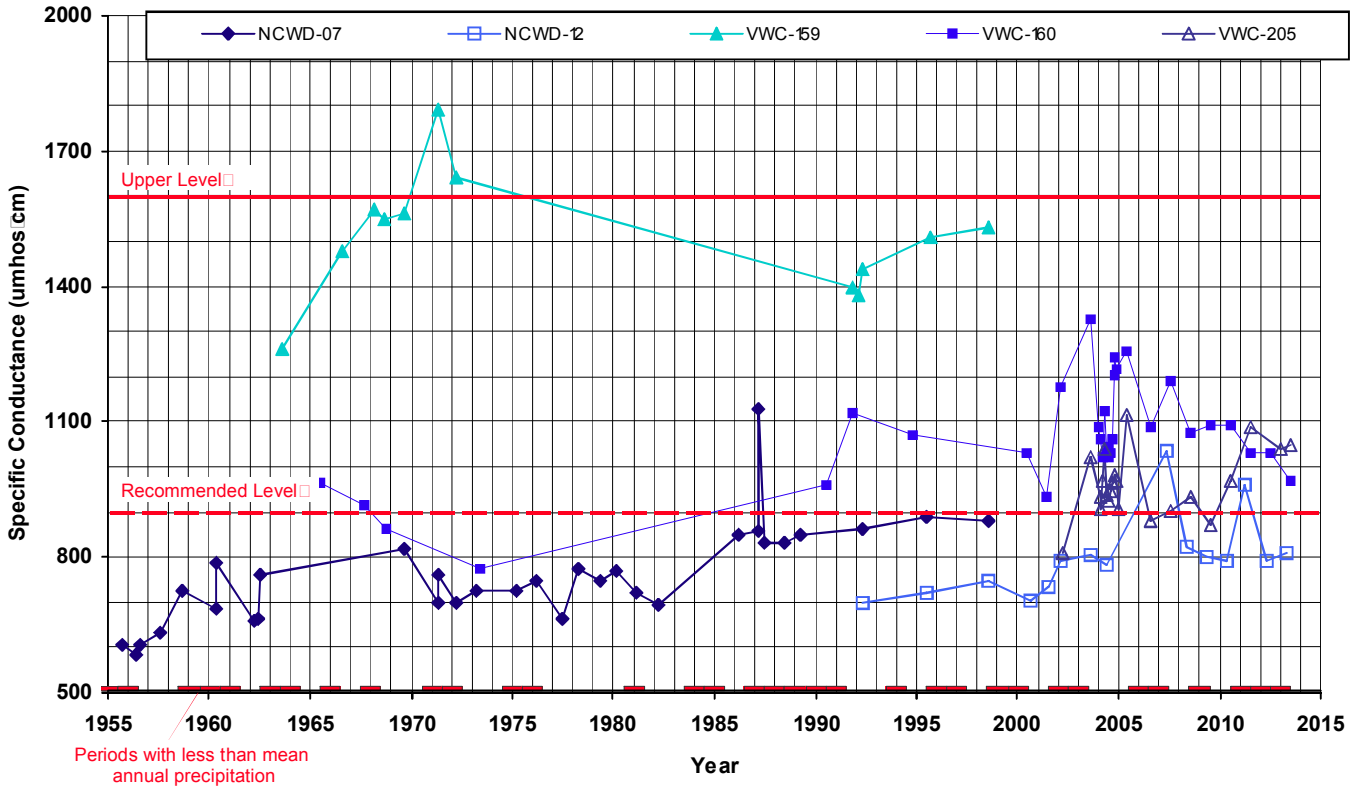
Figure 3-12
Groundwater Quality in Western Santa Clarita Valley Alluvial Wells



California Department of Public Health Secondary Maximum Contaminant Level

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Figure 3-13
Groundwater Quality in Saugus Wells

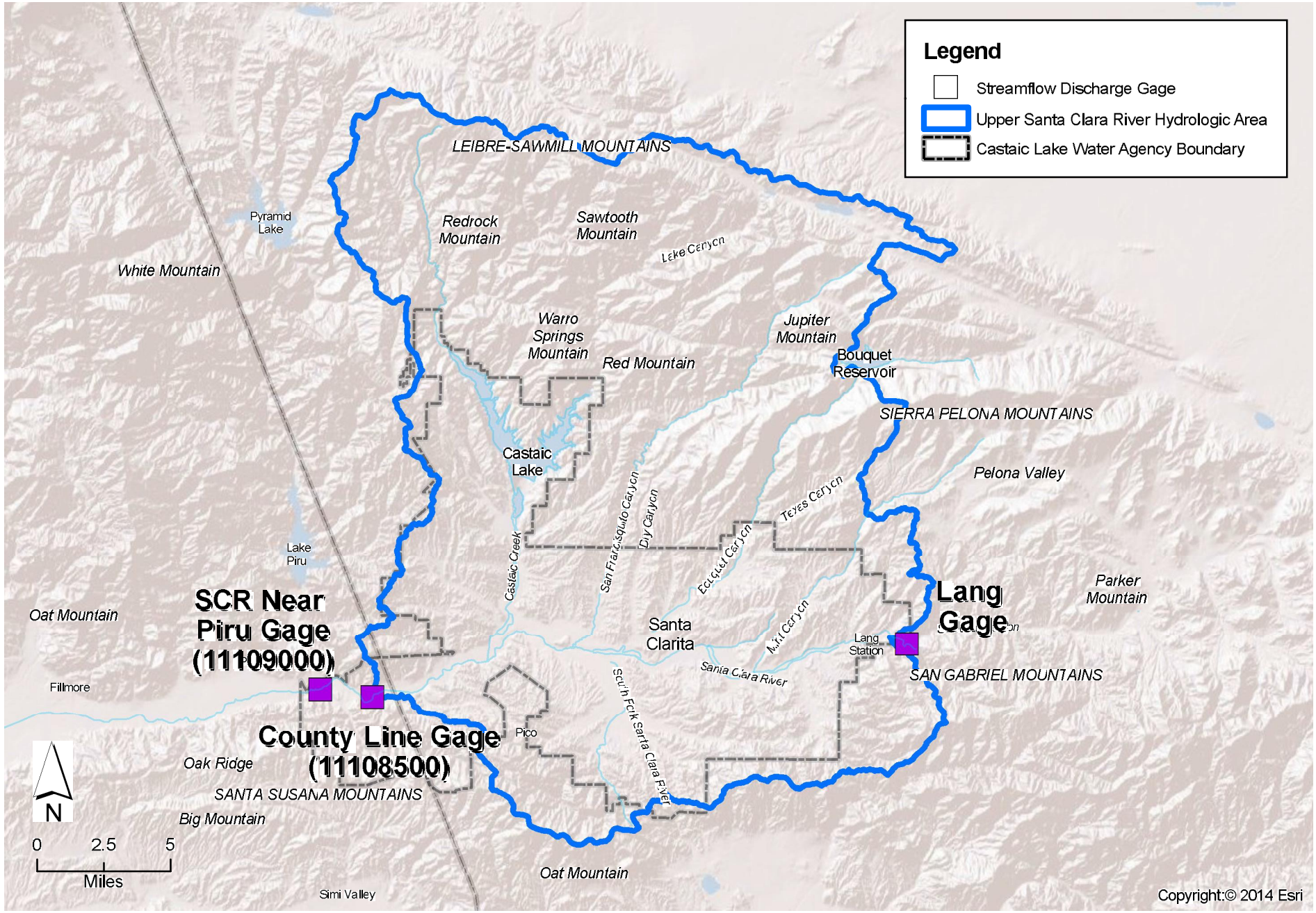

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Figure 3-14
Streamflow Discharge Gage Locations
Santa Clarita Valley Water Report

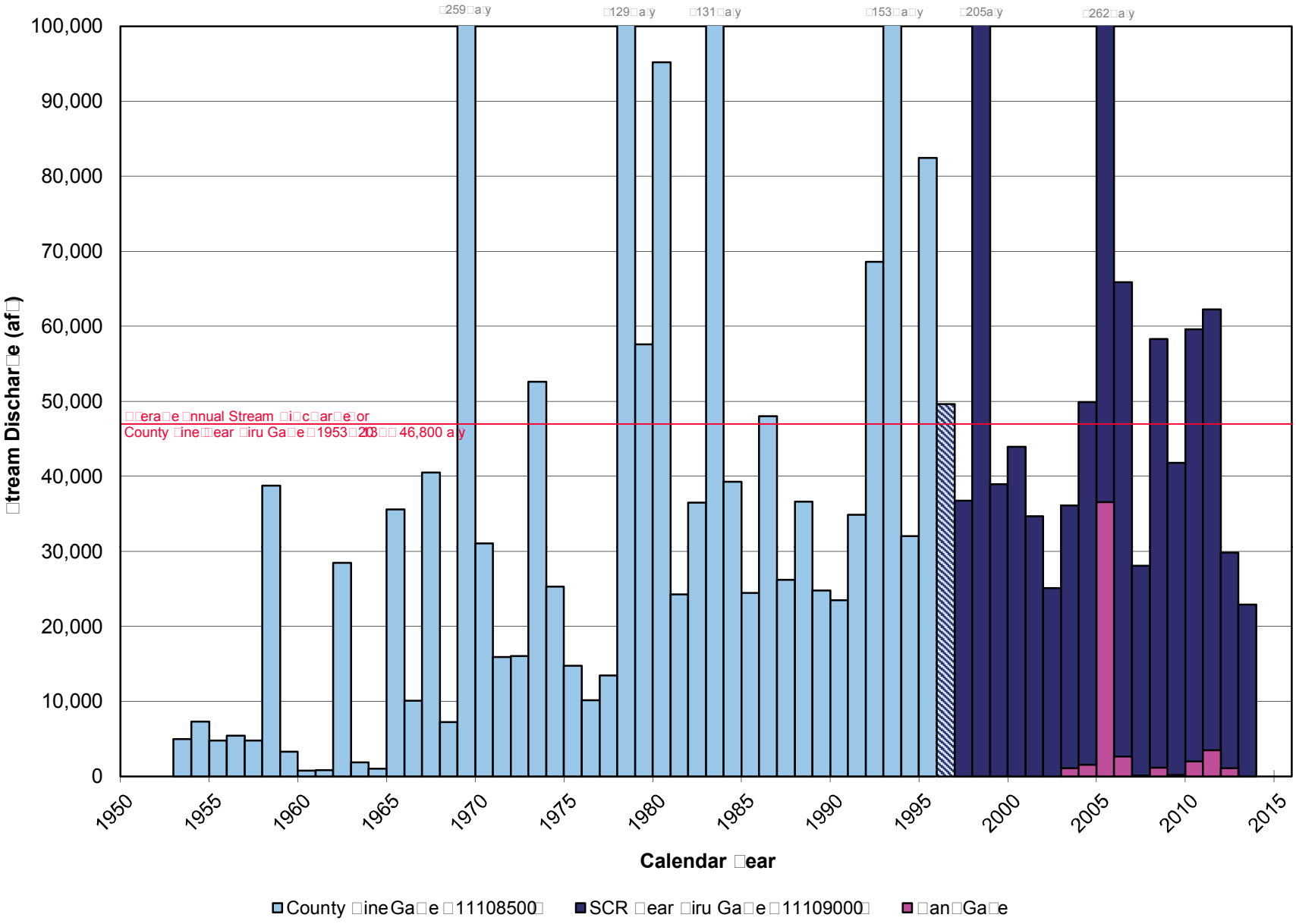

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Figure -1
nnual Strea i arge
Santa Clarita Valley Water Report

4. SUMMARY OF 2013 WATER SUPPLY AND 2014 OUTLOOK

As discussed in the preceding chapters, total water demands in the Santa Clarita Valley were 89,600 af in 2013, or about five percent higher than in 2012. Of the total demand in 2013, nearly 73,500 af were for municipal water supply (an increase of 4,000 af), and the balance (16,100 af, an increase of about 400 af) was for agricultural and other uses, including estimated individual domestic uses. As detailed in Chapter 2, the total demand in 2013 was met by a combination of local groundwater, SWP and other imported water, and a small amount of recycled water.

The water demand in 2013 was slightly above the average projection in the 2010 UWMP, (89,300 af), and also slightly above the short-term projected demand that was estimated in the 2012 Water Report (89,000 af). For a long-term illustration of demand, historical water use from 1980 through 2013 is plotted in **Figure 4-1** along with the currently projected municipal and agricultural water demands in the 2010 UWMP through 2050. Historically, the primary factor causing year-to-year fluctuations in water demands has been weather. In the short term, wetter years have typically resulted in decreased water demand, and drier years have typically resulted in higher water demand. Extended dry periods, however, have resulted in decreases in demand due to conservation and water shortage awareness due to outreach by the water suppliers. The decline in water demand toward the end of the 1987 to 1992 drought is a good example. Similarly, over the recent multi-year dry period beginning in 2006, total water demands progressively declined from a historical high in 2007 to the lowest in nearly a decade in 2010. However, these low demand levels resulted in part from the economic recession that started in 2008.

Adding to these types of demand fluctuations are some signs of improving broad economic conditions during a prolonged period of slow growth in new service connections. As reflected by the numbers of service connections in each Purveyor service area, growth in 2013 increased, with the addition of about 750 new service connections. This is the largest increase in new service connections since 2008. In addition, the Purveyors and the local community continue to be aware of recent drought conditions and potential water supply shortages. Although water use increased five percent in 2013 as compared to 2012, 2013 water demand is similar to 2008 levels. Additionally, the increase in water use in 2013 is also attributed to unseasonably high temperatures and below normal rainfall in early 2013 resulting in a longer irrigation season.

The preceding factors are expected to have some continuing effect in 2014, yet the estimated total water demand is expected to be about the same as last year. Despite the drier-than-average conditions in early 2014, total municipal water requirements in the first quarter of 2014 were only slightly higher than the first quarter of 2013. This less-than-expected rise in water demand for the first quarter 2014 is likely due to the Governorôs emergency drought proclamation on January 17 and a recent conservation campaign implemented at the end of January by the water

suppliers targeting an additional 20% reduction in municipal usersô consumption. Recognizing those early-year conditions, the potential impact of additional conservation, continued growth in the Valley, and consistent with the range of demand projections in the 2010 UWMP, total water demand in 2014 is estimated to be about 89,000 af.

It is expected that both municipal and agricultural water demands in 2014 will continue to be met with a mix of water supplies as in previous years, notably local groundwater and imported SWP and other supplemental water, complemented by recycled water that will continue to supply a small fraction of total water demand.

On November 19, 2013, the initial allocation of water from the SWP for 2014 was 5 percent. On January 31, 2014, it was decreased to 0 percent, and on April 18, 2014 it was increased to 5 percent; for CLWA, that equates to 4,670 af of its total Table A Amount of 95,200 af[1]. Combined with local groundwater from the two aquifer systems (about 50,000 af), total Flexible Storage Account water (6,060 af), total carryover SWP water from 2013 (21,482 af), annual acquisition from Buena Vista Water/Rosedale-Rio Bravo Water Storage Districts (11,000 af), estimated withdrawals from water storage bank accounts (4,950 af from Semitropic Groundwater Storage Bank[2], 5,400 af from Rosedale-Rio Bravo Water Banking and Exchange Program, and 2,000 af from West Kern Two-for-One Exchange Program), and recycled water (400 af), the total available water supplies for 2014 are about 106,400 af. CLWA plans to use banked supplies and conservation in 2014 to stretch water resources in preparation for a potentially dry 2015. Consequently, CLWA and the Purveyors anticipate having more than adequate supplies to meet all water demands in 2014. Projected 2014 water supplies and demand are summarized in **Table 4-1**.

In August, 2007, a federal court ruled that certain operational changes were required of the SWP in order to protect the endangered Delta smelt. With the objective of protecting endangered fish such as the Delta smelt and spring-run salmon, the court order resulted in the preparation of new Biological Opinions (BO) requiring DWR to implement mitigation requirements with resultant impacts on SWP water supply reliability. The current SWP Draft Delivery Reliability Report 2013, issued in December 2013, maintains the restrictions on SWP operations according to the Biological Opinions of the U.S. Fish and Wildlife Service and the National Marine Fishery Service issued on December 15, 2008 and June 4, 2009, respectively. In December 2010, a federal judge overruled most of the 2008 federal biological opinion and invalidated several of the

[1] This Table A Amount cannot be delivered to CLWA before September 1, 2014.

[2] CLWA is planning to use Newhall Landôs (NL) first priority extraction capacity at the Semitropic Water Storage District Banking Program which would permit 4,950 acre feet of CLWAôs banked water to be delivered to the service area. In consideration for the use of the capacity, CLWA would give Newhall Land an additional 5,000 af of water that Newhall Land would store in its banking program. If an agreement between CLWA and NL is executed for the use of NLôs extraction capacity, CLWAôs 2002 Semitropic Groundwater Storage Bank Program will be reduced by 9,950 af in 2014.

Table 4-1
2014 Water Supply and Demand
(acre-feet)

Projected 2014 Demand [1]		**89,000**
Available 2014 Water Supplies		
Local Groundwater		50,000
Alluvium [2]	*40,000*	
Saugus Formation [3]	*10,000*	
Imported Water		55,994
Table A Amount [4]	4,760	
Total Carryover from 2013 [5]	*21,482*	
Buena Vista/Rosedale-Rio Bravo[6]	*11,000*	
Flexible Storage Account (CLWA) [7]	*4,684*	
Flexible Storage Account (Ventura County) [7]	*1,376*	
Yuba Accord[8]	*342*	
Semitropic Groundwater Storage Bank Withdrawal	*4,950*	
Rosedale-Rio Bravo Water Banking and Exchange Program Withdrawal	*5,400*	
West Kern 2-for-1 Exchange Program Withdrawal	*2,000*	
Recycled Water		400
Total Available 2014 Supplies		**106,394**
Additional Dry Year Supplies [9]		
Semitropic Groundwater Storage Bank		35,970
2002 Account[10]	*6,700*	
2003 Account[10]	*29,270*	
Rosedale-Rio Bravo Water Banking and Exchange Program		94,600
2005 and 2006 Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement[11]	*16,600*	
2005 Banking of Table A[12]	*17,146*	
2006 Banking of Table A[12]	*17,860*	
2007 Rosedale Rio-Bravo Banking[12]	*7,323*	
2010 Rosedale Rio-Bravo Banking[13]	*29,132*	
2011 Rosedale Rio-Bravo Banking[14]	*810*	
2012 Rosedale Rio-Bravo Banking[15]	*5,729*	
Two-for-One Exchange Programs		10,009
2011 Rosedale-Rio Bravo Water Storage District[16]	7,555	
2011 West Kern Water District[17]	500	
2012 Rosedale-Rio Bravo Water Storage District[16]	1,954	
Total Additional Dry Year Supplies		**140,579**

1. Approximate linear interpolation from actual 2010 demand to projected 2015 demand in 2010 UWMP with adjustment for conservation.

2. The Alluvium represents 35,000 ï 40,000 afy of available supply under local wet-normal conditions, and 30,000 ï 35,000 afy under local dry conditions. Available supply in 2014 is shown to be reflective of wet-normal year sustainable production in Updated Basin Yield Analysis, August 2009. This available supply is achieved temporarily through redistribution of pumping to the central and western portions of the subbasin and a decrease in pumping from the easternmost areas of the subbasin.

3. The Saugus Formation represents 7,500 ï 15,000 afy of available water supply under non-drought conditions, and up to 35,000 afy under increasingly dry conditions. Available supply in 2014 is shown to be reflective of non-drought conditions due to current Saugus Formation well capacity.

4. CLWAôs SWP Table A amount is 95,200 af. The initial 2014 allocation was 5 percent (4,760 af). On January 31, 2014 the allocation was decreased to 0 percent (0 af) and on April 18, 2014 it was increased back to 5 percent (4,760 af).

5. Of the 21,482 af of total available carryover, some may be returned to the SWP if the system reservoirs were to go into a ôspillô mode due to the carryover water in storage needing to be reassigned. As of the drafting of this report, no water has spilled in 2014. As the likelihood of significant increases in SWP reservoir storage for the year have diminished, it is assumed that the total amount of carryover would be available for 2014 supply.

6. 2014 annual supply from Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement.

7. CLWA can directly utilize up to 4,684 af of storage capacity in Castaic Lake. By agreement in 2005, CLWA can also utilize 1,376 af of Ventura County SWP contractorsô flexible storage capacity in Castaic Lake.

8. Up to 850 af of non-SWP water supply is available to CLWA in critically dry years as a result of agreements among DWR, Yuba County Water Agency, and the U.S. Bureau of Reclamation regarding settlement of water rights issues on the Lower Yuba River (Yuba Accord). CLWA opted to not take any Yuba water in 2013, though it is likely to take some in 2014.

9. Does not include other reliability measures available to CLWA and the retail water Purveyors. These measures include short-term exchanges, participation in DWRôs dry-year water purchase programs, local dry-year supply programs and other future groundwater storage programs.

10. Net recoverable water after banking 24,000 af and 32,522 af in 2002 and 2003, respectively and recovering 4,950 af in 2009. CLWA will attempt to withdraw 4,950 af in 2014 through Newhall Landôs first priority extraction capacity; in consideration for this use, CLWA would give Newhall Land an additional 5,000 af of water that Newhall Land would store in its banking program.

11. Water stored in Rosedale-Rio Bravo Water Banking and Exchange Program back-credited for 2005 and 2006 pursuant to the Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement executed in 2007, not subject to losses. This amount includes a projected withdrawal of 5,400 af in 2014.

12. Net recoverable water after banking 20,000 af in both 2005 and 2006, and banking 8,200 af in 2007.

13. Net recoverable water after banking 33,668 af in 2010.

14. Net recoverable water after banking 1,006 af in 2011.

15. Net recoverable water after banking 6,031 af in 2012.

16. Net recoverable water after exchanging 15,602 af in 2011, and 3,969 af in 2012.

17. Net recoverable water after exchanging 5,000 af in 2011 and projecting to withdraw 2,000 af in 2014.

criteria that reduced SWPôs water supply. These matters were appealed to the U.S. Court of Appeals for the Ninth Circuit. The Ninth Circuit ruling upheld the Biological Opinions of the federal agencies. Therefore, the operational rules defined in these BOs continue to be legally required and were used by DWR in the analyses supporting its 2013 Draft Delivery Reliability Report. The SWP Draft Delivery Reliability Report 2013 also considers the impacts on SWP delivery reliability due to climate change, sea level rise, and vulnerability of the Deltaôs conveyance system and structure due to floods and earthquakes. With these factors, the Reliability Report projects that long-term reliability will be slightly less than the 2011 estimate of 60 percent during normal year hydrology. Specifically, under existing conditions, the average annual delivery of Table A water is estimated at 1% more than the 2011 report; under future conditions, the average annual delivery is estimated at 2% less than the 2011 report. CLWA staff has assessed the impact of the current SWP Delivery Reliability Report on the CLWA reliability analysis contained in the Agencyôs 2010 UWMP that current and anticipated supplies are available to meet anticipated water supply needs through the year 2050. The preceding discussion of SWP supply should be considered by noting that, while the SWP Reliability Report represents a reasonable scenario with respect to long term reliability, recent reductions in supply reduce the difference between available supply and demand in the future, thereby making the CLWA service area more subject to shortages in certain dry years. Accordingly, the reduction in SWP supply reinforces the need to continue diligent efforts to conserve potable water and increase the use of recycled water to maximize utilization of potable water supplies.

As discussed in Chapter 5, CLWA and the retail water purveyors have worked with Los Angeles County and the City of Santa Clarita to aggressively implement water conservation in the CLWA service area. In terms of short-term water supply availability, however, CLWA and the retail water purveyors have determined that even with operational changes of the SWP in effect, there are sufficient supplemental water supplies, including SWP water, to augment local groundwater and other water supplies such that overall water supplies will be sufficient to meet projected water requirements. CLWA, the retail water Purveyors, Los Angeles County and the City of Santa Clarita have formed the Santa Clarita Valley Water Committee (formerly convened as the Santa Clarita Drought Committee). The specific purpose of the committee is to work collaboratively to manage the conjunctive use of the Valleyôs water supplies, respond to drought conditions and ensure the progressive implementation of water use efficiency programs in the Santa Clarita Valley.

In addition to the regular and previously banked water supplies described above to meet projected demand in 2014, a residual of nearly 46,000 (less 9,950 af projected to be withdrawn in 2014 as shown in **Table 4-1**) af of recoverable water remains stored in the Semitropic Groundwater Storage Bank in Kern County. In 2005, CLWA finalized an agreement with the Rosedale-Rio Bravo Water Storage District to bank up to 100,000 afy of surplus Table A Amount in that Districtôs Water Banking and Exchange Program. In addition to 20,000 af

previously banked in both 2005 and 2006, CLWA banked 8,200 af of water in 2007, 33,668 af of water in 2010, 1,006 af of water in 2011, and 6,031 af of water in 2012. In accordance with the provisions of that agreement, CLWA can withdraw up to a total of 78,000 af of that water, at a rate up to 20,000 afy, to meet Valley water demands when needed. Additionally, as part of the Buena Vista Water Acquisition Agreement, CLWA is entitled to 22,000 af of water that was stored in the Rosedale Rio-Bravo Water Banking and Exchange Program in 2005 and 2006 on CLWAôs behalf. As of 2013, CLWA maintains a recoverable total of 100,000 af in the Rosedale Rio-Bravo Water Banking and Exchange Program. Pending the withdrawal of 5,400 af in 2014, the total water banked in this program will be reduced to 94,600 af as shown in **Table 4-1**.

In 2011, CLWA opened a second program with RRBWSD which is a two-for-one exchange program where CLWA can recover one acre-foot of water for each two acre-feet delivered to RRBWSD. In 2011, CLWA delivered 15,602 af to the program and, after program losses, has 7,555 af of recoverable water. In 2012, CLWA delivered an additional 3,969 af to the RRBWSD program and, after program losses, has 9,509 af of total recoverable water. CLWA also opened a two-for-one exchange program with the West Kern Water District in Kern County and delivered 5,000 af in 2011, resulting in a recoverable total of 2,500 af (less a projected 2,000 af to be withdrawn in 2014 as shown in **Table 4-1**). Total remaining recoverable water in all the Kern County storage banks at the end of 2013 is nearly 158,000 af and is projected to be about 140,600 af at the end of 2014. That component of overall water supply is separately reflected in **Table 4-1** because it is intended for future dry-year supply; banked water to be withdrawn and used for 2014 water supply is an estimate at this point. No water was delivered into any of the banking programs nor were there any extractions from any of the programs in 2013.

CLWA and the Purveyors have implemented a number of projects that are part of an overall program to provide facilities needed to firm up imported water supplies during times of drought. These involve water conservation, surface and groundwater storage, water transfers and exchanges, water recycling, additional short-term pumping from the Saugus Formation, and increasing the reliability of CLWAôs imported supply. This overall strategy is designed to meet increasing water demands while assuring a reasonable degree of supply reliability.

Part of the overall water supply strategy is to conjunctively use groundwater and imported water to area residents to ensure consistent quality and reliability of service. The actual blend of imported water and groundwater in any given year and location in the Valley is an operational decision and varies over time due to source availability and operational capacity of individual Purveyor and CLWA facilities. The goal is to conjunctively use the available water resources so that the overall reliability of water supply is maximized while utilizing local groundwater at a sustainable rate. Such is the case in 2014. Due to the small amount of available SWP supplies, temporary decrease in Saugus Formation well capacity due to perchlorate concentrations in the vicinity of some Saugus Formation production wells, and drought impacts on groundwater levels

in the eastern portion of the subbasin, groundwater pumping from the Alluvium will be more representative of normal year levels (about 40,000 af) rather than dry year levels (30,000 to 35,000 afy). The pumping of approximately 40,000 af from the Alluvium will be accomplished by redistribution of pumping to the central and western portions of the subbasin. This redistribution of pumping is planned to be a short term measure to help meet projected demands in 2014.

For long-term planning purposes, water supplies and facilities are added on an incremental basis and ahead of need. It would be economically unsound to immediately, or in the short term, implement all the facilities and water supplies needed for the next twenty to thirty years. This would unfairly burden existing customers with costs that should be borne by future customers. There are numerous ongoing efforts to produce an adequate and reliable supply of good quality water for Valley residents. Water consumers expect their needs will continue to be met with a high degree of reliability and quality of service. To that end, CLWAôs and the water suppliers stated reliability goal is to deliver a reliable and high quality water supply for their customers, even during dry periods. Based on conservative water supply and demand assumptions contained in the 2010 UWMP for a planning horizon over the next 36 years, in combination with conservation of non-essential demand during certain dry years, CLWA and the water suppliers believe implementing their water plan will successfully achieve this goal.

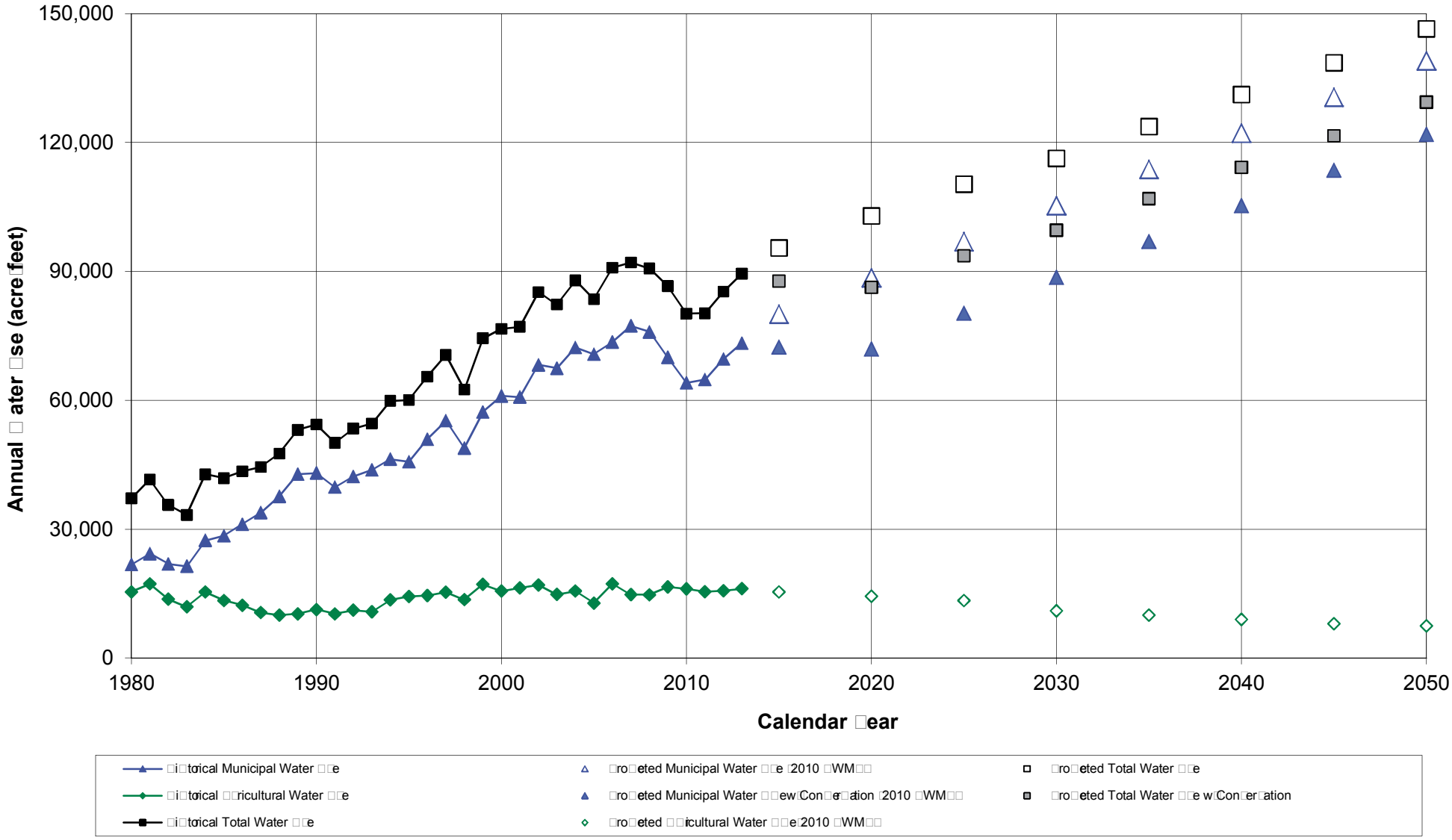

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Figure □-1
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Santa Clarita Valley Water Report

5. WATER CONSERVATION

The California Urban Water Conservation Council (CUWCC) was formed in 1991 through the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU). The urban water conservation Best Management Practices (BMPs) included in the MOU are intended to reduce Californiaôs long-term urban water demands. In 2001, the CLWA Board approved signing the CUWCCôs MOU on behalf of both the wholesale and retail service areas (CLWA and SCWD), thus meeting one of the recommendations of the 2000 UWMP. Los Angeles County signed the MOU prior to the 2000 UWMP on behalf of all its Waterworks Districts; NCWD signed the MOU on its own behalf in September 2002 and VWC signed in 2006. In 2009, the CUWCC changed its policy to specify that each signatory had to join individually and that a wholesaler could no longer be a signatory on behalf of its retailers. SCWD therefore signed the MOU independently in 2011. CLWA and the retail water purveyors are subject to the Urban Water Management Planning Act, AB1420 and SB X7-7 requirements, in addition to the commitment of compliance with the BMPs as signatories to the MOU. In the CLWA service area, demand management is addressed at both the local (retail agency) and regional (Santa Clarita Valley-wide) levels.

The MOU and BMPs were revised by the CUWCC in 2008. The revised BMPs now contain a category of ñFoundational BMPsò that signatories are expected to implement as a matter of their regular course of business. These include Utility Operations (metering, water loss control, pricing, conservation coordinator, wholesale agency assistance programs and water waste ordinances) and Public Education (public outreach and school education programs). The remaining ñProgrammaticò BMPs have been placed into three categories: Residential, Large Landscape, and Commercial, Industrial, Institutional (CII) Programs and are similar to the original quantifiable BMPs.

A key intent of the MOU revision was to provide retail water agencies with more flexibility in meeting requirements and allow them to choose program options most suitable to their specific needs. Therefore, as alternatives to the traditional Programmatic BMP requirements, agencies may also implement the MOU Flex Track or gallons per capita per day (GPCD) options. Under the Flex Track option, an agency is responsible for achieving water savings greater than or equal to those it would have achieved using only the BMP list items. The CUWCC has developed three Flex Track Menus ï Residential, CII, and Landscape ï and each provides a list of program options that may be implemented in part or any combination to meet the water savings goal of that BMP. Custom measures can also be developed and require documentation on how savings were realized and the method and calculations for estimating savings.

The GPCD option sets a water use reduction goal of 18 percent reduction by 2018. The MOU defines the variables involved in setting the baseline and determining final and interim targets. The GPCD option and requirements track well with the requirements of SB X7-7. All three retail suppliers ï SCWD, VWC and NCWD ï have chosen to implement the GPCD compliance option.

As the water wholesaler for the region, CLWA is responsible for the implementation of a subset of the BMPs. However, CLWA in partnership with the water purveyors has taken a leadership role in the implementation and support of a number of the BMPs that extend beyond a wholesalerôs responsibilities in the MOU. Additional detail on the water suppliersô conservation programs and compliance with the BMPs are presented below.

In 2007, VWC coordinated the development and execution of a MOU with CLWA and the other retail water purveyors to prepare a Santa Clarita Valley Water Use Efficiency Strategic Plan (SCVWUESP). The purpose of the effort was to prepare a comprehensive long-term conservation plan for the Santa Clarita Valley by adopting objectives, policies and programs designed to promote proven and cost-effective conservation practices. The preparation of the SCVWUESP included input from stakeholders and the community at large. The SCVWUESP was completed in 2008 and provides a detailed study of existing residential and commercial water use, and recommends programs designed to reduce overall Valley-wide water demand by ten percent by 2030. The programs are designed to provide Valley residents with the tools and education to use water more efficiently. The seven programs identified in the SCVWUESP are:

1. HET Rebates (Single and Multi-Family)
2. Large Landscape Audits (with incentives)
3. CII Audits and Customized Incentives
4. Landscape Contractor Certification
5. HE Clothes Washer Rebates
6. New Construction Building Code
7. Valley-Wide Marketing

In addition to these seven programs, the SCVWUESP also identifies other key factors that will help reduce the Valleyôs overall water demand including passive conservation and new, more efficient building ordinances. By 2010, CLWA and the retail water purveyors were implementing the majority of the programs identified in the SCVWUESP in some form.

Finally, the SCVWUESP includes an Appendix with more aggressive water use efficiency measures designed to meet a potential twenty percent reduction in water use by 2020. This includes funding more active conservation programs, retrofit on resale ordinances, water rate reform, water budget based rates and a more aggressive recycled water program.

By implementing a portfolio of water use efficiency programs, Santa Clarita Valley water suppliers and their customers benefit in a number of ways:

- **Cost Avoidance for Purchased Water**: Although the Santa Clarita Valley has projected adequate water supply for the near future, the cost of water has risen dramatically and is expected to continue to rise. The best way to avoid purchasing expensive imported water is to use less through efficiency. The implementation of the SCVWUESP programs will result in increased efficiency.
- **Limited State Resources**: Californiaôs water resources are becoming increasingly stretched due to population, housing growth and decreased water supply from state water projects. Agencies need to stretch water supplies and increase efficiencies.
- **Drought Preparedness**: It is inevitable that southern California, as well as the state, will experience droughts in the future, similar in nature to current drought conditions. The big question is when and how severe the future droughts will be. One way to lessen the severity of a droughtôs effect on Santa Clarita Valley is to prepare in advance for this event by creating a community that operates at a high level of efficiency.
- **Reduce Carbon Footprint**: The production and delivery of water requires a tremendous amount of energy on both a statewide and local level. The Santa Clarita Valley can do its part to reduce greenhouse gases by using water more efficiently.
- **Reduced Wastewater Flows**: Sanitation plants and systems must be sized to meet historic and planned wastewater flows. Increasing the efficient use of water will result in a reduction of wastewater into the system.
- **Reduced Urban Runoff**: Achieving increased water use efficiency outdoors means less water running off landscaped areas into the streets, storm drains and ultimately into the Santa Clara River. Education efforts and installation of efficient technologies will ensure that more of our valuable water is delivered to appropriate landscaping and less of it as urban runoff.

The water suppliers are administering, managing and financing the SCVWUESP programs. Since the adoption of the SCVWUESP in 2009 SB X7-7 was enacted, which requires a more aggressive demand reduction target of 20 percent by 2020. CLWA and the retail purveyors are currently developing an implementation plan that builds on the SCVWUESP while accelerating and expanding their goals to identify other opportunities that will help meet long-term goals such as those required by SB X7-7. As a result of these developments, the SCVWUESP is currently in the process of being updated.

In addition to the programs identified above, CLWA and the retail water suppliers have implemented a number of other conservation activities to meet the requirements of the SCVWUESP MOU and SB X7-7 goals. These activities include VWCôs internal Water Conservation Plan drafted in 2013. The Water Conservation Plan provides a broad framework

defining VWCôs conservation policies as well as detailed conservation programs. The Water Conservation Plan is reviewed annually and updated every three years. Notable VWC programs include:

- **Water SMART Allocation and Tiered Rates Program** ï provides customized monthly water allocations based on each customerôs specific indoor and outdoor water needs. Additionally, the Water SMART Allocation and Tiered Rates Program couples the water allocation with tiered rates by establishing pricing signals that encourage the efficient uses of water and incentives to reduce the inefficient, excessive and wasteful uses of water.
- **Residential Water Tune-Up Program** ï offers residential customers with a home water survey at no additional cost. A water use efficiency specialist will visit a customerôs home and check for leaks, install water saving devices, and perform an irrigation system inspection. The specialist will also provide information pertaining to the Water SMART Allocation and Tiered Rates Program and additional conservation program opportunities.
- **HELIUM Rebates (High Efficiency Landscape Irrigation Upgrade Measures)** ï provides customers with rebates and incentives for High Efficiency (ñHEò) irrigation improvements. Currently, VWC offers free nozzles via the www.freesprinklernozzles.com program and 50% rebates for the eligible HE nozzles, pressure regulated bodies, or master pressure regulation devices. VWC plans to add Drip Irrigation products to the HELIUM Program in 2014.
- **Water SMART Irrigation and Garden Care Workshops** ï provides customers with a $20 credit for attending the workshop. The Workshop provides information on easy-to-implement, no cost, solutions for improved irrigation efficiency. Topics include watering to the weather, cycle and soak irrigation scheduling, and when, where, and how to use Drip Irrigation.
- **High Consumption Notification Program** ï provides courtesy letters to customers with water consumption significantly greater than their monthly Water SMART Allocation. The letter informs customers that there are solutions available to assist them with their water conservation goals. Customers receiving the High Consumption Notification letter are encouraged to participate in the Residential Tune-Up Program.

SCWD developed a general Water Conservation Plan (WCP) in April 2009 to complement the SCVWUESP adopted by the CLWA Board of Directors in February 2009 and a specific Santa Clarita Water Division Water Use Efficiency Strategic Plan in 2012. In both plans, SCWD recognized the need to implement the urban water conservation BMPs as described by the CUWCC and identify additional conservation measures that could accelerate savings in the SCWD service area. Both plans identified the elements, processes, costs, staff resources and activities to further promote conservation and further complement the SCVWUESP. The plans also identified activities not addressed in the regional plan. SCWD is implementing all of the

Foundational BMPs as required in the revised MOU and UWMP Act. The Programmatic BMPs are being implemented through a GPCD approach.

NCWD has taken a number of steps to comply with SB X7-7 and help NCWD customers efficiently use water which meets the requirements of the SCVWUESP. NCWD participates in multiple public outreach events every year promoting water use efficiency within the community and has implemented a variety of programs. These programs include the following:

- **Residential Sprinkler Nozzle Program** - provides rebates to customers who replace standard irrigation spray nozzles with high efficiency nozzles.
- **Customized Water Efficiency Program** ï provides rebates to customers who demonstrate a process or product that conserves water.
- **Turf Replacement Program** ï NCWD participates with other Valley water purveyors in a turf replacement rebate program.
- **Water Efficiency Target (W.E.T.) Program** ï provides customers a customized water usage ñtargetò each month through their water bill to measure against their actual usage. If their usage is over their W.E.T., there will be various programs and opportunities for the customer to identify ways to reduce their usage and meet their target.

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Appendix 5.21G

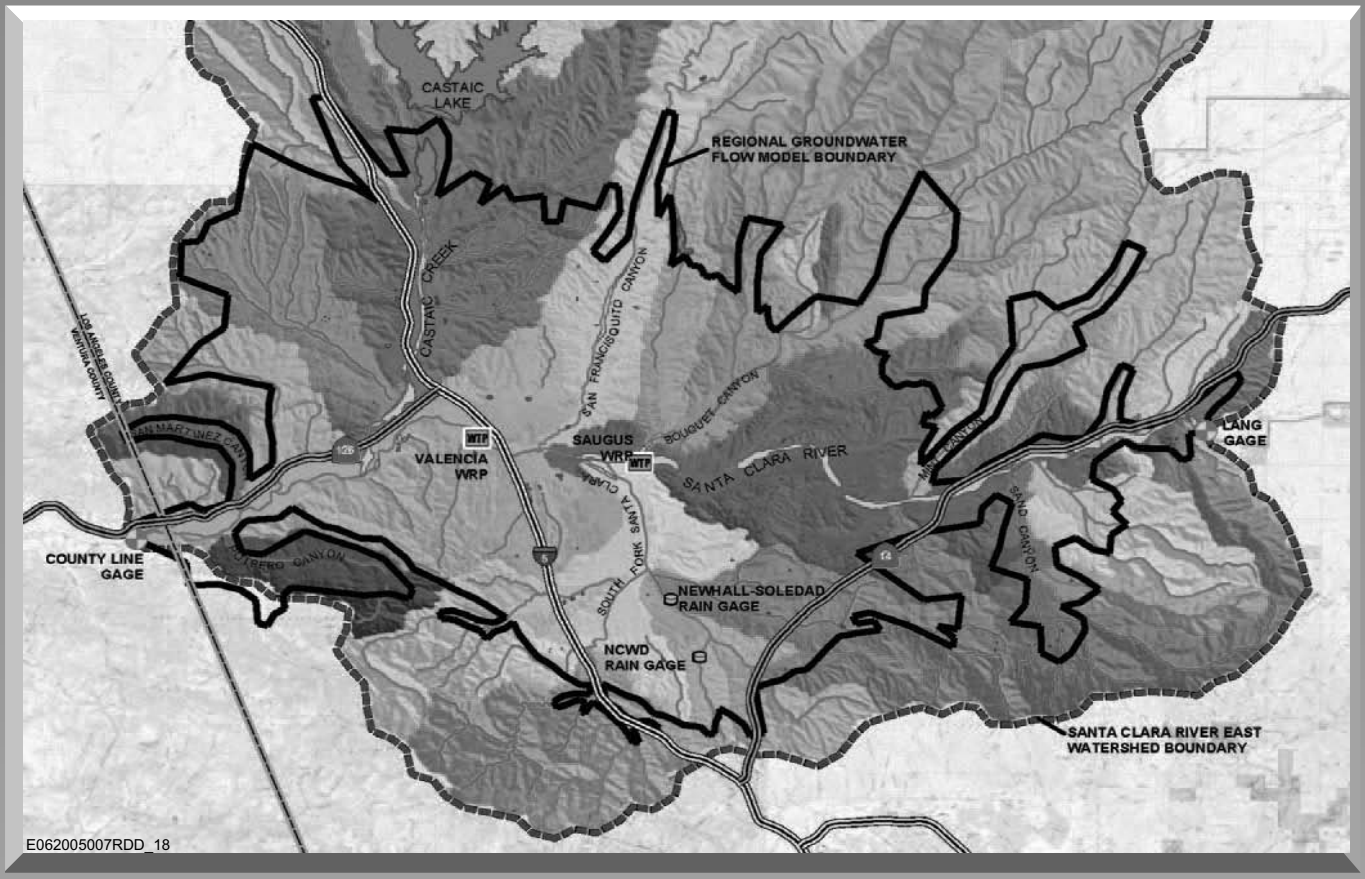
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

CH2M Hill and Luhdorff & Scalmanini Consulting Engineers

August 2005

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Prepared in Support of the August 2001 Memorandum of Understanding between the Upper Basin Water Purveyors and the United Water Conservation District



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CH2MHILL

In cooperation with
Luhdorff & Scalmanini Consulting Engineers

August 2005

Prepared for
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September 23, 2005

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Subject: Submittal of Report on Basin Yield Analysis

Dear Mr. DiPrimio, Mr. Masnada, Mr. Manetta, and Mr. Cole:

CH2M HILL is pleased to submit the enclosed report titled *Analysis of Groundwater Basin Yield, Upper Santa Clara River Basin, East Subbasin, Los Angeles County, California*. This report has been developed for the Upper Basin Water Purveyors and is the second of two reports that present and evaluate the groundwater operating plan for water supply wells completed in the Alluvial Aquifer and the Saugus Formation. This work has been performed as part of the August 2001 Memorandum of Understanding between the Santa Clara River Valley Upper Basin Water Purveyors and the United Water Conservation District. The first report, dated April 2004, documented the construction and calibration of a groundwater flow model for the Santa Clarita Valley. The enclosed report presents a modeling analysis of the groundwater operating plan and concludes that the groundwater operating plan is a reliable long-term component of water supply for the valley.

It has been our pleasure to serve the Upper Basin Water Purveyors on this important project. Please call me at 503/235-5022 if you have any questions.

Sincerely,

CH2M HILL

John J. Porcello
Project Manager

Nathan R. Brown, P.G.
Hydrogeologist

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Enclosures

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Prepared in Support of the August 2001 Memorandum of Understanding between the Upper Basin Water Purveyors and the United Water Conservation District

Prepared for

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Castaic Lake Water Agency (CLWA)
Newhall County Water District
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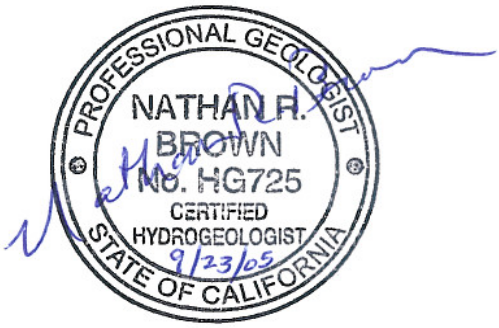

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August 2005

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Acronyms and Abbreviations

µg/L	micrograms per liter
AF/yr	acre-feet per year
AL	State of California's Action Level
Amended 2000 UWMP	2000 Urban Water Management Plan and 2005 amendments
CLWA	Castaic Lake Water Agency
DWR	California Department of Water Resources
ET	evapotranspiration
ft/day	feet per day
ft^2/day	square feet per day
in/yr	inches per year
Kh	horizontal hydraulic conductivity
LACSD	Los Angeles County Sanitation District
LADPW	Los Angeles County Department of Public Works
LSCE	Luhdorff & Scalmanini Consulting Engineers
MOU	Memorandum of Understanding
msl	mean sea level
NCWD	Newhall County Water District
NLF	Newhall Land & Farming Company
OCAP	Operating Criteria and Plan
Purveyors	Upper Basin Water Purveyors
RCS	Richard C. Slade and Associates, LLC
Regional Model	Santa Clarita Valley Regional Groundwater Flow Model
SCWC	Santa Clarita Water Company
SWP	State Water Project
SWRM	Surface Water Routing Model
T	transmissivity
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan

VWC	Valencia Water Company
WHR	Wayside Honor Rancho
WRP	water reclamation plant
UWCD	United Water Conservation District

SECTION 1

Introduction

This report presents an evaluation of the long-term sustainability of existing groundwater management practices in the Santa Clarita Valley, located in northwestern Los Angeles County, California. The groundwater system in the Santa Clarita Valley is identified by the California Department of Water Resources (DWR) as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07) and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Groundwater in the basin is pumped from a shallow Alluvial Aquifer and deeper groundwater resources that are present in an older, underlying unit called the Saugus Formation. Most groundwater pumping is by the local water purveyors (the Upper Basin Water Purveyors [herein referred to as the Purveyors[1]]) for municipal uses (in the range of approximately 23,000 to 28,000 acre-feet per year [AF/yr] in recent years), with some continuing pumping by private landowners, primarily for irrigation uses (approximately 15,000 to 16,000 AF/yr in recent years). The Purveyors also have access to other sources of water, including imported State Water Project (SWP) water, groundwater banking outside the basin, recycled water, short-term water exchanges, and dry-year water purchase programs (Luhdorff & Scalmanini Consulting Engineers [LSCE], 2005a). The water management practices of the Purveyors call for maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, and limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus Formation pumping during years when supplemental imported water supplies are significantly reduced because of drought conditions.

The evaluation of the Purveyors' current groundwater management practices has been performed using a detailed numerical groundwater flow model of the basin. The model, called the Santa Clarita Valley Groundwater Model (Regional Model), simulates the occurrence and flow of groundwater, including its interaction with streams in the area. The Regional Model has been developed for the Purveyors as a tool for the analysis of groundwater management options in the context of future water demands and water supply conditions in the valley. Among the objectives in developing the model were (1) to be able to evaluate the long-term sustainability (yield) of the Alluvial and Saugus aquifer systems under a range of existing and potential future water resource management conditions, and (2) to facilitate general management of water quantity and water quality issues. Figure 1-1 is a map showing the area simulated by the model (tables and figures are located at the end of each section).

1.1 Background

The Regional Model has been developed as part of the work scope contained in an August 2001 Memorandum of Understanding (MOU) that was entered into by the

[1]The Purveyors consist of the Castaic Lake Water Agency (CLWA), the Newhall County Water District, the Santa Clarita Water Division of CLWA, and the Valencia Water Company. The Santa Clarita Water Division of CLWA was acquired by CLWA in 1999. It was formerly called the Santa Clarita Water Company (SCWC).

Purveyors and the United Water Conservation District (UWCD), located downstream in Ventura County. The MOU, which is provided in Appendix A, is a commitment by the Purveyors to expand on previous analyses of groundwater conditions such that the adequacy of the local groundwater supply can be better understood and questions about surface water and groundwater resources can be more readily addressed. The MOU initiated a collaborative and integrated approach to data collection; database management; evaluating groundwater conditions and the sustainability of the Purveyors' operating plan; groundwater flow modeling; annual reporting on basin conditions; and technical reporting focused on geologic and hydrologic aspects of the overall stream-aquifer system.

In 2003, subsequent to the MOU, CLWA prepared and adopted a formal Groundwater Management Plan (CLWA, 2003), which includes 14 elements intended to achieve four management objectives, or goals, for the groundwater basin that were identified in the plan. Those four management objectives were development of local groundwater for water supply; avoidance of overdraft and associated undesirable effects; preservation of groundwater quality; and preservation of interrelated surface water resources. The intent of the Groundwater Management Plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, specifically avoidance of overdraft (Element 3 of the plan), no degradation of quality (Element 6 of the plan), no adverse impacts to surface waters (Element 2 of the plan). The plan identified these objectives and elements as being accomplished via continued conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Element 5 of the plan) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Elements 1 and 2 of the plan).

Both the MOU and the Groundwater Management Plan contain several technical components, including the development and calibration of a regional-scale groundwater flow model and the application of the model to evaluate the sustainability of the Purveyors' current groundwater operating plan. The development and calibration of the model was documented in detail in April 2004 in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a). A summary of the Regional Model's construction and calibration is presented in Appendix B. The analysis of the sustainability of the Purveyor's current groundwater operating plan began in 2004 and is the subject of this report. Consequently, this report and the earlier report on the development and calibration of the model represent the accomplishment of two of the key technical work components that were described in the MOU and in several elements of the Groundwater Management Plan.

The Purveyors prepared the first Urban Water Management Plan (UWMP) for the Santa Clarita Valley in 1985. At about that same time, the Purveyors began studying the local water resources to assess the condition, hydrogeologic character, storage capacity, water budgets, and water quality of the local groundwater aquifers. Some of that work involved evaluating the potential for conjunctive use of groundwater and imported water resources, specifically artificial recharge of the Alluvial Aquifer using spreading basins, and aquifer storage and recovery in the Saugus Formation. An update of the UWMP in December 2000 projected water demands in the valley through 2020 and delineated a number of local and other water supplies, in conjunction with SWP water, to meet those projected water demands. The UWMP also identified a water supply plan that consisted of using alternate

supplies and/or development of future supplies from groundwater storage projects, short-term transfers, local groundwater, and other sources to offset potentially reduced deliveries of SWP water, while meeting demands in a manner that would not cause overdraft conditions in the local aquifer systems. In 2005, CLWA amended the 2000 UWMP to address the adequacy of groundwater supplies in light of perchlorate contamination that had caused the inactivation of five municipal water supply wells. Included in the amendments to the 2000 UWMP (CLWA et al., 2005; hereafter referred to, together with the 2000 UWMP [Black & Veatch, 2000], as the Amended 2000 UWMP) was discussion of the plan currently being implemented to install treatment and restore impacted wells for water supply by 2006. In accordance with the California Urban Water Management Planning Act, the UWMP is currently undergoing a 5-year update that will be completed in late 2005.

The Purveyors and UWCD initially agreed in the MOU, and the Purveyors subsequently committed in the Groundwater Management Plan, to develop and use the Regional Model for the sustainability evaluation of the local groundwater operating plan, in part because (1) the available data showed that no long-term lowering of the water table or degradation of water quality had occurred during the 50 to 60 years of historical groundwater development in the valley, and (2) the various studies and water planning efforts performed up to that time had resulted in a local groundwater operating plan that places future pumping of the Alluvial Aquifer in the same range as historical pumping. However, although the MOU recognized a need to formally analyze the Alluvial Aquifer, it identified that the primary question to evaluate with the Regional Model would be the operational yield of the Saugus Formation, given that the Purveyors' operating plan called for dry-year pumping at rates higher than historically had been pumped. For that reason, the MOU identified that the model would evaluate the effect of the current groundwater operating plan on groundwater conditions in both the Alluvial Aquifer and the Saugus Formation over a multi-year wet/dry cycle. The operational yield was defined in the MOU as an operating plan for the local groundwater basin that would allow continued pumping from the Alluvial Aquifer and Saugus Formation while assuring that groundwater supplies would be adequately replenished from one wet/dry cycle to the next.

Together, the historical development of these plans and the evaluation of their sustainability that is described in this report are grounded in the following objectives, which have been identified by the Purveyors for local groundwater resource management:

1. Prepare a groundwater operating plan for the basin (locations of wells, pumping capacities, and variations in annual pumping volumes) that is integrated with SWP and other imported supplies and recycled water to meet local water demands.

2. Analyze the groundwater operating plan to quantify possible basin responses to the plan, in terms of temporal variations that could occur in groundwater levels, groundwater storage, and Santa Clara River streamflows. This includes evaluating the rate of recovery of Saugus Formation groundwater levels after 1 or more years of increased pumping in the Saugus Formation.

3. Evaluate the range of basin responses to the groundwater operating plan to determine whether the plan will result in sustainable groundwater resources and supplies. This includes evaluating the following:

    a. Whether groundwater level declines during future drought periods will continue to arise primarily from local drought conditions, instead of from the groundwater operating plan for the basin; and, more importantly, whether groundwater levels and storage will recover (recharge) in wet periods following dry or drought conditions

    b. Whether groundwater discharges to the Santa Clara River will continue to be relatively stable over time, compared to the year-to-year variations in groundwater recharge that occur in the rest of the basin

To meet these objectives, the Purveyors developed the Regional Model to be an evolving tool for local groundwater resource management. As discussed in the model development report (CH2M HILL, 2004a), specific objectives identified for the Regional Model were as follows:

1. To evaluate the long-term sustainability (yield) of the two aquifer systems in the valley, the Alluvial Aquifer and the Saugus Formation, under a range of existing and potential future water resource management conditions

2. To evaluate artificial recharge for the purpose of increasing the long-term sustainability of the aquifer system, particularly in conjunction with the availability of imported surface water supplies

3. To evaluate the influences of future water management plans and alternatives on groundwater conditions in the valley and on the flows of water into the downstream basins in Ventura County

4. To facilitate general management of water quantity and water quality issues

This report focuses on the application of the Regional Model to meet the first objective.

1.2 Report Organization

The remainder of this report is organized as follows:

- **Section 2** discusses the hydrogeology of the basin and describes the groundwater operating plan.
- **Section 3** describes the process that was used to simulate the groundwater operating plan with the Regional Model and evaluate the modeling results.
- **Section 4** discusses the results of the simulated groundwater operating plan.
- **Section 5** discusses the principal findings from the analyses of historical data and numerical modeling results, and the implications of these findings for long-term water management in the Santa Clarita Valley.
- **Section 6** is the reference list.

Figure

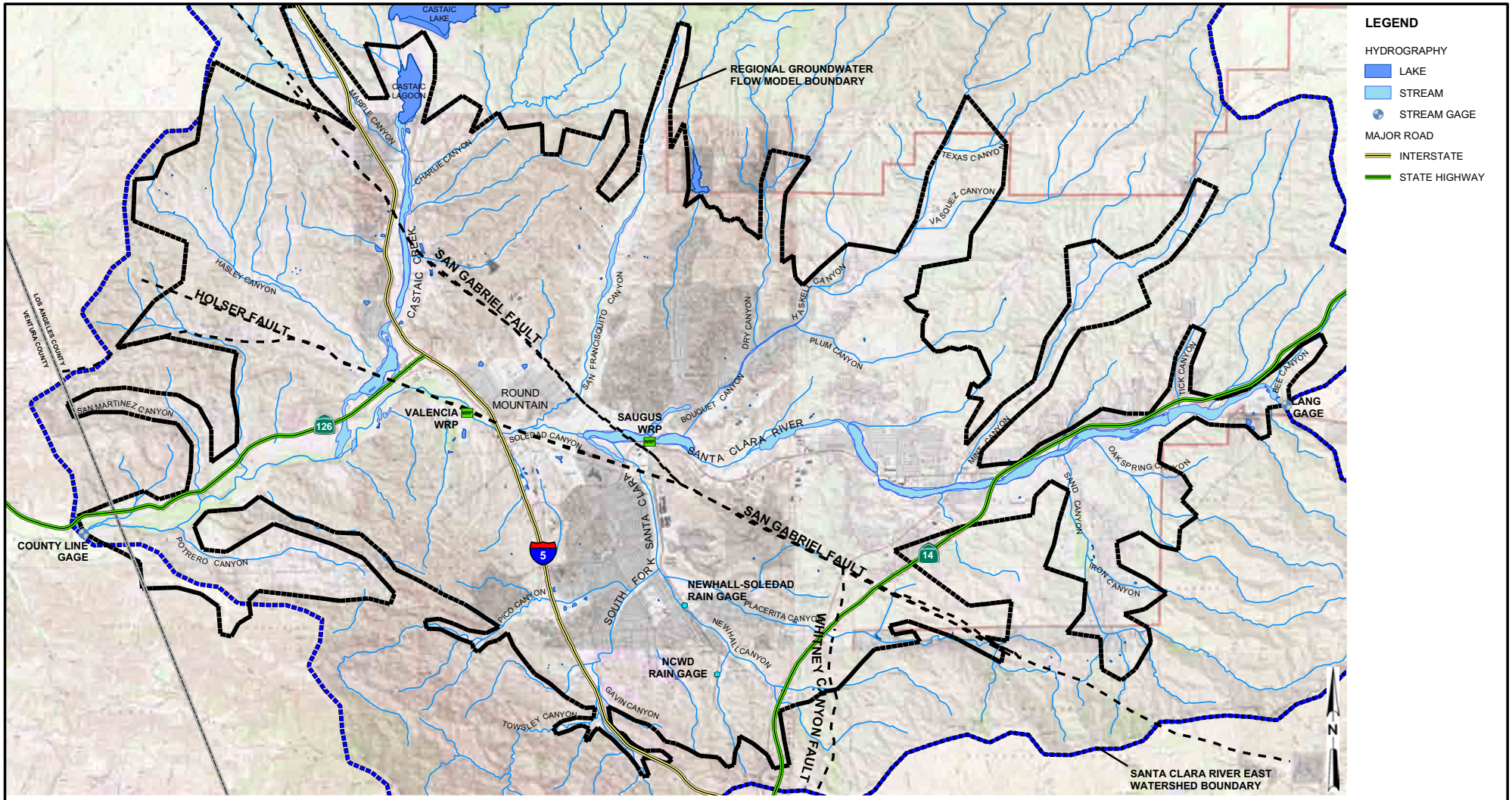

FIGURE 1-1
MAP OF STUDY AREA
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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SECTION 2

Groundwater Hydrology and Operating Plan

2.1 Basin Hydrogeology

The groundwater system in the Santa Clarita Valley is identified by DWR as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Figure 2-1 shows the location of this groundwater basin. The basin contains two aquifer systems: the Alluvial Aquifer and the Saugus Formation. Figure 2-2 is a geologic map showing the geographical extent of these and other rock units in and around the basin.

In general, natural groundwater recharge occurs in the eastern portion and at the northern and southern limits of the basin, and natural groundwater discharge occurs in the west-central portion of the basin, in the alluvial valley occupied by the Santa Clara River. Groundwater pumping is an additional groundwater discharge mechanism that occurs in discrete portions of the basin. A schematic representation of the regional-scale geology and hydrologic cycle in the Santa Clarita Valley is shown on Figure 2-3, and the components of the hydrologic cycle for the basin's groundwater and surface water resources are listed in Table 2-1. As indicated by the diagram and the table, groundwater is exchanged between the Alluvial Aquifer and the Saugus Formation, with the Alluvial Aquifer recharging the Saugus Formation in certain portions of the regional recharge areas, and the Alluvial Aquifer receiving groundwater from the Saugus Formation in the regional groundwater discharge areas. Additionally, the aquifer systems are affected by direct rainfall; stream-flows in the Santa Clara River and its tributaries; evapotranspiration (ET) by riparian vegetation along portions of the river; and human influences, which consist of pumping, agricultural and urban irrigation, discharge of treated water into the Santa Clara River from two water reclamation plants (WRP), and occasional releases of water into Castaic Creek from Castaic Lake and Castaic Lagoon.

The Santa Clarita Valley obtains its water supply from local groundwater sources and from imported water supplies. Total water use in the valley is largely for municipal and industrial uses and, to a lesser extent, for agricultural uses. In 2004, approximately 61 percent of groundwater pumping was by the Purveyors (for municipal uses) and 39 percent was by private land owners, primarily for irrigation. Figure 2-4 is a map showing the locations of production wells that are currently present in the Alluvial Aquifer and the Saugus Formation. Prior to the 1960s, agriculture was the predominant land use in the valley. Agricultural water was supplied by production wells, most of which were completed in the Alluvial Aquifer. Pumping from the Alluvial Aquifer during much of the 1950s and early 1960s ranged between approximately 35,000 and 44,000 AF/yr. Pumping from the Alluvial Aquifer dropped gradually from approximately 40,000 AF/yr in the mid-1960s to less than 30,000 AF/yr through the 1980s, and did not rise above 30,000 AF/yr until 1993. Since then, it has ranged between 30,000 and nearly 44,000 AF/yr. In the Saugus Formation, very little pumping occurred before 1960. From 1960 through 1990, total pumping from the Saugus Formation ranged from approximately 2,500 AF/yr to approximately 8,500 AF/yr. As a

result of statewide drought conditions, pumping from the Saugus Formation ranged between 10,000 and 15,000 AF/yr from 1991 through 1994. Saugus pumping was reduced beginning in 1995, as the drought ended and additional water supplies became available.

2.2 Groundwater Operating Plan

The water management practices of the Purveyors call for maximizing the use of Alluvial Aquifer groundwater and SWP water during years of normal or above-normal availability of SWP water supplies and local Alluvial Aquifer groundwater resources. These practices recognize ongoing Alluvial pumping for agricultural water supply as well as other smaller (private) domestic and related water supply, and are intended to maintain overall pumping within sustainable rates. Groundwater pumping is minimized from the Saugus Formation, except during years when SWP water allocations are below normal. These water management practices are based, in part, on observations about the historical hydrology of the basin (described in Section 2.2.1) and form the groundwater operating plan for the basin (described in Section 2.2.2).

2.2.1 Historical Groundwater Conditions

Long-term water level data have been collected over the years at agricultural wells and Purveyor-owned wells in the City of Santa Clarita and along the South Fork Santa Clara River. The data have been collected in pumping wells, and the hydrographs of these wells are steep at certain times, suggesting that the measured water levels are influenced, to a certain degree, by pumping at the well. Nonetheless, the data show general relationships between groundwater elevation trends and changes in groundwater recharge and pumping over time. These relationships have been identified by examining the 50-year period from 1950 through 1999. During this period, the average rainfall was close to the long-term average rainfall observed since 1883. Consequently, long-term changes in the basin's hydrology arising from other factors could be more easily identified because rainfall was near normal for the 50-year period as a whole.

Following are discussions of the observed hydrologic trends in the basin, including rainfall, groundwater elevations in the Alluvial Aquifer and the Saugus Formation, and flows in the Santa Clara River.

2.2.1.1 Historical Trends in Rainfall

Rainfall data have been recorded since 1883 at the Newhall-Soledad gage (Station No. FC32CE), located at the Los Angeles County Department of Public Works (LADPW) Newhall-Soledad Division Headquarters office, on San Fernando Road in the community of Newhall. The average rainfall at this gage was 17.95 inches from 1883 through 2000 and 17.84 inches from 1950 through 2000[2]. Figure 2-5 shows the annual rainfall at the Newhall-Soledad gage for calendar years 1950 through 2000. Figure 2-5 also shows the cumulative departure from the average annual precipitation since 1950. Cumulative departure refers to the cumulative amount of rainfall that is greater than or less than the long-term average rainfall. The slope of the cumulative departure plot shows the temporal trends in rainfall

[2]Annual rainfall values for the Newhall-Soledad gage were derived from monthly values reported by the National Climate Data Center and LADPW.

over successive years. The figure shows the following trends in precipitation within the Santa Clarita Valley:

1. 1950 through 1964: Dry conditions except for single wet years in 1952, 1957, 1958, and 1962 (a nearly continuous decrease in cumulative departure values)
2. 1965 through 1970: Wet conditions (increase in cumulative departure values)
3. 1971 through 1977: Average to dry conditions (flat or declining cumulative departure values)
4. 1978 through 1983: Wet conditions (increase in cumulative departure values)
5. 1984 through 1991: Dry conditions (decrease in cumulative departure values)
6. 1992 through 1999: Highly variable conditions from year to year, but overall increase in cumulative departure values

A second rain gage is located approximately 1.3 miles to the south, at the Newhall County Water District (NCWD) office (see Figure 1-1). Figure 2-6 compares the annual rainfall at the Newhall-Soledad and NCWD gages for calendar years 1950 through 2000. Rainfall at the NCWD gage is usually greater than at the Newhall-Soledad gage, because the NCWD gage is located closer to the hills that form the southern boundary of the watershed and receive a greater amount of orographic precipitation, as shown on Figure 2-7.

2.2.1.2 Historical Trends in Alluvial Aquifer Groundwater Elevations

Figure 2-8 shows trends in groundwater elevations in two Alluvial Aquifer wells located in the basin interior (wells VWC-N and NLF-S, near the mouth of the South Fork Santa Clara River) and two Alluvial Aquifer wells located near the regional groundwater discharge zone at the western end of the basin (wells NLF-C5 and NLF-C7). The figure also shows trends in the following other components of the hydrologic cycle:

1. Precipitation at the Newhall-Soledad rain gage (plotted as the cumulative departure from the average precipitation)
2. Annual pumping volumes from the Alluvial Aquifer and the Saugus Formation
3. Total discharges to the Santa Clara River from two WRPs (which are discussed further in Section 2.2.1.5)
4. Measured flow volume in the Santa Clara River during the lowest flow month of each year

Observations from Figure 2-8 are as follows:

1. Alluvial Aquifer groundwater elevations show greater variability over time within the basin interior (wells VWC-N and NLF-S) than near the basin outlet (wells NLF-C5 and NLF-C7). The range in water levels during the 50-year period of record is approximately 100 feet at the interior wells, but only 20 to 30 feet in the two wells near the basin outlet.
2. The effect of reduced pumping from the Alluvial Aquifer from 1967 through 1989 was to minimize seasonal fluctuations in Alluvial Aquifer water levels near the aquifer's regional discharge zone at the western end of the valley. In this area, fluctuations in

Alluvial Aquifer pumping over time affected Alluvial groundwater elevations only seasonally; year-to-year variations in groundwater elevations were small. This indicates that water levels in this area are controlled less by pumping than by the discharge of Alluvial Aquifer groundwater to the Santa Clara River in the area downstream of Interstate 5.

3. As with the western portion of the Alluvial Aquifer, the central portion of the Alluvial Aquifer has not shown long-term water level declines. During the 1950s and early 1960s, total pumping from the Alluvial Aquifer ranged between approximately 35,000 and 44,000 AF/yr during all but 1 year, and long-term (year-to-year) groundwater elevations were relatively stable (see the hydrographs for wells VWC-N and NLF-S). When pumping from the Alluvial Aquifer decreased beginning in 1967, Alluvial groundwater elevations in this area quickly rose and have been relatively stable since about 1970, despite an increase in Alluvial Aquifer pumping during the 1990s. The hydrographs indicate that after an extended drought and high rates of pumping, Alluvial Aquifer groundwater elevations recover very quickly when normal or above-normal rainfall patterns return.

4. The seasonal low flow in the Santa Clara River at the County Line gage has shown a long-term increase since the mid-1970s and, to some degree, since the late 1960s. Figure 2-5 shows that this increase in flow coincides with increases in the annual discharges of treated water to the Santa Clara River from the two WRPs. Although Alluvial Aquifer pumping increased during the 1980s and 1990s, the seasonal low river flow did not show a long-term decrease during this period. The increases in WRP and Santa Clara River flows and the fluctuations in Alluvial Aquifer pumping have not caused long-term changes in Alluvial Aquifer groundwater elevations at the two wells near the basin outlet.

2.2.1.3 Historical Trends in Saugus Formation Groundwater Elevations

Figures 2-9 and 2-10 compare groundwater elevation trends in the Saugus Formation near the Santa Clara River, below the mouth of the South Fork Santa Clara River, with the same hydrologic components displayed on Figure 2-8. Figure 2-9 shows this information for the period 1950 through 1999, and Figure 2-10 shows this information during the 1990s, when groundwater levels rose in the Saugus Formation. Figures 2-11 and 2-12 show the same information, but for groundwater elevations at Saugus Formation wells located farther away from the Santa Clara River, along the tributary valley containing the South Fork Santa Clara River.

In examining the four Saugus Formation figures, it is difficult to distinguish between the influences of precipitation and pumping trends on changes in Saugus water levels. Although a slight rise in water levels might have occurred at wells VWC-157 and VWC-160 during the late 1960s and early 1970s, it appears to follow the trends in Saugus pumping volumes more closely than the precipitation trends. The data at VWC-157 also suggest that a succession of above-normal precipitation years (e.g., 1978 through 1983) or a year of precipitation that is substantially above normal (e.g., 1983) might have some influence on Saugus water levels. However, the data are limited, and the periods of increased precipitation tend to coincide with periods of decreased pumping, making it difficult to identify the effect of precipitation or pumping on Saugus water levels.

Another observation is that the rise in Saugus Formation water levels in the late 1960s and early 1970s occurred despite an increase in annual pumping volumes from the Alluvial Aquifer. During the late 1980s and 1990s, Saugus pumping increased from slightly less than 6,000 AF/yr (in 1986 and 1987) to approximately 15,000 AF/yr in 1991. When SWP deliveries were substantially reduced in 1991, pumping from the Saugus Formation made up for almost half of the reduction that year. This increased Saugus pumping resulted in short-term declines in groundwater elevations at the pumping wells, particularly from 1991 through 1994, reflecting the use of naturally-stored Saugus groundwater. However, as shown on Figures 2-9 and 2-10, the water levels subsequently rose when pumping declined. This indicates that Saugus water levels are controlled by precipitation and/or Saugus pumping trends, and not by pumping trends in the Alluvial Aquifer.

2.2.1.4 Comparison of Historical Trends in Alluvial and Saugus Groundwater Elevations

Figure 2-13 compares groundwater elevations at Alluvial Aquifer and Saugus Formation wells located near each other along the Santa Clara River, just below the mouth of the South Fork Santa Clara River. At this location, the trends in Alluvial groundwater elevations show no clear relationship with the trends in Saugus groundwater elevations. A moderate overall increase in groundwater elevations was observed in both the Alluvial Aquifer and the Saugus Formation during the late 1960s. However, this similarity in the water level trends might be a coincidence arising from reduced pumping in both aquifers. During the early 1970s, water levels in Saugus well VWC-157 decreased while water levels in the nearby Alluvial Aquifer well (VWC-N) generally increased. During the 1990s, the Alluvial Aquifer groundwater elevations at well VWC-N were generally stable despite (1) increased pumping from the Alluvial Aquifer and (2) a sharp decrease, then increase, in Saugus groundwater elevations, which correlated with the trends in Saugus pumping. In summary, although there might be a relationship between Alluvial and Saugus groundwater elevations near the margins of the groundwater basin, where folding of Saugus beds has brought permeable zones in contact with the alluvium, Figure 2-13 indicates that there is general independence between the Alluvial and Saugus water level trends at this location, which is near the center of the bowl-shaped Saugus Formation structure shown on Figure 2-3.

2.2.1.5 Historical Trends in Santa Clara River Baseflow

Long-term records of flows in the Santa Clara River are available for the eastern and western ends of the basin. The locations of the two gages are shown on Figure 1-1 and Figure 2-3. At the western end of the basin, the County Line gage has recorded Santa Clara River flows leaving the basin for most of the period since 1952, except for a 1-year period during water year 1969 (October 1968 through September 1969). At the eastern end of the basin, the Lang gage has recorded Santa Clara River flows entering the basin from October 1949 through September 1989 and from April 2003 to the present.

Baseflow in the Santa Clara River is perennial in the western portion of the Santa Clarita Valley. The following sources of water contribute to the river's baseflow:

1. **Groundwater discharge from the Alluvial Aquifer to the riverbed.** Groundwater in the Alluvial Aquifer seeps into the riverbed near, and downstream of, Round Mountain (which is located just below the mouth of San Francisquito Canyon).

2. **Discharges from two WRPs.** Treated water is discharged to the Santa Clara River from two Los Angeles County Sanitation District (LACSD) WRPs in the valley. The Saugus WRP (Plant No. 26) is located along the south side of the river near Bouquet Canyon, just above the mouth of the South Fork Santa Clara River. The Valencia WRP (Plant No. 32) is located along the north side of the river, just west of Interstate 5.

3. **Flood Flows in Castaic Creek.** DWR stores SWP water in Castaic Lake. In some years, DWR releases flood flows from Castaic Dam/Lagoon into Castaic Creek during the winter or spring months. Depending on the magnitude of the releases, some of these flows enter the Santa Clara River downstream of the Valencia WRP. As shown on Figure 2-14, these releases have occurred during many, though not all, years since the release program began in the late 1970s.

Hydrograph separation techniques were applied to the daily streamflow data for the County Line gage to estimate historical groundwater discharges (baseflow) to the Santa Clara River within the Santa Clarita Valley. The hydrograph separation was performed for calendar years 1953 through 1999 using the following five steps:

1. For each day, the average daily flow at the County Line gage, in cubic feet per second (cfs), was converted to acre-feet of volumetric flow for the day.

2. The daily flows from Castaic Dam and at the Castaic Creek South gage (located near the mouth of Castaic Creek) were subtracted from the flow at the County Line gage. These data reflect surface water flow from tributaries. Data from the Castaic Creek South gage were used through June 1977. Beginning in July 1977, operational data for Castaic Lagoon, presented in annual reports by DWR, were used to estimate surface flow contributions from Castaic Creek.

3. The discharges of treated water from the two WRPs were subtracted. This step was performed for calendar years 1975 and later, because 1975 was the first year that such records were available.

4. The resulting day-to-day trends in streamflows were scrutinized for days when notably elevated flows occurred suddenly. These days were assumed to be dominated by storm flow. In some cases, the elevated flows lasted for only 2 to 5 days. In other cases, flows remained elevated for several days, but showed steady declines, indicating that only the beginning of the elevated-flow period was dominated by surface runoff.

5. On all other days, storm flow was considered to be minimal or zero, and the flow values calculated for days not dominated by storm flow were assumed to represent river base-flow (that is, groundwater discharge to the river). For each month, an average flow was calculated for these non-storm days. The average flow was then converted to a total flow for the month, and the monthly flow volumes were summed to come up with the total flow for each year.

Table 2-2 presents the annual calculations from the hydrograph separation analysis. Table 2-3 presents summary statistics for the entire 47-year period that was analyzed, as well as for shorter time frames. Tables 2-4 and 2-5 show dry-year, normal-year, and

wet-year statistics for the entire period of record and the shorter time frames. The shorter time frames are as follows:

1. Calendar years 1953 through 1965, which were years of primarily agricultural water use prior to urbanization and construction of WRPs. This 13-year period was also characterized by 5 years of below-normal rainfall.

2. Calendar years 1975 through 1999, which represent 25 years of significant urbanization, including SWP water importation and WRP operations. This 25-year period was characterized by 6 years of below-normal rainfall, although rainfall volumes in general were somewhat higher (19.4 inches per year [in/yr] average, versus 15.5 in/yr average for 1953 through 1965).

3. Calendar years 1953 through 1999, but excluding 8 years (1966 through 1974) when WRP discharges occurred but were not recorded.

The daily streamflow data and the hydrograph separation technique indicate the following:

1. Summary statistics in Table 2-3 for all types of rainfall years (dry, normal, and wet) show that average groundwater discharges to the river from 1953 through 1965 were approximately 2,500 AF/yr (3.5 cfs). Groundwater discharges to the river were typically 14,000 to 22,000 AF/yr (19 to 31 cfs) from 1975 through 1999 because of more rainfall, increasing urbanization, and increasing importation of water from outside the valley.

2. For normal rainfall years only, median and average groundwater discharges to the river were approximately 4,000 and 3,600 AF/yr (5.5 and 5.0 cfs), respectively, from 1953 through 1965 (see Table 2-4); and approximately 12,500 and 14,300 AF/yr (17 and 20 cfs), respectively, during 1975 through 1999 (see Table 2-4).

3. For drought years only, Table 2-4 shows that groundwater discharges to the river ranged from 400 to 4,900 AF/yr (0.5 to 7 cfs) between 1953 and 1965, and from 5,200 to 14,500 AF/yr (7 to 20 cfs) between 1975 and 1999. Table 2-4 also shows that median and average groundwater discharges to the river during drought years were 600 and 1,700 AF/yr (1 and 2 cfs), respectively, from 1953 through 1965, and typically 9,600 and 10,200 AF/yr (13 and 14 cfs), respectively, from 1975 through 1999.

In summary, significant increases in the baseflow of the Santa Clara River have occurred since urbanization of the Santa Clarita Valley began during the late 1960s and early 1970s. Water imports began in 1980, and have increased in volume as urbanization has continued. The imported water has reached the river through releases from Castaic Dam/Lagoon and, more significantly, discharges of treated water into the river. As a result, water is now present in the Santa Clara River on a continuous basis in the western portion of the basin, even during dry years. This is a sharp contrast to conditions prior to the 1970s, when the river would become dry during drought periods.

2.2.2 Historical Estimates of Basin Yield

During the late 1980s, Richard C. Slade, Consulting Groundwater Geologist, now known as Richard C. Slade and Associates, LLC (both hereafter referred to as RCS), conducted hydrogeologic assessments of the two aquifer systems in the basin. RCS performed separate

evaluations for the Alluvial Aquifer in 1986 and the Saugus Formation in 1988, then updated this work in 2002.

The first study of the Alluvial Aquifer (RCS, 1986) identified a "practical or perennial yield" of 31,600 to 32,600 AF/yr. RCS derived these values using the so-called "Pumpage and Change-In-Storage" method, a commonly used method at the time that compares groundwater pumping volumes with changes in the volume of groundwater in storage during a multi-year period when cumulative rainfall is close to average. As RCS discussed in a more recent report (2002), this method works best in aquifers that are fully developed or in overdraft, and where recharge does not play an important role in determining the amount of groundwater in storage. Consequently, as discussed by RCS (2002), this method is not well suited to estimating sustainable pumping rates in this setting because natural recharge and water importation are major influences on the groundwater basin in the Santa Clarita Valley, and the local groundwater resources are not fully developed or in overdraft.

The first study of the Saugus Formation (RCS, 1988) did not identify a practical or perennial yield or a range of pumping rates that were estimated to be sustainable on a long-term basis. Instead, this study first estimated the "usable groundwater in storage," which was defined as the volume of Saugus Formation groundwater that is economically obtainable and of satisfactory quality for beneficial use. RCS estimated the usable groundwater in storage to be 1.41 million acre-feet. Then, using precipitation records and calculations of the exposed area of the Saugus Formation and overlying terrace deposits, and also considering the hydraulic potential for inter-aquifer flow from the overlying Alluvial Aquifer, RCS estimated that the Saugus Formation potentially receives between approximately 11,000 and 22,000 AF/yr of recharge from a combination of direct rainfall and inter-aquifer flow in any given year, depending on local hydrologic conditions. However, RCS did not discuss the relationship of these estimates to long-term pumping from the Saugus Formation. In fact, RCS noted that these assessments "…should not be construed as a rigorous determination of the perennial yield of the Saugus…."

In the *2001 Update Report: Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems* (RCS, 2002), RCS concluded that groundwater levels in the Alluvial Aquifer and Saugus Formation have fluctuated over time, but have shown no long-term progressive declines in the amount of groundwater storage that could be considered indicative of overdraft conditions. From the long-term pumping and water level data, the report concluded that the Alluvial Aquifer can be pumped at rates between 30,000 and 40,000 AF/yr over the long term, and suggested that pumping be between 30,000 and 35,000 AF/yr during local droughts. For the Saugus Formation, the report concluded that pumping can occur at rates between 7,500 and 15,000 AF/yr on a long-term basis, with short-term increases to as much as 35,000 AF/yr toward the end of a multi-year period of reduced availability of imported water supplies.

RCS (2002) referred to these pumping rates for the Alluvial and Saugus aquifer systems as the "operational yield" of both aquifers, a term that was previously described in the August 2001 MOU. The term perennial yield is often interpreted as a "not-to-exceed" volume, with a related potential for pumping above the perennial yield value in any given year to be incorrectly interpreted as "overdraft." Consequently, the MOU advanced the concept of operational yield to deal with the misinterpretations commonly associated with the concept of perennial yield. In the Santa Clarita Valley, operational yield is used today to describe the

flexible use of groundwater that allows increased pumping during dry periods and subsequent recharge (direct or in-lieu) in wet/normal rainfall periods, performed in a manner that protects the aquifer by assuring that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. This concept is the basis for the development of the current groundwater operating plan for the local groundwater basin, which is discussed in the following section.

2.2.3 Development of Current Operating Plan

The groundwater operating plan for the Santa Clarita Valley's groundwater resources has been defined in the Amended 2000 UWMP for the Santa Clarita Valley (Black & Veatch, 2000; CLWA et al., 2005) and in annual water reports that discuss the water demands, water supplies, and surface water and groundwater resources of the valley (including the *Santa Clarita Valley Water Report 2004* [LSCE, 2005a]). These reports provide ranges of values for groundwater extractions from the Alluvial Aquifer and the Saugus Formation during wet/normal years and dry years. The Purveyors have developed the operating plan by considering the water supply needs of the valley, the availability of imported water supplies, and knowledge of the historical recovery of both aquifers (following the peak pumping years that occurred prior to the mid-1960s in the Alluvial Aquifer and during the early 1990s in the Saugus Formation). The plan is summarized in Table 2-6 and is as follows:

1. Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern part of the basin. Under the operating plan, pumping ranges between 30,000 and 40,000 AF/yr during normal and above-normal rainfall years, but, because of operational constraints in the eastern part of the basin, is reduced to between 30,000 and 35,000 AF/yr during locally dry years.

2. Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly imported water from the SWP system. For the Saugus Formation, the operating plan consists of pumping between 7,500 and 15,000 AF/yr during average-year conditions within the SWP system. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 AF/yr during a drought year, and increases to between 21,000 and 25,000 AF/yr if SWP deliveries are reduced for 2 consecutive years, and between 21,000 and 35,000 AF/yr if SWP deliveries are reduced for 3 consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 AF/yr, to further enhance the effectiveness of natural recharge processes that would rapidly recover water levels and groundwater storage volumes in the Saugus Formation, as has been historically experienced.

The Purveyors have developed this plan as part of an overall water supply strategy designed to meet increasing water demands in the Santa Clarita Valley while assuring a reasonable degree of water supply reliability[3] and not exceeding the operational yield of the local aquifer systems on a long-term basis. In particular, this plan employs an integrated use

[3]As discussed in Section ES.5 of the *2004 Santa Clarita Valley Water Report* (LSCE, 2005a), the Purveyors are in the process of establishing a water reliability policy, for planning purposes, sufficient for meeting projected demands 95 percent of the time over each 20-year period. In the remaining 5 percent of the time, it is planned that the maximum supply shortage will be 10 percent of demand, a level that is based on past experience that a 10 percent water demand reduction is feasible during a drought. (During the last drought, in the early 1990s, voluntary conservation efforts by area residents resulted in a reduction in water demands of approximately 20 percent below demands in preceding years.)

of the Alluvial Aquifer and the Saugus Formation that recognizes the fundamental differences in the hydrogeologic characteristics of these two units[4]. Maintaining the substantial volume of water in the Saugus Formation is an important part of this strategy, to help maintain local groundwater supplies on a long-term basis. In implementing this operating plan, the Purveyors blend groundwater and imported water for area residents to ensure consistent quality and reliability of service. The actual blend of imported water and groundwater in any given year and any given location in the valley is an operational decision, which varies over time according to source availability and the operational capacities of Purveyor-owned facilities. In years when SWP supplies are reduced because of regulatory factors and/or dry weather conditions in the watersheds that provide SWP water supplies, the water demands in the Santa Clarita Valley can be met through a combination of the following alternate supplies:

1. Local groundwater pumping (increased short-term Saugus pumping)
2. Deliveries from CLWA's groundwater banking programs, such as the Semitropic Groundwater Storage Program in Kern County, where CLWA has banked excess SWP water in recent years
3. Deliveries from CLWA's flexible storage account in Castaic Lake Reservoir
4. Participation in DWR dry-year water purchase programs
5. Short-term water exchanges

The Purveyors have emphasized developing water supplies that add diversity in water supply options, especially in years of dry conditions in the Santa Clarita Valley (which can reduce Alluvial Aquifer supplies) and/or reduced availability of SWP imports. Drought periods, local or in the SWP system, can affect water supplies in single and multiple years. Details concerning the nature of local hydrologic variations, which govern Alluvial Aquifer pumping, are presented in Section 2.2.3.1. Section 2.2.3.2 discusses variations in imported water availability, which governs pumping from the Saugus Formation.

2.2.3.1 Variations in Local Hydrology and Alluvial Aquifer Pumping

The rate of pumping from the Alluvial Aquifer in a given year is partly affected by groundwater elevations in the eastern portion of the basin, which is the primary groundwater recharge area for the local groundwater systems. Historically, during dry years, decreases in Alluvial Aquifer pumping occur in the eastern-most Alluvial Aquifer production wells, which are located adjacent to the Santa Clara River in Soledad Canyon, upstream of the mouth of Bouquet Canyon. Reduced groundwater pumping occurs in these areas because of declines in groundwater elevations resulting from reduced groundwater recharge by the Santa Clara River during dry years. Groundwater levels in this area have historically decreased between approximately 50 and 100 feet during multi-year periods of below-normal rainfall and Santa Clara River streamflows. Consequently, the approximate

[4]As discussed in this report and other documents (RCS, 2002; CH2M HILL, 2004a; LSCE, 2005a), the Alluvial Aquifer is more permeable and much thinner than the Saugus Formation. The eastern portion of the Alluvial Aquifer also shows considerably greater short-term (month-to-month) and long-term (year-to-year) fluctuations in groundwater levels than the rest of the Alluvial Aquifer and the Saugus Formation.

5,000 AF/yr reduction in Alluvial Aquifer pumping in dry years that is called for under the operating plan occurs primarily as reduced pumping from wells in eastern Soledad Canyon.

Elsewhere in the Alluvial Aquifer, where groundwater elevations have fluctuated much less during single-year or multi-year dry periods, reductions in pumping rates have been unnecessary. Throughout the Alluvial Aquifer, groundwater elevations have historically recovered fully in response to the normal and above-normal rainfall and stream flows that mark the end of each dry period.

The historical record of rainfall and pumping indicates that the 5,000 AF/yr of dry-year reduction in Alluvial Aquifer pumping typically occurs when rainfall is below 12 in/yr, as measured at the Newhall-Soledad rain gage. Annual rainfall at this gage was below 12 in/yr during 14 years of this 50-year period, as shown on Figure 2-5.

2.2.3.2 Variations in State Water Project Hydrology and Saugus Formation Pumping

The rate of pumping from the Saugus Formation in a given year is governed by the availability of imported water supplies, particularly imported water from the SWP system. CLWA has performed a statistical evaluation of SWP deliveries (Kennedy/Jenks Consultants, 2003) using the 2021B scenario from the CALSIM II model, which was developed by DWR for its SWP Delivery Reliability Report (DWR, 2003). The CALSIM II model and the SWP Delivery Reliability Report were developed to support (1) the preparation of urban water management plans by the water agencies that are SWP contractors, (2) analyses required to comply with Senate Bills 221 and 610, and (3) other water supply planning activities that include the SWP as a supply component. The 2021B scenario simulates the anticipated deliveries of water to the 29 SWP contractors using an historical hydrologic record and anticipated operating and regulatory conditions for the SWP system in 2021. The U.S. Bureau of Reclamation (USBR) has also used CALSIM II to perform biological assessment studies for the Operating Criteria and Plan (OCAP) for the SWP (USBR, 2004). Both the CLWA and the USBR studies, which were made public for review in February 2004, include evaluations of the role and function of an Environmental Water Account (EWA), which consists of water purchased to mitigate the water supply impacts of protection measures for endangered species. These CALSIM II simulations have been performed for the SWP system at a present-day level of development and for the anticipated level of development in 2020. Table 2-7 compares the municipal and industrial water use allocations calculated by CALSIM II for the SWP Reliability Report (DWR, 2003) and for the OCAP (USBR, 2004) for the hydrology that occurred from 1950 through 1993.

CLWA's evaluation reached the following conclusions regarding the deliveries it will receive under this scenario (Kennedy/Jenks Consultants, 2003):

1. A regression analysis indicates that there is a weak relationship between the SWP delivery in a given year and the previous year's delivery.
2. SWP deliveries will equal or exceed 70 percent of CLWA's 95,200 AF/yr Table A water amount during approximately 75 percent of the simulated years. During the remaining years, the deliveries will vary between 20 and 70 percent.
3. A Monte Carlo analysis of projected deliveries during 73 consecutive years indicated that at a 95 percent confidence level, 4 years of a 7-year drought period in the SWP

system (such as was observed from 1988 through 1994) will have sufficiently low deliveries to require short-term pumping of increased groundwater volumes to meet local water demands. This includes a period of 3 consecutive years of increased pumping.

Section 3.3.3 of this report discusses the relationship between SWP hydrology, SWP allocations to the 29 SWP contractors, and corresponding pumping from the Saugus Formation, and how this relationship was built into the modeling analysis of the groundwater operating plan.

Tables

TABLE 2-1
Recharge and Discharge Components of the Hydrologic Cycle in the Upper Santa Clara River Basin
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Recharge	Discharge
Surface Water	
Direct runoff of precipitation	Evapotranspiration of precipitation
Precipitation runoff from upstream watershed areas	Santa Clara River flow to Ventura County
Castaic Lake/Lagoon releases into Castaic Creek	Streamflow seepage to the Alluvial Aquifer
WRP discharges to the Santa Clara River	Evapotranspiration of applied irrigation water
Groundwater seepage into the Santa Clara River	
Irrigation return flows (agricultural and urban)	
Groundwater	
Infiltration of precipitation	Pumping
Infiltration of outdoor applied water (agricultural and urban)	Evapotranspiration of Alluvial Aquifer groundwater by riparian vegetation
Alluvial Aquifer subsurface inflow (Castaic Dam, Lang gage)	Alluvial Aquifer subsurface outflow (western study area boundary)
Streamflow seepage to Alluvial Aquifer	Groundwater seepage into the Santa Clara River

Notes:

The two sources of water for agricultural and municipal water uses in the basin are groundwater pumping and imported water from the SWP.

Because SWP water is stored in Castaic Lake, which is outside the limits of the Alluvial and Saugus aquifers, it is not considered a part of the valley's hydrologic cycle while it is still in storage. However, SWP water that is land-applied or that is discharged from a WRP qualifies as a component of the hydrologic cycle. In addition, subsurface groundwater flow into the Santa Clarita Valley occurs beneath Castaic Creek through water seepage beneath Castaic Dam.

TABLE 2-2
Estimated Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Calendar Year	Total Flow at Mouth of Castaic Creek (acre-feet)[a]	Total Gaged Flow at County Line (acre-feet)[b]	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[c]	Local Rainfall Condition[d]
1953	0	4,986	4,943	0	4,943	4.88	Dry
1954	977	7,316	5,554	0	5,554	15.82	Normal
1955	134	4,795	4,122	0	4,122	13.91	Normal
1956	311	5,429	3,803	0	3,803	14.21	Normal
1957	559	4,782	2,410	0	2,410	22.85	Wet
1958	21,204	38,756	5,344	0	5,344	23.14	Wet
1959	473	3,277	2,206	0	2,206	9.81	Dry
1960	1	777	586	0	586	11.64	Dry
1961	79	804	410	0	410	8.82	Dry
1962	5,101	28,460	2,433	0	2,433	21.22	Wet
1963	32	1,884	1,058	0	1,058	12.79	Normal
1964	1	1,030	646	0	646	10.09	Dry
1965	3,702	35,614	996	0	996	32.28	Wet
1966	5,780	10,101	2,332	No data	---	14.57	Normal
1967	27,819	40,480	8,640	No data	---	23.23	Wet
1968	4,381	7,216	3,895	No data	---	6.90	Dry
1969	46,461	258,660	29,395	No data	---	32.42	Wet
1970	6,597	31,066	14,924	No data	---	23.19	Wet
1971	2,310	15,883	10,843	No data	---	13.75	Normal
1972	2,205	16,027	12,975	No data	---	4.15	Dry
1973	12,671	52,631	26,115	No data	---	19.79	Wet
1974	7,288	25,265	11,918	No data	---	18.04	Wet
1975	2,027	14,770	10,806	5,534	5,272	10.92	Dry
1976	156	10,162	9,754	6,095	3,659	14.02	Normal
1977	1,380	13,454	9,359	6,004	3,355	20.87	Wet
1978	35,378	129,187	60,955	6,982	53,973	42.17	Wet
1979	13,626	57,594	42,448	7,397	35,051	21.47	Wet
1980	16,785	95,211	57,593	7,372	50,221	27.00	Wet
1981	6,519	24,232	21,172	7,949	13,223	13.42	Normal
1982	9,102	36,488	32,531	8,436	24,095	20.20	Wet
1983	67,058	131,236	55,878	9,420	46,458	39.07	Wet

TABLE 2-2
Estimated Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Calendar Year	Total Flow at Mouth of Castaic Creek (acre-feet)[a]	Total Gaged Flow at County Line (acre-feet)[b]	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[c]	Local Rainfall Condition[d]
1984	13,787	39,279	35,215	9,512	25,703	12.86	Normal
1985	2,619	24,466	24,089	9,614	14,475	8.37	Dry
1986	4,945	48,024	31,327	10,822	20,505	18.02	Wet
1987	911	26,198	23,663	11,844	11,819	14.45	Normal
1988	2,415	36,611	24,934	12,363	12,571	16.92	Wet
1989	Unavailable	24,799	23,453	13,560	9,893	7.56	Dry
1990	0	23,472	21,772	14,006	7,766	6.98	Dry
1991	65	34,901	18,702	14,108	4,594	17.21	Wet
1992	4,450	68,577	23,601	15,703	7,898	32.03	Wet
1993	7,725	152,783	65,054	17,179	47,875	32.72	Wet
1994	Unavailable	32,039	31,239	16,946	14,293	10.27	Dry
1995	5,611	82,409	51,001	17,824	33,177	29.15	Wet
1996	5,632	47,930	36,366	16,831	19,535	15.88	Normal
1997	9,885	36,780	27,521	15,778	11,743	13.35	Normal
1998	47,803	205,139	81,744	17,695	64,049	30.73	Wet
1999	5,830	32,382	27,176	17,847	9,329	8.96	Dry

[a]Values through June 1977 are from the former Castaic Creek South gage (U.S. Geologic Survey [USGS] Gage Station 11108145). Values after June 1977 are derived from records of releases from Castaic Dam/Lagoon into Castaic Creek, as provided by DWR.

[b]Values through September 30, 1996, are from USGS Gage Station 11108500. This gage was located immediately downstream of the Los Angeles-Ventura County Line and was taken permanently out of service after October 21, 1996. Data beginning on October 1, 1996, are from new USGS gage station 11109000, located approximately 2.5 miles farther downstream, near Piru Junction, at the Las Brisas Bridge.

[c]Annual rainfall values are based on monthly records for this gage, as reported by the National Climate Data Center and LADPW.

[d]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-3
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	311	4,795	2,410	0	2,410	13.91
Average	2,506	10,608	2,655	0	2,655	15.50
Maximum	21,204	38,756	5,554	0	5,554	32.28
Statistics for 1975 through 1999						
Minimum	0	10,162	9,359	5,534	3,355	6.98
Median	5,632	36,611	27,521	11,844	14,293	16.92
Average	11,466	57,125	33,894	11,873	22,021	19.38
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	3,161	30,250	22,613	11,844	8,613	15.14
Average	8,230	41,211	23,207	11,873	15,396	18.05
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	4,450	28,460	18,702	11,844	8,613	15.82
Average	9,151	43,050	21,338	11,873	15,396	17.92
Maximum	67,058	258,660	81,744	17,847	64,049	42.17

TABLE 2-4
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1965 versus 1975 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 5 Dry Years during 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	1	1,030	646	0	646	9.81
Average	111	2,175	1,758	0	1,758	9.05
Maximum	473	4,986	4,943	0	4,943	11.64
Statistics for 4 Normal Years during 1953 through 1965						
Minimum	32	1,884	1,058	0	1,058	12.79
Median	222	5,112	3,963	0	3,963	14.06
Average	363	4,856	3,634	0	3,634	14.18
Maximum	977	7,316	5,554	0	5,554	15.82
Statistics for 4 Wet Years during 1953 through 1965						
Minimum	559	4,782	996	0	996	21.22
Median	4,402	32,037	2,421	0	2,421	23.00
Average	7,641	26,903	2,796	0	2,796	24.87
Maximum	21,204	38,756	5,344	0	5,344	32.28
Statistics for 6 Dry Years during 1975 through 1999						
Minimum	0	14,770	10,806	5,534	5,272	6.98
Median	2,323	24,633	23,771	13,783	9,611	8.67
Average	2,619	25,322	23,089	12,918	10,171	8.84
Maximum	5,830	32,382	31,239	17,847	14,475	10.92
Statistics for 6 Normal Years during 1975 through 1999						
Minimum	156	10,162	9,754	6,095	3,659	12.86
Median	6,076	31,489	25,592	10,678	12,521	13.72
Average	6,148	30,763	25,615	11,335	14,280	14.00
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 13 Wet Years during 1975 through 1999						
Minimum	65	13,454	9,359	6,004	3,355	16.92
Median	7,725	68,577	42,448	10,822	33,177	27.00
Average	16,642	83,970	42,702	11,639	31,063	26.74
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-5
Statistics on Annual Groundwater Discharge to the Santa Clara River, Including and Excluding 1966 through 1974
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 13 Dry Years during 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	473	14,770	10,806	13,783	5,272	8.82
Average	1,601	14,311	12,630	12,918	6,347	8.41
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 12 Normal Years during 1953 through 1999						
Minimum	0	7,316	2,433	6,004	2,433	13.35
Median	5,101	26,198	21,172	11,844	11,743	16.92
Average	5,238	27,883	16,963	10,788	8,671	17.10
Maximum	12,671	52,631	27,521	15,778	13,223	21.22
Statistics for 22 Wet Years during 1953 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	7,507	44,252	25,525	10,822	20,505	23.17
Average	15,807	73,060	29,877	11,639	24,412	25.62
Maximum	67,058	258,660	81,744	17,824	64,049	42.17
Statistics for 11 Dry Years during 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	79	14,770	10,806	13,783	5,272	8.96
Average	1,226	14,800	13,393	12,918	6,347	8.94
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 10 Normal Years during 1953 through 1965 and 1975 through 1999						
Minimum	32	1,884	1,058	6,095	1,058	12.79
Median	944	17,197	15,463	10,678	8,649	13.97
Average	3,834	20,400	16,823	11,335	10,022	14.07
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 17 Wet Years during 1953 through 1965 and 1975 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	5,611	48,024	31,327	10,822	20,505	23.14
Average	14,524	70,543	33,312	11,639	24,412	26.30
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-6
Annual Pumping Rates Specified by the Operating Plan for Santa Clarita Valley Groundwater Resources
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Aquifer	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Operating Plan Pumping				
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**
Modeled Pumping				
Alluvium	38,429	33,767	33,767	33,767
Saugus	10,679	15,760	24,346	34,096
Total	**49,108**	**49,527**	**58,113**	**67,863**

Notes:

All pumping volumes are listed in acre-feet.

The operating plan is defined in the Amended 2000 UWMP (Black & Veatch, 2000; CLWA et al., 2005).

In the model simulations, total pumping is different than listed in this table when dry-year pumping conditions in one aquifer coincide with normal-year pumping conditions in the other aquifer (because of differences in the timing of dry conditions locally versus reduced deliveries of SWP water imports).

TABLE 2-7
CALSIM II Calculated State Water Project Municipal and Industrial Allocations
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	OCAP Current EWA[a]	OCAP Future EWA[a]	2020 SWP Reliability[b]
1950	0.88	0.91	0.79
1951	1.00	1.00	0.96
1952	1.00	1.00	1.00
1953	1.00	1.00	0.95
1954	1.00	1.00	0.96
1955	0.44	0.45	0.43
1956	1.00	1.00	1.00
1957	0.94	0.91	0.75
1958	1.00	1.00	1.00
1959	0.84	0.88	0.83
1960	0.51	0.55	0.56
1961	0.68	0.72	0.76
1962	0.93	0.98	0.87
1963	1.00	1.00	1.00
1964	0.84	0.74	0.73
1965	0.87	0.81	0.77
1966	1.00	1.00	0.92
1967	1.00	1.00	1.00
1968	0.89	0.90	0.85
1969	1.00	1.00	1.00
1970	1.00	1.00	0.95
1971	1.00	1.00	1.00
1972	0.76	0.75	0.65
1973	1.00	1.00	0.91
1974	1.00	1.00	1.00
1975	1.00	1.00	1.00
1976	0.78	0.75	0.65
1977	0.03	0.04	0.20
1978	1.00	1.00	1.00
1979	1.00	0.94	0.89
1980	1.00	0.91	0.85
1981	0.90	0.92	0.84
1982	1.00	1.00	1.00
1983	1.00	1.00	1.00
1984	0.66	1.00	0.99
1985	0.97	0.91	0.83
1986	0.74	0.70	0.78
1987	0.70	0.77	0.71
1988	0.12	0.17	0.23
1989	0.96	0.95	0.83
1990	0.24	0.27	0.28
1991	0.24	0.29	0.25
1992	0.39	0.43	0.29
1993	1.00	1.00	1.00

[a]Source: USBR, 2004

[b]Source: DWR, 2003

Figures

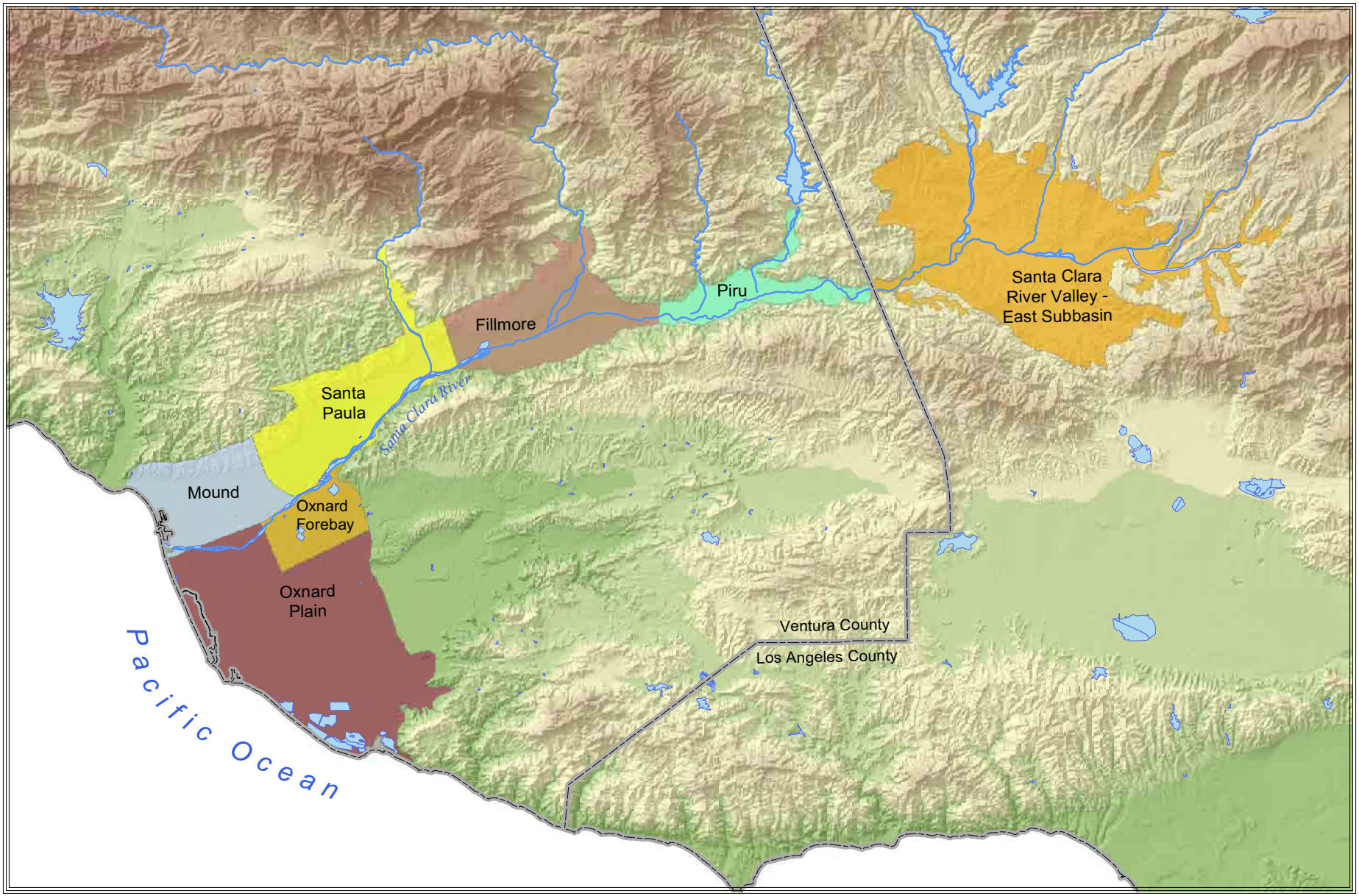

FIGURE 2-1
GROUNDWATER BASINS IN THE SANTA CLARA RIVER DRAINAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

E062005007RDD_08 (7/8/05)

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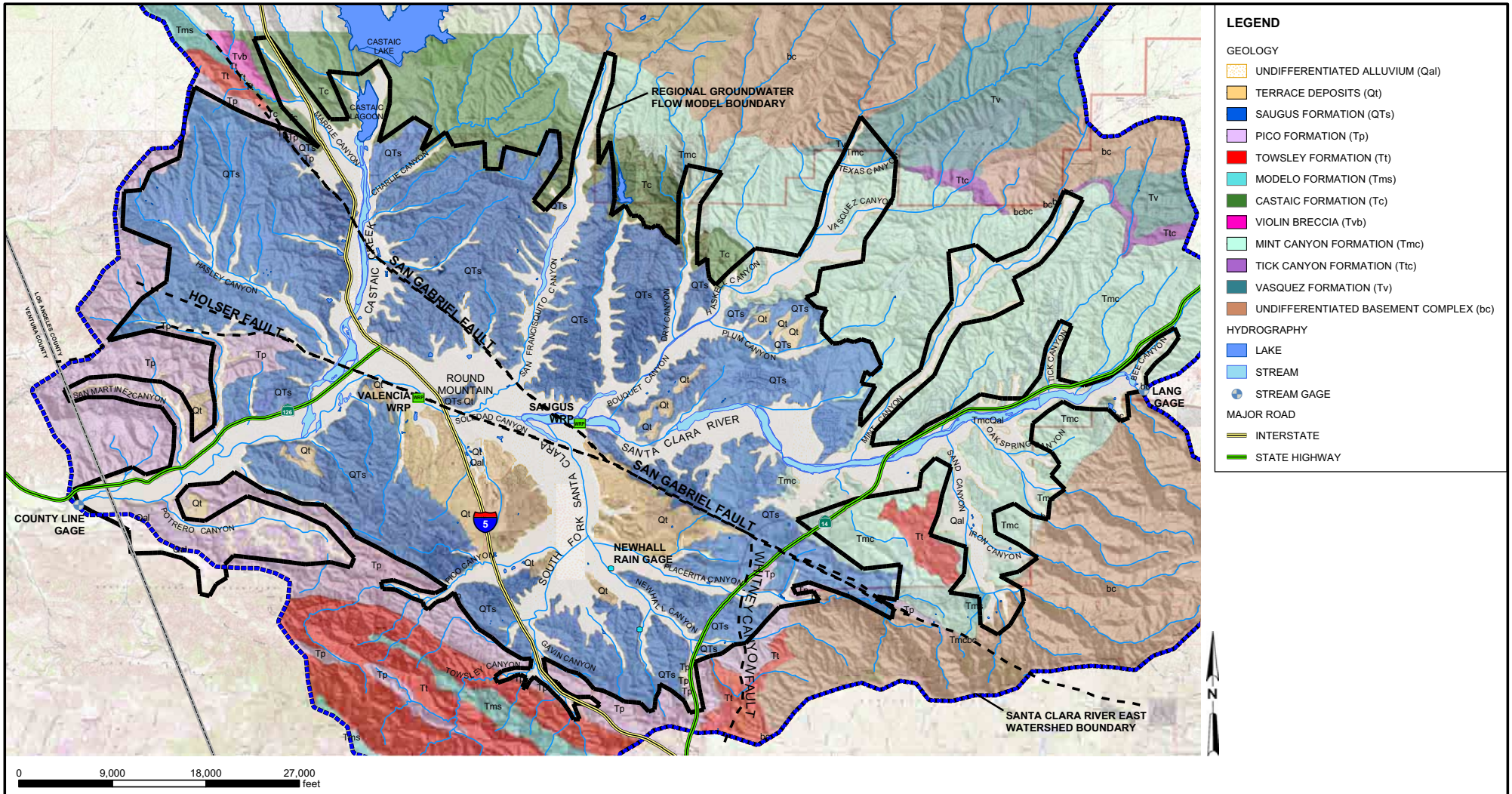

LEGEND

GEOLOGY

- UNDIFFERENTIATED ALLUVIUM (Qal)
- TERRACE DEPOSITS (Qt)
- SAUGUS FORMATION (QTs)
- PICO FORMATION (Tp)
- TOWSLEY FORMATION (Tt)
- MODELO FORMATION (Tms)
- CASTAIC FORMATION (Tc)
- VIOLIN BRECCIA (Tvb)
- MINT CANYON FORMATION (Tmc)
- TICK CANYON FORMATION (Ttc)
- VASQUEZ FORMATION (Tv)
- UNDIFFERENTIATED BASEMENT COMPLEX (bc)

HYDROGRAPHY

- LAKE
- STREAM
- STREAM GAGE

MAJOR ROAD

- INTERSTATE
- STATE HIGHWAY

FIGURE 2-2
BASIN GEOLOGIC MAP
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

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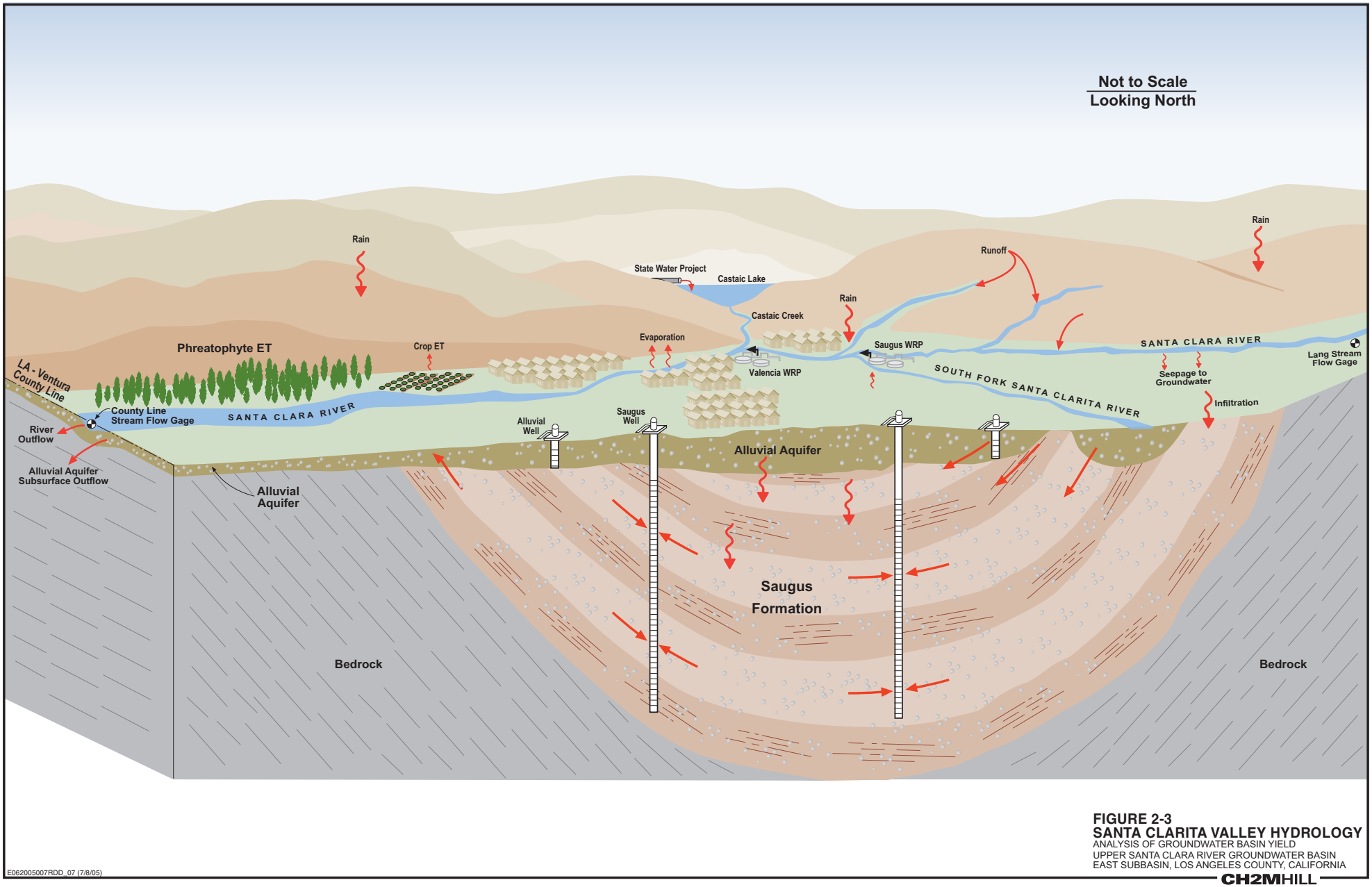

FIGURE 2-3
SANTA CLARITA VALLEY HYDROLOGY
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

E062005007RDD_07 (7/8/05)

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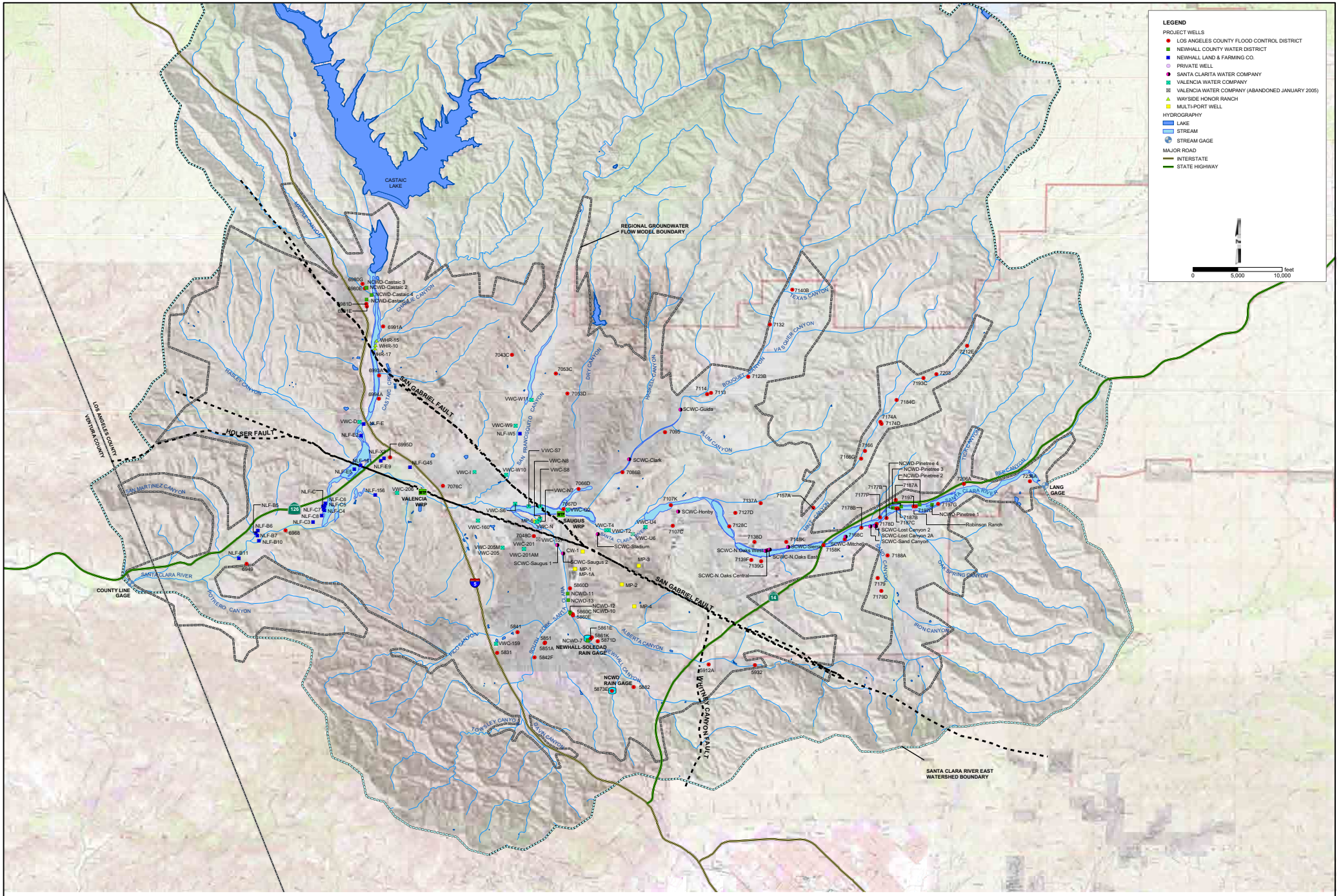

LEGEND
PROJECT WELLS
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
NEWHALL COUNTY WATER DISTRICT
NEWHALL LAND & FARMING CO.
PRIVATE WELL
SANTA CLARITA WATER COMPANY
VALENCIA WATER COMPANY
VALENCIA WATER COMPANY (ABANDONED JANUARY 2005)
WAYSIDE HONOR RANCH
MULTI-PORT WELL
HYDROGRAPHY
LAKE
STREAM
STREAM GAGE
MAJOR ROAD
INTERSTATE
STATE HIGHWAY
feet
0
5,000
10,000
CASTAIC LAKE
REGIONAL GROUNDWATER FLOW MODEL BOUNDARY
SAN GABRIEL FAULT
HOLSER FAULT
WALKER CANYON FAULT
SANTA CLARA RIVER EAST WATERSHED BOUNDARY
LOS ANGELES COUNTY
VENTURA COUNTY
COUNTY LINE GAGE
VALENCIA WRP
SAUGUS WRP
NEWHALL-SOLEDAD RAIN GAGE
NCWD RAIN GAGE
LANG GAGE
SANTA CLARA RIVER
SAN MARTINEZ CANYON
TRASLEY CANYON
CASTAIC CREEK
GRANDE CANYON
SAN FRANCISQUITO CANYON
DRY CANYON
HASKELL CANYON
BOUQUET CANYON
VASQUEZ CANYON
TEXAS CANYON
ELSMERE CANYON
POTRERO CANYON
PICO CANYON
SOUTH FORK SANTA CLARA RIVER
ALBERTA CANYON
NEWHALL CANYON
TOWSLEY CANYON
GALLON CANYON
DRY CREEK
BEER CANYON
DEER CREEK
OAK SPRING CANYON
IRON CANYON
SCWC-Clark
SCWC-Guida
SCWC-Honby
SCWC-Stadium
SCWC-Saugus 1
SCWC-Saugus 2
SCWC-N.Oaks West
SCWC-N.Oaks East
SCWC-N.Oaks Central
SCWC-Sierra
SCWC-Mitchell
SCWC-Lost Canyon 2
SCWC-Lost Canyon 2A
SCWC-Sand Canyon
NCWD-Castaic 3
NCWD-Castaic 2
NCWD-Castaic 4
NCWD-Castaic 1
NCWD-Pinetree 4
NCWD-Pinetree 3
NCWD-Pinetree 2
NCWD-Pinetree 1
Robinson Ranch
MP-1
MP-1A
MP-2
MP-3
MP-4
MP-5
CW-1
NCWD-11
NCWD-13
NCWD-12
NCWD-10
NCWD-7
VWC-I
VWC-N
VWC-N7
VWC-N8
VWC-S7
VWC-S8
VWC-S6
VWC-W10
VWC-W11
VWC-W9
VWC-T2
VWC-T4
VWC-U4
VWC-U6
VWC-160
VWC-201
VWC-201AM
VWC-205
VWC-205M
VWC-202
VWC-203
VWC-159
NLF-W5
NLF-D
NLF-E
NLF-E2
NLF-E5
NLF-E6
NLF-E9
NLF-G45
NLF-C
NLF-C4
NLF-C5
NLF-C6
NLF-C7
NLF-C8
NLF-G3
NLF-156
NLF-B5
NLF-B6
NLF-B7
NLF-B10
NLF-B11
WHR-15
WHR-10
WHR-17
6980C
6980E
6981D
6981E
6991A
6995D
6998A
6994A
6968
6949
7043C
7053C
7053D
7076C
7066D
7067D
7086B
7095
7107K
7107C
7127D
7128C
7137A
7138D
7139F
7139G
7148K
7157A
7158K
7166
7166G
7168C
7174A
7174D
7177B
7177F
7178B
7178D
7179
7179D
7187A
7187B
7187C
7188A
7197
7197G
7206A
7212E
7123B
7114
7132
7140B
7193C
7203
7184C
5841
5851
5851A
5842F
5831
5860C
5860D
5860E
5861E
5861K
5871D
5912A
5932
5873E
5862
FIGURE 2-4
REGIONAL WELL LOCATION MAP
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA
CH2MHILL

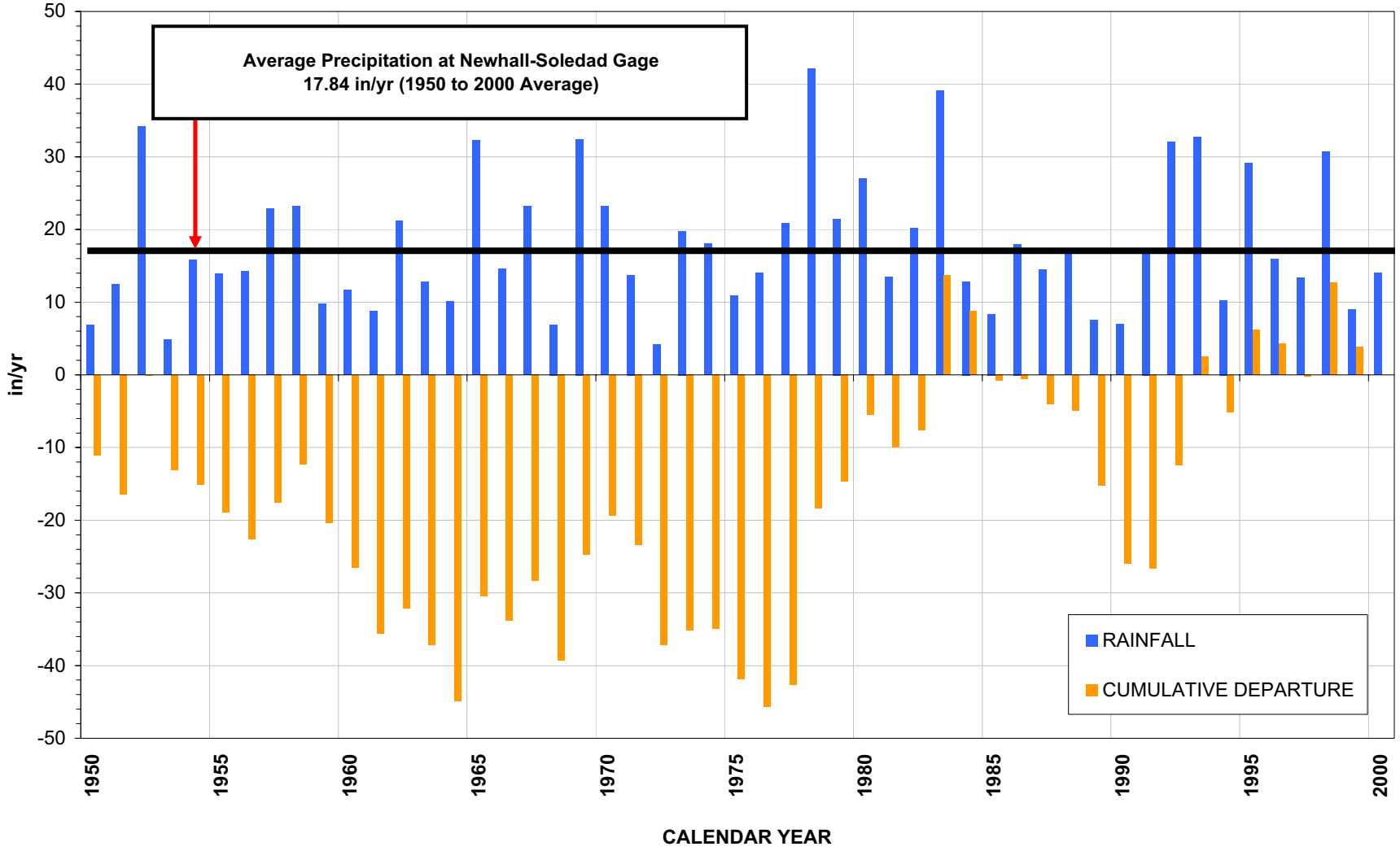


FIGURE 2-5
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 THROUGH 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE

ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

178973-411.xls/FIG2-5

CH2MHILL

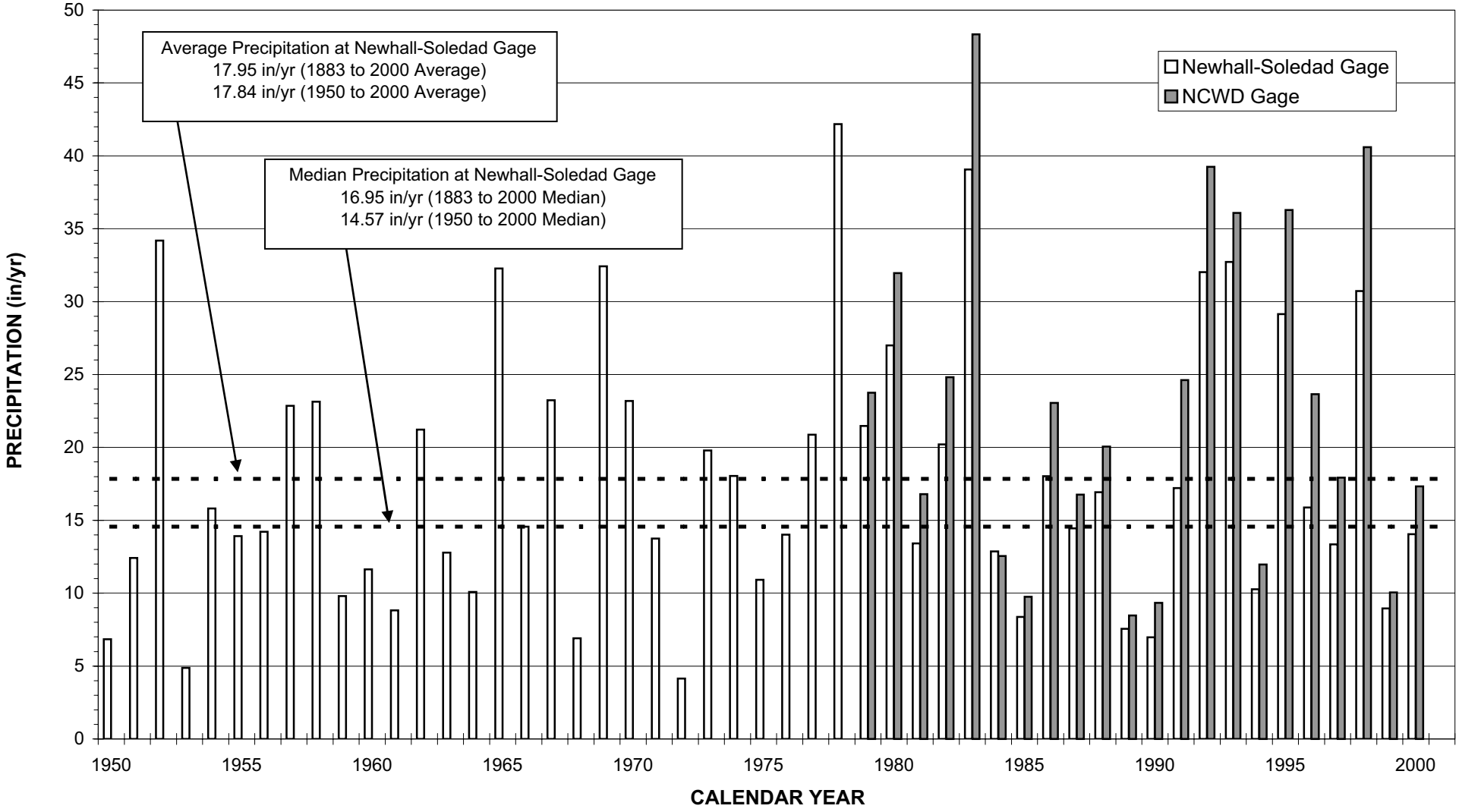
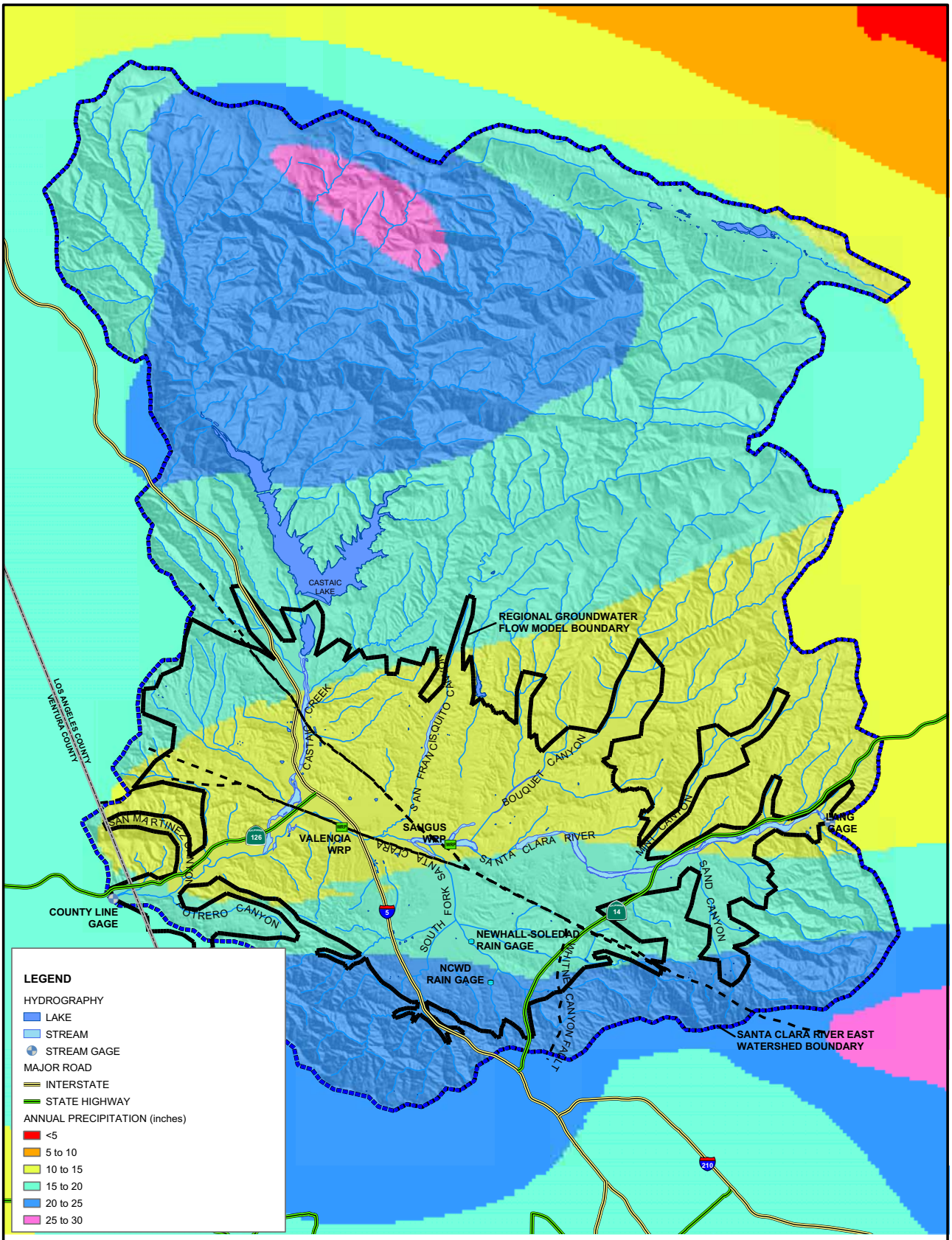


FIGURE 2-6
ANNUAL PRECIPITATION AT THE NEWHALL-SOLEDAD AND NCWD RAIN GAGES SINCE 1950
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

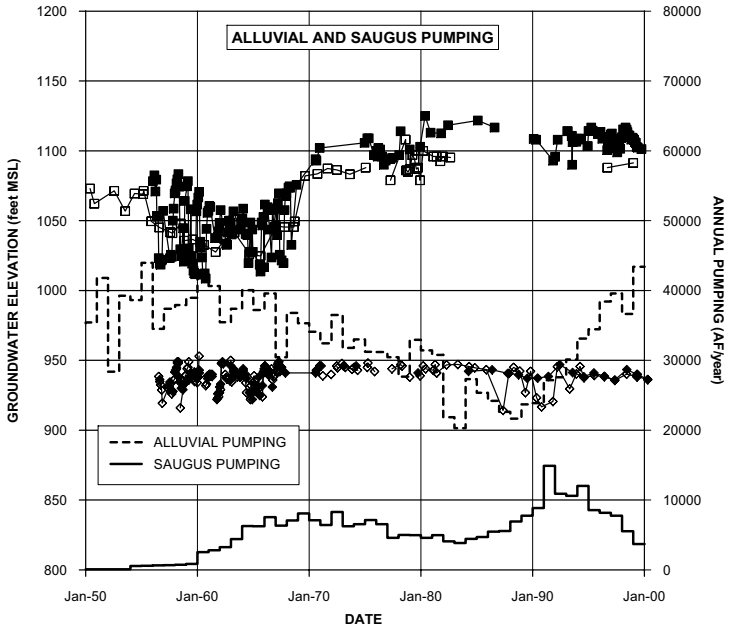
178973-412.xls\Fig 2-5

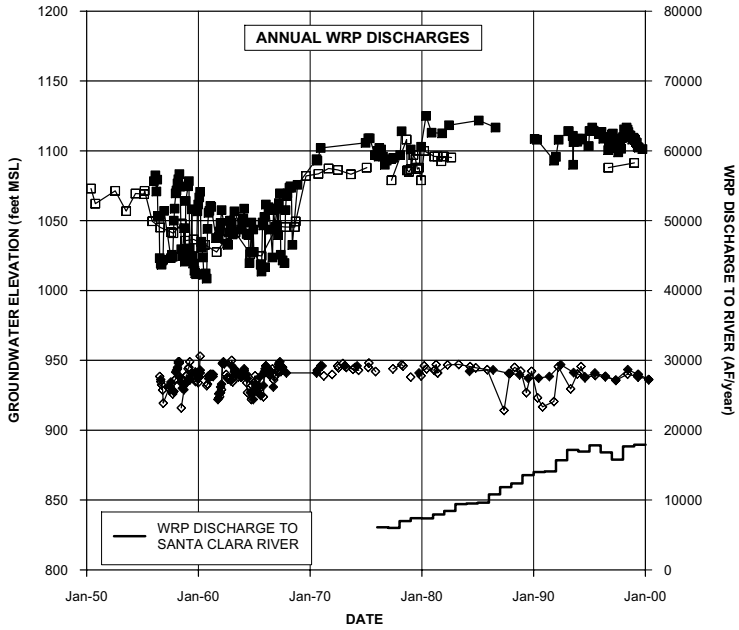


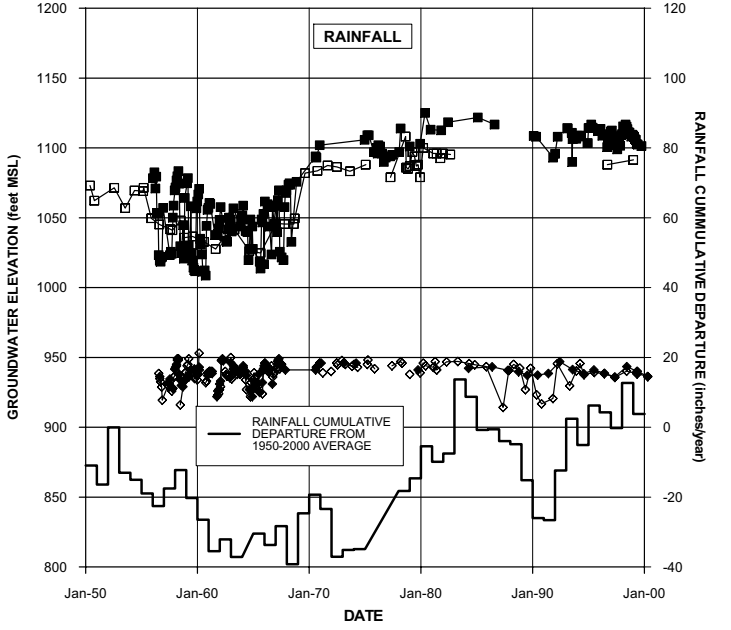
SOURCE: SEE THE INTERNET SITE HTTP://GIS.CA.GOV/META.EPL?OID=286 FOR MORE INFORMATION.

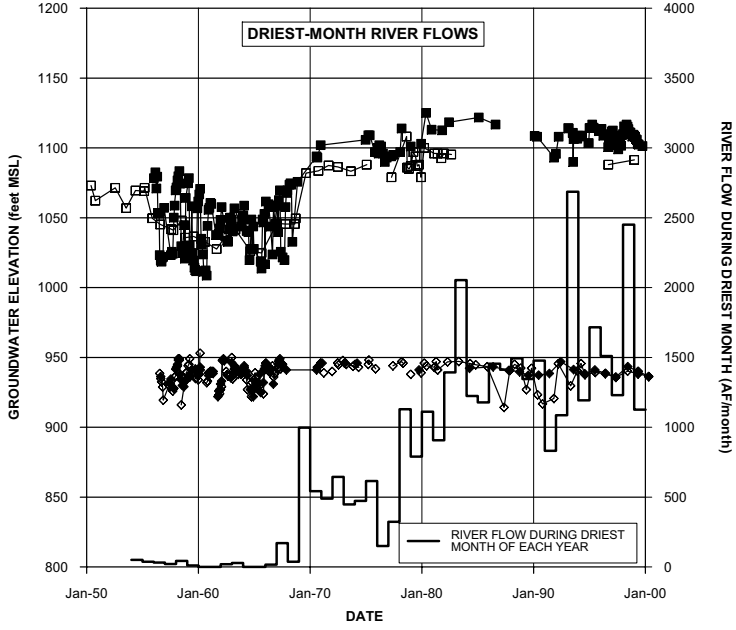
FIGURE 2-7
ISOHYETAL MAP SHOWING AVERAGE ANNUAL PRECIPITATION PATTERN FROM 1900 TO 1960
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL









LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N
- ELEVATION OF GROUNDWATER IN NLF-S
- ELEVATION OF GROUNDWATER IN NLF-C5
- ELEVATION OF GROUNDWATER IN NLF-C7

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS. FORMER WELL NLF-S WAS LOCATED 940 feet SOUTHWEST OF WELL VWC-S6.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-8
ALLUVIAL GROUNDWATER ELEVATIONS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

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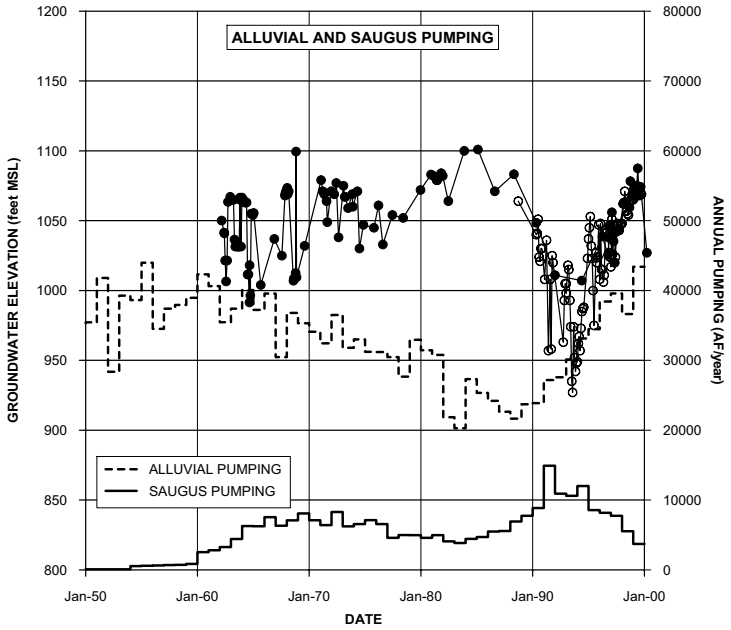

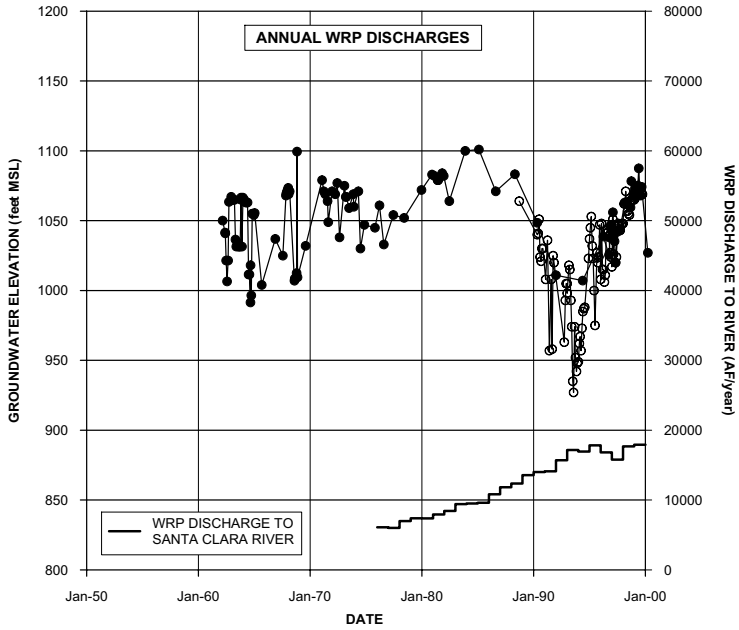

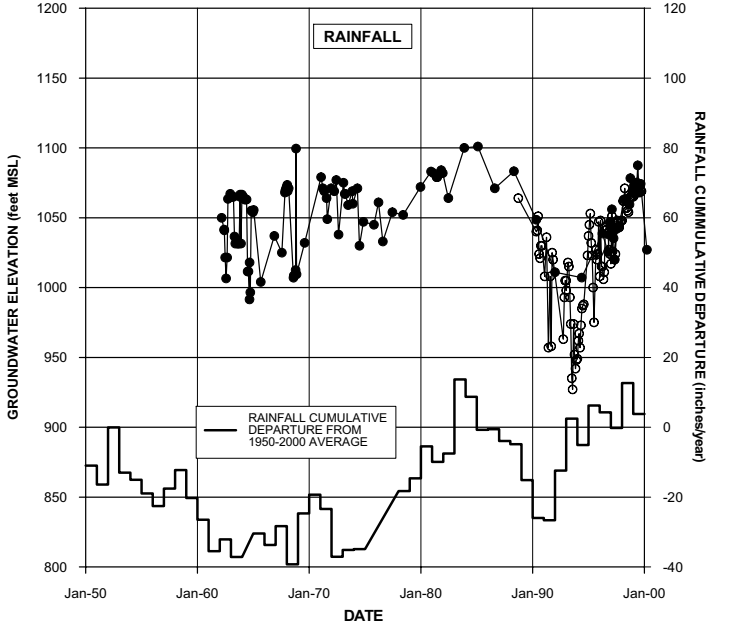

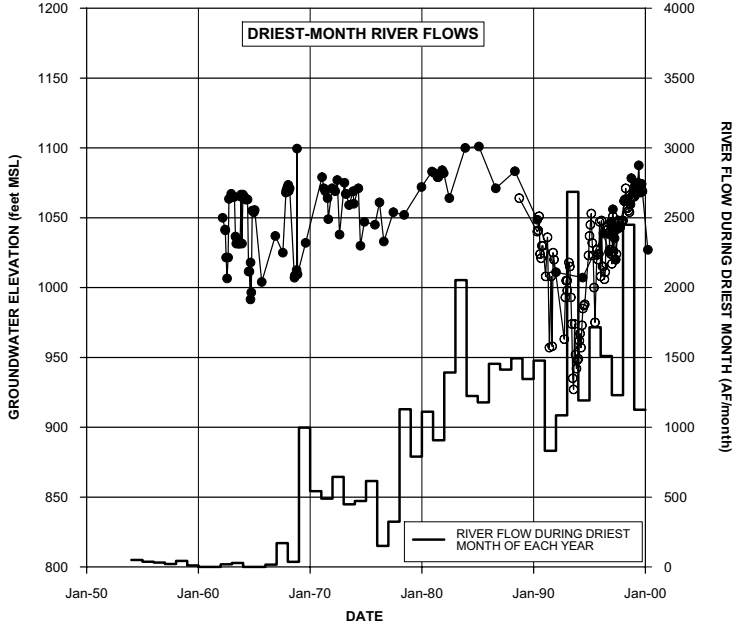

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157 (DESTROYED JANUARY 2005)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-9
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

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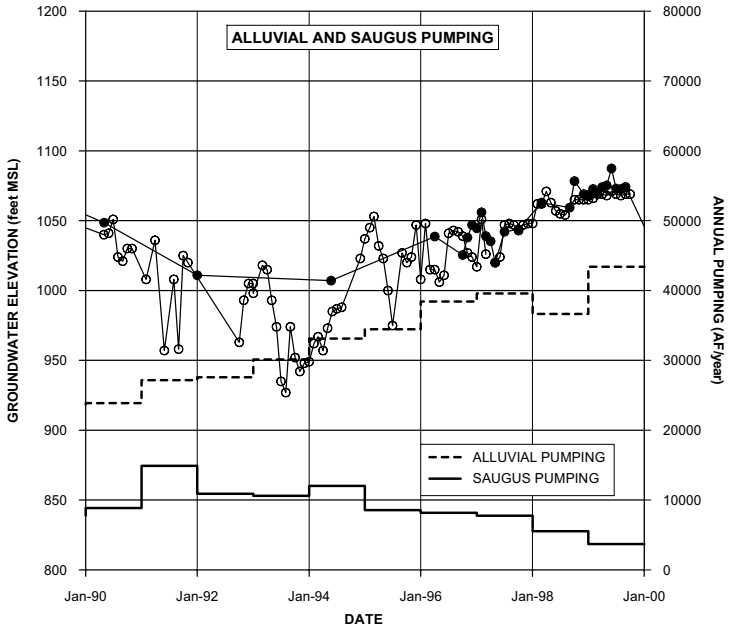

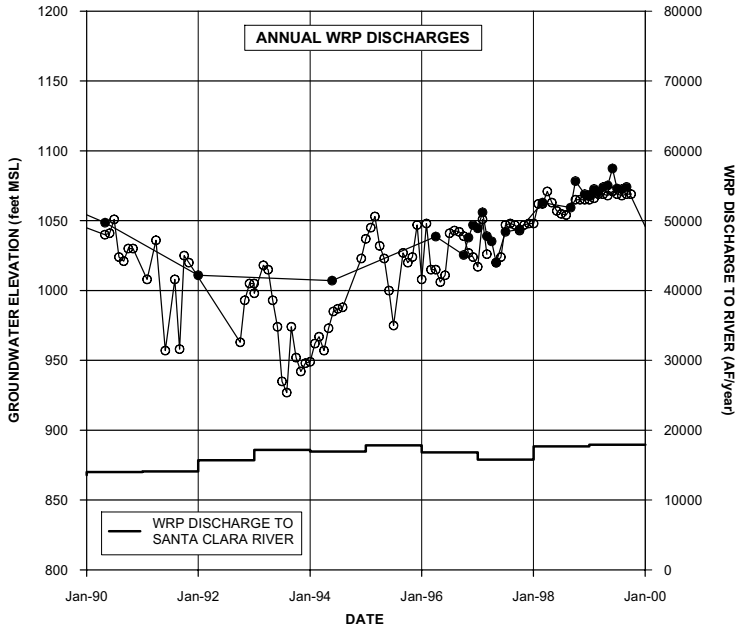

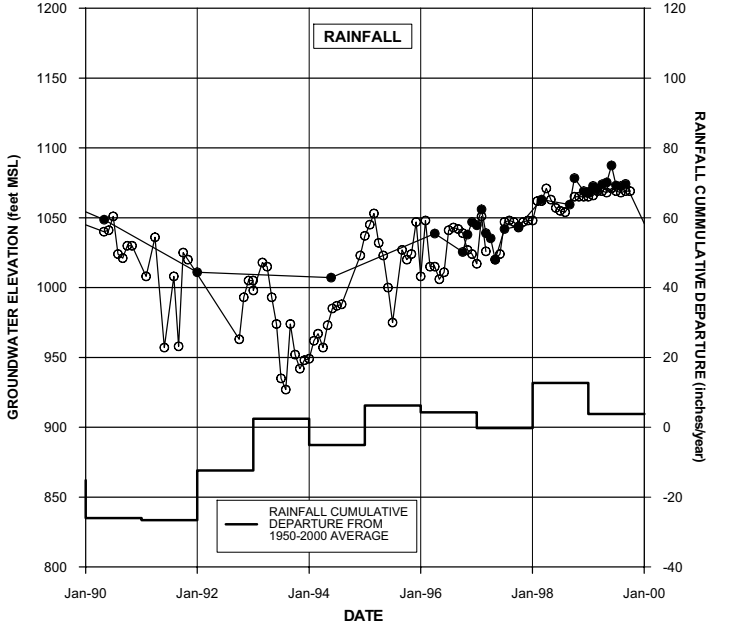

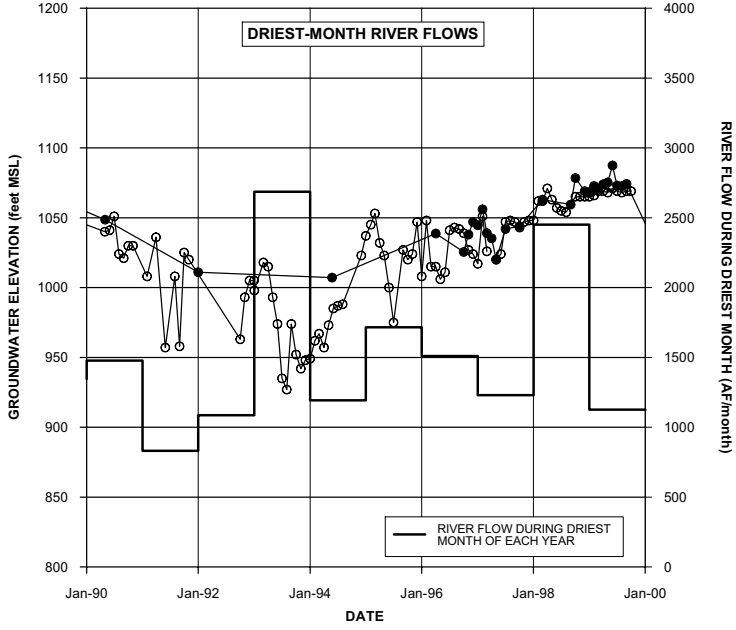

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157 (ABANDONED JANUARY 2005)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-10
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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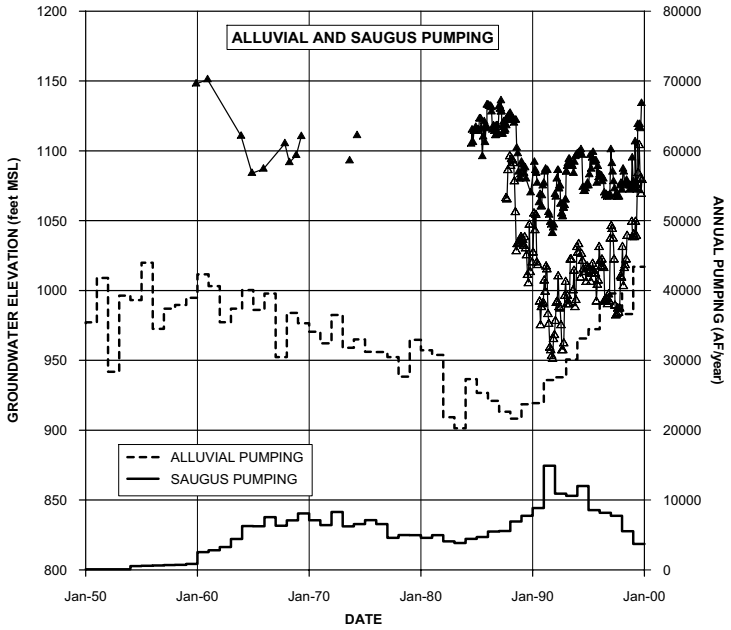

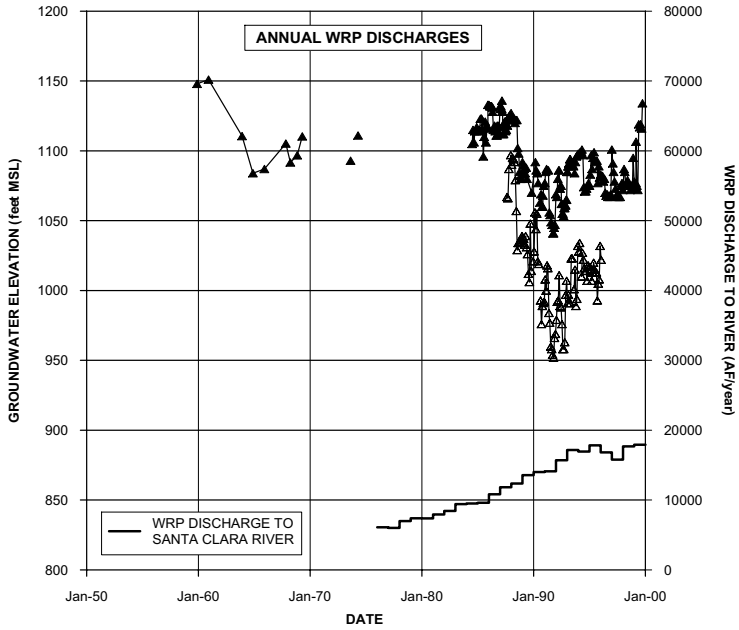

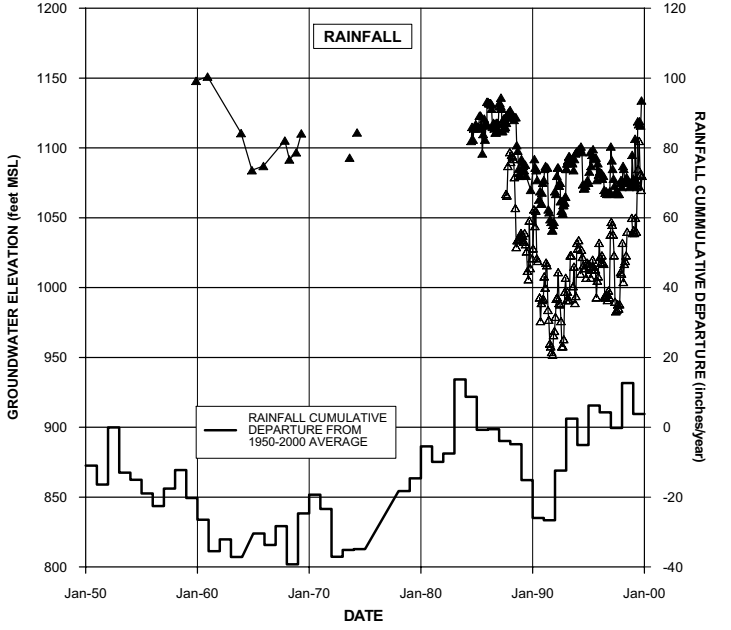

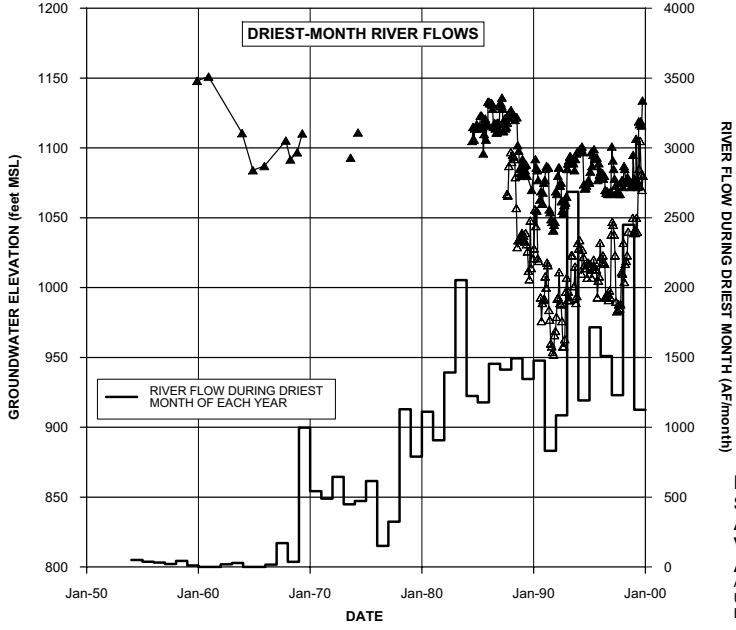

LEGEND

- ELEVATION OF GROUNDWATER IN NCWD-7
- ELEVATION OF GROUNDWATER IN NCWD-12

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-11
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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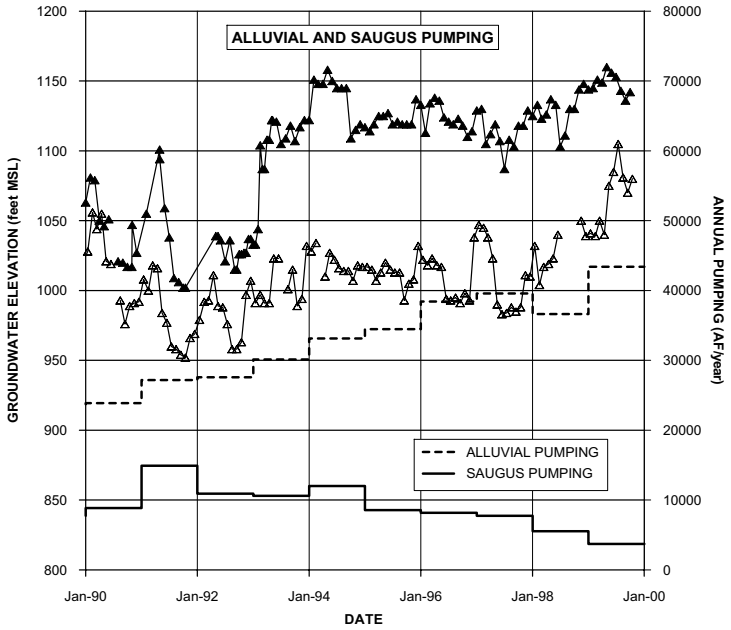

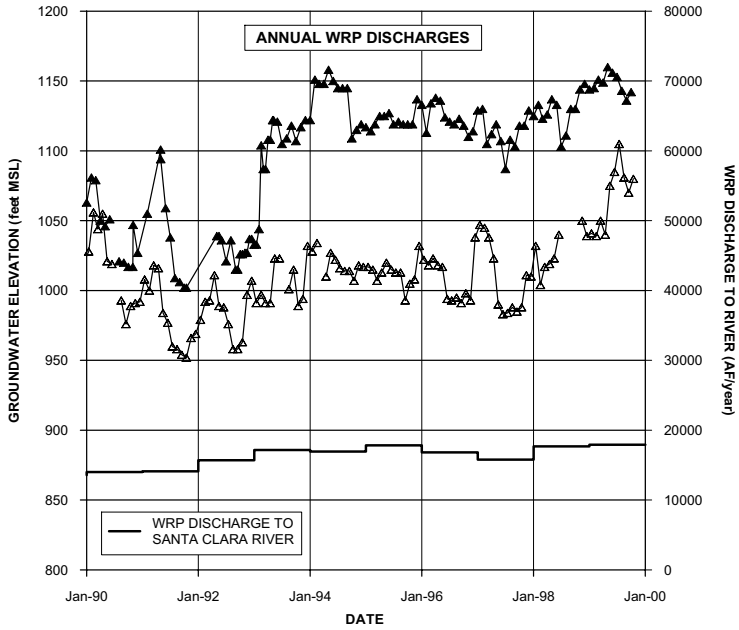

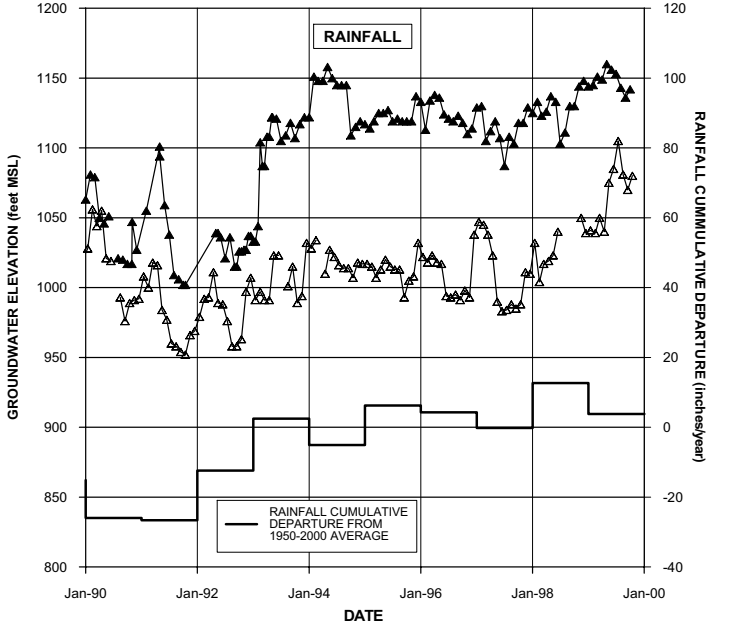

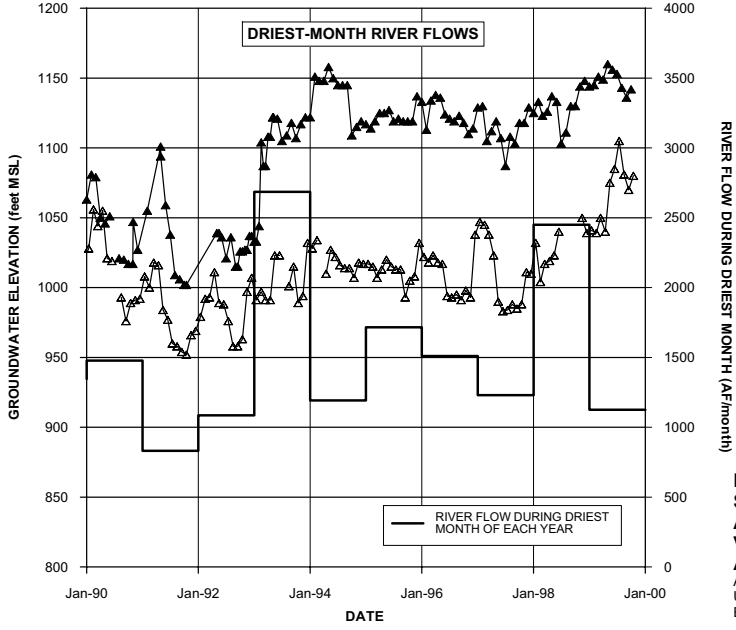

LEGEND

ELEVATION OF GROUNDWATER IN NCWD-10
ELEVATION OF GROUNDWATER IN NCWD-12

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-12
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

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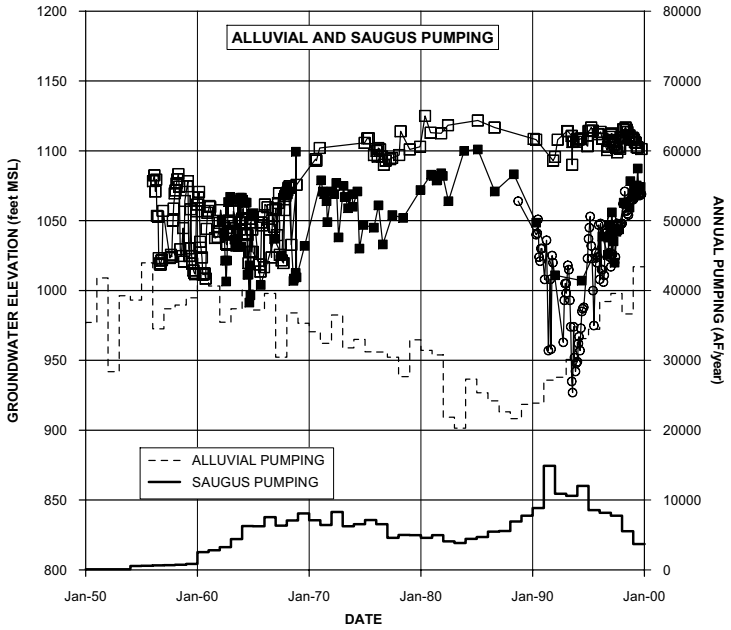

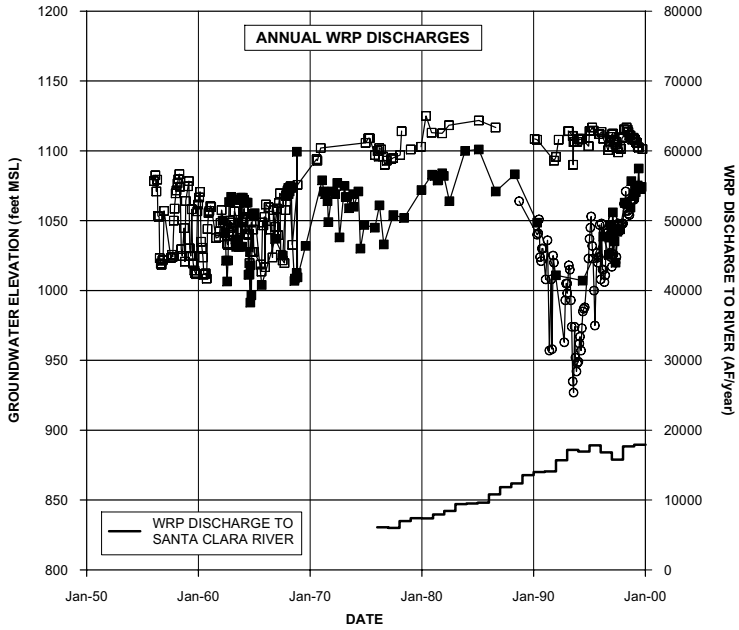

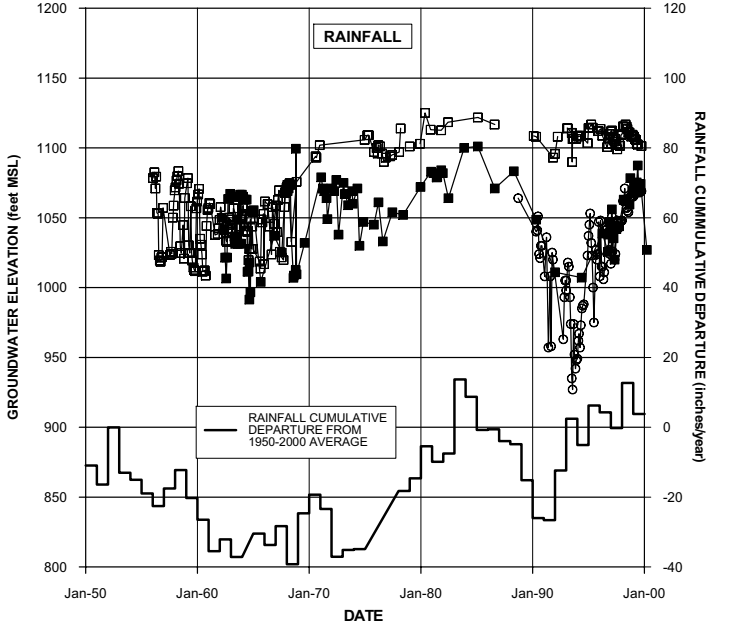

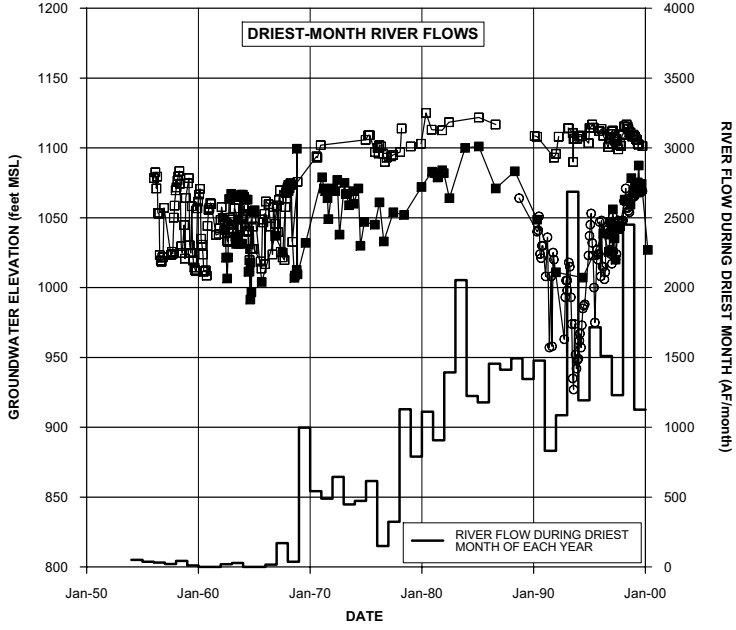

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N (ALLUVIUM)
- ELEVATION OF GROUNDWATER IN VWC-157 (SAUGUS)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2 (SAUGUS)

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-13
GROUNDWATER ELEVATIONS IN ADJACENT ALLUVIAL AND SAUGUS WELLS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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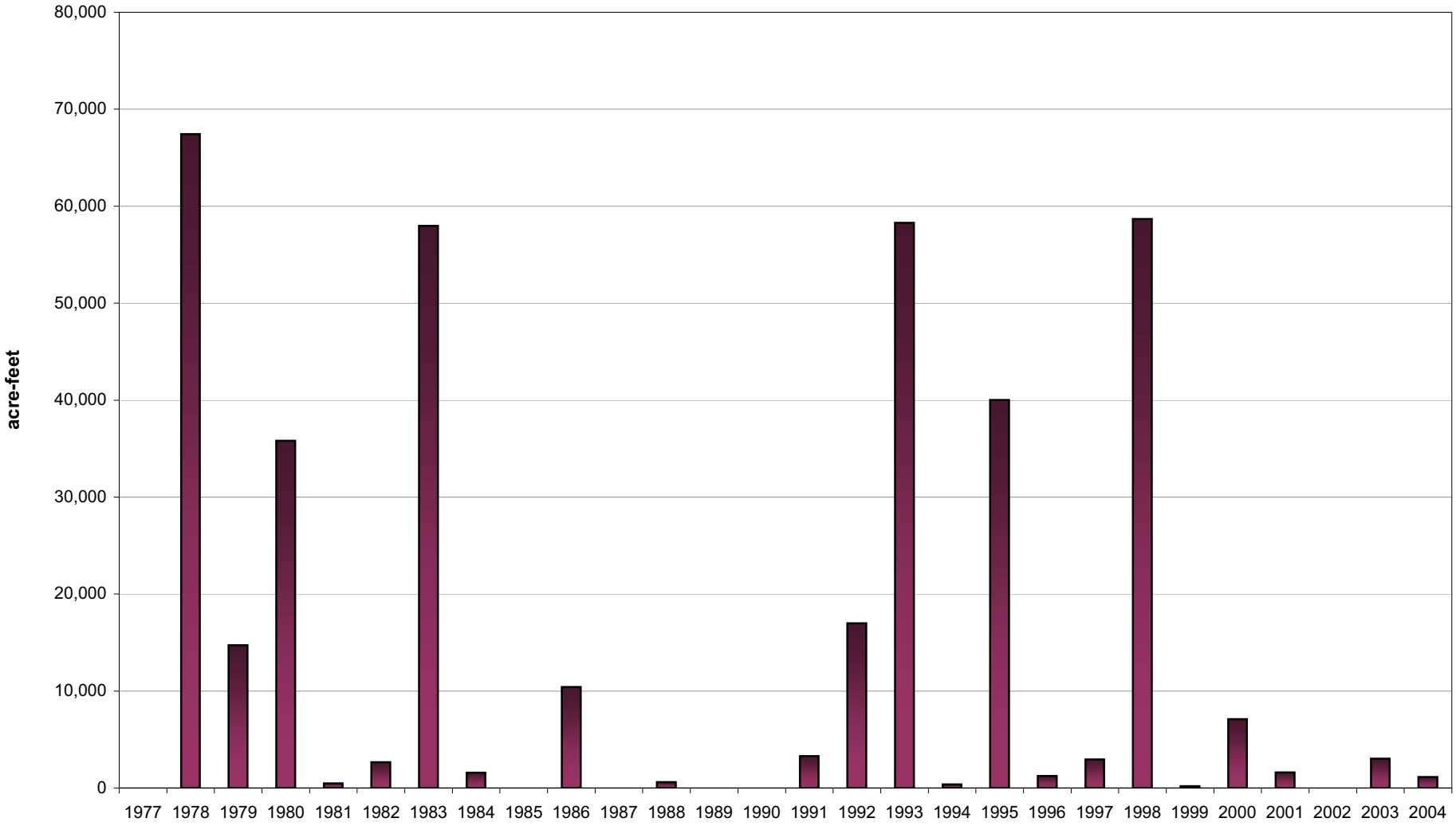

Note:
This chart shows the potential Flood Flows available during water years 1977 through 2004. Water Year 1977 is defined as October 1, 1976, through September 30, 1977, but the water is generally available only from October 1 through April 30.

FIGURE 2-14
HISTORICAL CASTAIC CREEK FLOOD FLOWS AVAILABLE TO DOWNSTREAM USERS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

178973-413.xls\FIG2-14

SECTION 3

Modeling Approach for Analyzing Basin Yield

The approach to using the Regional Model for the basin yield analysis began with identifying a simulation period spanning several decades to capture short-term (year-to-year) and longer-term (multi-year) variations in pumping from both aquifer systems. Pumping was then assigned in the Regional Model in accordance with historical and current uses of each production well, and in consideration of how the pumping rate assignments are currently impacted by the presence of perchlorate in groundwater in specific areas. Regional Model simulation results were then studied to evaluate short-term and long-term trends in groundwater elevations, groundwater budgets, and river flows. This section presents the design details of this modeling evaluation.

3.1 Model Description

The Regional Model is a three-dimensional, numerical model that uses MicroFEM® finite-element software (Hemker and de Boer, 2003). The Regional Model covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. Figure 3-1 shows the model domain, along with its location relative to the upstream watersheds that contribute runoff into the model study area. The Regional Model's construction and calibration is summarized in Appendix B and discussed in detail in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a).

The Regional Model area largely coincides with the Santa Clara River Valley Groundwater Basin, East Subbasin, delineated by DWR, extending from the Lang stream gage at the eastern end of the valley to the County Line stream gage area in the west. The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. Figure 3-2 shows the spacing of the individual nodes that make up the grid. The upper model layer simulates the Alluvial Aquifer and also the upper portion of the Saugus Formation where the Alluvial Aquifer is not present. The underlying layers simulate the underlying freshwater Saugus Formation and its Sunshine Ranch Member. The layer representation is summarized schematically on Figure 3-3. Figure 3-4 shows the model layering in three cross-sectional views.

The boundary conditions in the model consist of the following:

1. Specified flux boundaries for the following:

    a. Precipitation
    b. Irrigation
    c. Recharge from ephemeral streams
    d. Pumping
    e. Underflow from beneath Castaic Dam

2. Head-dependent flux boundaries for the following:
    a. Groundwater discharges to the perennial reach of the Santa Clara River
    b. Residual drainage of groundwater to the Santa Clara River in the ephemeral reach under high water table conditions
    c. Evapotranspiration (ET) by phreatophyte plants, which extract groundwater from the shallow water table that lies along riparian river corridors
3. Constant-head boundaries for the following:
    a. Subsurface inflow in the Alluvial Aquifer at the eastern end of the valley, at the Lang gage[5]
    b. Subsurface outflow in the Alluvial Aquifer at the western end of the valley, at the County Line gage

Groundwater recharge rates are estimated using precipitation records; streamflow records; watershed maps; topographic maps; and aerial photography. These recharge rates are calculated using a detailed Surface Water Routing Model (SWRM), which was written specifically to provide time-dependent, spatially varying recharge rates as input to the Regional Model. The SWRM relies on streamflow records at the Lang and County Line gages; historical records of rainfall data from the NCWD rain gage (see Figure 1-1 for the location of this gage); spatial variations in rainfall across the basin (see Figure 2-7); and, for the basin yield analysis, the rates and locations of future WRP discharges to the Santa Clara River and irrigation from agricultural and urban water uses.

The depths from which production wells obtain water are defined in the Regional Model from well construction records. The rates and locations of pumping are based on the Purveyors' operating plan for the basin and on the surveyed location of each production well.

3.2 Modeling Approach

The process of designing the modeling analysis of the operating plan for the basin consisted of the following five activities:

1. Selecting a period over which to simulate groundwater conditions resulting from various pumping configurations
2. Defining pumping rates and schedules for each production well in the Santa Clarita Valley, considering the variability in pumping demands that occur due to cycles of drought and nondrought conditions and year-to-year variations in the availability of other water supplies
3. Defining the variation in local hydrology (rainfall, streamflows, and groundwater recharge) on a month-to-month basis throughout the simulation period

[5]A constant-head boundary was established in the Regional Model at this location using recent field conditions that were observed after the model calibration report (CH2M HILL, 2004a) was published. This change improved the Regional Model's calibration in the Alluvial Aquifer in the upper reaches of Soledad Canyon and did not appreciably change the calibration quality elsewhere. See CH2M HILL (2005) for further details.

4. Running the model to calculate time-varying (monthly) groundwater elevations and groundwater discharge terms throughout the multi-year simulation period
5. Evaluating the modeling results by examining forecasted time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the effects of the operating plan in the Alluvial Aquifer, the Saugus Formation, and the Santa Clara River

These activities are described in further detail below.

3.3 Simulation Period

The locations and temporal variation in pumping from the Alluvial Aquifer were defined in the model from the operating plan and from historical records of the year-to-year variability in local hydrology. Simulated pumping from the Saugus Formation was defined from the operating plan, historical pumping records, and operational constraints and historical patterns of SWP water supply availability.

3.3.1 Selection of Simulation Period

Because the operating plan for the Saugus Formation is linked to the hydrology and operational constraints for the SWP system, the year-to-year variability in Saugus Formation pumping is, to a great extent, dependent on the hydrology outside the valley (i.e., in northern California). As shown in Table 3-1, local hydrology is often not a good indicator of local pumping conditions in the Saugus Formation, because local droughts and SWP droughts frequently do not coincide with each other. The following are examples:

1. In 1955, dry conditions in the SWP system coincided with approximately 14 inches of rainfall at the Newhall-Soledad rain gage, which is similar to the long-term median rainfall recorded at this gage.
2. In 1976 and 1977, the SWP system hydrology was critical, while the local hydrology during those years was near normal (1976) and wetter than normal (1977).
3. In 1987 and 1988, the SWP system hydrology was dry (1987) and critical (1988), while the local hydrology during those years was near normal (1987) and wetter than normal (1988).
4. In 1991 and 1992, the SWP system hydrology was in its fifth and sixth consecutive years of dry or critical hydrology, while the local hydrology was wetter than normal both years.
5. In 2001, dry conditions in the SWP system coincided with wetter-than-normal local conditions.

Consequently, it was decided that the model would need to be run over several decades to capture the year-to-year variability in the hydrology of each system, as well as the less frequent times when both systems experience similar hydrologic conditions (as occurred

periodically during the 1960s and in 1994). Historical records were then analyzed to identify a synthetic simulation period that would meet the following criteria:

1. The simulation time should be long enough to include an historical period that accounts for the year-to-year variations in local hydrology that have been observed in the past.
2. The period should be long enough to include longer-term (i.e., on the order of decades) periods of relatively dry conditions and relatively wet conditions.
3. The average rainfall during the simulation period should be similar to the average rainfall of 17.84 in/yr that was observed from 1950 through 2000 at the Newhall-Soledad gage.
4. The period should be sufficiently long to allow simulation of two occurrences of reduced SWP water supplies during the period 1990 through 1992, which corresponds to periods of increased pumping from the Saugus Formation under the operating plan.
5. The frequency of dry-year occurrences in the SWP system, corresponding to increased pumping from the Saugus Formation, should be similar to the historical frequency.
6. If necessary to meet other criteria, the simulation should repeat parts of this sequence before and/or after the historical sequence.

Examination of historical local hydrology and independent simulations of SWP deliveries resulted in the selection of a 78-year period over which the model was run, with monthly time steps. The 78-year period replicates the historical hydrology of the following years:

1. Years 1 through 24 = 1980 through 2003
2. Years 25 through 78 = 1950 through 2003

3.3.2 Relationship of Simulation Period to Variations in Alluvial Aquifer Pumping

Figure 3-5 shows the year-to-year rainfall in the valley and the cumulative departure from average rainfall for each year during the 78-year simulation period. The figure also shows each simulation year's corresponding historical year. The cumulative departure from average rainfall is plotted to show the occurrence of relatively wet versus relatively dry periods. A year-to-year decline in the slope of the cumulative departure curve indicates that conditions are dry, whereas a year-to-year increase indicates that rainfall is above normal. Also plotted are the occurrences of SWP droughts. The figure shows the following:

1. The first 19 years of the simulation period are generally wet, as a whole, though a multi-year drought occurs in years 5 through 12 (1984 through 1991).
2. A prolonged dry period begins in year 20, as indicated by the downward slope in the cumulative departure curve. This period lasts through year 39, as the curve starts to slope upward to the right beginning in year 40[6]. This 20-year period of generally dry conditions corresponds to the historical period 1999 through 2003, followed by 1950 through 1964.

[6]Year 40 is equivalent to historical year 1965, when rainfall was over 32 inches, or 2.2 times the long-term median rainfall and 1.8 times the long-term average rainfall.

3. Rainfall was generally at or above normal from years 40 through 45 (historical years 1965 through 1970), before a drought ensued from years 46 through 51 (historical years 1971 through 1976).

4. Rainfall was then generally above normal during years 52 through 58 (1977 through 1983), followed by the drought years 59 through 66 (1984 through 1991), the wetter-than-normal years 67 through 76 (1992 through 2001), and dry years 77 and 78 (2002 and 2003).

Table 3-2 shows the sequence of local hydrologic conditions and resulting valleywide pumping volumes for the Alluvial Aquifer that have been defined from the groundwater operating plan for the valley. The 78-year simulation period contains the following:

1. Twenty-four years of sporadic dry-year pumping, which is approximately 30 percent of the simulated 78-year period.

2. One drought consisting of 4 consecutive years of below-normal pumping (in years 34 through 37, based on historical hydrology from 1959 through 1962).

3. Two droughts consisting of 3 consecutive years of below-normal pumping (in years 10 through 12 and 64 through 66, both of which are based on historical hydrology from 1989 through 1991).

4. Three years (years 12, 37, and 66) when rainfall is near or above normal, but pumping is assigned at a dry-year rate because the year was preceded by a multi-year local drought.

3.3.3 Relationship of Simulation Period to Variations in Saugus Pumping

Table 3-3 shows the sequence of SWP droughts, SWP allocations, and resulting pumping volumes for the Saugus Formation that have been defined based on the CLWA and USBR analyses. With respect to Saugus Formation pumping, the 78-year period contains the following:

1. Two droughts lasting 2 years
2. Two droughts lasting 3 years
3. A dry year that occurs 2 years before the beginning of each 3-year drought
4. A dry year that begins 1 year after each 3-year drought has ended
5. A total of 18 dry years, or an average of 1 dry year approximately every 4 years
6. Sixty years of normal-year pumping from the Saugus Formation

3.4 Assignment of Pumping Rates

Pumping rates for Purveyor-owned wells and known private pumping wells (owned by the Newhall Land & Farming Company (NLF), the Wayside Honor Rancho, and Robinson Ranch) were assigned in accordance with the groundwater operating plan for the Santa Clarita Valley, which defines ranges of valleywide annual pumping, given the water supply needs of the Purveyors. Pumping rates at individual wells were also assigned using the recent and planned production schedules for each well, information on the depths and lengths of the intake sections (open intervals) of each well, and by incorporating current

plans addressing the presence of perchlorate in specific portions of the Saugus Formation and the Alluvial Aquifer.

As noted in the discussion of the groundwater operating plan in Section 2.2, the water management practices of the Purveyors recognize ongoing Alluvial Aquifer pumping for agricultural water supply, as well as other smaller private domestic and related pumping. For the last 7 years of formal annual water report preparation in the Santa Clarita Valley, those reports have included estimates of the latter private pumping. In recent years, that estimate has been 500 AF/yr. Initially in 2003, during the preparation of the Groundwater Management Plan (CLWA, 2003), and recently, during ongoing preparation of the 2005 UWMP, the Santa Clarita Valley Well Owners' Association submitted limited information about the nature and magnitude of private well pumping. The most notable input from the Well Owners' Association was its detailed estimate of private well pumping in the San Francisquito Canyon portion of the basin: a total of 85 AF/yr by 73 individual private pumpers, or an average of approximately 1.2 AF/yr per private well (equivalent to approximately 0.7 gallon per minute). As a result of that information, there is increased confidence that total private pumping in the basin by smaller users is within the 500 AF/yr estimate presented in recent annual water reports and is, therefore, approximately 1 percent of typical Alluvial Aquifer pumping by the Purveyors and other known private well owners (including agricultural pumpers) combined. However, the small private wells are not explicitly modeled in the basin yield analysis described herein because their locations and operations are not known, and their operation creates a pumping stress that is essentially negligible at the scale of the regional model. Ultimately, as discussed throughout this report, the intent to maintain overall pumping within the operating plan, including private pumping, will result in sustainable groundwater conditions to support the combination of municipal (Purveyor), agricultural, and private groundwater use on an ongoing basis. Thus, private well owners in the basin, like the large municipal and agricultural pumpers, can expect groundwater supplies to continue to be available as they have been in the past, with some fluctuations in water levels through wet and dry periods, but no long-term depletion of supply.

Details of pumping rate assignments for Purveyor-owned wells and known private pumping wells are discussed for the Alluvial Aquifer in Section 3.4.1 and for the Saugus Formation in Section 3.4.2. Section 3.4.3 discusses the monthly distribution of pumping for each well. Section 3.4.4 discusses how the pumping rate assignments relate to the presence of perchlorate in groundwater.

3.4.1 Variations in Alluvial Aquifer Pumping

Pumping rates at specific wells were assigned for normal and dry years using the operating plan and information on the capacity, recent and planned use, and location of each well. Figure 2-4 shows the locations of these wells and other wells in the valley. Table 3-4 compares recent annual pumping volumes at each Alluvial Aquifer well with the assumed future production rates at each well under normal and dry-year conditions. Most Alluvial Aquifer wells were specified to operate at similar rates regardless of year type. However, there were two exceptions, as follows:

1. Wells in the eastern portion of the basin (the NCWD-Pinetree wells, nine wells owned by SCWC, and the privately owned Robinson Ranch well) were assumed to have lower

pumping capacities during dry years than nondrought years because of lower groundwater elevations during dry periods. This assumption was based on historical observations indicating that the eastern portion of the Alluvial Aquifer, in contrast to other parts of the valley, experiences declines in water levels during dry periods.

2. Pumping was also reduced at NCWD's three operating wells in Castaic Valley, in accordance with recent pumping records from those wells.

3.4.2 Variations in Saugus Formation Pumping

Pumping rates at specific Saugus Formation production wells were assigned for each type of year (normal, dry year 1, dry year 2, and dry year 3) using the operating plan for the valley and information on the capacity, recent and planned use, and location of each well. Table 3-5 summarizes the annual pumping volumes at each Saugus Formation well[7]. Significant aspects of the pumping rate selection at each well are as follows:

1. Pumping from most existing Saugus Formation production wells was based on recent and planned use of these wells, as defined by the Purveyors. The simulation included increased dry-year pumping from the Saugus Formation in the western portion of the basin, where it is anticipated that future wells will be installed.

2. Each Saugus Formation production well has an intake section (open interval) that is significantly longer in vertical extent than the thicknesses of the individual layers that represent the Saugus Formation in the Regional Model. Consequently, the Saugus pumping rates were assigned to multiple layers in the model by considering the depths of the intake section of each well and the transmissivity of each model layer. Table 3-6 shows the allocation of pumping in each model layer for each Saugus Formation production well, along with the intake sections of each well and the model-simulated transmissivity in each layer at each well location.

3.4.3 Monthly Allocation of Pumping

Table 3-7 shows the allocation of pumping, by month, for agricultural and urban production wells in both the Saugus Formation and the Alluvial Aquifer. Separate distributions were used because agricultural demands are for exclusively outdoor uses, whereas urban demands are for both indoor and outdoor uses. As discussed in the model development report (CH2M HILL, 2004a), the monthly distribution of agricultural pumping was derived from crop consumptive use requirements published by the California Irrigation Management Information Service. The monthly distribution of urban demand was determined by examining historical monthly flow records for the two LACSD WRPs and monthly demand distributions recorded by the Purveyors during the past several years.

3.4.4 Influence of Perchlorate Contamination on Groundwater Pumping

In 1997, two Saugus Formation production wells owned by CLWA's Santa Clarita Water Division (formerly SCWC) (wells SCWC-Saugus1 and SCWC-Saugus2), one Saugus Formation production well owned by the Newhall County Water District (NCWD)

[7]Table 3-5 only lists wells that are anticipated to be operating in the future. Existing wells that are not listed in this table (such as NCWD-7 and NCWD-10) are currently not in service or pump very limited quantities of groundwater, and, therefore, are not expected to provide significant quantities of water in the future.

(well NCWD-11), and one Saugus Formation production well owned by VWC (well VWC-157) were shut down because perchlorate was detected in groundwater at these wells[8]. In 2002, an Alluvial Aquifer production well owned by SCWC (well SCWC-Stadium) was shut down because of perchlorate detection. In March 2005, an Alluvial Aquifer production well owned by VWC (well VWC-Q2) was shut down because of perchlorate detection. The locations of the six impacted production wells and nearby nonimpacted production wells are shown on Figure 3-6, along with the locations of monitoring wells and exploratory borings that have been installed to investigate the extent of perchlorate contamination. Figure 3-6 also shows perchlorate concentrations at locations where perchlorate has been detected in groundwater. At each of the six production wells, the detected perchlorate concentrations exceeded the State of California's Action Level (AL) for perchlorate at the time of the detection[9].

In 2003, the Purveyors entered into a voluntary cleanup agreement with the California Department of Toxic Substances Control whereby the Department of Toxic Substances Control provides review and oversight of the activities of the Purveyors in response to the perchlorate detections. The Purveyors have also initiated a process for approval by the California Department of Health Services, in accordance with its Policy 97-005, for restoration of water supply from "severely impaired" water sources, such as the perchlorate-impacted wells. Also in 2003, the Purveyors and the responsible party (the Whittaker Corporation) entered into an Interim Settlement Agreement. Activities since execution of the Interim Settlement Agreement have consisted of developing the elements of a remedial strategy that will entail pumping of two impacted wells for containment of perchlorate migration; treatment and subsequent use of the pumped water for water supply; and installation of replacement wells in non-impacted portions of the basin to restore the remainder of groundwater supply impacted by perchlorate. A noteworthy detail of these activities is that the Regional Model was used to identify the design of a pumping scheme that would meet the Purveyors' objectives for perchlorate containment in the Saugus Formation (CH2M HILL, 2004b).

With respect to perchlorate presence in the Alluvial Aquifer, the selection of pumping rates for the basin yield analysis was as follows:

1. Well SCWC-Stadium was simulated as pumping during each year of the 78-year simulation period. The Whittaker Corporation is developing plans to mitigate the source of perchlorate to the portion of the Alluvial Aquifer immediately north and downgradient of the Whittaker-Bermite property. The modeled pumping scenario simulates the possibility that the well will be returned to service in the future and pump at a rate similar to historical volumes after source mitigation activities have reduced perchlorate concentrations to undetectable levels in the Alluvial Aquifer at and near this well.

[8]As part of the ongoing implementation of perchlorate containment and restoration of impacted capacity, well VWC-157 was abandoned in January 2005 and replaced by new well VWC-206. Thus, this analysis includes planned pumping from replacement well VWC-206.

[9]The AL has varied over time. The California Department of Health Services initially established an AL of 18 micrograms per liter (μg/L) in 1997, at the same time the four impacted Saugus Formation production wells were taken offline. In 2002, the Department of Health Services revised the AL to 4 μg/L based on studies by the U.S. Environmental Protection Agency. In March 2004, the AL was revised to 6 μg/L based on a public health goal published by the Office of Environmental Health Hazard Assessment. See http://www.dhs.ca.gov/ps/ddwem/chemicals/perchl/actionlevel.htm for further details.

2. Well VWC-Q2 was simulated as pumping during each year of the 78-year simulation period. VWC and the Whittaker Corporation are currently implementing plans to install perchlorate treatment (ion exchange) facilities at the wellhead to remove perchlorate so that the well can be returned to service (LSCE, 2005b). VWC is working with USFilter to install and maintain this treatment and is preparing an application to amend its water supply permit to allow treatment at this well, which is expected to be returned to service by fall 2005. The perchlorate detected in well VWC-Q2 does not significantly impact the water supplies used to meet demand in the Santa Clarita Valley during the time required to respond to the contamination at this well (LSCE, 2005b).

With respect to perchlorate presence in the Saugus Formation, the Purveyors have developed a hydraulic containment plan for the Saugus Formation that consists of pumping from the SCWC-Saugus1 and SCWC-Saugus2 production wells. The three Saugus wells impacted by perchlorate had produced a combined average of 4,186 AF/yr of water during the 5 years preceding the detection of perchlorate. Restoration of that volume of water is currently planned to be achieved by reactivating wells SCWC-Saugus1 and SCWC-Saugus2, with treatment for removal of perchlorate, and by constructing replacement wells in other parts of the Saugus Formation not impacted by perchlorate. Full restoration of impacted water supply, including implementation of the containment plan, is currently scheduled for 2006. The containment plan will consist of (1) pumping groundwater on a nearly continual basis from production wells SCWC-Saugus1 and SCWC-Saugus2 production wells; (2) treating the pumped water using ion exchange resins followed by chlorine and ammonia disinfection; and (3) pumping the treated water to CLWA's Rio Vista Intake Pump Station for subsequent distribution for municipal water supply. This containment plan was developed to meet the following objectives, which were identified by the Purveyors:

1. Hydraulically contain perchlorate that is migrating westward in the Saugus Formation from the Whittaker-Bermite property toward the impacted production wells
2. Hydraulically contain perchlorate that is present at monitoring well MP-5 and production well VWC-157, which are located downgradient of the impacted wells
3. Protect downgradient production wells that are currently not impacted
4. Restore the annual volumes of water that were pumped from the impacted wells before they were shut down
5. Operate the impacted wells in a manner that is consistent with the groundwater operating plan
6. If possible, pump one or more of the impacted Saugus Formation production wells in a manner that also contains perchlorate migrating in the Alluvial Aquifer from the northern portion of the Whittaker-Bermite property

A detailed analysis of this perchlorate containment plan in the Saugus Formation is presented in *Final Report: Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property* (CH2M HILL, 2004b). The pumping plan described in that report for the SCWC-Saugus1 and SCWC-Saugus2 production wells was also used in the basin yield modeling evaluation. These wells were assumed to operate on a continuous basis to contain perchlorate in this portion of the Saugus Formation. The analysis assumed each well

would be offline 1 month each year for routine maintenance, but would otherwise operate on a continuous basis.

Additionally, for the previous evaluations of the containment plan and for the basin yield analysis, the third impacted production well (NCWD-11) was assumed to operate at a yield of 1,200 gallons per minute for a period of 5 months during the peak-demand season, providing a volume of 811 acre-feet that would be treated prior to entering the distribution system. Consequently, total pumping from the three perchlorate-impacted Saugus Formation production wells that will be returned to service (SCWC-Saugus1, SCWC-Saugus2, and NCWD-11) was simulated as 4,355 AF/yr. Total pumping from NCWD wells completed in the Saugus Formation was simulated as 3,441 AF/yr in normal years and 4,899 AF/yr in dry years, with pumping occurring from NCWD-11 and nearby production wells NCWD-12 and NCWD-13. Because they are closely spaced geographically, the three wells together form a pumping center in the Saugus Formation. Thus, although NCWD may choose to no longer use well NCWD-11, this analysis includes a pumping distribution that examines the sustainability of the Saugus Formation with a conservatively high pumping capacity at this pumping center.

3.5 Simulation Methods for Other Local Hydrologic Processes

In addition to groundwater pumping, infiltration from irrigation (from urban and agricultural lands), precipitation, and streamflows (stormwater and WRP discharges) were also modeled. These other local hydrologic processes were defined using the Surface Water Routing Model (SWRM), which is described in Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Key aspects of the derivation of these terms are described in the following sections.

3.5.1 Recharge from Urban Irrigation

Under existing land use and water use conditions, the estimated long-term infiltration rates of applied irrigation water beneath urban areas, under full build-out conditions in the valley, were estimated to be 1.0 in/yr for industrial and retail lands, 2.2 in/yr for residential developments and parks, and 4.6 in/yr for golf courses. These rates were applied during each year (and each month) of the 78-year simulation period. The areas over which these rates were applied were larger than under current conditions. The areas were defined from existing land use data and from LACSD mapping of projected future land uses in the rest of the Santa Clarita Valley under full build-out conditions[10]. Figure 3-7 shows the land use that was simulated in the model for full build-out conditions.

3.5.2 Recharge from Agricultural Irrigation

As discussed in the *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002), irrigation of lands owned by NLF results in existing agricultural return flows. The source of most irrigation water is groundwater pumping from the Alluvial Aquifer, with some limited pumping occurring from one Saugus Formation well (NLF-156).

[10]LACSD land use mapping indicates that, including Newhall Ranch, approximately 14,000 acres of currently undeveloped land will be urbanized in the future within the Regional Model simulation area. Additional urbanization will also occur in areas that are within the watershed, but outside the Regional Model's boundaries.

Under full valley build-out conditions, the currently irrigated lands will no longer be irrigated because their water source will be used as part of the water supply for Newhall Ranch. Therefore, under full build-out conditions, no agricultural irrigation will occur within the area simulated by the Regional Model.

3.5.3 Precipitation Recharge

Infiltration from direct precipitation within the Regional Model domain was defined using data from the Newhall-Soledad and NCWD rain gages, an isohyet map of rainfall throughout the watershed, and a power-function equation developed by Turner (1986) that describes the relationship between annual rainfall and ET rates within the valley. Details concerning the derivation of precipitation infiltration rates from these data are contained in Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Table 3-8 lists the simulated monthly precipitation at the NCWD rain gage for the 78-year model period[11].

3.5.4 Stormwater Flows and Recharge from Streams

For each month of the simulation, the SWRM calculated the amounts of stormwater flow and groundwater recharge in all streams, plus the amount of flow and groundwater recharge arising from projected future WRP discharges to the Santa Clara River. For the Santa Clara River, the volume of streamflow was defined from measured and estimated streamflow data at the Lang gage (Table 3-9). For Castaic Creek, the volume of streamflow was defined from historical DWR operations and consideration of the hydrologic year type (Table 3-10). For the remaining Santa Clara River tributaries, streamflow volumes were defined by the SWRM using monthly rainfall data and the Turner (1986) relationship between rainfall, ET, and the subsequent yield from each watershed.

3.5.5 WRP Discharges to the Santa Clara River

Treated water is discharged to the Santa Clara River from two LACSD WRPs. As shown on Figure 1-1, the Saugus WRP discharges to the river immediately above the mouth of the South Fork Santa Clara River, and the Valencia WRP discharges to the river just west of Interstate 5.

Under full valley build-out conditions, future flows into and from WRPs will be higher than historical flows because of increased development and the associated increase in indoor water use volumes. Additionally, a portion of the future treated water will be reclaimed, as described in CLWA's recycled water master plan (Kennedy/Jenks Consultants, 2002). Future inflows to the Saugus and Valencia WRPs were estimated from projected future water demands and from comparisons of historical water use and measured inflows to both WRPs. Table 3-11 shows the derivation of urban water demands outside the Newhall Ranch development (which will be served by a new, separate WRP). Table 3-12 shows the total amount of treated water generated by the Saugus and Valencia WRPs, and the amount of this water that is reclaimed and discharged to the river, by month. The analysis assumes that the reclaimed water volume will be no more than 16,000 AF/yr, to maintain existing flow volumes in the Santa Clara River. For the Newhall Ranch WRP, discharges to the river

[11]The simulated monthly precipitation was defined from measurements at the NCWD gage from 1979 through 2003, as well as by combining the isohyet map with measurements at the Newhall-Soledad gage from 1950 through 1978.

will be 286 AF/yr, occurring primarily in December and January, when demands for reclaimed water are at their seasonal low. The total combined volumes of treated water discharged to the Santa Clara River under full valley build-out conditions (including Newhall Ranch) are summarized, by month, in Table 3-13. These rates were used in each year of the 78-year simulation.

3.5.6 Monthly Assignment and Tracking of Surface Water Budget

The month-by-month assignment of the rates and locations of surface water infiltration to the underlying Alluvial Aquifer system was performed by the SWRM using the procedures described in Section C.8.5 of Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Streambed infiltration capacities were the same as those used in the calibrated model. For each of the 78 years in the model simulation, the streambed infiltration capacity values were selected by matching the year to 1 of the 20 years (1980 through 1999) from the model calibration runs, using rainfall and streamflow data to select the corresponding streambed infiltration rates.

The SWRM also tracked the volume of surface water in each simulated stream that does not infiltrate during each month because of gaining stream conditions (i.e., rejected stream leakage). This rejected stream leakage was calculated to remain as surface water in the Santa Clara River and to eventually exit the Regional Model at the west end of the valley, at the County Line gage.

3.6 Running the Model and Evaluating Results

As discussed in the previous sections, the modeling evaluations were performed by simulating conditions on a monthly basis for the 78-year simulation period. The first step in this process consisted of running the SWRM to calculate the monthly distribution of recharge to the Alluvial Aquifer system (from rainfall, streamflow, irrigation, and WRP discharges) and recharge to the Saugus Formation (from rainfall and irrigation) in areas where the Alluvial Aquifer is not present. The output from the SWRM consisted of monthly files that assigned recharge to each node in the model grid.

The Regional Model was then run using monthly time steps, in which pumping and recharge terms were varied each month. The model was run by solving the groundwater flow equations for three time intervals during each month to improve the accuracy of the calculations. For each sub-interval of time, the model was run with a convergence criterion of 0.0001 foot for groundwater elevations and a water budget convergence criterion of 1 cubic foot per day. The model results were then evaluated by generating time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the potential effects of the groundwater operating plan across the basin. The hydrographs were used to evaluate whether the operating plan is consistent with the objective of operating the basin in a manner that maintains long-term stability in groundwater levels and river flows. This analysis and its findings are presented in Section 4.

Tables

TABLE 3-1
Historical Hydrology in Northern California and the Santa Clarita Valley, 1950 through 2003
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Northern California Hydrology[a]	Local Rainfall[b]
1950	Below Normal	6.84
1951	Above Normal	12.42
1952	Wet	34.19
1953	Wet	4.88
1954	Above Normal	15.82
1955	Dry	13.91
1956	Wet	14.21
1957	Above Normal	22.85
1958	Wet	23.14
1959	Below Normal	9.81
1960	Dry	11.64
1961	Dry	8.82
1962	Below Normal	21.22
1963	Wet	12.79
1964	Dry	10.09
1965	Wet	32.28
1966	Below Normal	14.57
1967	Wet	23.23
1968	Below Normal	6.90
1969	Wet	32.42
1970	Wet	23.19
1971	Wet	13.75
1972	Below Normal	4.15
1973	Above Normal	19.79
1974	Wet	18.04
1975	Wet	10.92
1976	Critical	14.02
1977	Critical	20.87
1978	Above Normal	42.17
1979	Below Normal	21.47
1980	Above Normal	27.00
1981	Dry	13.42
1982	Wet	20.20
1983	Wet	39.07
1984	Wet	12.86

TABLE 3-1
Historical Hydrology in Northern California and the Santa Clarita Valley, 1950 through 2003
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Northern California Hydrology[a]	Local Rainfall[b]
1985	Dry	8.37
1986	Wet	18.02
1987	Dry	14.45
1988	Critical	16.92
1989	Dry	7.56
1990	Critical	6.98
1991	Critical	17.21
1992	Critical	32.03
1993	Above Normal	32.72
1994	Critical	10.27
1995	Wet	29.15
1996	Wet	15.88
1997	Wet	13.35
1998	Wet	30.73
1999	Wet	8.96
2000	Above Normal	14.04
2001	Dry	22.24
2002	Dry	7.90
2003	Above Normal	15.70

[a]Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest.

[b]Records are for the Newhall-Soledad rain gage (Station No. FC32CE), in inches. As shown on Figure 2-6, the median and average rainfall at this gage from 1950 through 2002 were 14.57 in/yr and 17.84 in/yr, respectively.

TABLE 3-2
Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Model Year	Based on Historical Year	Local Rainfall (inches)[a]	Alluvial Aquifer Pumping under the Groundwater Operating Plan[b,c] (AF/yr)
1	1980	27.00	35,000-40,000
2	1981	13.42	35,000-40,000
3	1982	20.20	35,000-40,000
4	1983	39.07	35,000-40,000
5	1984	12.86	35,000-40,000
6	1985	8.37	30,000-35,000
7	1986	18.02	35,000-40,000
8	1987	14.45	35,000-40,000
9	1988	16.92	35,000-40,000
10	1989	7.56	30,000-35,000
11	1990	6.98	30,000-35,000
12	1991	17.21	30,000-35,000
13	1992	32.03	35,000-40,000
14	1993	32.72	35,000-40,000
15	1994	10.27	30,000-35,000
16	1995	29.15	35,000-40,000
17	1996	15.88	35,000-40,000
18	1997	13.35	35,000-40,000
19	1998	30.73	35,000-40,000
20	1999	8.96	30,000-35,000
21	2000	14.04	35,000-40,000
22	2001	22.24	35,000-40,000
23	2002	7.90	30,000-35,000
24	2003	15.70	35,000-40,000
25	1950	6.84	30,000-35,000
26	1951	12.42	35,000-40,000
27	1952	34.19	35,000-40,000
28	1953	4.88	30,000-35,000
29	1954	15.82	35,000-40,000
30	1955	13.91	35,000-40,000
31	1956	14.21	35,000-40,000
32	1957	22.85	35,000-40,000
33	1958	23.14	35,000-40,000
34	1959	9.81	30,000-35,000
35	1960	11.64	30,000-35,000
36	1961	8.82	30,000-35,000
37	1962	21.22	30,000-35,000
38	1963	12.79	35,000-40,000
39	1964	10.09	30,000-35,000
40	1965	32.28	35,000-40,000
41	1966	14.57	35,000-40,000

TABLE 3-2
Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Model Year	Based on Historical Year	Local Rainfall (inches)[a]	Alluvial Aquifer Pumping under the Groundwater Operating Plan[b,c] (AF/yr)
42	1967	23.23	35,000-40,000
43	1968	6.90	30,000-35,000
44	1969	32.42	35,000-40,000
45	1970	23.19	35,000-40,000
46	1971	13.75	35,000-40,000
47	1972	4.15	30,000-35,000
48	1973	19.79	35,000-40,000
49	1974	18.04	35,000-40,000
50	1975	10.92	30,000-35,000
51	1976	14.02	35,000-40,000
52	1977	20.87	35,000-40,000
53	1978	42.17	35,000-40,000
54	1979	21.47	35,000-40,000
55	1980	27.00	35,000-40,000
56	1981	13.42	35,000-40,000
57	1982	20.20	35,000-40,000
58	1983	39.07	35,000-40,000
59	1984	12.86	35,000-40,000
60	1985	8.37	30,000-35,000
61	1986	18.02	35,000-40,000
62	1987	14.45	35,000-40,000
63	1988	16.92	35,000-40,000
64	1989	7.56	30,000-35,000
65	1990	6.98	30,000-35,000
66	1991	17.21	30,000-35,000
67	1992	32.03	35,000-40,000
68	1993	32.72	35,000-40,000
69	1994	10.27	30,000-35,000
70	1995	29.15	35,000-40,000
71	1996	15.88	35,000-40,000
72	1997	13.35	35,000-40,000
73	1998	30.73	35,000-40,000
74	1999	8.96	30,000-35,000
75	2000	14.04	35,000-40,000
76	2001	22.24	35,000-40,000
77	2002	7.90	30,000-35,000
78	2003	15.70	35,000-40,000

[a]From records at Newhall-Soledad rain gage (Station No. FC32CE).

[b]Alluvial Aquifer pumping rates listed in this column will occur under the operating plan for the valley if the 1950 through 2003 local hydrology repeats itself in the future.

[c]Alluvial Aquifer pumping is set at the dry-year rate in years 12, 37, and 66 because each of these years is the first nondrought year that occurs after a multi-year drought ends.

TABLE 3-3
State Water Project Allocations and Corresponding Saugus Formation Pumping for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	SWP Hydrology[a]	SWP Allocations[b] (%)	Simulated Saugus Pumping Conditions (AF/yr)
1	Above Normal	90	Normal (7,500-15,000)
2	Dry	90	Normal (7,500-15,000)
3	Wet	100	Normal (7,500-15,000)
4	Wet	100	Normal (7,500-15,000)
5	Wet	100	Normal (7,500-15,000)
6	Dry	95	Normal (7,500-15,000)
7	Wet	70	Normal (7,500-15,000)
8	Dry	75	Normal (7,500-15,000)
9	Critical	15	Dry Year 1 (15,000)
10	Dry	95	Normal (7,500-15,000)
11	Critical	25	Dry Year 1 (15,000)
12	Critical	30	Dry Year 2 (25,000)
13	Critical	45	Dry Year 3 (35,000)
14	Above Normal	100	Normal (7,500-15,000)
15	Critical	50	Dry Year 1 (15,000)
16	Wet	80	Normal (7,500-15,000)
17	Wet	100	Normal (7,500-15,000)
18	Wet	100	Normal (7,500-15,000)
19	Wet	100	Normal (7,500-15,000)
20	Wet	100	Normal (7,500-15,000)
21	Above Normal	90	Normal (7,500-15,000)
22	Dry	39	Dry Year 1 (15,000)
23	Dry	70	Normal (7,500-15,000)
24	Above Normal	90	Normal (7,500-15,000)
25	Below Normal	90	Normal (7,500-15,000)
26	Above Normal	100	Normal (7,500-15,000)
27	Wet	100	Normal (7,500-15,000)
28	Wet	100	Normal (7,500-15,000)
29	Above Normal	100	Normal (7,500-15,000)
30	Dry	45	Dry Year 1 (15,000)
31	Wet	100	Normal (7,500-15,000)
32	Above Normal	90	Normal (7,500-15,000)
33	Wet	100	Normal (7,500-15,000)
34	Below Normal	85	Normal (7,500-15,000)
35	Dry	55	Dry Year 1 (15,000)
36	Dry	70	Dry Year 2 (25,000)
37	Below Normal	95	Normal (7,500-15,000)
38	Wet	100	Normal (7,500-15,000)
39	Dry	75	Dry Year 1 (15,000)
40	Wet	80	Normal (7,500-15,000)
41	Below Normal	100	Normal (7,500-15,000)
42	Wet	100	Normal (7,500-15,000)

TABLE 3-3
State Water Project Allocations and Corresponding Saugus Formation Pumping for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	SWP Hydrology[a]	SWP Allocations[b] (%)	Simulated Saugus Pumping Conditions (AF/yr)
43	Below Normal	90	Normal (7,500-15,000)
44	Wet	100	Normal (7,500-15,000)
45	Wet	100	Normal (7,500-15,000)
46	Wet	100	Normal (7,500-15,000)
47	Below Normal	75	Normal (7,500-15,000)
48	Above Normal	100	Normal (7,500-15,000)
49	Wet	100	Normal (7,500-15,000)
50	Wet	100	Normal (7,500-15,000)
51	Critical	75	Dry Year 1 (15,000)
52	Critical	4	Dry Year 2 (25,000)
53	Above Normal	100	Normal (7,500-15,000)
54	Below Normal	95	Normal (7,500-15,000)
55	Above Normal	90	Normal (7,500-15,000)
56	Dry	90	Normal (7,500-15,000)
57	Wet	100	Normal (7,500-15,000)
58	Wet	100	Normal (7,500-15,000)
59	Wet	100	Normal (7,500-15,000)
60	Dry	95	Normal (7,500-15,000)
61	Wet	70	Normal (7,500-15,000)
62	Dry	75	Normal (7,500-15,000)
63	Critical	15	Dry Year 1 (15,000)
64	Dry	95	Normal (7,500-15,000)
65	Critical	25	Dry Year 1 (15,000)
66	Critical	30	Dry Year 2 (25,000)
67	Critical	45	Dry Year 3 (35,000)
68	Above Normal	100	Normal (7,500-15,000)
69	Critical	50	Dry Year 1 (15,000)
70	Wet	80	Normal (7,500-15,000)
71	Wet	100	Normal (7,500-15,000)
72	Wet	100	Normal (7,500-15,000)
73	Wet	100	Normal (7,500-15,000)
74	Wet	100	Normal (7,500-15,000)
75	Above Normal	90	Normal (7,500-15,000)
76	Dry	39	Dry Year 1 (15,000)
77	Dry	70	Normal (7,500-15,000)
78	Above Normal	90	Normal (7,500-15,000)

[a]Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest.

[b]Defined from simulations performed by CLWA (Kennedy/Jenks Consultants, 2003) and USBR (2004) using the CALSIM II model. This condition is for the year 2020 level of development. In any given year, the allocation may be made up, in part, of carryover water from the prior year.

TABLE 3-4

Recent and Simulated Future Annual Groundwater Pumping Volumes from the Alluvial Aquifer

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

		Historical Pumping			UWMP Pumping	
Well Name	**Location**[a]	**2001**	**2002**	**2003**	**Normal Years**	**Dry Years**
NCWD-Castaic 1	Castaic Valley	345	385	561	385	345
NCWD-Castaic 2	Castaic Valley	166	0	123	166	125
NCWD-Castaic 3	Castaic Valley	0	0	0	0	0
NCWD-Castaic 4	Castaic Valley	100	47	56	100	45
NCWD-Pinetree 1	Mint Canyon	164	0	0	164	0
NCWD-Pinetree 2	Mint Canyon	0	0	0	0	0
NCWD-Pinetree 3	Mint Canyon	566	544	525	545	525
NCWD-Pinetree 4	Mint Canyon	300	5	0	300	0
NCWD Total		**1,641**	**981**	**1,265**	**1,660**	**1,040**
NLF-161	Downstream of Valencia WRP	496	485	2,021	485	485
NLF-B10	Downstream of Valencia WRP	1,240	534	344	344	344
NLF-B11	Downstream of Valencia WRP	205	232	271	232	232
NLF-B5	Downstream of Valencia WRP	1,680	2,280	1,582	1,582	1,582
NLF-B6	Downstream of Valencia WRP	1,312	2,175	1,766	1,766	1,766
NLF-B7	Downstream of Valencia WRP	474	584	402	584	584
NLF-C	Downstream of Valencia WRP	1,319	1,720	1,373	1,373	1,373
NLF-C3	Downstream of Valencia WRP	93	192	186	192	192
NLF-C4	Downstream of Valencia WRP	1,028	809	764	809	809
NLF-C5	Downstream of Valencia WRP	680	850	622	850	850
NLF-C6	Downstream of Valencia WRP	231	241	108	241	241
NLF-C7	Downstream of Valencia WRP	741	866	443	866	866
NLF-C8	Downstream of Valencia WRP	293	594	408	594	594
NLF-E	Castaic Valley	1,691	16	28	16	16
NLF-E2	Castaic Valley	141	55	14	55	55
NLF-E4	Downstream of Valencia WRP	0	0	0	0	0
NLF-E5	Downstream of Valencia WRP	172	679	537	679	679
NLF-E9	Downstream of Valencia WRP	238	814	47	814	814
NLF-G45	Downstream of Valencia WRP	291	283	60	283	283
NLF-W4	San Francisquito Canyon[b]	46	1	0	0	0
NLF-W5	San Francisquito Canyon	276	104	23	107	107
NLF-X3	Downstream of Valencia WRP	12	0	0	0	0
NLF Total		**12,659**	**13,514**	**10,999**	**11,872**	**11,872**
SCWD-Clark	Bouquet Canyon	696	782	712	782	700
SCWD-Guida	Bouquet Canyon	1,047	1,320	1,230	1,320	1,230
SCWD-Honby	Above Saugus WRP	721	696	874	696	870
SCWD-Lost Canyon 2	Mint Canyon	741	730	644	741	640
SCWD-Lost Canyon 2A	Mint Canyon	1,034	905	593	1,034	590
SCWD-Mitchell #5A	Mint Canyon	407	143	19	0	0
SCWD-Mitchell #5B	Mint Canyon	0	150	0	557	0
SCWD-N. Oaks Central	Mint Canyon	822	1,646	1,641	822	1,640
SCWD-N. Oaks East	Mint Canyon	1,234	448	485	1,234	485
SCWD-N. Oaks West	Mint Canyon	898	1,123	31	898	0
SCWD-Sand Canyon	Mint Canyon	930	705	195	930	195
SCWD-Sierra	Mint Canyon	846	87	0	846	0
SCWD-Stadium	Above Saugus WRP	565	778	0	800	800
SCWD Total		**9,941**	**9,513**	**6,424**	**10,660**	**7,150**

TABLE 3-5
Simulated Annual Groundwater Pumping from the Saugus Formation for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Owner	Well Name	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
NCWD	11	811	811	811	811
	12	1,315	2,044	2,044	2,044
	13	1,315	2,044	2,044	2,044
Total Pumping (NCWD)		**3,441**	**4,899**	**4,899**	**4,899**
NLF	156	369	369	369	369
Total Pumping (NLF)		**369**	**369**	**369**	**369**
SCWC	Saugus1	1,772	1,772	1,772	1,772
	Saugus2	1,772	1,772	1,772	1,772
Total Pumping (SCWC)		**3,544**	**3,544**	**3,544**	**3,544**
VWC	159	50	50	50	50
	160 (Municipal)	500	830	830	830
	160 (Valencia Country Club)	500	500	500	500
	201	100	100	3,577	3,577
	205	1,000	2,734	3,827	3,827
	206	1,175	2,734	3,500	3,500
Total Pumping (VWC)		**3,325**	**6,948**	**12,284**	**12,284**
To Be Determined	Future #1	0	0	3,250	3,250
	Future #2	0	0	0	3,250
	Future #3	0	0	0	3,250
	Future #4	0	0	0	3,250
Total Pumping (Future)		**0**	**0**	**3,250**	**13,000**
Total Saugus Formation Pumping		**10,679**	**15,760**	**24,346**	**34,096**

Notes:

All pumping volumes are listed in acre-feet.

Wells VWC-157 and NCWD-7, 8, 9, and 10 are assumed to no longer operate in the future.

TABLE 3-6

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
NCWD-11	2	200	1,075	300	10	3,000	72.3
	3			500	2	1,000	24.1
	4			75	2	150	3.6
NCWD-12	2	485	1,280	15	10	150	8.8
	3			500	2	1,000	58.5
	4			280	2	560	32.7
NCWD-13	2	420	750	80	10	800	61.5
	3			250	2	500	38.5
NLF-156	2	320	1,800	180	10	1,800	21.8
	3			500	6.5	3,250	39.4
	4			500	4	2,000	24.2
	5			300	4	1,200	14.5
SCWC-Saugus1	2	490	1,620	10	10	100	1.8
	3			500	6.5	3,250	59.9
	4			500	4	2,000	36.8
	5			20	4	80	1.5
SCWC-Saugus2	2	490	1,591	10	10	100	1.7
	3			500	6.5	3,250	56.9
	4			500	4	2,000	35.0
	5			91	4	364	6.4
VWC-159	3	662	1,900	338	0.025	8.45	27.3
	4			500	0.025	12.5	40.4
	5			400	0.025	10	32.3
VWC-160	3	950	2,000	50	6.5	325	7.6
	4			500	4	2,000	46.2
	5			500	4	2,000	46.2
VWC-201	3	540	1,670	460	6.5	2,990	52.7
	4			500	4	2,000	35.3
	5			170	4	680	12.0
VWC-205	3	820	1,930	180	6.5	1,170	23.9
	4			500	4	2,000	40.9
	5			430	4	1,720	35.2
VWC-206	3	500	2,000	500	6.5	3,250	44.8
	4			500	4	2,000	27.6
	5			500	4	2,000	27.6

TABLE 3-6

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
Future Wells	3	820	1,930	180	6.5	1,170	23.9
Near VWC-206	4			500	4	2,000	40.9
(Assumed)	5			430	4	1,720	35.2

Notes:

Existing wells NCWD-7 and NCWD-10 are assumed to no longer operate in the future.

Kh = horizontal hydraulic conductivity
T = transmissivity
ft/day = feet per day
ft^2/day = square feet per day

TABLE 3-7
Allocation of Pumping, by Month, for Agricultural and Urban Production Wells
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Month	Percent of Annual Water Use, Agricultural	Percent of Annual Water Use, Urban	Percent of May through October Water Use, Urban
January	3.75	5.2	
February	5.10	3.7	
March	6.60	5.2	
April	9.10	6.6	
May	10.55	8.7	13.2
June	11.40	10.4	15.8
July	14.10	13.0	19.7
August	12.95	13.6	20.6
September	10.20	10.9	16.6
October	7.50	9.3	14.1
November	5.00	7.1	
December	3.75	6.3	
Total	**100.0**	**100.0**	**100.0**

TABLE 3-8

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
2	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
3	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
4	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
5	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
6	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
7	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
8	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
9	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
10	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
11	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
12	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
13	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
14	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
15	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
16	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
17	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
18	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
19	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
20	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
21	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
22	5.96	9.79	3.70	1.88	0.00	0.00	0.00	0.00	0.00	0.36	3.33	1.08	26.10
23	1.08	1.10	0.26	0.05	0.05	0.00	0.00	0.00	0.01	0.00	2.48	4.25	9.27
24	0.00	9.88	2.73	2.42	0.05	0.00	0.00	0.00	0.09	0.10	0.63	2.57	18.47
25	2.58	1.69	1.27	0.86	0.01	0.00	0.00	0.00	0.32	0.36	0.73	0.21	8.03
26	2.96	0.93	1.16	1.69	0.09	0.00	0.00	0.05	0.00	0.49	1.33	5.88	14.57
27	17.68	0.61	10.30	1.80	0.00	0.00	0.00	0.00	0.12	0.00	4.52	5.09	40.12
28	0.80	0.02	0.21	1.64	0.69	0.00	0.00	0.00	0.00	0.00	2.32	0.04	5.73
29	6.38	3.36	4.86	0.12	0.00	0.00	0.00	0.00	0.00	0.00	2.38	1.47	18.56
30	5.69	1.69	0.21	3.38	1.91	0.00	0.00	0.00	0.00	0.00	1.43	2.01	16.32
31	7.55	1.00	0.00	5.90	1.82	0.00	0.11	0.00	0.00	0.15	0.00	0.15	16.68
32	7.22	2.71	3.05	1.16	1.06	0.25	0.00	0.00	0.00	2.68	0.40	8.30	26.81
33	2.11	10.42	5.82	7.18	0.00	0.00	0.00	0.00	0.04	1.35	0.23	0.00	27.15
34	3.70	5.47	0.00	0.59	0.00	0.00	0.00	0.00	0.08	0.00	0.00	1.68	11.51
35	4.17	2.21	0.20	2.05	0.00	0.00	0.00	0.00	0.00	0.00	4.96	0.07	13.66
36	1.88	0.00	0.76	0.33	0.09	0.00	0.07	0.00	0.11	0.00	4.12	2.99	10.35
37	3.86	19.44	1.53	0.00	0.02	0.00	0.00	0.00	0.00	0.05	0.00	0.00	24.90
38	0.99	3.63	4.10	2.23	0.06	0.43	0.00	0.00	0.77	0.50	2.29	0.01	15.01
39	2.95	0.00	1.88	2.41	0.04	0.12	0.00	0.00	0.00	0.52	1.47	2.48	11.84
40	0.25	0.07	1.65	9.14	0.00	0.02	0.26	0.16	0.95	0.00	17.49	7.89	37.88
41	1.42	1.55	0.33	0.00	0.09	0.00	0.00	0.00	0.09	0.11	7.56	5.95	17.10

TABLE 3-8

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	6.76	0.22	3.23	5.41	0.19	0.00	0.00	0.00	0.50	0.00	9.36	1.58	27.26
43	0.86	0.93	2.91	0.97	0.07	0.00	0.00	0.38	0.00	0.39	0.35	1.24	8.10
44	19.53	13.89	0.82	1.16	0.05	0.05	0.18	0.00	0.00	0.00	2.32	0.05	38.04
45	0.94	6.63	4.33	0.00	0.00	0.00	0.00	0.00	0.00	0.13	8.86	6.33	27.21
46	1.23	1.41	0.48	0.94	0.15	0.00	0.00	0.00	0.47	0.50	0.38	10.57	16.14
47	0.00	0.12	0.00	0.02	0.05	0.05	0.00	0.06	0.00	0.05	3.45	1.08	4.87
48	5.19	11.74	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.15	1.83	1.03	23.22
49	10.58	0.02	4.30	0.06	0.00	0.00	0.02	0.00	0.00	1.17	0.12	4.89	21.17
50	0.28	3.02	6.04	2.96	0.00	0.00	0.00	0.00	0.00	0.39	0.04	0.09	12.81
51	0.00	7.39	1.47	0.46	0.15	0.35	0.01	0.00	3.40	0.22	2.09	0.90	16.45
52	5.75	0.12	2.15	0.00	5.27	0.00	0.00	2.68	0.02	0.05	0.06	8.40	24.49
53	10.74	13.23	17.10	2.72	0.00	0.00	0.00	0.00	1.23	0.01	2.70	1.76	49.49
54	12.44	3.20	6.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.89	1.19	23.75
55	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
56	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
57	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
58	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
59	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
60	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
61	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
62	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
63	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
64	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
65	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
66	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
67	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
68	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
69	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
70	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
71	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
72	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
73	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
74	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
75	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
76	5.96	9.79	3.70	1.88	0.00	0.00	0.00	0.00	0.00	0.36	3.33	1.08	26.10
77	1.08	1.10	0.26	0.05	0.05	0.00	0.00	0.00	0.01	0.00	2.48	4.25	9.27
78	0.00	9.88	2.73	2.42	0.05	0.00	0.00	0.00	0.09	0.10	0.63	2.57	18.47

TABLE 3-9

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
2	594	98	339	240	107	18	18	12	338	321	258	394	2,739
3	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
4	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
5	0	596	405	240	143	166	228	411	154	220	904	578	4,044
6	483	461	274	215	77	0	0	0	12	179	221	301	2,224
7	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
8	117	117	65	31	12	0	0	0	0	0	258	516	1,116
9	222	209	506	117	77	68	0	0	0	0	12	25	1,236
10	50	111	60	25	6	0	0	0	102	94	34	18	499
11	212	276	230	46	46	5	0	0	0	27	36	147	1,025
12	162	775	879	736	145	142	14	0	45	69	62	263	3,291
13	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
14	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
15	388	493	497	319	163	80	20	7	37	102	193	941	3,239
16	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
17	666	896	730	315	151	46	7	0	54	154	307	510	3,836
18	517	346	140	85	33	5	4	50	66	240	566	809	2,859
19	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
20	92	85	204	224	197	107	80	46	52	54	31	80	1,252
21	117	117	65	31	12	0	0	0	0	0	258	516	1,116
22	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
23	50	111	60	25	6	0	0	0	102	94	34	18	499
24	666	896	730	315	151	46	7	0	54	154	307	510	3,836
25	83	198	184	126	105	83	51	54	56	53	43	42	1,078
26	49	40	66	91	98	84	79	72	57	71	47	53	807
27	9,629	636	7,091	2,114	895	326	153	138	86	97	178	313	21,656
28	300	282	271	237	165	134	102	86	85	83	74	68	1,888
29	145	278	404	356	181	108	110	99	91	90	80	75	2,017
30	103	156	157	128	153	99	78	76	74	68	66	62	1,220
31	69	85	130	137	139	98	86	80	77	76	67	69	1,113
32	67	55	78	90	93	80	78	78	76	79	66	71	910
33	66	329	743	4,550	825	283	130	108	95	145	146	116	7,536
34	246	351	189	127	111	92	84	86	83	69	68	68	1,575
35	68	67	70	69	70	68	65	65	60	58	316	164	1,140
36	124	91	38	38	36	32	28	33	22	19	19	119	597
37	139	1,904	791	449	329	169	97	82	80	84	82	82	4,287
38	85	142	145	131	104	86	79	74	66	65	62	58	1,096
39	69	50	51	62	66	54	53	53	54	45	43	41	640
40	30	23	25	46	43	36	31	34	37	35	1,305	3,300	4,944
41	1,765	1,014	778	450	308	115	68	54	45	63	91	523	5,274

TABLE 3-9

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	757	489	1,028	2,295	1,880	729	212	104	89	73	255	487	8,397
43	300	247	276	180	72	32	32	30	25	133	208	851	2,384
44	13,797	2,856	1,005	489	320	147	98	98	46	318	392	399	19,966
45	461	550	1,168	465	290	169	74	60	58	27	501	1,338	5,161
46	614	524	556	397	262	167	70	25	5	30	200	420	3,270
47	332	250	131	90	50	22	32	6	0	0	11	58	983
48	153	1,717	950	471	226	71	18	12	8	3	8	44	3,679
49	608	229	392	190	129	49	17	6	0	3	19	87	1,728
50	53	90	228	181	104	31	15	3	0	0	0	0	704
51	0	110	63	39	33	12	0	0	1	0	0	0	258
52	28	7	28	19	60	5	0	0	0	0	0	0	147
53	744	9,486	11,412	1,696	2,736	1,154	418	209	101	264	422	86	28,730
54	1,254	433	1,113	506	246	190	178	111	125	90	120	558	4,925
55	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
56	594	98	339	240	107	18	18	12	338	321	258	394	2,739
57	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
58	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
59	0	596	405	240	143	166	228	411	154	220	904	578	4,044
60	483	461	274	215	77	0	0	0	12	179	221	301	2,224
61	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
62	117	117	65	31	12	0	0	0	0	0	258	516	1,116
63	222	209	506	117	77	68	0	0	0	0	12	25	1,236
64	50	111	60	25	6	0	0	0	102	94	34	18	499
65	212	276	230	46	46	5	0	0	0	27	36	147	1,025
66	162	775	879	736	145	142	14	0	45	69	62	263	3,291
67	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
68	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
69	388	493	497	319	163	80	20	7	37	102	193	941	3,239
70	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
71	666	896	730	315	151	46	7	0	54	154	307	510	3,836
72	517	346	140	85	33	5	4	50	66	240	566	809	2,859
73	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
74	92	85	204	224	197	107	80	46	52	54	31	80	1,252
75	117	117	65	31	12	0	0	0	0	0	258	516	1,116
76	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
77	50	111	60	25	6	0	0	0	102	94	34	18	499
78	666	896	730	315	151	46	7	0	54	154	307	510	3,836

TABLE 3-10

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
2	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
3	0	0	0	0	0	667	842	735	0	0	0	0	2,244
4	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
8	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
9	0	0	809	341	900	0	0	0	0	0	0	0	2,050
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	66	66
13	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
14	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
15	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
16	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
17	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
18	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884
19	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
20	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
21	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086
22	0	0	0	0	0	667	842	735	0	0	0	0	2,244
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
25	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
28	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
30	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
31	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
32	0	0	0	0	0	667	842	735	0	0	0	0	2,244
33	0	0	0	0	0	667	842	735	0	0	0	0	2,244
34	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
35	0	0	0	0	0	0	0	0	0	0	0	0	0
36	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
37	0	0	0	0	0	667	842	735	0	0	0	0	2,244
38	0	0	0	0	0	0	0	0	0	0	0	0	0
39	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
40	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
41	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853

TABLE 3-10

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	0	0	0	0	0	667	842	735	0	0	0	0	2,244
43	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
45	0	0	0	0	0	667	842	735	0	0	0	0	2,244
46	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
47	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	667	842	735	0	0	0	0	2,244
49	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
50	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
51	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
52	0	0	0	0	0	667	842	735	0	0	0	0	2,244
53	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
54	0	0	0	0	0	667	842	735	0	0	0	0	2,244
55	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
56	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
57	0	0	0	0	0	667	842	735	0	0	0	0	2,244
58	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
59	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0
61	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
62	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
63	0	0	809	341	900	0	0	0	0	0	0	0	2,050
64	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	66	66
67	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
68	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
69	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
70	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
71	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
72	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884
73	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
74	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
75	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086
76	0	0	0	0	0	667	842	735	0	0	0	0	2,244
77	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632

TABLE 3-11
Water Demands and Indoor Water Use under Full Build-out Conditions (Excluding Newhall Ranch)
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year 2000 Actual (AF/yr)	Full Build-out Conditions (AF/yr)	Comments
Annual Urban Water Use Outside Newhall Ranch		
60,988	123,038	Year 2000 value is retail purveyor demand plus other demands in Table II-6 of the *2004 Santa Clarita Valley Water Report* (LSCE, 2005a). Year 2045 value is from Table 2.5-4 of the *Newhall Ranch Draft Additional Analysis* (Impact Sciences, Inc., 2001). Consists of 89,805 AF/yr Development Monitoring System[a] demand, plus 55,995 AF/yr additional urban demand, minus 14,480 AF/yr conservation, minus 5,193 AF/yr agricultural uses and 3,089 AF/yr "other" uses. Does not include 4,500 AF/yr for aquifer storage and recovery or 17,680 AF/yr of demand for the Newhall Ranch Specific Plan.
Annual Indoor Water Use Outside Newhall Ranch (Equal to LACSD WRP Influent Volumes)		
18,723	40,313 (average year)	The year 2000 volume is from the Saugus and Valencia WRPs for the period January 2000 through December 2000. The long-term current generated effluent volume is based on the influent volume estimated from water balance calculations performed for the chloride mass balance analysis. The effluent volume is 32.8 percent of the total urban water production of 123,038 AF/yr, which includes other uses.

[a]Development Monitoring System water demands are demands associated with future build-out of developments identified in Los Angeles County's Development Monitoring System for the Santa Clarita Valley.

TABLE 3-12

Treated Water Discharges from the Saugus and Valencia WRPs to the Santa Clara River under Full Build-out Conditions

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Month	Treated Water Volume (2000)[a]	Treated Water Volume (Full Build-out Conditions)[b]	Percent of Annual Outdoor Demand	Reclaimed Volume under Full Build-out Conditions (Before Maintaining Existing Streamflows)	Reclaimed Volume under Full Build-out Conditions (After Maintaining Existing Streamflows)	WRP Discharges to River under Full Build-out Conditions[c]	Month
January	1,503	3,237	3.75	637	637	2,600	January
February	1,443	3,106	5.10	867	867	2,239	February
March	1,528	3,290	6.60	1,122	1,122	2,168	March
April	1,505	3,240	9.10	1,547	1,547	1,693	April
May	1,569	3,379	10.55	1,794	1,794	1,585	May
June	1,543	3,322	11.40	1,938	1,781	1,541	June
July	1,606	3,459	14.10	2,397	1,854	1,605	July
August	1,649	3,550	12.95	2,202	1,902	1,648	August
September	1,593	3,430	10.20	1,734	1,734	1,696	September
October	1,631	3,512	7.50	1,275	1,275	2,237	October
November	1,546	3,329	5.00	850	850	2,479	November
December	1,607	3,459	3.75	637	637	2,822	December
Total Annual	**18,723**	**40,313**	**100.0**	**17,000**	**16,000**	**24,313**	**Total Annual**

[a]Values shown are the actual volumes of treated water discharged to the Santa Clara River from the Saugus and Valencia WRPs during calendar year 2000. (See also Table 3-11.)

[b]Values shown are the combined treated water volumes estimated to be produced by the Saugus and Valencia WRPs for full build-out conditions in the Santa Clarita Valley. These values do not include the future Newhall Ranch WRP, which will be operated by LACSD.

[c]Values shown do not include discharges of treated water to the river from the future Newhall Ranch WRP. These volumes are 10 acre-feet in November, 138 acre-feet in December, and 138 acre-feet in January. During the other nine months of the year, this WRP will not discharge treated water to the river (see the *Newhall Ranch Draft Additional Analysis* [Impact Sciences, Inc., 2001] for further details). The combined total discharge from the Saugus, Valencia, and Newhall Ranch WRPs is summarized in Table 3-13.

Note:
All units are in acre-feet.

TABLE 3-13

Simulated Monthly Treated Wastewater Discharges from Santa Clarita Valley WRPs under Full Build-out Conditions

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

WRP	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Saugus	493	487	500	490	503	466	457	508	586	555	514	596	6,155
Valencia	2,107	1,752	1,668	1,203	1,082	1,075	1,148	1,140	1,110	1,682	1,965	2,226	18,158
Newhall	138	0	0	0	0	0	0	0	0	0	10	138	286
Total	**2,738**	**2,239**	**2,168**	**1,693**	**1,585**	**1,541**	**1,605**	**1,648**	**1,696**	**2,237**	**2,489**	**2,960**	**24,599**

Note:

Wastewater discharge volumes are listed in acre-feet.

Figures

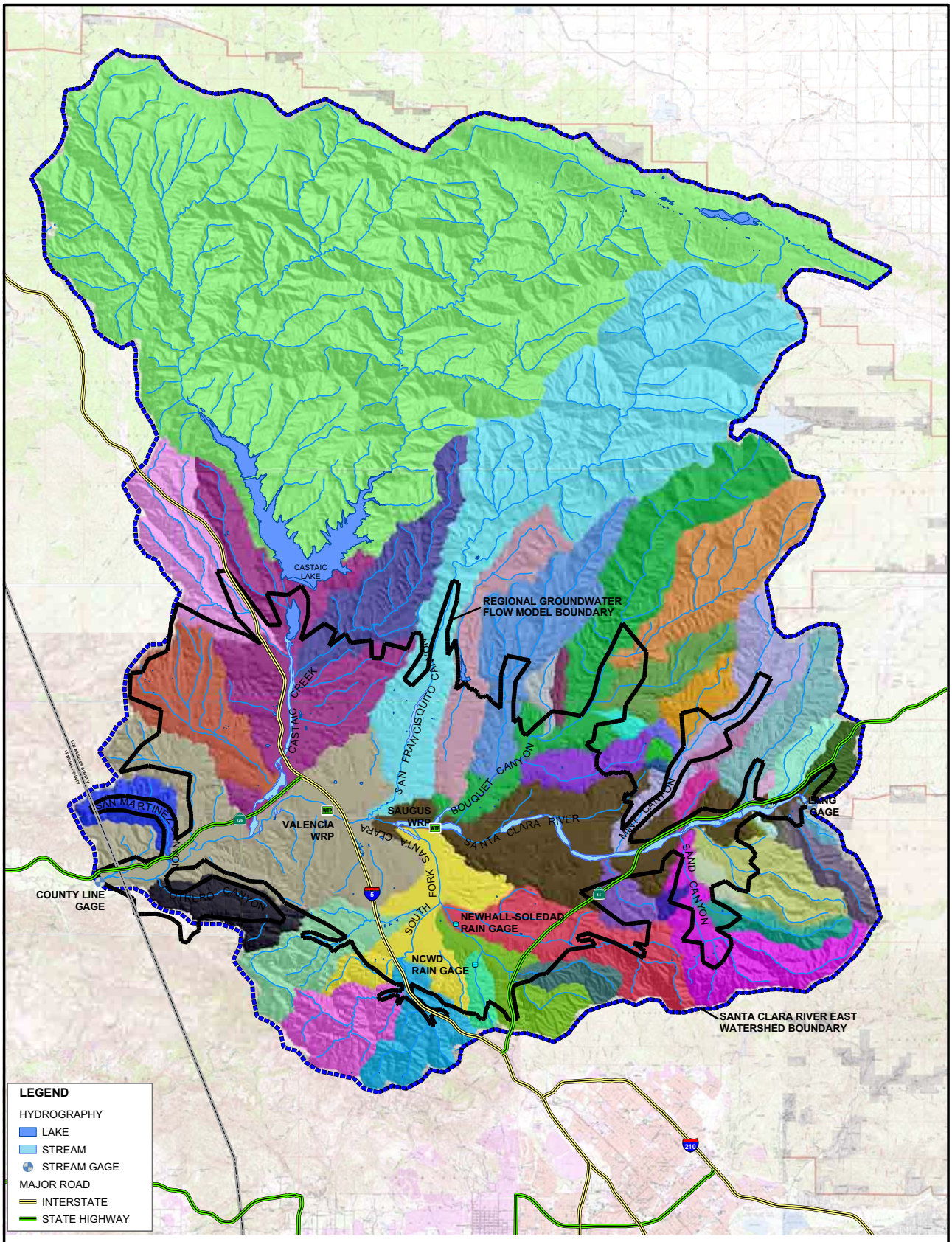

FIGURE 3-1
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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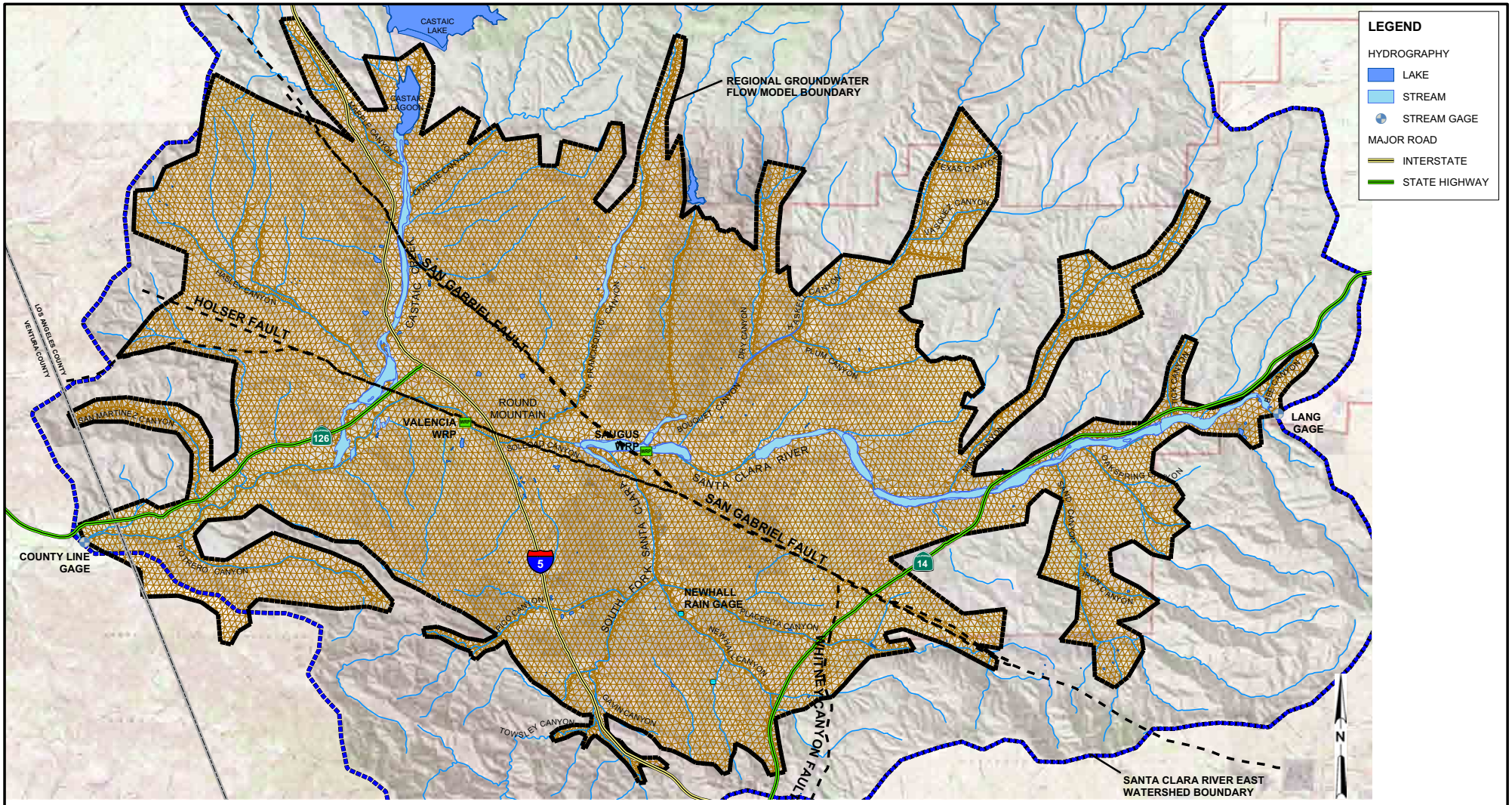

FIGURE 3-2
REGIONAL MODEL GRID
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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	Stratigraphy		Model Layer	Thickness (feet)
Saugus	Alluvium	Saugus	1	500
Saugus	Saugus	Saugus	2	
Saugus	Saugus	Saugus	3	500
Saugus	Saugus	Saugus	4	500
Saugus	Saugus	Saugus	5	500
Saugus	Saugus	Saugus	6	500
Sunshine	Sunshine	Sunshine	7	Variable

FIGURE 3-3
SCHEMATIC DIAGRAM OF THE MODEL'S REPRESENTATION OF STRATIGRAPHY IN THE MIDDLE OF THE BASIN
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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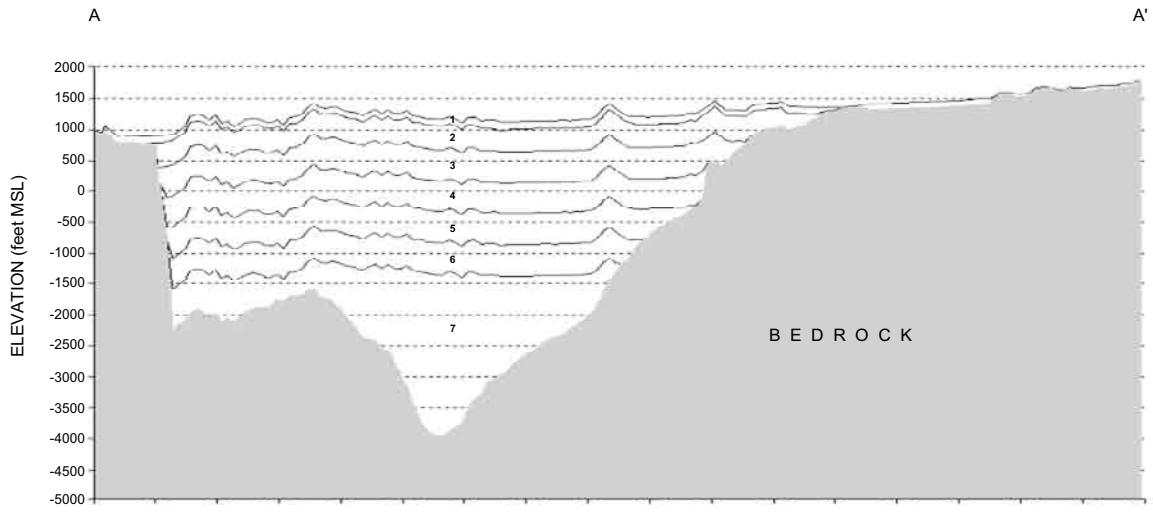
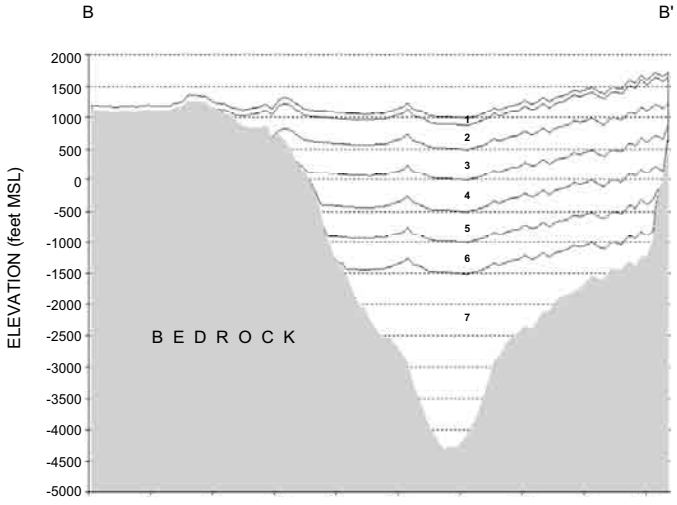
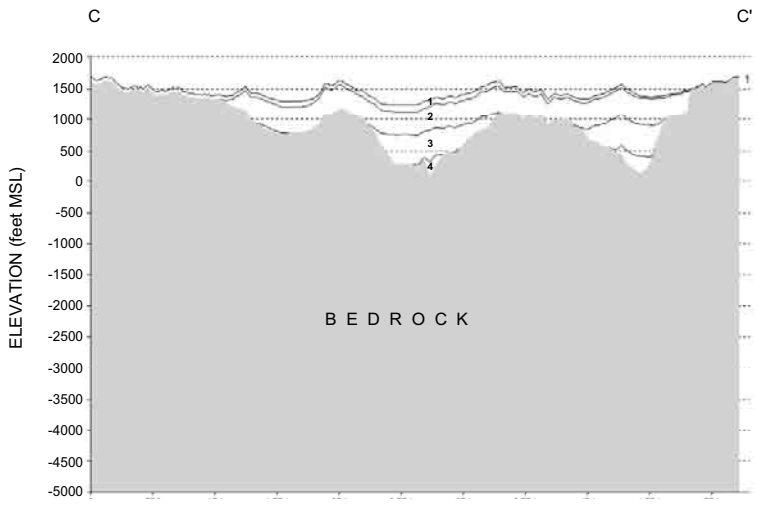
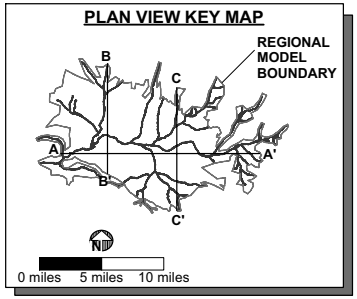
178973-414.xls\FIG3-3









LEGEND

1 = MODEL LAYER 1

2 = MODEL LAYER 2

3 = MODEL LAYER 3

4 = MODEL LAYER 4

5 = MODEL LAYER 5

6 = MODEL LAYER 6

7 = MODEL LAYER 7

HORIZONTAL CROSS SECTION SCALE

0 feet 10,000 feet 20,000 feet

5x VERTICAL EXAGGERATION

FIGURE 3-4
SCHEMATIC CROSS SECTIONS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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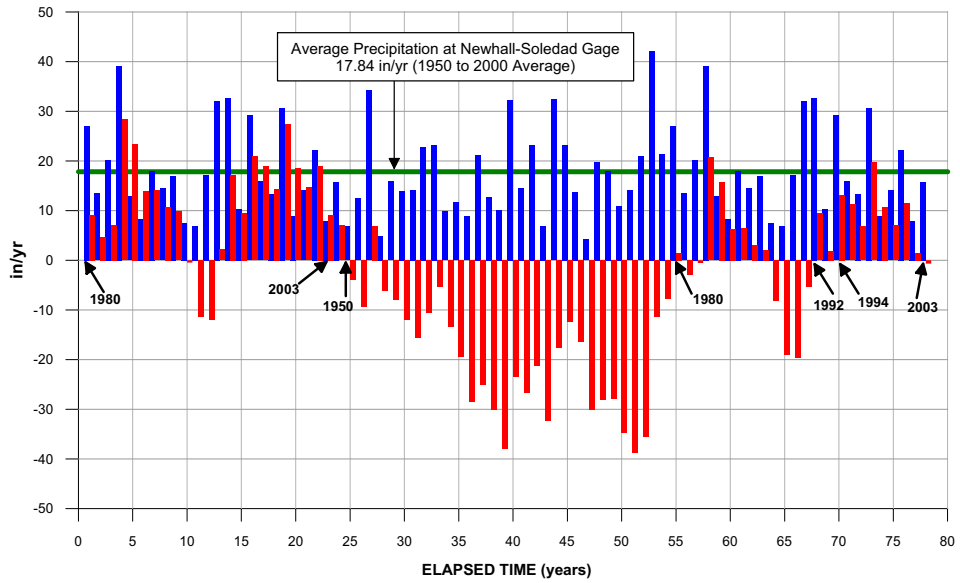

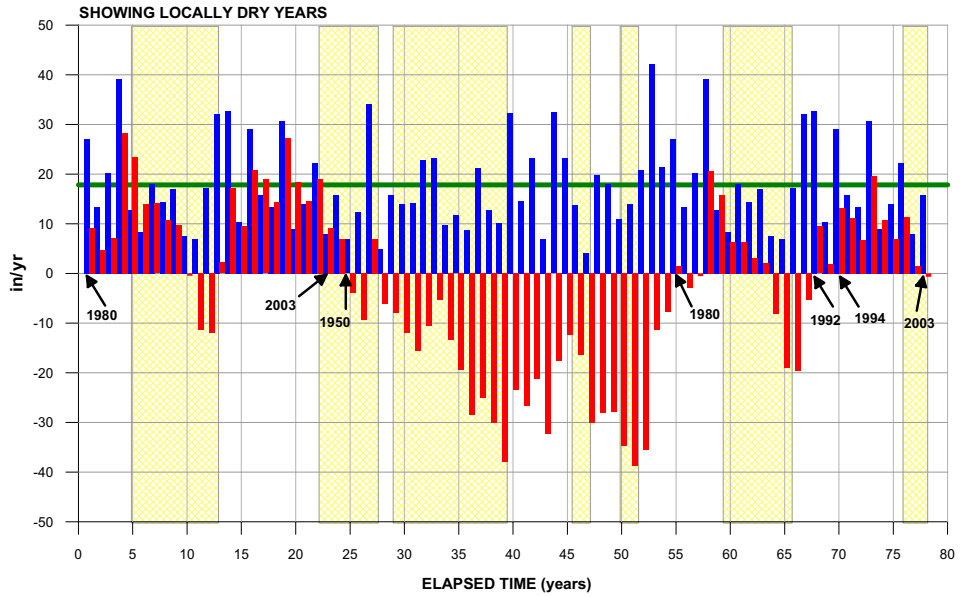

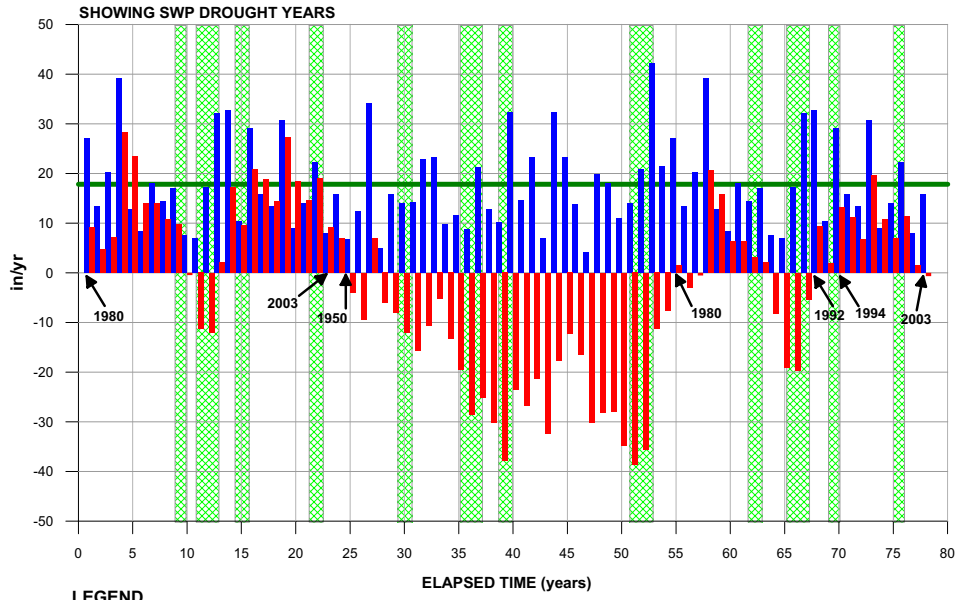

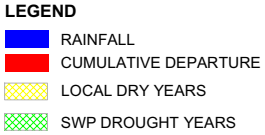

FIGURE 3-5
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 THROUGH 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE FOR THE 78-YEAR SIMULATION PERIOD
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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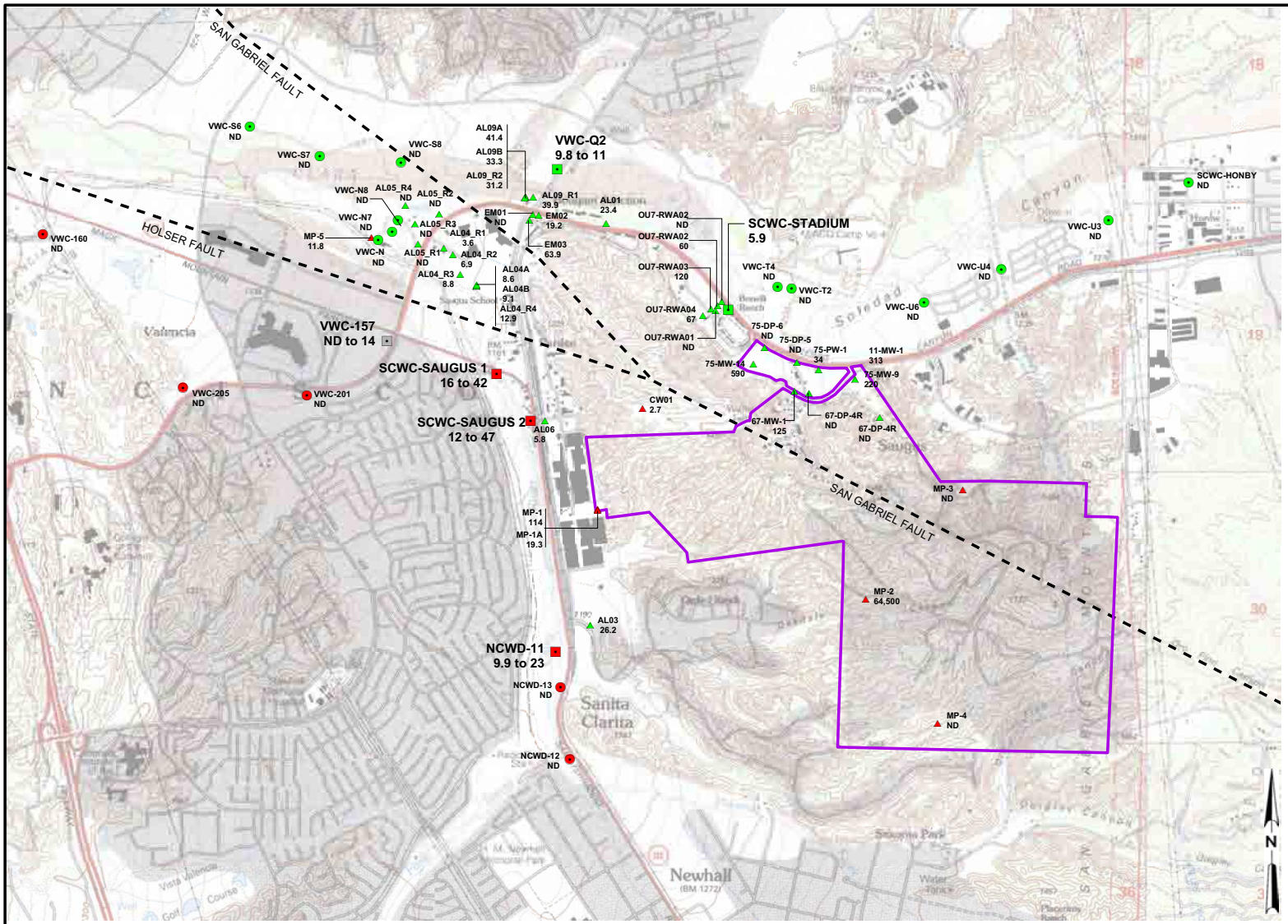

LEGEND

CONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS
- SAUGUS (DESTROYED JANUARY 2005)

UNCONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

MONITORING WELL

- ALLUVIUM
- SAUGUS
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
3. µg/L = MICROGRAMS PER LITER.

FIGURE 3-6
WELL LOCATIONS AND PERCHLORATE CONCENTRATIONS NEAR THE WHITTAKER-BERMITE PROPERTY
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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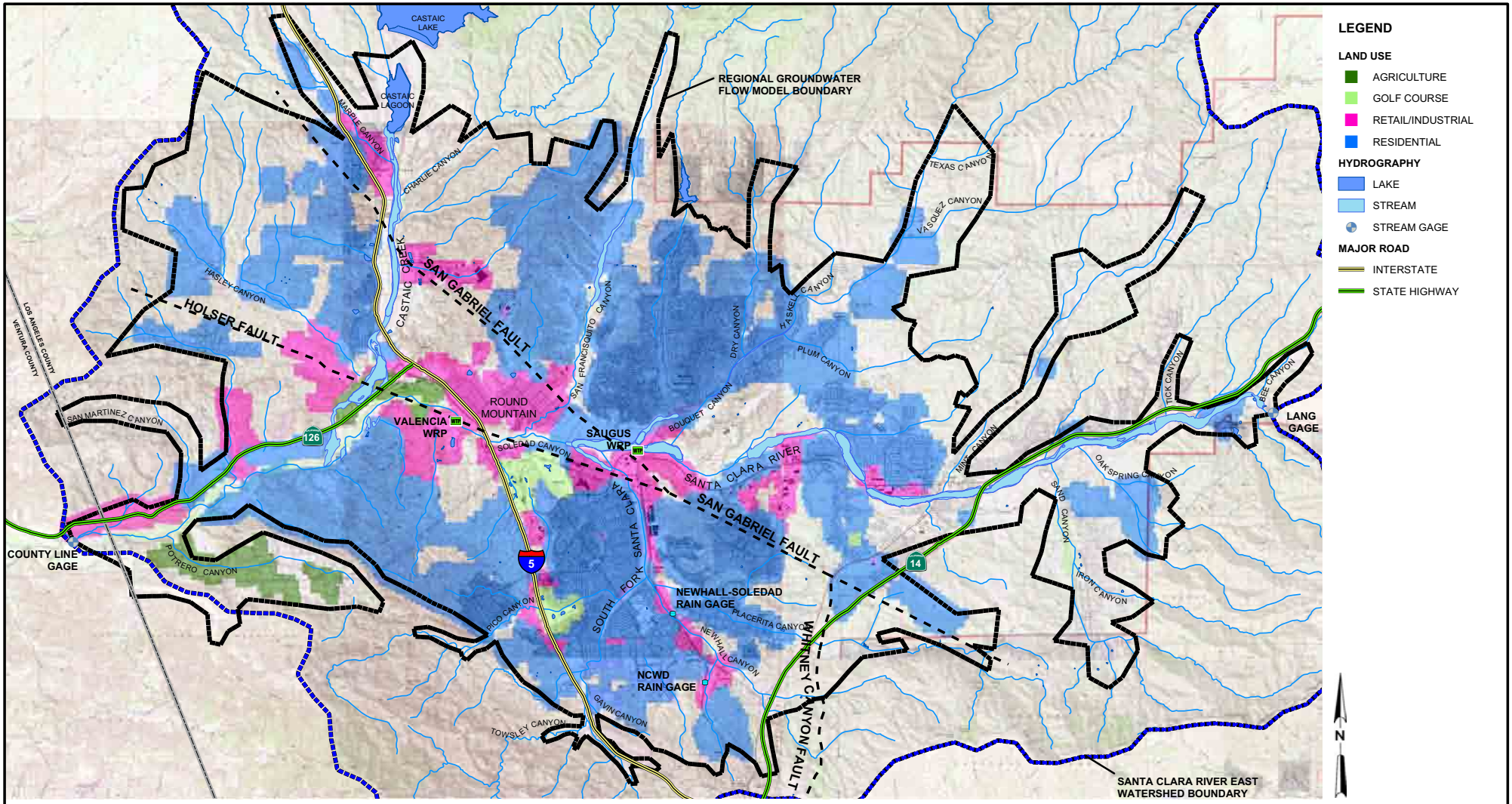

NOTE:
LAND USES UNDER FULL BUILD-OUT CONDITIONS ARE SHOWN ONLY INSIDE THE MODEL BOUNDARY, AND ARE NOT SHOWN OUTSIDE THE MODEL BOUNDARY.

FIGURE 3-7
SIMULATED LAND USE WITHIN THE REGIONAL MODEL BOUNDARY UNDER FULL BUILD-OUT CONDITIONS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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SECTION 4

Model Results

This section of the report presents and discusses hydrographs of simulated groundwater elevations, groundwater budget terms, and Santa Clara River flows for the 78-year modeling period.

4.1 Groundwater Elevations

Groundwater elevation hydrographs for different portions of the Alluvial Aquifer are presented on Figures 4-1 through 4-5. Hydrographs for different portions of the Saugus Formation are presented on Figures 4-6 and 4-7. Each figure shows the monthly groundwater elevations simulated for the 78-year modeling period.

These figures show that the spatial distribution and temporal variation of pumping are not expected to cause a long-term decline in groundwater levels in the Alluvial Aquifer or the Saugus Formation. The Regional Model simulates distinct multi-year periods of overall declining or overall increasing groundwater elevations resulting from cycles of below-normal and above-normal rainfall periods. This variation is consistent with historical observations of the relationship between rainfall and groundwater level fluctuations (CH2M HILL, 2004a). The Regional Model also simulates short-term declines in Saugus Formation groundwater elevations that arise from the increased Saugus pumping that occurs during the second and third years of reduced water imports. The model simulates water level recovery within a few years after Saugus pumping returns to normal-year pumping rates, a finding that is consistent with historical observations following a peak pumping period in the early 1990s (see Figures 2-9 and 2-10).

4.2 Groundwater Recharge, Discharge, and Storage

Figures 4-8 and 4-9 show the annual valleywide variations in groundwater recharge and discharge, respectively, throughout the 78-year simulation period. These groundwater recharge and discharge rates are also listed in Table 4-1. Figure 4-10 shows the annual and cumulative changes in groundwater storage volumes. Figures 4-8 through 4-10 and Table 4-1 together show the following:

1. Groundwater recharge rates (see Figure 4-8) vary greatly from year to year, because of variations in (a) precipitation within the groundwater basin and (b) precipitation and stormwater generation in the watersheds lying upstream of the groundwater basin. In contrast, total groundwater discharge (see Figure 4-9) is much less variable from year to year, with the more limited variations arising from increased pumping during drought years and increased ET and groundwater discharge to the Santa Clara River during wet years.
2. Year-to-year and cumulative changes in groundwater storage during the 78-year simulation period (see Figure 4-10) provide insights as to the manner in which the basin is

functioning hydrologically under the groundwater operating plan for the valley. The cumulative change in groundwater storage is a measure of the longer-term trends in the amount of groundwater in storage, and is plotted on a monthly basis. Table 4-1 tabulates the annual water budget for each year of the 78-year simulation, and shows the cumulative change on an annual basis (in contrast to the monthly basis shown on Figure 4-10). Figure 4-10 and Table 4-1 together show the following:

a. The cumulative change in total groundwater storage volume, which measures the continuous change in storage in the combined Alluvial-Saugus aquifer system since the beginning of the simulation, ranges between approximately a 150,000-acre-foot decline and a 260,000-acre-foot increase. The change in groundwater storage during a single year ranges from approximately an 80,000-AF/yr decline to a 170,000-AF/yr increase.

b. A nearly 20-year period of overall decline in the cumulative groundwater storage volume occurs between years 19 and 39, as shown on Figure 4-10. Beginning in year 40, the cumulative change in storage shows a generally upward trend, with occasional downward trends during specific drought periods.

3. Implementation of the groundwater operating plan will not cause permanent declines in groundwater storage volumes. This is shown by the forecasted recovery of groundwater storage volumes after periods of continued decline, such as after the 20-year period of groundwater declines that occurs during years 19 through 39.

4. Based on the previous observations, changes in groundwater storage volumes, particularly over a period of many years, are governed significantly by variations in local hydrologic conditions. Local precipitation and streamflows are the primary recharge mechanisms in the valley and therefore have a direct influence on year-to-year and longer-term changes in groundwater storage volumes.

4.3 River Flows

Figure 4-11 shows the total flows estimated by the model for the Santa Clara River at the County Line gage, which is located at the western end of the valley. The figure contains both a linear plot and a semi-logarithmic plot, to better illustrate the flows during low-flow periods. As shown by both plots, the total streamflows vary considerably over time at this location, due primarily to variations in rainfall.

The influences of the local hydrology and the groundwater operating plan on the Santa Clara River are also shown by Figure 4-12, which displays the model-calculated volumes of monthly groundwater discharge to the river. Groundwater discharges to the river occur along the river reach lying downstream of the mouth of San Francisquito Canyon. The figure shows that the groundwater discharge rates to the river also vary over time, both seasonally and over multi-year periods. Additionally, the figure shows that the Regional Model simulates a period of relatively low groundwater discharge to the river from years 23 through 39 (historical years 2002 through 2003, followed by 1950 through 1964), which corresponds to the prevailing below-normal rainfall conditions in those years. The figure also shows higher volumes of groundwater discharge to the river in years of above-normal

rainfall, particularly the very wet periods years 1 through 4, 13 through 19, 52 through 58, and 67 through 72.

The similarity between rainfall and groundwater discharges to the river indicates that local hydrology is the primary influence on these discharges. Additionally, the groundwater discharge hydrographs do not show any marked short-term declines in flows when Saugus Formation groundwater levels decrease during years of increased Saugus Formation pumping. The Regional Model, therefore, indicates that the operating plan for the groundwater system is not expected to adversely affect river flows.

4.4 Relationship of Simulation Results to Future Conditions

The curves presented on Figures 4-1 through 4-12 provide a general indication of the types of fluctuations in groundwater conditions that could be expected to occur in the future in the Santa Clarita Valley over a period of many years. However, these curves have been derived using an assumed sequence of local hydrologic conditions that is based on the sequence of rainfall and streamflow volumes that were measured during the past several decades. In the future, the year-to-year volumes and trends in rainfall and streamflow could vary from those observed in the past. Consequently, actual future trends in rainfall and streamflow might differ from those presented in this simulation on a short-term basis. However, over a period of several years or decades, the model-simulated recharge values and basin responses are more likely to reflect actual long-term average basin conditions under this operating plan.

The modeling simulation described in this report meets the intended objectives of quantifying possible basin responses to the operating plan, in terms of temporal variations that could occur in groundwater levels, groundwater storage, and Santa Clara River streamflows; and using the quantified responses to evaluate the sustainability of the operating plan with respect to potential trends in groundwater levels and Santa Clara River flows. The principal conclusions about the groundwater operating plan that have been drawn from the historical analyses and modeling simulations presented in this report are discussed in Section 5.

Table

TABLE 4-1

Simulated Annual Groundwater Budget

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year			Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Subsurface Inflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
0	to	1	41,053	13,970	39,953	17,871	112,847	49,119	21,649	17,524	18,464	106,756	6,091	6,091
1	to	2	11,601	13,970	3,373	18,632	47,576	49,035	10,147	10,469	18,136	87,788	-40,212	-34,120
2	to	3	51,672	13,970	28,415	18,444	112,501	49,035	10,925	12,319	18,585	90,863	21,638	-12,483
3	to	4	181,820	13,970	89,448	16,985	302,223	49,035	36,265	29,506	19,056	133,861	168,361	155,879
4	to	5	687	13,970	527	18,253	33,437	49,119	16,665	23,150	18,225	107,158	-73,721	82,158
5	to	6	2	13,970	535	18,927	33,434	44,372	9,497	13,286	18,171	85,326	-51,891	30,266
6	to	7	42,574	13,970	19,998	18,619	95,161	49,035	11,479	14,376	18,568	93,458	1,703	31,969
7	to	8	11,415	13,970	2,484	19,419	47,288	49,035	7,923	10,419	18,277	85,654	-38,366	-6,397
8	to	9	27,363	13,970	10,507	19,743	71,583	54,214	6,664	10,234	18,507	89,618	-18,036	-24,433
9	to	10	0	13,970	523	20,113	34,606	44,372	4,739	8,041	18,359	75,510	-40,904	-65,336
10	to	11	0	13,970	1,472	20,347	35,789	49,446	2,584	5,612	18,354	75,996	-40,208	-105,544
11	to	12	50,580	13,970	28,173	19,613	112,336	58,025	3,061	8,476	18,563	88,125	24,211	-81,334
12	to	13	130,074	13,970	80,760	17,850	242,654	72,600	14,234	18,462	18,728	124,024	118,630	37,296
13	to	14	112,433	13,970	51,561	17,509	195,472	49,035	24,221	29,084	18,797	121,137	74,335	111,632
14	to	15	414	13,970	1,979	18,575	34,939	49,446	7,788	16,616	18,157	92,007	-57,068	54,563
15	to	16	113,543	13,970	60,100	17,636	205,250	49,035	29,255	26,983	18,745	124,018	81,232	135,795
16	to	17	45,609	13,970	21,594	18,204	99,376	49,119	15,122	21,342	18,635	104,218	-4,842	130,954
17	to	18	16,967	13,970	5,320	18,758	55,015	49,035	11,851	16,757	18,242	95,885	-40,870	90,084
18	to	19	137,727	13,970	59,717	17,397	228,810	49,035	27,143	31,249	18,923	126,350	102,460	192,544
19	to	20	13	13,970	4,717	18,586	37,286	49,035	14,305	20,865	18,200	102,405	-65,119	127,425
20	to	21	14,095	13,970	4,962	19,294	52,321	49,119	11,194	14,485	18,342	93,139	-40,818	86,607
21	to	22	58,364	13,970	35,154	18,639	126,127	54,116	12,710	19,337	18,655	104,818	21,309	107,917
22	to	23	0	13,970	523	19,557	34,050	44,372	8,105	13,129	18,311	83,916	-49,866	58,051
23	to	24	19,602	13,970	5,065	19,867	58,504	49,035	8,138	10,710	18,375	86,258	-27,754	30,297
24	to	25	0	13,970	524	20,258	34,752	44,441	5,486	7,896	18,418	76,240	-41,489	-11,192
25	to	26	3,053	13,970	518	20,406	37,947	49,035	4,033	6,132	18,386	77,587	-39,639	-50,832
26	to	27	135,033	13,970	73,747	18,014	240,763	49,035	16,024	17,254	18,639	100,951	139,812	88,980
27	to	28	0	13,970	536	18,764	33,270	44,372	9,238	15,229	18,125	86,963	-53,693	35,287
28	to	29	20,048	13,970	4,960	19,518	58,496	49,119	7,646	10,808	18,326	85,898	-27,402	7,885
29	to	30	9,397	13,970	2,999	19,929	46,296	54,116	4,726	8,252	18,339	85,433	-39,138	-31,253
30	to	31	11,022	13,970	2,348	20,308	47,647	49,035	4,024	7,140	18,409	78,609	-30,962	-62,215
31	to	32	62,138	13,970	37,429	19,568	133,105	49,035	6,854	11,497	18,820	86,205	46,900	-15,315
32	to	33	63,939	13,970	36,375	18,890	133,174	49,119	11,471	19,025	18,678	98,293	34,881	19,566
33	to	34	244	13,970	2,395	20,199	36,808	44,372	6,943	11,585	18,375	81,275	-44,466	-24,900
34	to	35	1,555	13,970	524	20,530	36,579	49,446	3,767	7,507	18,404	79,124	-42,545	-67,445
35	to	36	32	13,970	4,852	20,690	39,543	58,025	303	5,882	18,401	82,610	-43,067	-110,512
36	to	37	52,098	13,970	24,510	19,931	110,509	44,441	4,564	10,236	18,620	77,860	32,648	-77,864
37	to	38	4,170	13,970	616	20,483	39,239	49,035	2,503	6,237	18,378	76,152	-36,913	-114,777
38	to	39	362	13,970	2,463	20,816	37,610	49,446	719	4,966	18,418	73,549	-35,938	-150,716
39	to	40	122,459	13,970	74,037	19,276	229,741	49,035	8,546	10,468	18,766	86,814	142,927	-7,789
40	to	41	12,997	13,970	4,096	19,066	50,129	49,119	8,998	13,953	18,220	90,290	-40,161	-47,950
41	to	42	64,499	13,970	40,945	18,797	138,210	49,035	10,243	16,890	18,577	94,745	43,465	-4,484
42	to	43	0	13,970	536	19,752	34,258	44,372	6,577	12,461	18,301	81,711	-47,454	-51,938
43	to	44	123,377	13,970	53,751	18,022	209,121	49,035	17,543	21,442	18,640	106,660	102,461	50,523
44	to	45	64,250	13,970	39,379	18,423	136,022	49,119	13,271	20,449	18,544	101,383	34,639	85,163
45	to	46	8,541	13,970	2,217	19,103	43,830	49,035	10,232	18,196	18,249	95,712	-51,882	33,281
46	to	47	0	13,970	533	19,897	34,399	44,372	6,746	10,372	18,334	79,823	-45,424	-12,143

TABLE 4-1

Simulated Annual Groundwater Budget

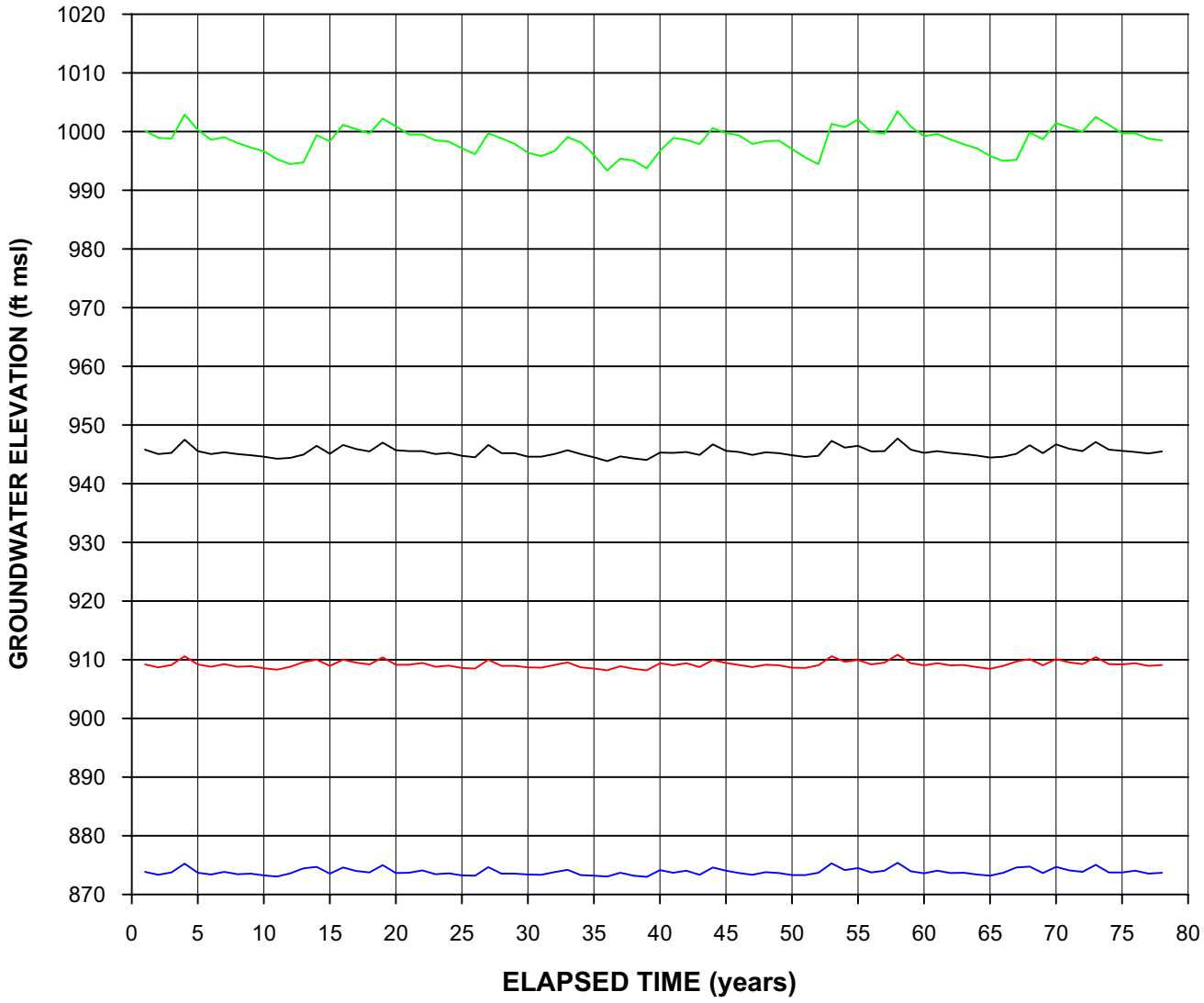
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Subsurface Inflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
47 to 48	43,414	13,970	18,560	19,505	95,448	49,035	8,927	12,755	18,638	89,355	6,094	-6,050
48 to 49	32,966	13,970	13,527	19,953	80,416	49,119	8,497	12,634	18,666	88,916	-8,499	-14,549
49 to 50	839	13,970	1,856	20,451	37,117	44,372	5,528	8,992	18,434	77,326	-40,209	-54,758
50 to 51	9,990	13,970	2,645	20,684	47,289	54,116	3,517	6,845	18,455	82,933	-35,643	-90,401
51 to 52	49,961	13,970	25,027	20,153	109,112	62,702	3,319	9,913	18,755	94,689	14,423	-75,978
52 to 53	188,493	13,970	69,633	17,584	289,679	49,119	22,292	27,398	18,933	117,742	171,937	95,959
53 to 54	46,125	13,970	20,155	18,290	98,539	49,035	15,148	24,661	18,522	107,366	-8,827	87,132
54 to 55	89,718	13,970	39,953	17,979	161,620	49,035	20,589	29,655	18,624	117,903	43,716	130,848
55 to 56	11,601	13,970	3,373	19,267	48,211	49,035	11,347	18,242	18,316	96,940	-48,729	82,119
56 to 57	51,672	13,970	28,415	19,203	113,260	49,119	11,982	18,862	18,806	98,769	14,491	96,610
57 to 58	181,820	13,970	89,448	17,106	302,343	49,035	32,399	38,747	19,048	139,229	163,114	259,725
58 to 59	687	13,970	527	18,350	33,534	49,035	16,623	29,046	18,213	112,917	-79,383	180,342
59 to 60	2	13,970	535	19,266	33,773	44,372	10,576	17,223	18,266	90,437	-56,664	123,678
60 to 61	42,574	13,970	19,998	18,987	95,529	49,119	12,553	18,152	18,704	98,527	-2,998	120,680
61 to 62	11,415	13,970	2,484	19,754	47,622	49,035	9,005	13,268	18,366	89,674	-42,052	78,628
62 to 63	27,363	13,970	10,507	20,014	71,853	54,116	7,752	12,812	18,539	93,219	-21,366	57,262
63 to 64	0	13,970	523	20,416	34,909	44,372	5,755	10,119	18,437	78,683	-43,774	13,488
64 to 65	0	13,970	1,472	20,680	36,121	49,522	3,569	7,254	18,475	78,820	-42,698	-29,210
65 to 66	50,580	13,970	28,173	19,854	112,576	58,025	4,004	10,335	18,623	90,989	21,588	-7,622
66 to 67	130,074	13,970	80,760	17,898	242,702	72,452	13,502	21,223	18,686	125,863	116,839	109,216
67 to 68	112,433	13,970	51,561	17,536	195,499	49,035	23,462	32,532	18,803	123,833	71,667	180,883
68 to 69	414	13,970	1,979	18,661	35,024	49,522	8,596	18,842	18,226	95,186	-60,162	120,721
69 to 70	113,543	13,970	60,100	17,647	205,261	49,035	29,552	30,176	18,761	127,523	77,737	198,459
70 to 71	45,609	13,970	21,594	18,166	99,339	49,035	15,740	23,534	18,602	106,911	-7,572	190,886
71 to 72	16,967	13,970	5,320	18,777	55,034	49,035	12,551	18,552	18,264	98,402	-43,368	147,518
72 to 73	137,727	13,970	59,717	17,442	228,856	49,119	28,296	34,847	19,001	131,263	97,592	245,111
73 to 74	13	13,970	4,717	18,592	37,292	49,035	14,986	23,059	18,220	105,299	-68,007	177,103
74 to 75	14,095	13,970	4,962	19,254	52,281	49,035	11,783	15,930	18,311	95,059	-42,779	134,324
75 to 76	58,364	13,970	35,154	18,654	126,142	54,116	13,385	20,958	18,673	107,132	19,010	153,334
76 to 77	0	13,970	523	19,646	34,139	44,441	8,624	14,082	18,380	85,527	-51,388	101,946
77 to 78	19,602	13,970	5,065	19,899	58,536	49,035	8,607	11,515	18,393	87,550	-29,014	72,932
Minimum	0	13,970	518	16,985	33,270	44,372	303	4,966	18,125	73,549	-79,383	-150,716
Maximum	188,493	13,970	89,448	20,816	302,343	72,600	36,265	38,747	19,056	139,229	171,937	259,725
Average	42,498	13,970	21,480	19,092	97,040	49,823	11,520	16,262	18,498	96,105	935	44,866
Median	19,602	13,970	5,193	19,153	58,500	49,035	9,822	14,430	18,446	92,573	-28,384	36,292

Note:

All flow volumes are listed in AF/yr.

Figures



NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS. WELL NLF-TOPCO1 IS LOCATED 210 feet SOUTHWEST OF WELL NLF-B11.

FIGURE 4-1
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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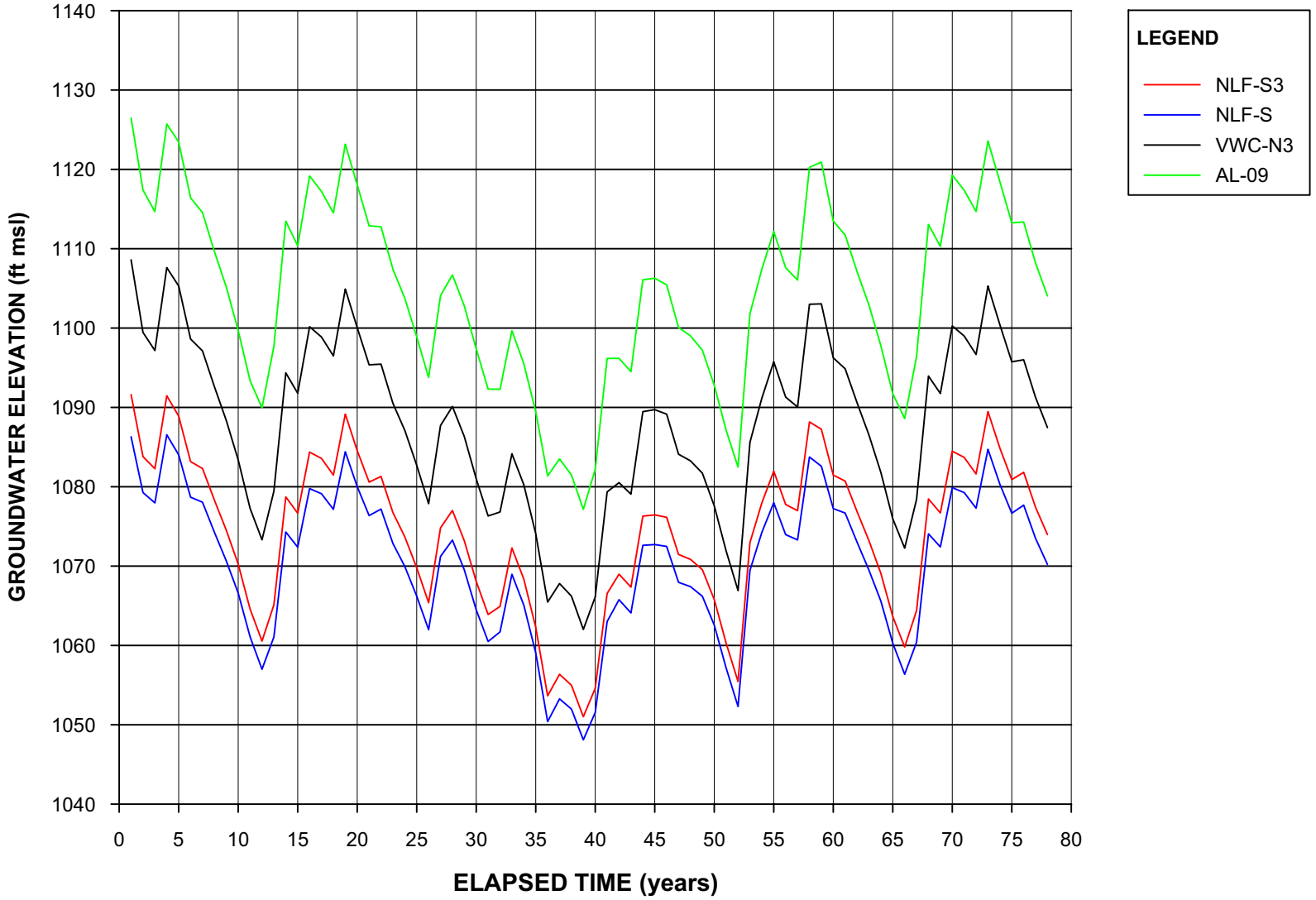

NOTES:

1. AL09 IS A CLUSTER OF OBSERVATION WELLS LOCATED 845 feet SOUTHWEST OF PRODUCTION WELL VWC-Q2.

2. THE REMAINING HYDROGRAPHS REPRESENT FORMER ALLUVIAL AQUIFER WELLS THAT HAVE BEEN ABANDONED AND THEREFORE ARE NOT PUMPED IN THE MODEL SIMULATIONS. RELATIVE TO EXISTING WELLS SHOWN ON FIGURE 2-4, THESE FORMER WELLS WERE LOCATED AS FOLLOWS:

   – WELL NLF-S3 WAS LOCATED 305 feet EAST OF WELL VWC-S6
   – WELL NLF-S WAS LOCATED 940 feet SOUTHWEST OF WELL VWC-S6
   – WELL VWC-N3 WAS LOCATED 435 feet NORTHEAST OF WELL VWC-N8

FIGURE 4-2
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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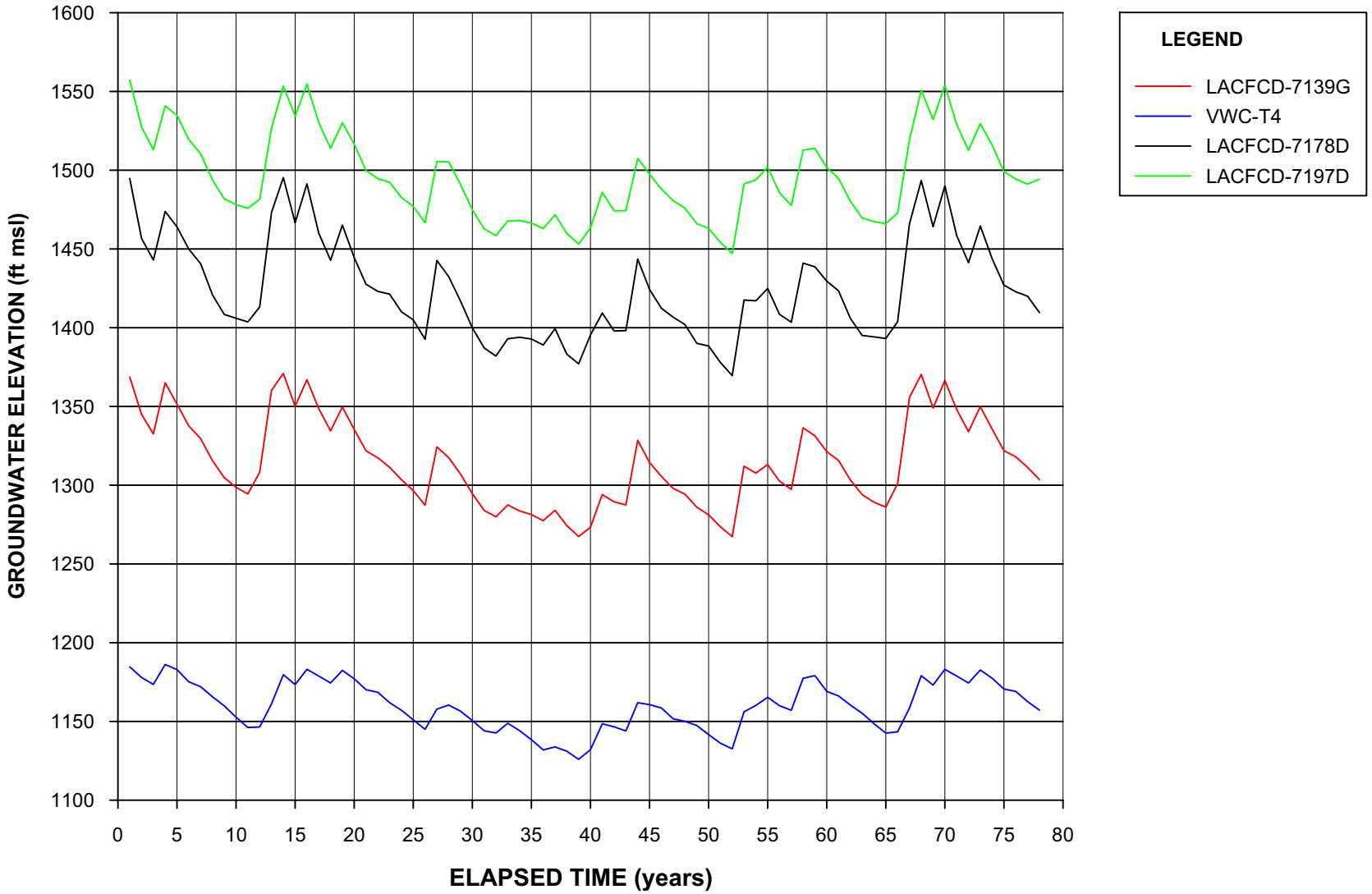

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR VWC- T4 = 1101 ft msl; ALLUVIUM BOTTOM ELEVATION ~1050 TO 1065 ft msl.
3. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7139G = 1289 ft msl; ALLUVIUM BOTTOM ELEVATION ~1256 ft msl OR LOWER.
4. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7178D = 1463 ft msl; ALLUVIUM BOTTOM ELEVATION ~1398 TO 1425 ft msl.
5. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7197D = 1474 ft msl; ALLUVIUM BOTTOM ELEVATION ~1423 TO 1447 ft msl.

FIGURE 4-3
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER IN SOLEDAD CANYON
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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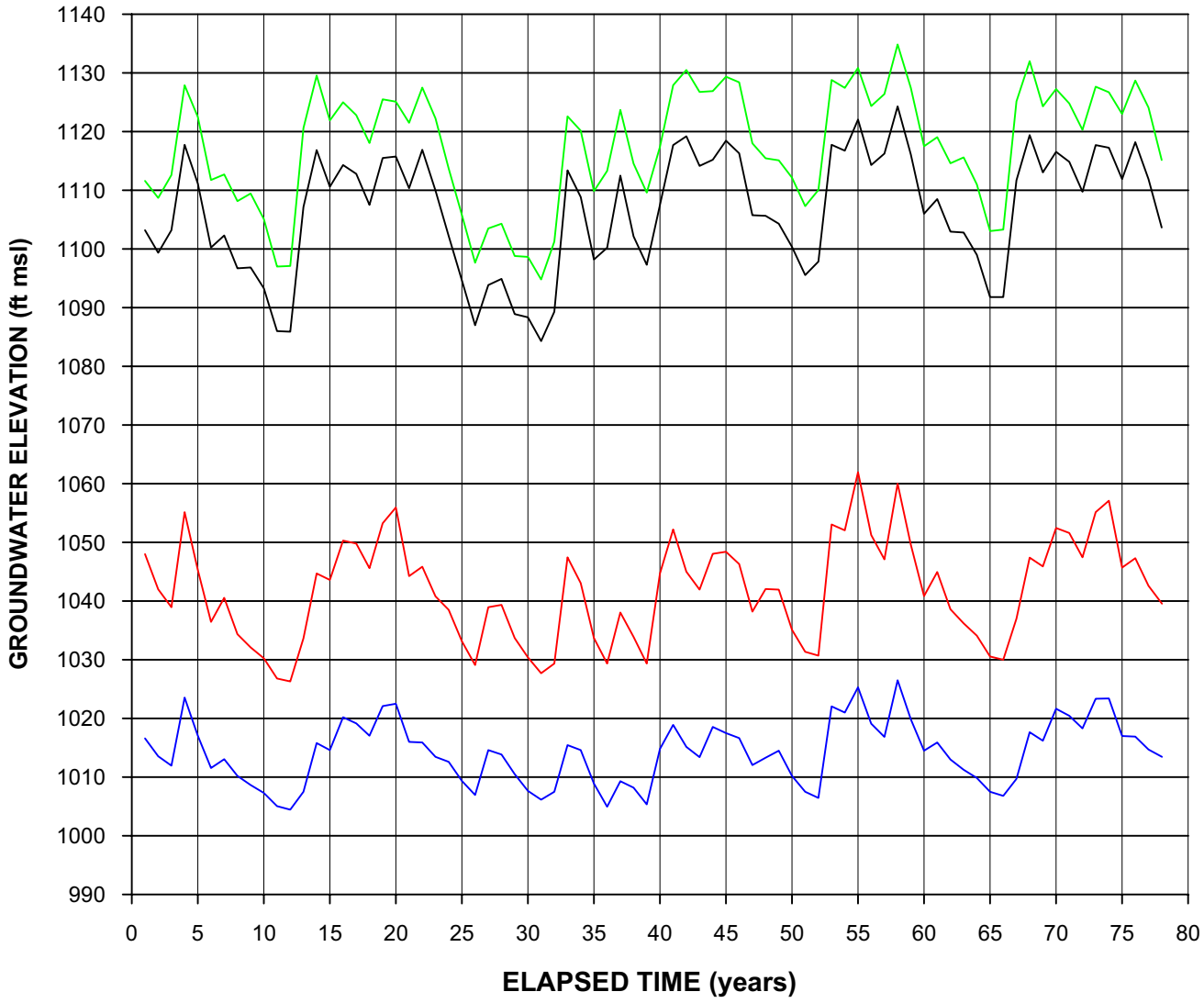

NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE 4-4
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG CASTAIC CREEK
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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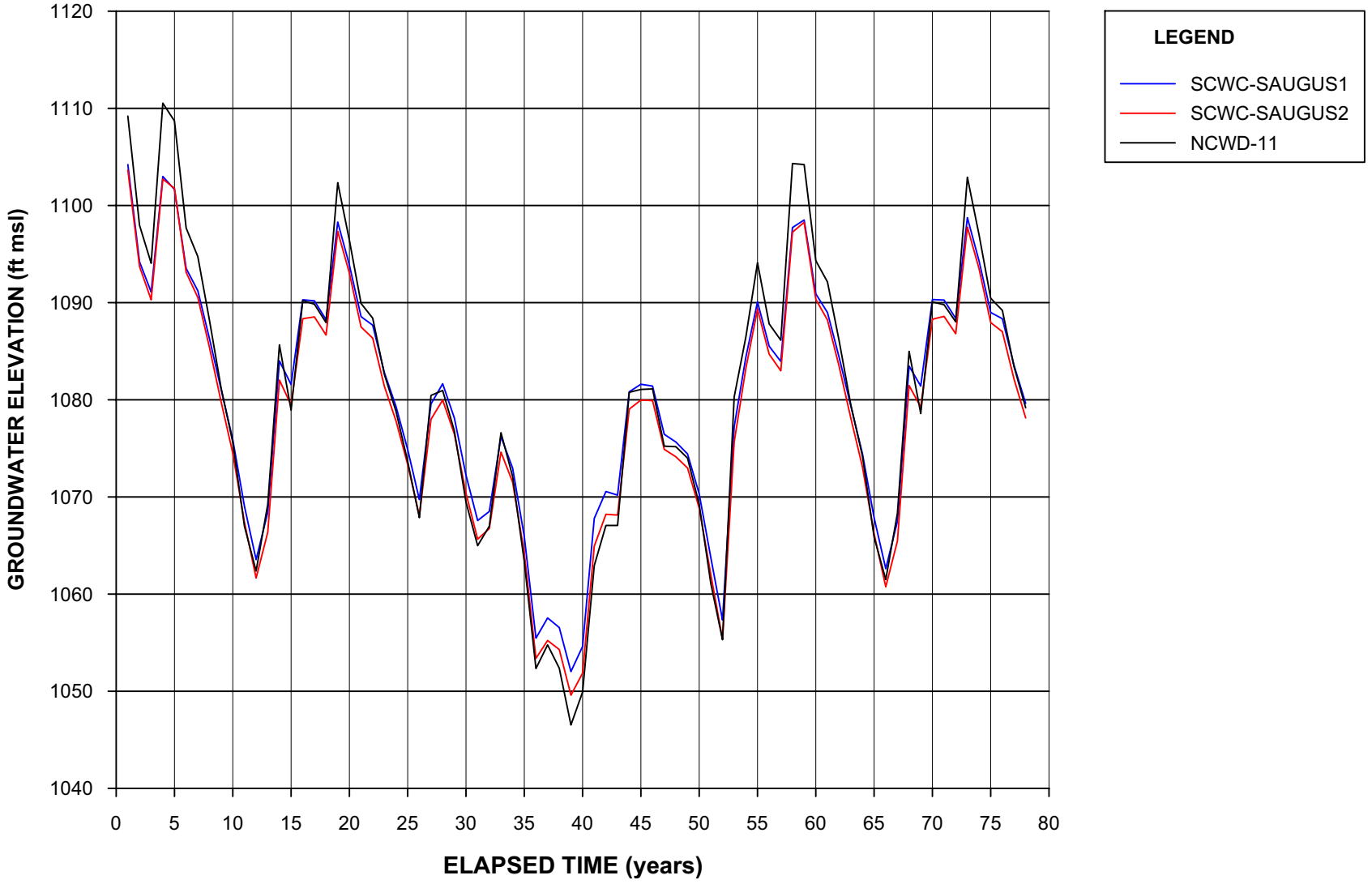

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

2. THESE WELLS ARE CONSTRUCTED IN THE SAUGUS FORMATION AND ARE NOT OPEN TO THE ALLUVIAL AQUIFER. THE SIMULATED HYDROGRAPHS AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE ALLUVIAL AQUIFER, ABOVE THE OPEN INTERVALS OF THESE WELLS.

FIGURE 4-5
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG THE SOUTH FORK SANTA CLARA RIVER
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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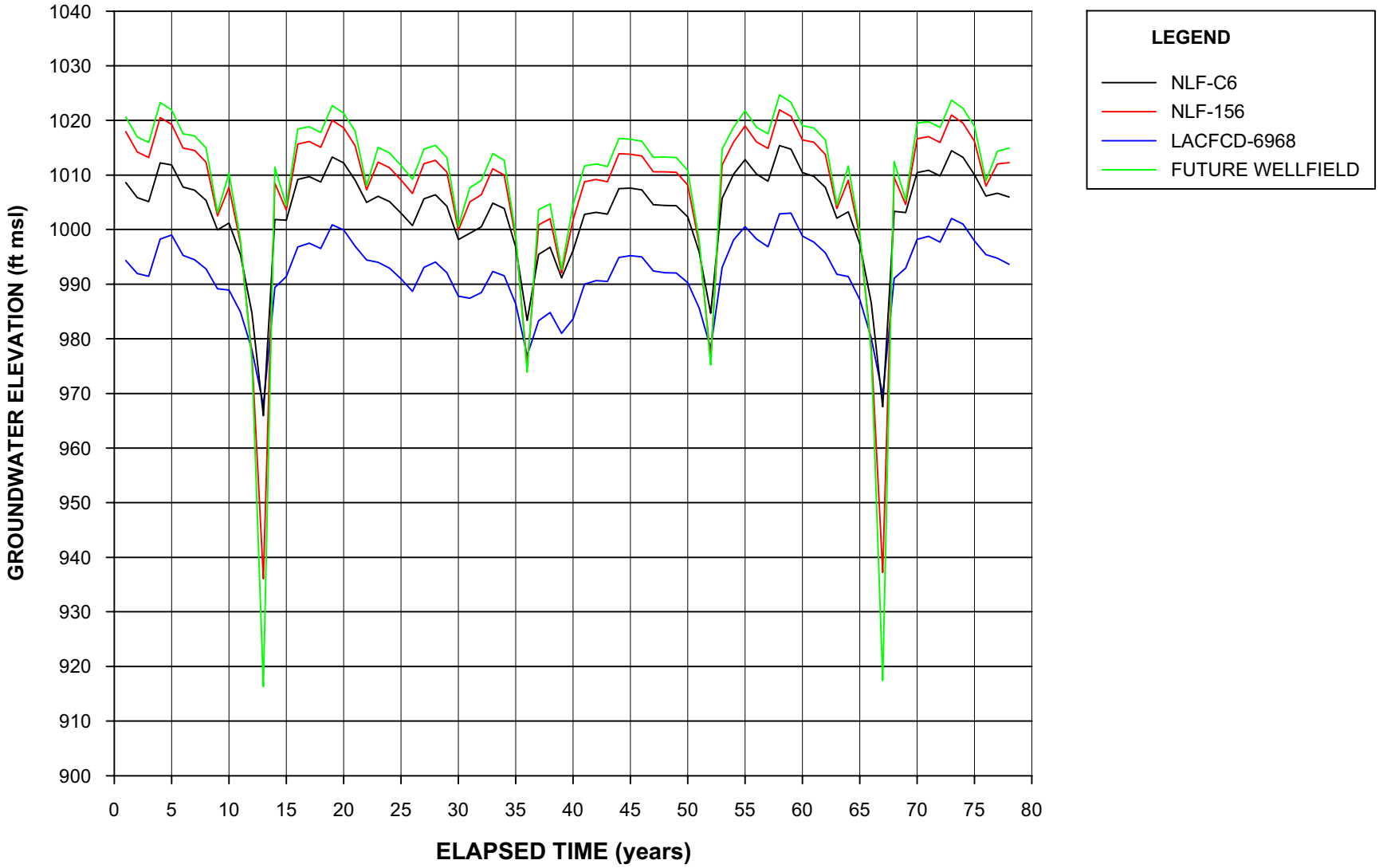

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WELLS NLF-C6 AND LACFCD-6968 ARE CONSTRUCTED IN THE ALLUVIAL AQUIFER AND ARE NOT OPEN TO THE SAUGUS FORMATION. THE SIMULATED HYDROGRAPHS SHOWN AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE SAUGUS FORMATION, BELOW THE OPEN INTERVALS OF THESE WELLS.
3. THE SIMULATED HYDROGRAPH FOR THE FUTURE WELLFIELD IS FOR A MODEL NODE WITH NO ASSIGNED PUMPING, LOCATED INSIDE THE WELLFIELD NEAR VWC-206.

FIGURE 4-6
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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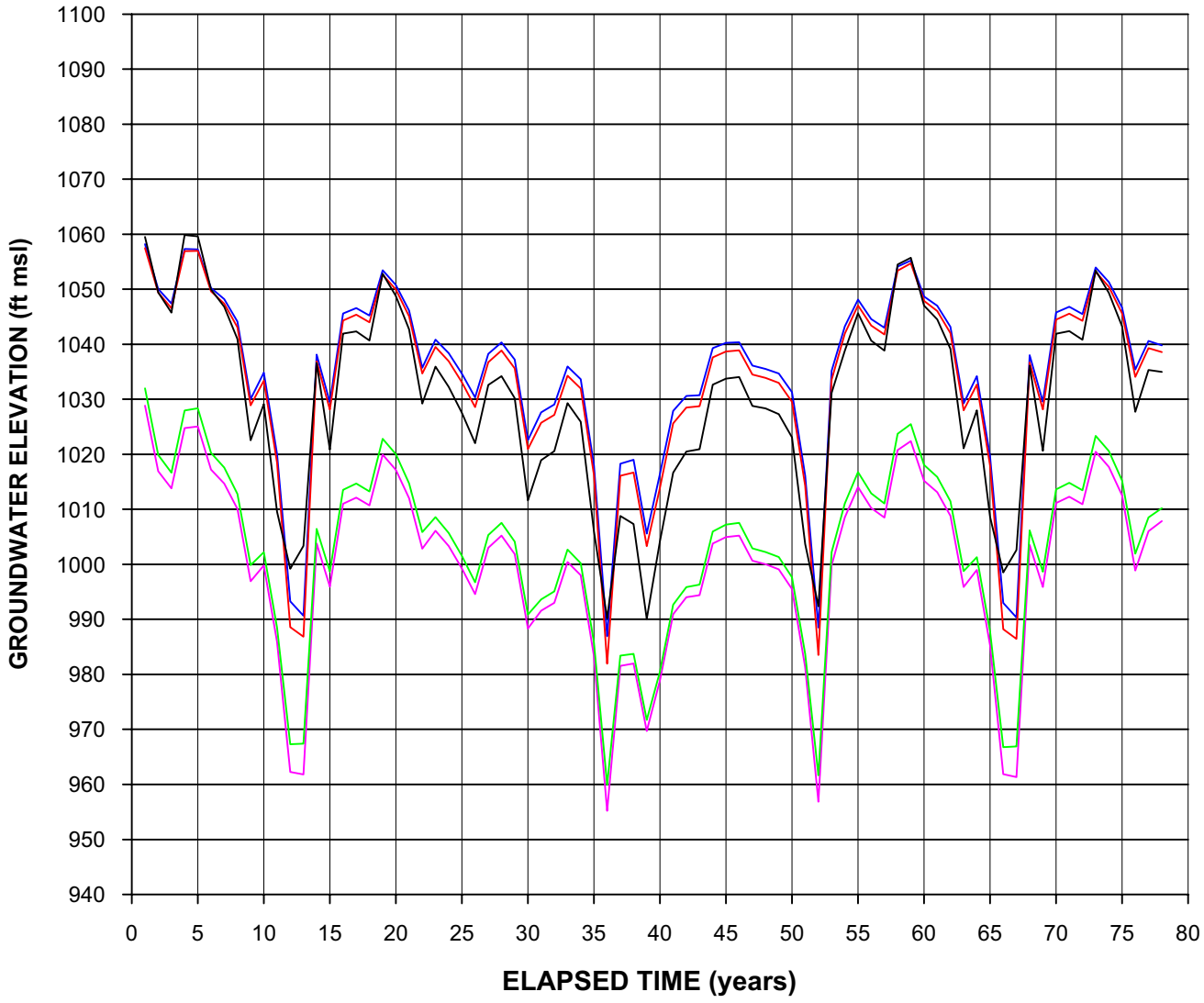

NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE 4-7
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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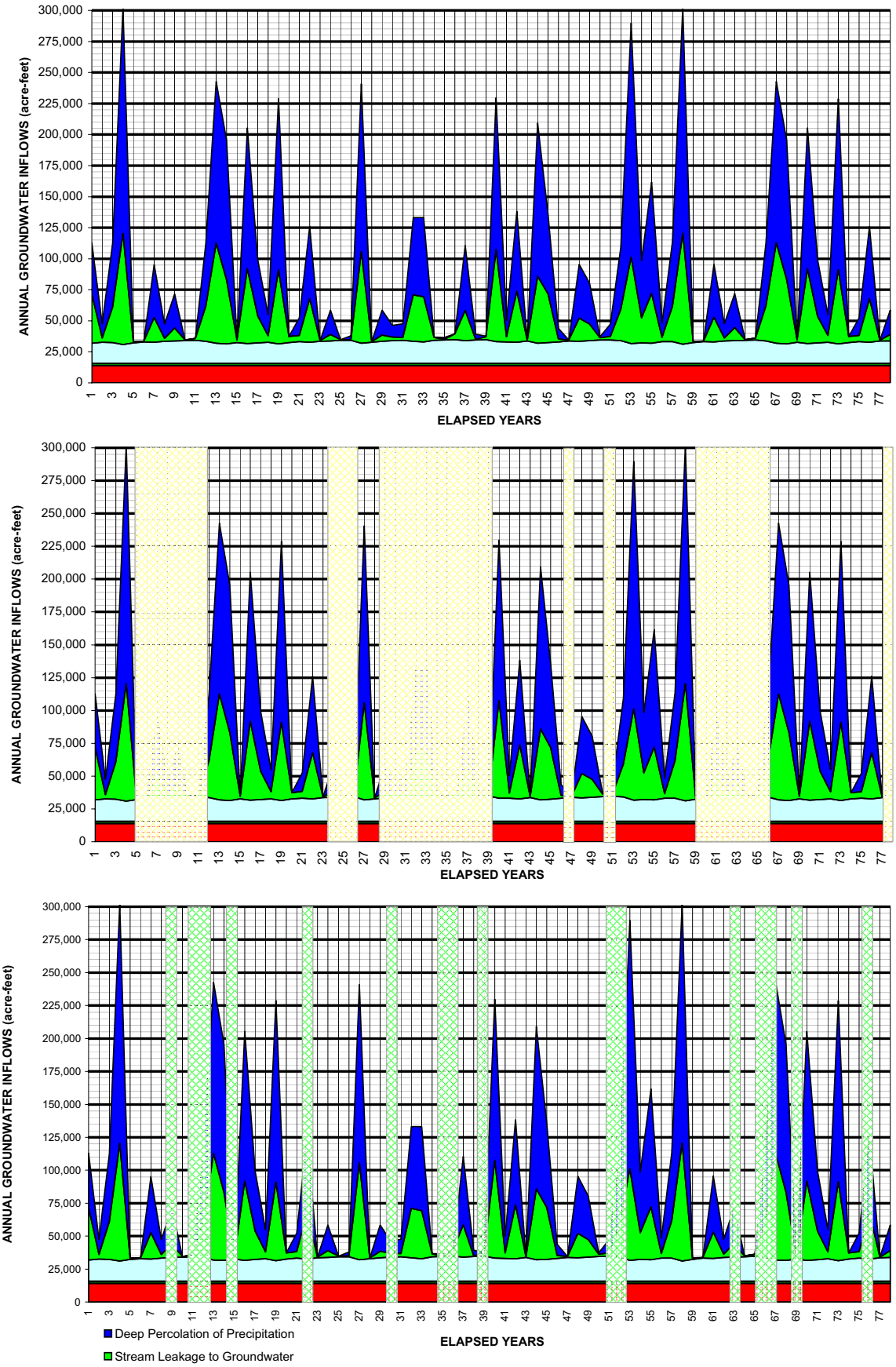

Note:

The deep percolation of applied water is calculatedfor full build-out conditions within the Regional Model boundary, as shown on Figure 3-7 and discussed in Section 3.5.

FIGURE 4-8
SIMULATED ANNUAL GROUNDWATER INFLOWS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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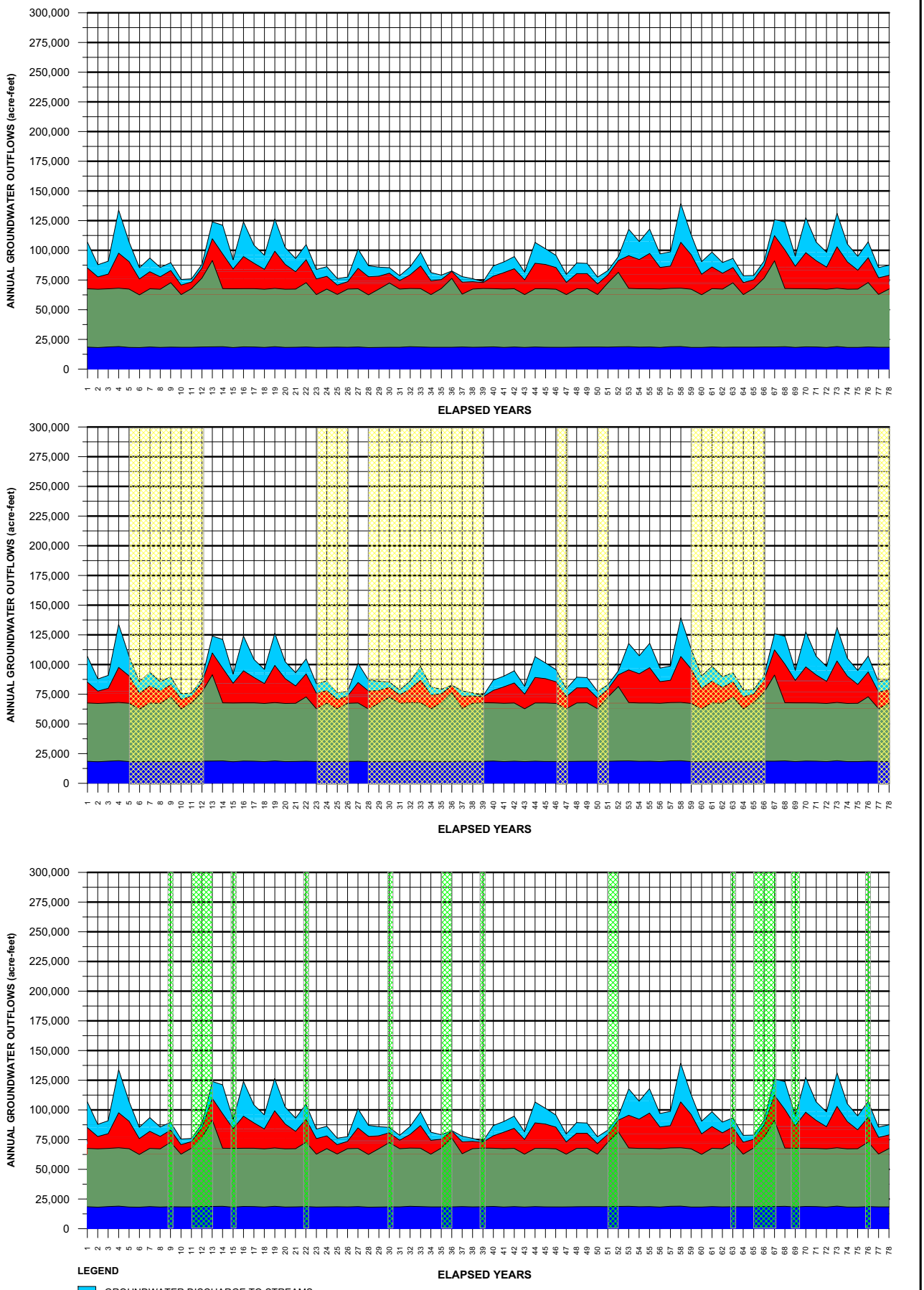

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FIGURE 4-9
SIMULATED ANNUAL GROUNDWATER OUTFLOWS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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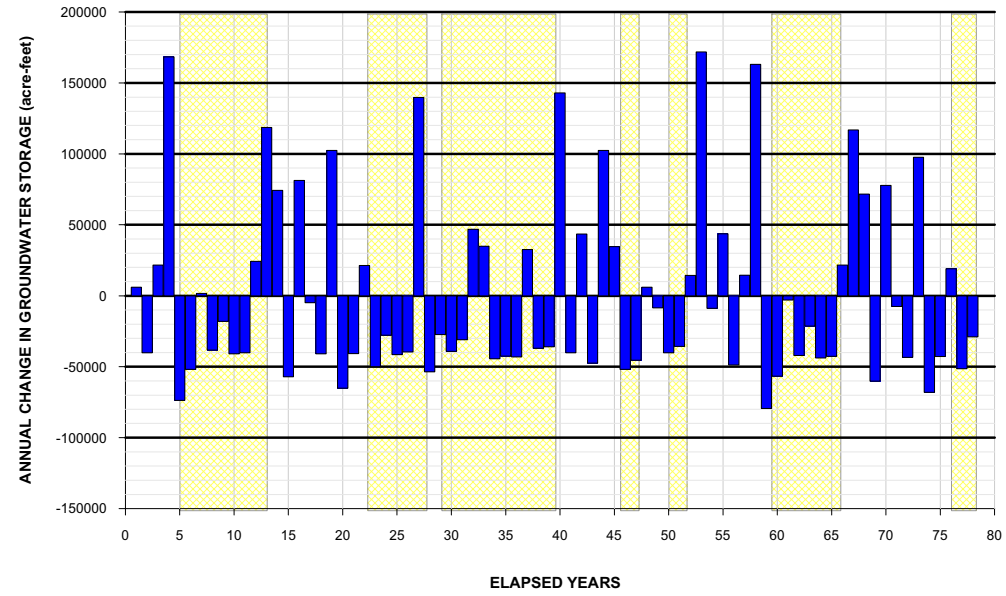

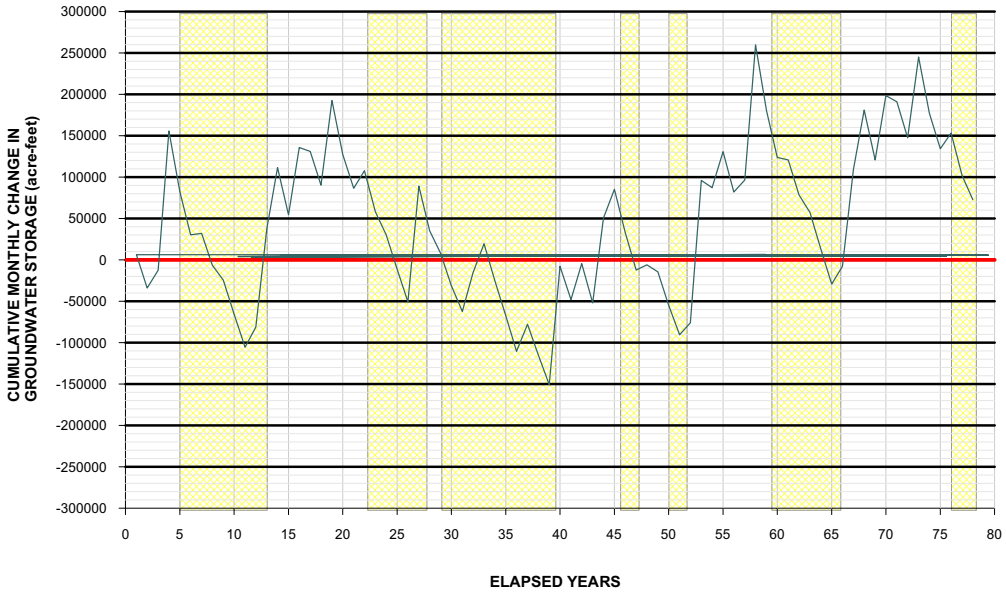

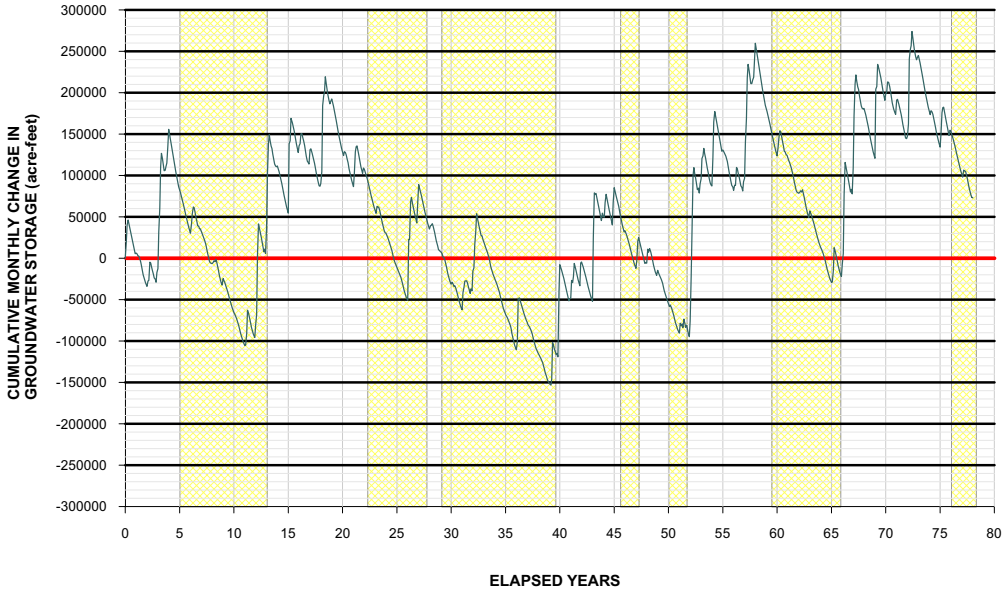

LOCAL DRY YEARS

FIGURE 4-10 (PAGE 1 OF 2)
ANNUAL AND CUMULATIVE CHANGE IN SIMULATED GROUNDWATER STORAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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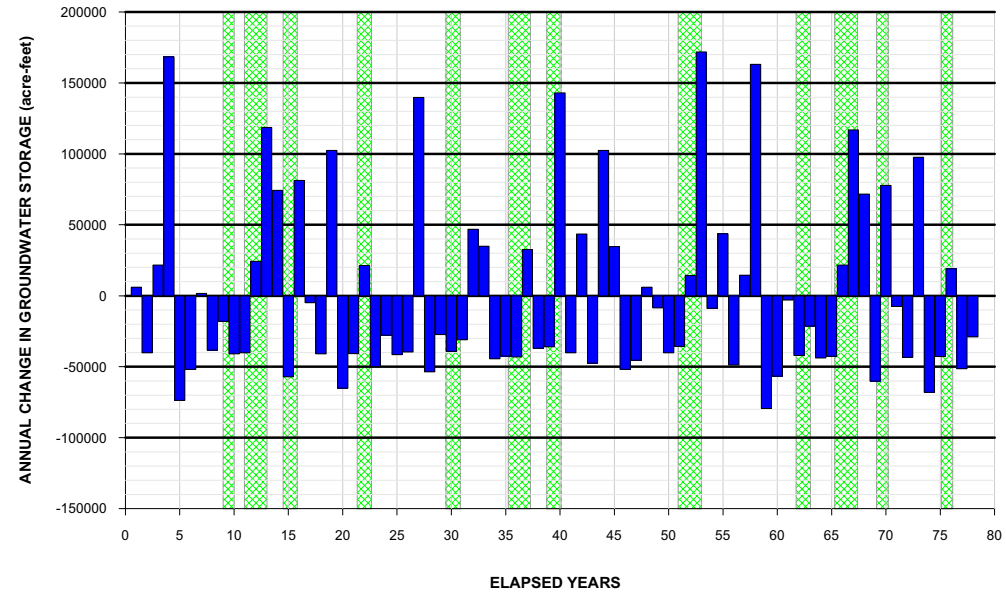

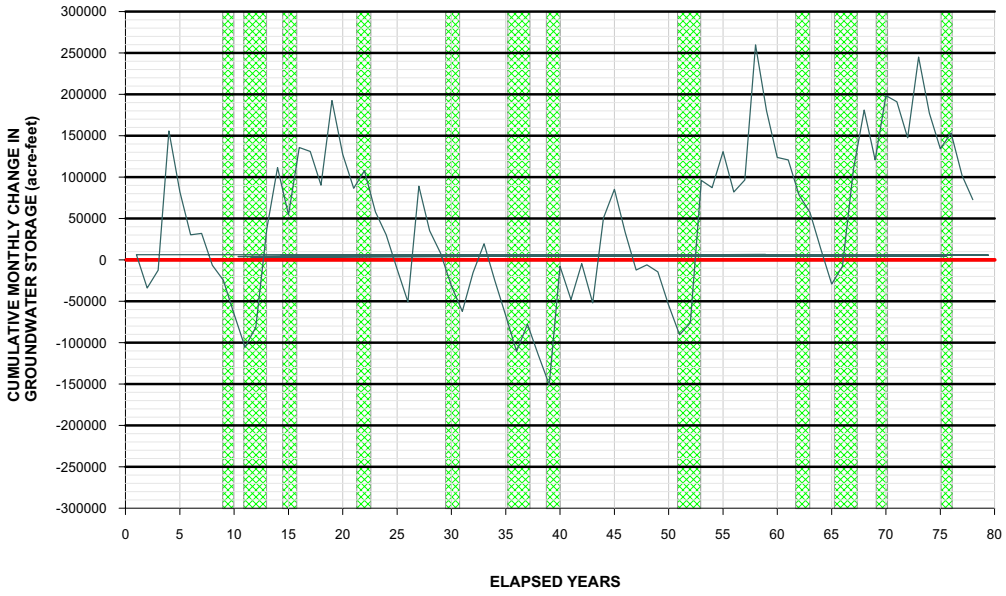

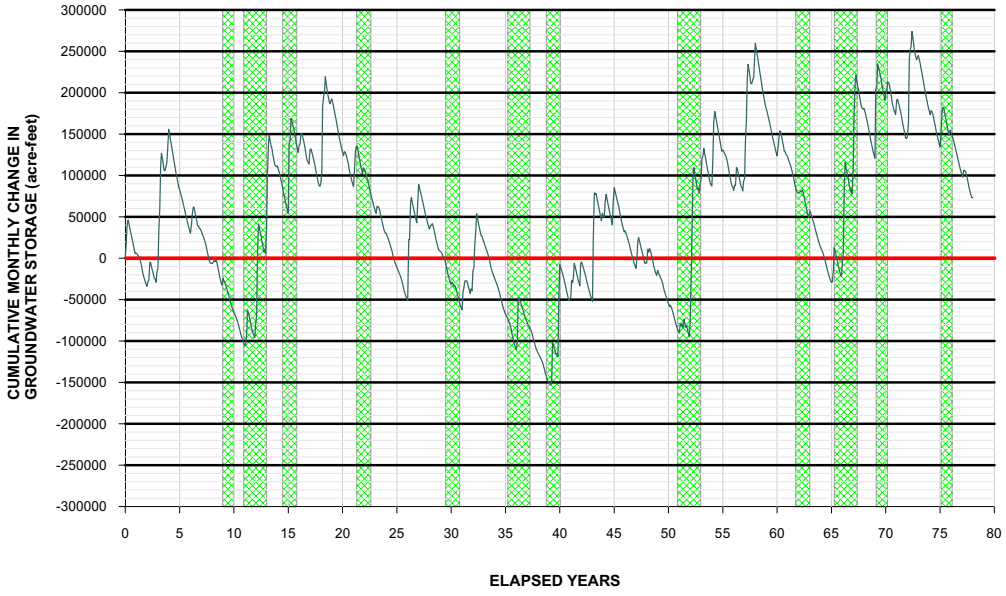

FIGURE 4-10 (PAGE 2 OF 2)
ANNUAL AND CUMULATIVE CHANGE IN SIMULATED GROUNDWATER STORAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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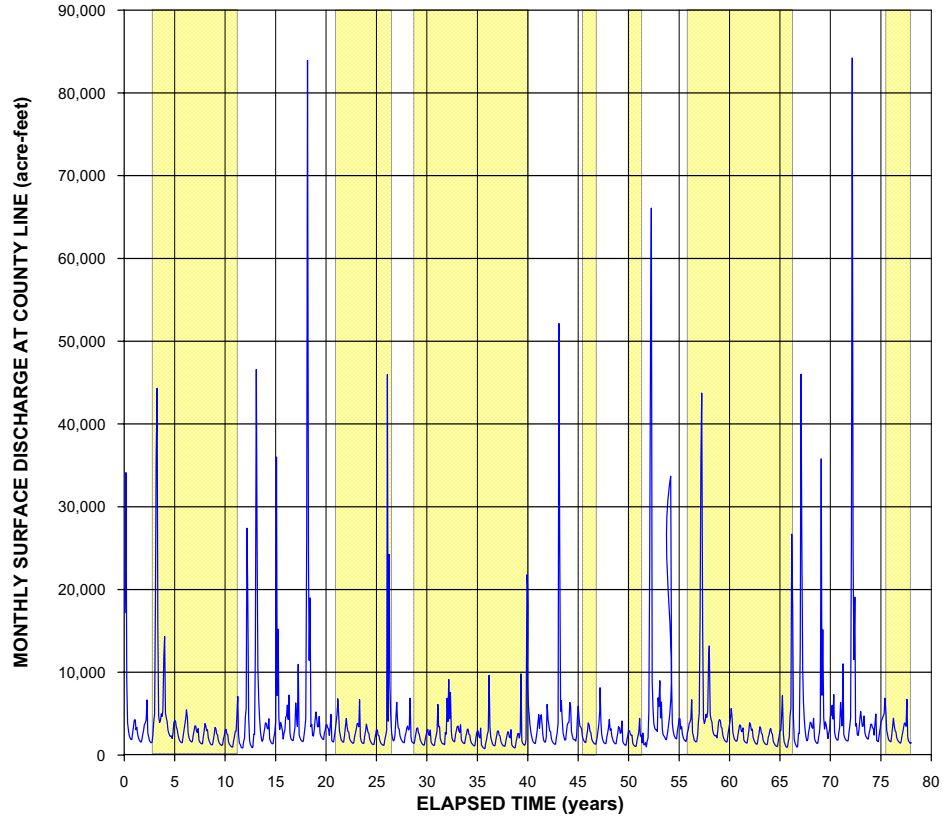

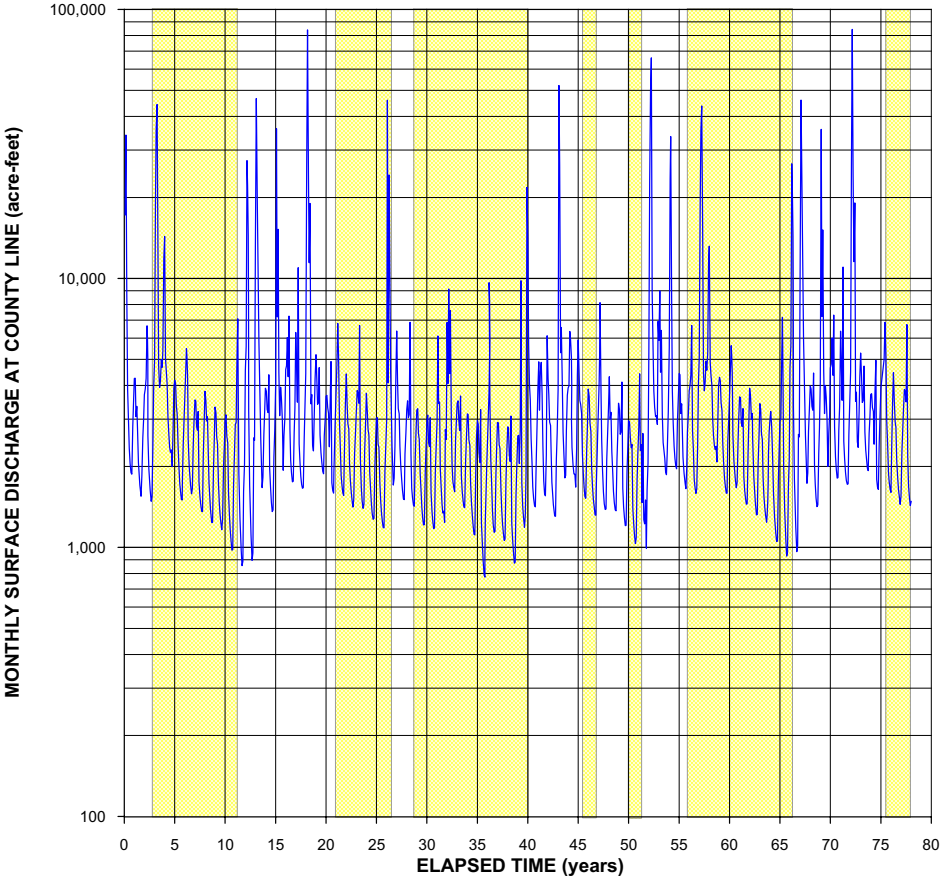

LEGEND

LOCAL DRY YEARS

FIGURE 4-11
SIMULATED SANTA CLARA RIVER FLOW AT COUNTY LINE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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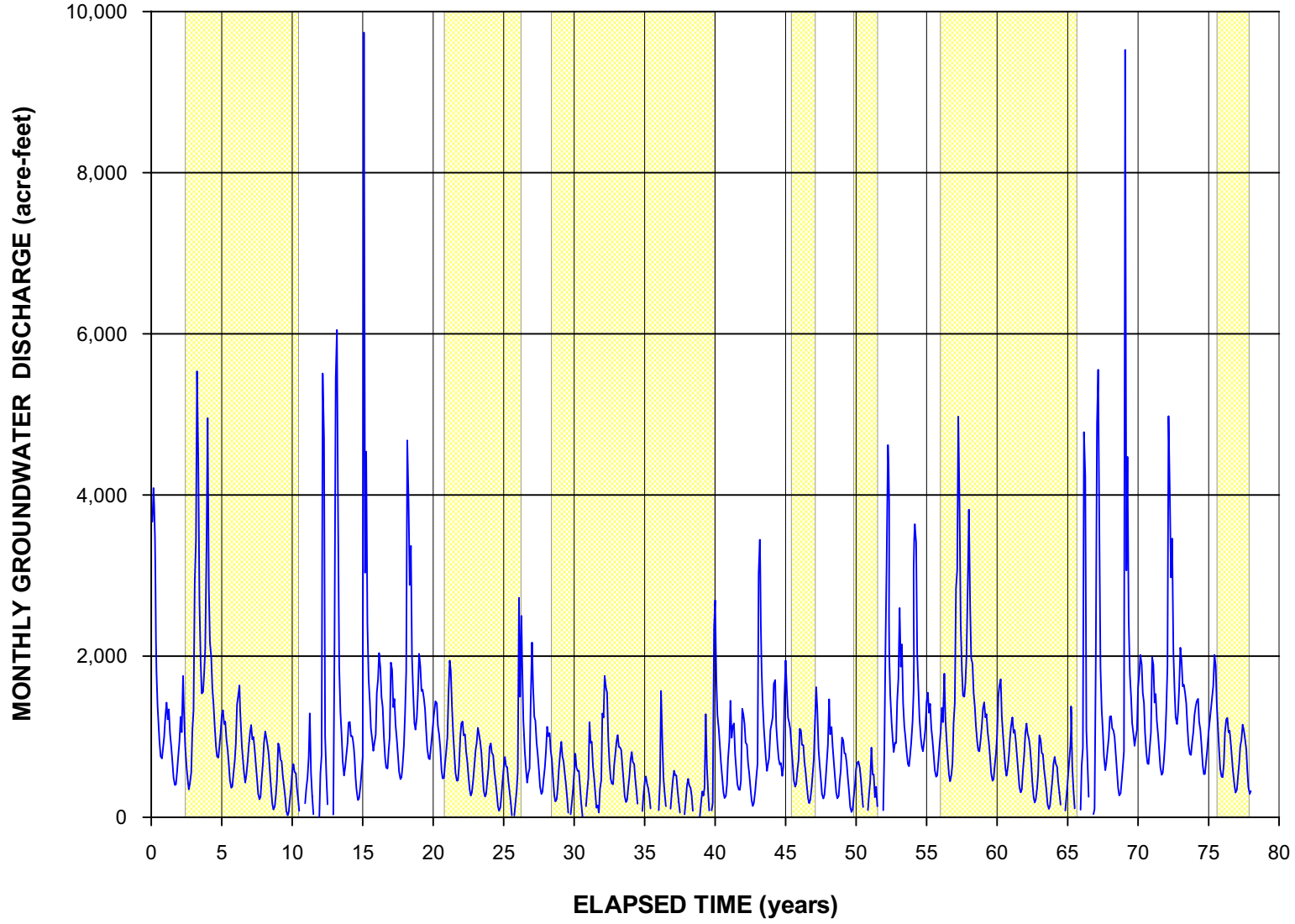

FIGURE 4-12
SIMULATED GROUNDWATER DISCHARGE TO SANTA CLARA RIVER
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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SECTION 5

Conclusions

This section discusses the principal findings from the analyses of historical data and numerical modeling results and the implications of these findings for both groundwater management and water supply in the Santa Clarita Valley.

5.1 Principal Findings

The primary objective of the groundwater basin yield evaluation was to use the Regional Model to examine the groundwater operating plan under a range of potential hydrologic conditions to determine whether the groundwater resources in the valley could be expected to respond to such operations in a sustainable fashion. For the purposes of this evaluation, as in other settings, sustainability is defined in terms of renewability (recharge) of groundwater as reflected by the following indicators:

1. Lack of chronic, or sustained, depletion of groundwater storage, as indicated by projected groundwater levels, over a reasonable range of wet, normal, and dry hydrologic conditions

2. Maintenance of surface water flows in the western portion of the basin (which are partially maintained by groundwater discharge) and surface water outflow to downstream basins over the same range of hydrologic conditions

Regarding maintenance of surface water flows, although the development and use of groundwater in a sustainable manner necessitates the inducement of recharge from surface water, sustainability, in this case, does not rely on inducing groundwater recharge by eliminating surface water flows. Rather, it retains and, as supported by increased supplemental water importation, generally increases surface water outflow. Regarding both indicators of sustainability, the range of analyzed hydrologic conditions is a long-term period that includes anticipated occurrences of the types of years and groups of year types that have historically occurred in the basin.

The primary conclusion from the modeling analysis is that the current operating plan for the groundwater basin in the Santa Clarita Valley will not cause detrimental short- or long-term effects to the groundwater and surface water resources in the valley and is, therefore, sustainable. The modeling analysis, along with the historical data described in this report, result in the following specific conclusions regarding the sustainability of the operating plan:

1. The groundwater basin has historically been, and continues to be, in good operating condition and not in overdraft conditions, as indicated by historical data.

2. The operating plan is sustainable over varying hydrologic conditions, because it is feasible to intermittently exceed a long-term average yield for 1 or more years without

creating long-term adverse impacts to the groundwater system and the Santa Clara River.

3. Yields from the Alluvial Aquifer and the Saugus Formation during wet and dry years can be used for long-term water supply planning purposes. In particular, although increased pumping from the Saugus Formation during years of reduced SWP deliveries can be expected to cause short-term declines in groundwater levels during such pumping, it is not projected to cause permanent declines in groundwater discharges or streamflow. Additionally, Saugus groundwater levels will rapidly recover to pre-drought conditions.

4. The strategy around which the plan was designed (maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, while limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus pumping during years when SWP supplies are significantly reduced because of drought conditions) is viable on a long-term basis.

5. The historical observations of basin conditions and the model simulations together support the historical and ongoing confidence that groundwater can continue to be a sustainable source of water supply under the current groundwater operating plan described in the Amended 2000 UWMP (Black & Veatch, 2000; CLWA et al., 2005), the Groundwater Management Plan (CLWA, 2003), and the annual water reports (LSCE, 2005a).

In summary, the groundwater basin can be expected to respond to the operating plan in a manner similar to what has been experienced over approximately the last 50 years: use of water from groundwater storage during drier periods, mostly reflected by small to large fluctuations in Alluvial Aquifer groundwater levels from the middle to the eastern part of the basin, followed by full to near-full recovery in wet years or periods of years. A notable difference from historically experienced conditions is in the Saugus Formation. Greater Saugus pumping during periods of significantly reduced imported water supplies is projected to cause larger fluctuations in groundwater levels during such pumping, with full to near-full recovery of Saugus water levels in subsequent years, when the availability of imported water supplies returns to normal.

5.2 Groundwater Management and Water Supply Implications

The primary focus of the MOU and a key focus of the Groundwater Management Plan is basin yield; specifically, whether a groundwater operating yield could be developed whereby some defined amount of groundwater could be pumped on a sustainable basis. The evaluation described in this report addresses that question. The MOU did not envision impacts from groundwater contamination such as have recently impacted a number of municipal water supply wells. Fortunately, the Regional Model could be used, and has been used, to also examine the effectiveness of the operating plan in containing groundwater contaminants while concurrently pumping (with appropriate treatment at contaminated wells) for municipal water supply (CH2M HILL, 2004b). Thus, in addition to the water supply and groundwater management findings derived from the original intent of the MOU, as discussed below, an additional significant finding derived from the

development and application of the model is that groundwater supply and the control of groundwater contamination migration can be concurrently accomplished without having to modify or, more importantly, compromise the operating yield of the basin.

In addition to the preceding contamination-related findings, there are other findings that directly relate to the original intent of the MOU and can be classified as findings related to the yield of the basin and/or the long-term water supply in the valley. First, the long-term yield of the basin can be considered, for the present, to be equivalent to the operating plan for the basin, based on the simulated projections of groundwater levels, storage, and stream flows. In other words, with the existing and planned distribution of wells and pumping capacities in the operating plan, the basin can be expected to sustainably yield the annual volumes of groundwater in the operating plan for ongoing municipal and agricultural water supply. Additionally, other pumpers in the basin, such as small private well owners, can expect to experience Alluvial Aquifer groundwater conditions generally similar to what they have experienced in the past. This expression of basin yield, based on the existing and planned distribution of wells and pumping capacities, should not be considered or interpreted as a limit to the yield of the basin. It is possible that some alternate configurations of well locations and pumping capacities, potentially complemented by other management actions (e.g., artificial recharge activities), could increase the yield of the basin in the future. The Regional Model, developed for analysis of the current operating plan, can be used to examine potential changes in the operating plan and associated changes in basin yield if that is ever desirable. For the present, however, the main finding of the current groundwater operating plan is that basin conditions can be expected to generally repeat what has been experienced over the last several decades, with some increase in Saugus groundwater level fluctuations if dry-year increases in pumping are actually needed as planned, all resulting in no long-term depletion of groundwater.

From a water supply perspective, the main finding of the operational yield analysis is that it supports the groundwater component of overall water supply for the Santa Clarita Valley as described in the 2000 UWMP, and as expected to be carried forward in the 2005 UWMP.

As discussed in Section 5.1, the Saugus Formation has not been historically pumped at the dry-year rates described in the operating plan. Consistent with the ongoing water resource management, data collection, data management, data evaluation, and reporting activities that have been ongoing in the basin for the past several years, the Purveyors will closely monitor the effects of the greater-than-historical Saugus Formation pumping when it occurs. Depending on the findings from monitoring activities during the first period of increased Saugus pumping, the conjunctive use program that currently relies on SWP deliveries could potentially expand to include artificial recharge activities to enhance Saugus water level recovery after periods of increased Saugus pumping.

In conclusion, through the UWMP, the MOU, the Groundwater Management Plan, and other related water resource management activities, the Purveyors have developed an ongoing process for groundwater resource management in the Santa Clarita Valley that results in a sustainable operating plan for the local groundwater basin. As discussed in the annual water reports (including LSCE, 2005a), the ongoing process of groundwater management relies not only on the historical evaluations and numerical modeling analyses, but also on other program elements identified in the MOU—data gathering, database maintenance, and annual reporting—as well as other activities, such as implementing

conservation measures, increasing the use of recycled water, planning for water reliability, updating the UWMP on a regular schedule, and administering the Groundwater Management Plan. The development and implementation of the UWMP, the MOU, and the Groundwater Management Plan have resulted in a significantly improved understanding of the local water resources, and, in particular, have demonstrated that the current groundwater operating plan results in a reliable, long-term component of water supply for the valley. Ongoing monitoring and interpretation of actual groundwater conditions, as discussed in the MOU and the Groundwater Management Plan, will allow (1) continued assessment of basin responses to future pumping; (2) verification that, as public and private development increase with time, both within and adjacent to the basin, the groundwater basin responds in the same general manner as described herein; and (3) identification of whether adjustments to the operating plan might be warranted to achieve its primary objective of a sustainable groundwater resource.

SECTION 6

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Appendix A
Memorandum of Understanding

Memorandum of Understanding
Between the
Santa Clara River Valley
Upper Basin Water Purveyors and
United Water Conservation District

August 2001

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into effective August 20, 2001, by and among Castaic Lake Water Agency ("CLWA"), CLWA's Santa Clarita Water Division ("SCWC"), Newhall County Water District ("NCWD"), Valencia Water Company ("VWC") and Los Angeles County Waterworks District No. 36 ("LACWD"), which are collectively referred to as the "Upper Basin Water Purveyors" and United Water Conservation District "UWCD", hereinafter referred together as the "parties."

RECITALS

WHEREAS, UWCD is a public agency that encompasses approximately 214,000 acres of land located in central Ventura County. UWCD's service area covers the downstream portion of the Santa Clara River Valley in Ventura County, as well as the Oxnard Plain (sometimes referred to as the "Lower Santa Clara River Area"). UWCD manages surface and groundwater resources within seven groundwater basins in the Lower Santa Clara River Valley Area. UWCD's Boundary is shown on Figure 1-1; and,

WHEREAS, the Upper Basin Water Purveyors meet regularly as a technical group to coordinate conjunctive use of imported, recycled and groundwater resources of the water basins east of the Los Angeles/ Ventura County line (sometimes referred to as the "Upper Santa Clara River Area"), which is located almost entirely within northwestern Los Angeles County. The respective services areas of the Upper Basin Water Purveyors members (CLWA, SCWC, NCWD, VWC and LACWD) are shown on Figure 1-2; and,

WHEREAS, UWCD has been involved in the review of water resources in both the Lower Santa Clara River Area and also the Upper Santa Clara River Area as part of UWCD's review of the Newhall Ranch Specific Plan and EIR (NRSP); and,

WHEREAS, litigation of the Newhall Ranch Specific Plan and EIR resulted in preparation of an additional analysis to the previously certified EIR for the NRSP, including the section addressing water resource issues; and,

WHEREAS, the Additional Analysis includes a water flow model and impact analyses of the future water usage projections for the Upper Santa Clara River Area; and,

WHEREAS, UWCD, Newhall Land and Farming Company (NLF) and others have had several technical meetings to further study the Additional Analysis as it relates to the water issues, and, based on this information, and further discussions between UWCD and the Upper Basin Water Purveyors, UWCD believes that it is in the best interests of the parties and the future beneficial water resources management in the upper and lower basins to enter into a cooperative working relationship among the parties; and,

WHEREAS, the parties have determined that this MOU is the best format for establishing a program that would be implemented over time for purposes of agreeing upon overall water resources management techniques and an information database that would benefit the upper and lower basins; and,

WHEREAS, this MOU is prepared by UWCD and the Upper Basin Water Purveyors because the parties believe that a cooperative water resource monitoring program in the Upper and Lower Santa Clara River Areas is desirable to protect and enhance the conjunctive use of imported water, groundwater and surface water resources within the region; and,

WHEREAS, the parties support regional water planning efforts that rely on the provision of accurate and timely information about available water resources; and,

WHEREAS, the parties to this MOU desire to create and maintain a cooperative relationship for purposes of gathering information for UWCD and the Upper Basin Water Purveyors to be used in further assessing imported water, surface water and groundwater conditions in both the Upper and Lower Santa Clara River Areas; and,

WHEREAS, the parties to this MOU intend to form a reciprocal relationship. In order to do this, UWCD will designate an individual or individuals with technical knowledge and experience appointed by the General Manager of UWCD who will be included in discussions and efforts that take place with the Upper Basin Water Purveyors and others regarding the Upper Santa Clara River Area. Likewise, the Upper Basin Water Purveyors will designate an individual or individuals with technical knowledge and experience appointed by the General Managers of the Upper Basin Purveyors who will be included in discussions and efforts with UWCD and others regarding the Lower Santa Clara River Area, and,

WHEREAS, the goal of the MOU is to establish a joint monitoring program, which includes: (a) data collection (monitoring and testing); (b) database management; (c) groundwater flow modeling; (d) assessment of groundwater basin conditions (operational yield); and (e) report preparation and presentation.

NOW, THEREFORE, in consideration of the mutual promises and covenants herein contained, the parties to this MOU agree as follows:

1.1 **Program Monitoring.** The parties will participate in a joint monitoring program.

1.2 **Program Content.** The technical aspects of this joint monitoring program are set forth in a technical memorandum entitled, "Water Resource Monitoring Program Upper Santa Clara River Area," (Program) which is attached as Exhibit 1 and incorporated by this reference.

1.3 **Program Meetings.** The General Manager or President of each party to this MOU (or their designee) shall meet as the "Program Committee" within 30 days of the execution of this MOU. The "Program Committee" will establish appropriate subcommittees to initiate the Program and determine the meeting times and locations for the committees. The Program Committee and subcommittees will discuss and coordinate technical aspects of the Program, including the gathering, interpretation and reporting of information as outlined in the technical memorandum (Exhibit 1). Other attendees may be permitted by agreement of the parties to this MOU.

1.4 **Monitoring Costs.** The costs incurred in administrating the Monitoring Program will be determined as implementation of the Program takes place. However, it is understood that, unless the parties to this MOU agree otherwise, the Upper River monitoring costs of the program will be borne by the Upper Basin Water Purveyors because such monitoring will take place within their service areas and the Lower River monitoring costs of the program will be borne by UWCD because such monitoring will take place within its service area.

1.5 **Program Implementation**. The parties to this MOU have prepared a schedule, attached as Exhibit 2, that describes the tasks and estimated time to implement the Program. The Parties acknowledge that Program Implementation will be an on-going and evolving process and may change due to future amendments to the Program, challenging technical issues or other unforeseen circumstances.

1.6 **Water Rights**. Notwithstanding the provisions of this MOU, nothing in either this MOU or the technical memorandum (Exhibit 1) shall be construed as affecting the water rights or operations of any party, person or entity.

1.7 **Term.** This MOU shall remain in effect for an initial period of seven (7) years and shall be automatically renewed for additional one year increments unless otherwise unanimously terminated by the members of the Program Committee as that committee exists at the time action is taken to terminate this MOU.

1.8 **Counterparts.** This MOU may be executed in any number of counterparts, each of which, when so executed, will be deemed to be an original and all of which taken together will constitute one and the same agreement.

IN WITNESS WHEREOF, the parties have executed this MOU as of the date first set forth above.

United Water Conservation District

By _____
General Manager

Castaic Lake Water Agency

By _____
General Manager

Newhall County Water District

By _____
General Manager

Valencia Water Company

By _____
President

Santa Clarita Water Company

By _____
President

Los Angeles County Waterworks District No. 36

By _____
County of Los Angeles

United Water Conservation District Boundary

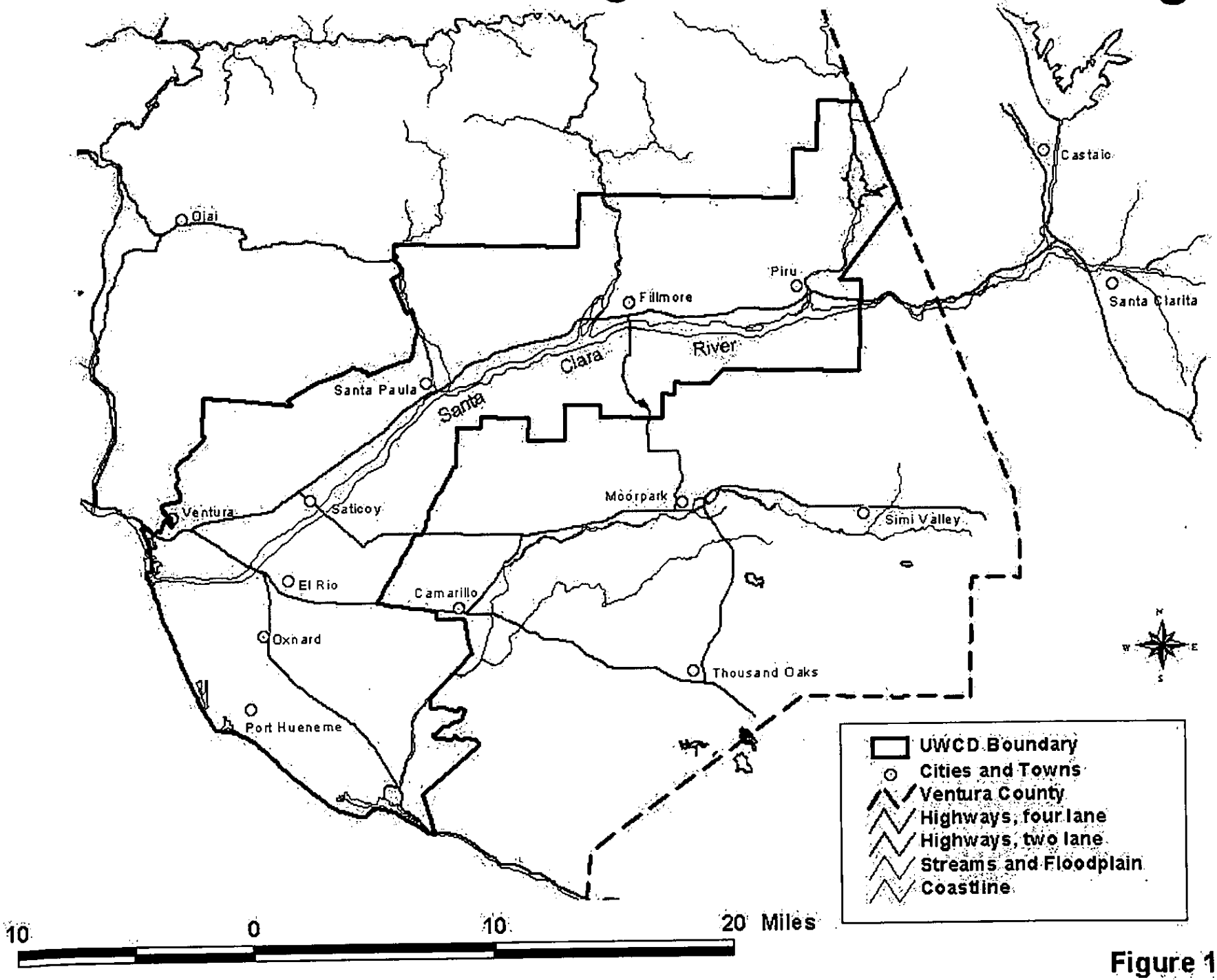


Figure 1-1

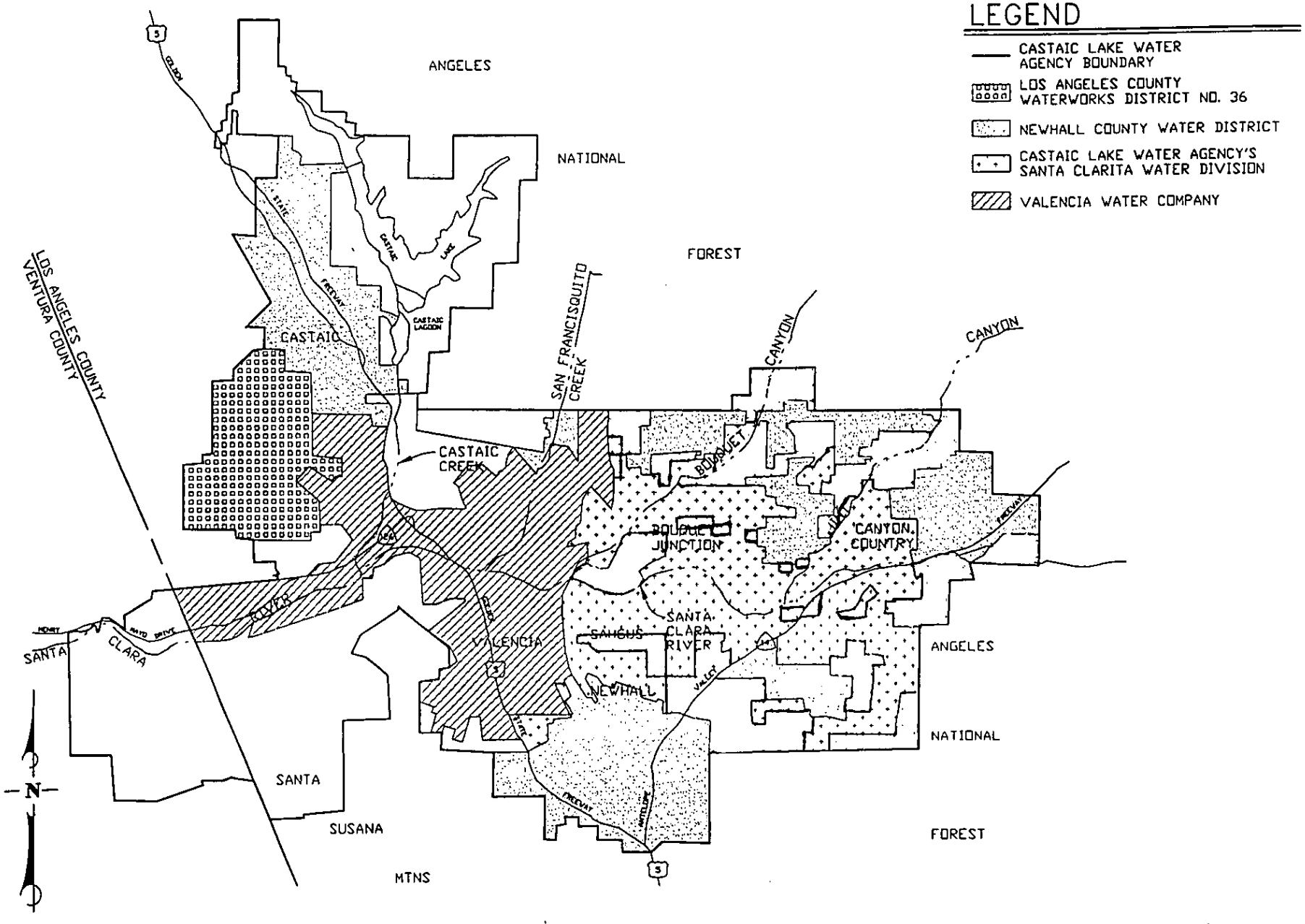


FIGURE 1-2

CLWA AND WATER PURVEYOR SERVICE AREAS

Exhibit 1
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA

INTRODUCTION

As part of its ongoing monitoring, interpretation, and reporting on imported water supplies and groundwater conditions in the aquifer systems underlying the Upper Santa Clara River Area, generally east of the Los Angeles County - Ventura County line and extending east to about the vicinity of Lang Station, the principal water purveyors in the area (primarily the municipal water purveyors - Castaic Lake Water Agency, Los Angeles County Waterworks District No. 36, Newhall County Water District, and Valencia Water Company) have committed to formalizing the data base on which water supply conditions are analyzed, and expanding the analysis of groundwater conditions such that the adequacy of water supply is well understood, and that both local and regional questions or issues about surface and groundwater can be addressed.

This water monitoring program outline has been prepared as a cooperative effort by the Upper Basin Water Purveyors operating in the Santa Clarita Valley and by the United Water Conservation District in Ventura County, the latter as the primary groundwater resource management entity in the Lower Santa Clara River Area (west of the Los Angeles - Ventura County line). The intent of the program outline is to delineate a series of elements that will be undertaken primarily by the Upper River Area entities, but in cooperation with United such that there is ultimately an integrated and coordinated data base, as well as agreed-upon technical tools such as a numerical groundwater flow model, to allow a continued regional understanding of water resources along the Santa Clara River. In that light, the following program includes elements which address data collection (monitoring and testing), database management, groundwater modeling, operational yield analyses, and report preparation and presentation.

DATA COLLECTION (MONITORING AND TESTING)

Historically, data on groundwater and related hydrologic conditions have been collected on varying frequencies and in varying formats throughout the Upper River Area. Fortunately, more than sufficient data have historically been collected on groundwater levels, quality, and production (pumpage) to permit general assessment of groundwater conditions, in some detail in the widely developed Alluvial aquifer and to a lesser extent the Saugus Formation aquifer. In order to expand on the general assessment of groundwater conditions, historical data collection efforts will be updated and formalized in the following areas.

Groundwater Levels and Quality - Wells in which historical and current water level data are available will be "qualified" (to confirm locations, depths, well completion details, annular seals, etc.) to confirm their utility for ongoing monitoring of water level and/or water quality in a particular aquifer. Based on a combination of qualified well details and available historical and current data, a network of existing and future wells will be developed for ongoing monitoring of groundwater levels (initially on a semi-annual frequency) and groundwater quality (initially on an annual to triennial frequency, depending on the use of the well) in both the Alluvium and the Saugus Formation aquifers. The water level and water quality monitoring networks may not be identical (as with most basins, the number of water level monitoring points will likely be greater than the number of water quality monitoring points). Also, in light of the relative differences in development of the two aquifer systems, there will be more monitoring points in the Alluvium than in the Saugus. However, as future development of the Saugus increases, particularly as the spatial extent of the Saugus "well field" expands, the Saugus monitoring network will evolve and expand accordingly. Water quality details are expected to begin with what historical analyses have been made; monitored details are expected to increase as the use of local Groundwater continues to change from irrigation supply to municipal supply, with the addition of organic and other hazardous chemical analyses of drinking water supplies in recent years. Finally, such as any dedicated monitoring wells are installed in the

area, for specific site investigation or other purposes, they will be added to the qualified well network as appropriate.

Groundwater Pumpage - Essentially all pumpage in the Upper Area (except small capacity individual domestic and similar wells) is metered or directly estimated from electrical power records, and the results are maintained in a decentralized data base. Metered measurement of all substantial capacity wells (all municipal and agricultural, as well as other private wells, e.g. golf course irrigation wells) will be continued on at least an annual basis, with progression to monthly data collection as appropriate for particular analyses that may be undertaken.

Surface Water Flows and Quality - Historical stream gage sites will be preserved as possible to allow ongoing surface water gaging of stream inflows to the Upper River area, stream outflows from the Upper River area into Ventura County, and return flows to the River system from in-area wastewater treatment plant discharges. Surface water quality at the same points will also be sampled on some frequency to continue historical records as appropriate or to document episodic or other (e.g. treated wastewater discharges) surface water flows into or out of the Upper River area.

Well and Aquifer Characteristics - Recently constructed wells, in both the Alluvium and Saugus Formation, have been tested, in some cases with the benefit of nearby monitoring wells, to determine well yields and aquifer hydraulic properties (e.g. transmissivity and storage coefficient). In limited cases, production logging and depth-specific water quality sampling has been undertaken to examine variations in aquifer productivity and quality with depth. Such as there is a need for additional spatial or vertical distribution of well yield or aquifer characteristic data, selected qualified wells will be tested in the Alluvium and Saugus aquifers. In general, all new production wells will be tested to determine the yields of the wells and the hydraulic characteristics of the aquifer materials in which they are completed at various locations in the Upper River area.

Precipitation - The locations of historical precipitation gaging will be verified and the quality of the

gaging stations will be assessed. Continuation of historical gaging will be a primary goal, with additions as appropriate to assess inflow of water within the Upper River area as well as distribution of precipitation throughout the area.

DATABASE MANAGEMENT

Geographic Information System - There is a good start on a regional GIS from the US Geological Survey's Regional Aquifer Study. For instance, roads, streams and other basic geographic features are in the USGS GIS that has been maintained and expanded by United Water Conservation District. United has commercial digital air photo coverage of Ventura County that includes a small portion of western Los Angeles County; additional digital imagery will be sought from agencies in Los Angeles County.

Most of the wells in the Valencia/Santa Clarita area are also in a USGS GIS coverage that includes well construction information. The wells are identified by owners designations as well as state well number. By using the state well number in identifying all monitoring data, information from the databases can be linked directly to the GIS well coverage.

Water Level Database - Monitoring data will be collected together in common databases, using an easily accessible program such as Microsoft Access. Groundwater level information is presently in a variety of forms, including paper copy, spreadsheet files, and agency databases. The digital information will be incorporated into a master database, but the data on paper copies will have to be entered into a computer. This will be accomplished by prioritizing the order in which this information is entered. Historic groundwater level data will be obtained from as many wells as possible, public and private, to ensure meaningful area coverage.

Water Quality Database - Water quality information may be a larger chore to organize in a database than water levels because each water sample collected is commonly analyzed for a large number of constituents. For water quality data collected in the future, analytical labs can provide results in digital form for ease of integration into a database. Historical water quality information is available digitally from the California Department of Health Services for public water supply wells (data is available for about the past ten years). For the rest of the historical water quality data, prioritizing the order of manual data entry would be necessary. Constituents of concern are obviously the first to be entered. Whether to enter all historical data will need to be addressed; this information is valuable in identifying long-term trends, but data entry takes time. United Water now has all historic water quality data for seven basins in Ventura County in a database, but it took several years to do this.

Water quality data from surface sources such as streams will also be included in the main water quality database. A location identifier can be used to tie the sample to the monitoring location in a GIS coverage. The approximate flow of the surface water source at the time of measurement should accompany each water quality data entry.

Pumpage Database - Pumpage data from individual wells is key to assessing both water level and water quality trends. This information is also required to construct a groundwater model. Some of this information has already been entered in computer files and can be readily imported into a database. Other information will likely have to be obtained on a cooperative basis. If pumpers do not have their own metered pumping records, pumpage will be estimated from other sources such as utility bills. For wells where no records have been kept, probable pumping quantities can be estimated through land use records and, in the case of irrigated agriculture, from irrigation methods and practices. This calculated information should not be entered directly in the pumpage database.

Streamflow Database - There should be a database of streamflow measured at various monitoring points. For USGS gauges, much of this information is already in digital form. Other agencies, such as County Flood Control, may also have digital data.

GROUNDWATER FLOW MODELING

As part of the technical analysis of water supply alternatives to meet projected water demands of the proposed Newhall Ranch project in the Upper River area, a numerical groundwater flow model was prepared for that project's proponent. That model was developed to focus on the feasibility and impacts of a potential storage and recovery project in the Saugus Formation, including the impacts of injection and recovery pumping in the Saugus on the overlying Alluvium, and the resultant impacts on Santa Clara River flows out of the Upper River area. The current model is calibrated for a steady state condition, including the addition of some focused injection and pumping. As a result, it represents a useful initial modeling effort of the overall aquifer system in the Upper River area. Depending on its availability for other uses in the Upper River area, that initial model will be subjected to transient calibration efforts and additional calibration of the Alluvial aquifer. The model will then become an evolving tool for analysis of ongoing groundwater development and recharge, in conjunction with imported surface water, and the resultant impacts on groundwater conditions in the Upper River area, as well as on surface outflows to the downstream basins on the Santa Clara River.

OPERATIONAL YIELD OF THE BASIN

A primary objective of the monitoring efforts, database management efforts, and modeling efforts described above is to assess groundwater basin conditions in the Upper River area in the context of the long term sustainability of the Alluvium aquifer and the generally underlying Saugus Formation, and to operate the basin such that the operating yield is not exceeded over a multi-year wet/dry cycle. This operational yield includes flexibility of groundwater use by allowing increased groundwater use during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is

available. The operational yield protects the aquifer by assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. Historical groundwater data demonstrates that the Alluvium has been, and continues to be developed within its long-term sustainability (i.e. no chronic lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data in the Saugus Formation shows no lowering of water levels or degradation of water quality where it has been developed.

While current planning places future pumping of the Alluvium in the same range as has historically occurred for several decades, with anticipated similar results in terms of Alluvial water levels, storage, and quality, the model described above will be a useful tool to quantify the impacts in water budget terms and to analyze a range of scenarios as appropriate to optimize the use of the high-yielding Alluvium. The Saugus Formation is alternately being considered for short-term dry-period water supply at capacities higher than have historically been pumped from that formation, and for injection, storage and recovery of water as part of the overall water supply of the Upper Santa Clara River area. The model will also be used to determine the operational yield of the Saugus under a wide-ranging set of low to high pumping capacities (during wet to dry years, respectively), and with varying aquifer storage (recharge), to avoid undesirable impacts and assure that the operating yield is not exceeded over a multi-year wet/dry cycle.

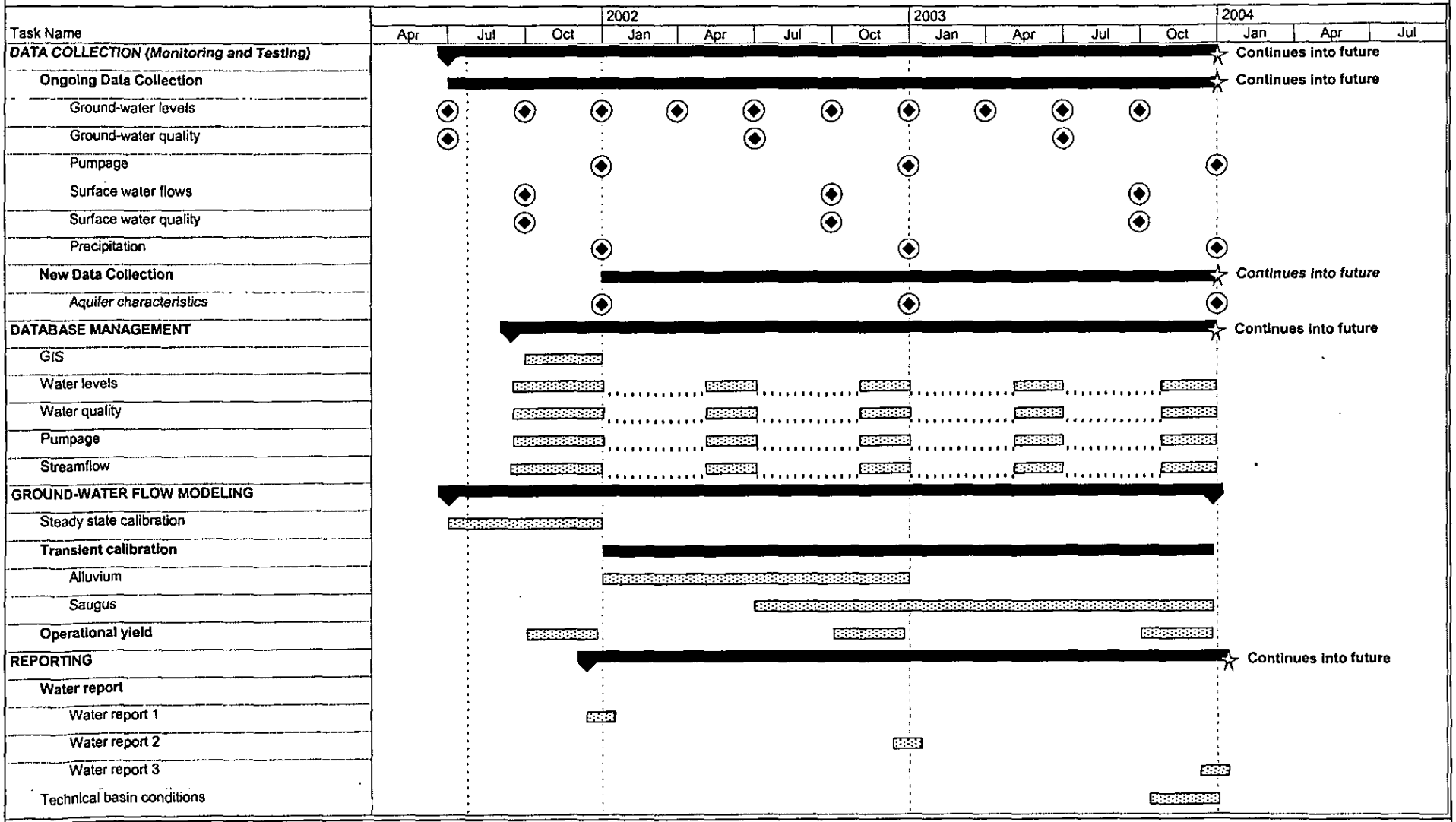
REPORTING

Beginning in 1998, an annual report on water supply conditions in the Upper Santa Clara River area has been prepared by the water purveyors in the Upper River area. Those reports have focused on a planning-level discussion of current and immediate future water demands, and the availability of local Groundwater and imported surface water to meet those demands. The overall primary objectives of the reports have been to provide some documentation, to local and County planners as

well as County Supervisors, on the water supply conditions in the Santa Clarita Valley and to present a general assessment of the status of groundwater conditions in both the Alluvial and Saugus aquifer systems, with a focus of that assessment on historical and recent groundwater development within operating yield parameters.

As the water resource monitoring program described above is implemented and evolves, it is planned that reporting on groundwater basin conditions will evolve in two generally parallel ways: 1) a continuation of the annual reporting on current water supply conditions, as a basis for current planning and consideration of development proposals; and 2) the addition of less frequent, more technically oriented reports on the geologic and hydrologic aspects of the groundwater resources of the Upper River area, including documentation of: a) groundwater basin conditions, b) development and application of modeling efforts to assess operational yield and the impacts of long-term planned utilization of local groundwater as part of the overall water supply, and c) assessment of actual versus predicted impacts on groundwater and surface water, including basin outflows, combined with ongoing updated assessments of the adequacy of local groundwater management actions and identification of any needed changes which are identified over time. As needed, the resource monitoring program and technical reports will be coordinated with interested regulatory agencies such as the Regional Water Quality Control Board, the California Department of Health Services and the California Department of Toxics and Substance Control.

Exhibit 2
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA



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Appendix B
Description of the Santa Clarita Valley Regional Groundwater Flow Model

APPENDIX B

Description of the Santa Clarita Valley Regional Groundwater Flow Model

B.1 Introduction

The Santa Clarita Valley Regional Groundwater Flow Model (hereafter referred to as the Regional Model) is a three-dimensional, numerical model of groundwater flow that covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. A Surface Water Routing Model (SWRM) was also developed specifically for this basin as a pre- and post-processor for the Regional Model.

The approach to developing the Regional Model included the following steps:

1. Compiling information on the geology and hydrogeology of the valley and developing a conceptual understanding of the groundwater flow system
2. Creating a variety of data sets to conduct steady-state and transient calibrations
3. Constructing the Regional Model using the MicroFEM® finite-element groundwater flow code (Hemker and de Boer, 2003), and also using the available database and geographic information system (GIS) information for the Santa Clarita Valley
4. Calibrating the Regional Model
5. Performing sensitivity tests on the Regional Model

This appendix provides an overview of the Regional Model's construction and calibration. The construction and calibration of the Regional Model and the SWRM are described in detail in the *Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California* (CH2M HILL, 2004a).

B.2 Model Construction

B.2.1 Software

The Regional Model was constructed using the three-dimensional, finite-element groundwater modeling software MicroFEM® (Hemker and de Boer, 2003). MicroFEM® operates in a Windows™ environment and can be used to solve groundwater flow problems for unconfined, semi-confined, or confined aquifer systems. This software simulates steady-state or transient flow conditions in up to a 20-layer aquifer system; the finite-element mesh may contain as many as 50,000 nodes in each model layer. The software contains several different methods for simulating groundwater/surface water interactions. MicroFEM® is based on software developed in the Netherlands during the 1980s for use in evaluating the effects of groundwater pumping in areas with complicated meandering rivers. Further

details regarding this software's design, capabilities, and functionality can be found on the Internet at www.microfem.com and in two reviews of the software by Diodato (1997, 2000).

B.2.2 Model Grid

The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. The nodes are spaced 500 feet apart in the majority of the modeled area. However, a finer node spacing (150 feet) was used along the Santa Clara River and its tributaries to allow a more exact simulation of surface water/ groundwater exchanges. Additionally, specific nodes were placed within this regional grid at the locations of production and monitoring wells.

B.2.3 Layering

The upper model layer simulates the Alluvial Aquifer, or the upper portion of the Saugus Formation wherever the Alluvial Aquifer is not present. The six underlying layers simulate the underlying freshwater Saugus Formation and the Sunshine Ranch Member. The northern and southern edges of the model domain are defined by the geologic contacts mapped by Richard C. Slade and Associates, LLC (2002), formerly known as Richard C. Slade, Consulting Groundwater Geologist (both hereafter referred to as RCS), for the Alluvial Aquifer and the Saugus Formation.

The saturated thickness of the Alluvial Aquifer was defined from the average base elevation of the aquifer and the water level elevations measured during the fall of 1985 and the spring of 2000, as described by RCS (1986 and 2002). Along the Santa Clara River, the typical saturated thickness of the Alluvial Aquifer is as much as 130 feet in the western (down-gradient) portion of the basin and between 80 and 90 feet in the eastern (upgradient) portion of the basin, though it can be notably less in this area during droughts. Saturated thicknesses can be less than 60 feet in some tributary canyons, particularly along the South Fork Santa Clara River, where all production wells are constructed in the Saugus Formation, rather than the alluvium (RCS, 2002).

The Saugus Formation is generally a bowl-shaped structure that thins at its margins and has its greatest thickness (about 5,500 feet) in the center of the basin. The upper, freshwater-bearing portion of the Saugus Formation was simulated using 500-foot-thick model layers to depths as great as 2,500 feet in the center of the basin (RCS, 1988 and 2002). The deepest active model layer at any given location represented the Sunshine Ranch Member of the Saugus Formation, which is of marine origin and is, therefore, more saline and thought to have lower water-bearing potential than the overlying Saugus Formation deposits that are terrestrial in origin.

B.2.4 Boundary Conditions

The following boundary conditions were used in the Regional Model:

1. **Specified flux for precipitation within the model grid.** Deep percolation of precipitation was simulated using the precipitation top-system package contained in MicroFEM®.
2. **Specified flux for irrigation.** Deep percolation of agricultural irrigation and urban irrigation in developed areas was simulated using the precipitation top-system package contained in MicroFEM®.

3. **Specified flux and head-dependent flux along ephemeral streams**. With respect to groundwater discharges to streams, the Santa Clara River was modeled as an ephemeral, predominantly losing stream at and upstream of the mouth of San Francisquito Canyon, and as a perennial, predominantly gaining stream downstream of San Francisquito Canyon. The tributaries to the Santa Clara River were modeled as ephemeral streams, using the precipitation top-system package to specify stream leakage to groundwater. For these tributaries and the ephemeral reach of the Santa Clara River, groundwater recharge rates were estimated from precipitation records, stream-flow records, watershed maps, topographic maps, and aerial photography using the SWRM, which was developed specifically to calculate time-varying recharge at each stream node from these data. Aerial photos and historical observations indicated that under high water table conditions, groundwater can locally discharge into Castaic Creek and the ephemeral reach of the Santa Clara River wherever Alluvial groundwater levels rise above the riverbed elevation. Consequently, the drain package in MicroFEM® was used in these streams to allow for drainage of any groundwater that was calculated by MicroFEM® to be above the riverbed elevation in any given river node at any given time step.

4. **Specified flux and head-dependent flux along perennial Santa Clara River**. The perennial reach of the Santa Clara River was modeled using the wadi top-system package contained in MicroFEM®. The wadi package allows groundwater to discharge to the river whenever groundwater elevations are higher than the specified river stage. When groundwater levels are below the river stage, the river recharges the Alluvial Aquifer. The rate of recharge is proportional to the difference between the river stage elevation and the model-calculated groundwater elevation. However, after the groundwater elevation drops below the streambed sediments, the rate of leakage from the stream is constant (i.e., does not vary as the groundwater elevation fluctuates). For the Regional Model, each node along the perennial reach of the Santa Clara River was assigned a river stage 1 foot higher than the mapped bed elevation of the river. The riverbed permeability, or conductance, which helps control the model-calculated groundwater/surface water exchange rates, was adjusted during model calibration by calibrating to streamflow data collected at the County Line gage.

5. **Specified flux for pumping**. Pumping rates and locations for wells completed in the Alluvial Aquifer and the Saugus Formation were directly imported into the Regional Model from the Upper Santa Clara River Groundwater Basin database. For model calibration, pumping rates were assigned from water use records maintained by the Upper Basin Water Purveyors; estimates of monthly water demand for urban water use and agricultural water use; and well construction records, which were needed to determine which model layers at each individual well should be assigned pumping

6. **Specified flux at upgradient Alluvial Aquifer boundaries.** Where there is Alluvial groundwater flow into the study area from beneath Castaic Dam, the magnitude of the specified flux was adjusted during the model calibration process using groundwater elevations and gradients published by RCS (1986 and 2002).

7. **Specified groundwater elevation in the Alluvial Aquifer at the county line.** The groundwater elevation (805 feet) was obtained from water level contour maps for the

Alluvial Aquifer prepared by RCS (1986, 2002). (See Figure 2-7 in the main text for groundwater elevation contours during Spring 2000, as mapped by RCS [2002].)

8. **Specified groundwater elevation in the Alluvial Aquifer at the Lang gage.** The groundwater elevation (1,746 feet) was derived from topographic maps of the elevation of the Santa Clara River bed. As discussed in CH2M HILL in *Final Report: Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property* (2004b), the boundary condition at this location was converted to a constant-head boundary shortly after completion of the model development report. This change was made based on results from field reconnaissance that was performed in April and May of 2004, when the Santa Clara River was dry at the Lang gage. At that time, groundwater was locally discharging from the bed of the Santa Clara River in isolated locations where the riverbed intersects the water table, then seeping back into the riverbed nearby. Significant phreatophyte growth was also present along the riverbed in this same area (just downstream of the Lang gage). Additionally, water was present and actively flowing in the river east (upstream) of the Santa Clarita Valley (in the area between the Santa Clarita Valley and the upstream Acton Basin). Based on these observations, a specified groundwater elevation of 1,746 feet was established in the Alluvial Aquifer at the eastern boundary of the Regional Model to simulate subsurface flow beneath the channel of the Santa Clara River at the Lang gage. This specified elevation was held constant throughout the simulation period.

9. **Head-dependent flux for evapotranspiration (ET).** ET from the water table by riparian vegetation was simulated using the evaporation top-system package contained in MicroFEM®. This package requires specification of the maximum rooting depth for the riparian vegetation, the maximum potential ET rate, and the ground surface elevation.

10. **No-flow boundaries**. In general, the outermost line of nodes that form the model boundary and the bottom of the model are no-flow boundaries. The exceptions are the western model boundary (specified head) and the specified-flux nodes representing underflow into the Alluvial Aquifer from beneath Castaic Dam. Also, all nodes on the model boundary are assigned specified fluxes due to precipitation and, in some cases, ephemeral streamflow.

B.2.5 Aquifer Parameters

The selection of the aquifer parameter values (horizontal and vertical hydraulic conductivity, storage coefficients, streambed conductance, and ET parameters) is described in detail in Sections 4 and 5 of the Regional Model development report (CH2M HILL, 2004a). Initial estimates of, and ranges of values for, these parameters were defined during initial model development and adjusted on an as-needed basis, and within certain limits, during model calibration. Additionally, the calibration process adjusted the coefficients for an empirical power-function equation (Turner, 1986) that was used in the SWRM to define the relationship between precipitation, stormwater flow, and the amount of stormwater flow available for potential infiltration to groundwater.

B.3 Model Calibration

B.3.1 Calibration Process

Calibration of the Regional Model involved matching both steady-state and transient conditions in the Alluvial Aquifer and the Saugus Formation. The steady-state calibration was performed for calendar years 1980 through 1985, and the transient calibration was performed for calendar years 1980 through 1999. The goals of the initial calibration process were generally to match groundwater flow directions, groundwater gradients, and groundwater elevations that were measured throughout the 20-year simulation period at wells across the valley. An additional calibration goal was to match the patterns of total flow in the Santa Clara River and estimated groundwater discharge rates to the river. The Alluvial Aquifer and the Saugus Formation were each subdivided into zones to facilitate parameter selection and model calibration. Model variables were adjusted in a manner that sought to honor independent estimates of parameter values while resulting in the best possible calibration.

B.3.2 Calibration Quality

The Regional Model meets most of the qualitative and quantitative goals that were established for the calibration process. For the steady-state model, statistical goals for the head residuals, which are equal to the modeled minus measured groundwater elevations, were easily met for the Alluvial Aquifer and adequately met for the Saugus Formation. For the transient model, trends in groundwater elevations were generally well matched, and groundwater discharges to the river were simulated well for both the steady-state and transient models. However, during the middle and late 1990s, the model tended to simulate too much decline in Alluvial Aquifer groundwater elevations in the eastern-most portion of the valley. This is the area where local droughts have the greatest effect on the Upper Basin Water Purveyors' ability to pump groundwater, so this deviation is acceptable because predictive simulations of various groundwater pumping strategies will not overestimate the degree to which groundwater can be pumped from the Alluvial Aquifer in this area during periods of below-normal rainfall.

The groundwater budget for the 20-year transient calibration period showed that recharge from precipitation and streamflows varied considerably from year to year, ranging from less than 15,000 acre-feet per year (AF/yr) in the driest years to as much as 270,000 AF/yr in the wettest years. In contrast, total groundwater discharges were less variable, ranging from approximately 61,000 AF/yr at the end of the late 1980s/early 1990s drought to 116,000 AF/yr during 1998. This variability in groundwater discharge did not follow the year-to-year pumping patterns, but instead was caused by year-to-year fluctuations in ET and groundwater discharges to the river. These fluctuations, in turn, correlated well with groundwater recharge patterns. During the 20-year transient calibration period, changes in the volume of groundwater stored in the combined Alluvial-Saugus aquifer system varied primarily according to year-to-year variations in regional rainfall. No long-term decline in groundwater storage was observed in the field or simulated by the Regional Model during the calibration period.

B.3.3 Calibration Update

In a recent technical memorandum (CH2M HILL, 2005), the calibration of the Regional Model was extended an additional 62 months (from January 2000 through February 2005) to update and test the model's calibration against an independent data set consisting of recently observed hydrologic and pumping conditions in the basin. Examination of groundwater elevation hydrographs for the Alluvial Aquifer and the Saugus Formation indicated that the model showed a similar overall ability to simulate conditions during the recent 5-year period, as was the case for the preceding 20-year period to which the model was originally calibrated.

B.4 Model Sensitivity

Sensitivity analyses were performed to evaluate whether further changes in the values of key model parameters would improve the calibration quality of the Regional Model. Variables that were tested were the hydraulic properties (horizontal and vertical hydraulic conductivities and storage coefficients) for the Alluvial Aquifer and the Saugus Formation, the riverbed leakage terms for the Santa Clara River and Castaic Creek, and the ET parameters. The sensitivity analysis indicated that the Regional Model is calibrated well and that it is sensitive to the choices of horizontal hydraulic conductivity in both aquifers and the vertical hydraulic conductivity values in the Saugus Formation. The model is also sensitive to the surface water parameters, specifically the choice of empirical coefficients used by the Turner (1986) equation to estimate stormwater flows from rainfall data and the riverbed leakage terms in both the eastern (groundwater recharge) and western (groundwater discharge) portions of the basin. The model is relatively insensitive to the choice of ET parameters.

B.5 Model Applicability

The process of developing the conceptual model of the local groundwater basin, developing a detailed numerical model, calibrating the model to a 20-year period of groundwater elevation and streamflow data, and independently testing the calibration against a recent set of basin conditions has resulted in a groundwater flow model that is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies. The primary design and calibration attributes that make the Regional Model appropriate for its intended uses are as follows:

1. Its ability to simulate historical trends in groundwater elevations and river flows during a 2-decade period that reflects increased urbanization, increased State Water Project water imports (from outside the valley), and associated changes in land use and water use
2. Its ability to simulate trends in smaller geographic areas of interest within the valley (for example, near the Whittaker-Bermite property)
3. Its use of an integrated model of the watershed to define the amount of rainfall and stormwater that is potentially available to recharge the groundwater system

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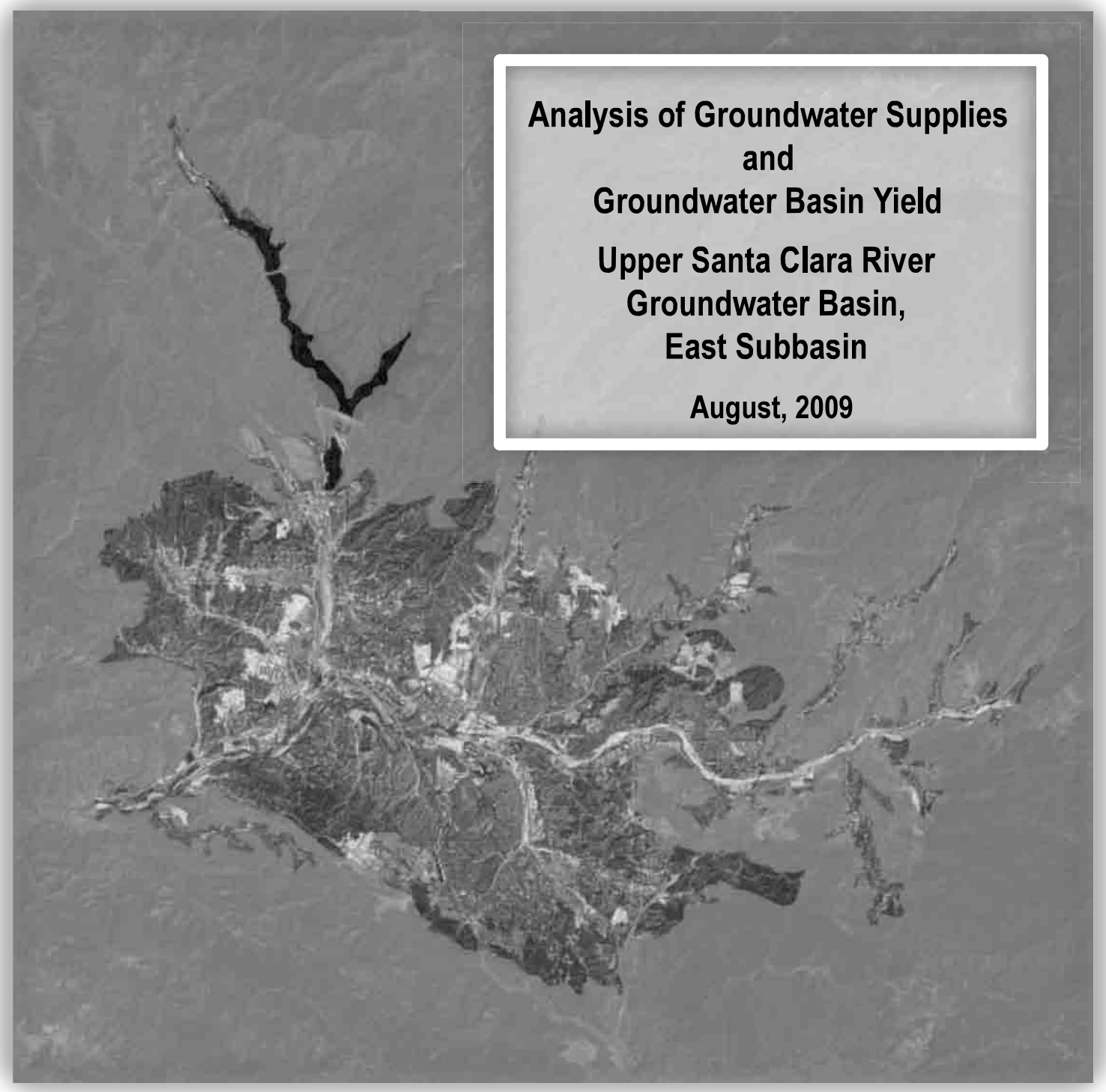
Appendix 5.21H

Analysis of Groundwater Supplies and Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin

Luhdorff & Scalmanini Consulting Engineers and
GSI Water Solutions, Inc.

August 2009



Analysis of Groundwater Supplies and Groundwater Basin Yield

Upper Santa Clara River Groundwater Basin, East Subbasin

August, 2009

prepared for

Santa Clarita Valley Municipal Water Purveyors

prepared by

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

GSI Water Solutions, Inc.

Analysis of Groundwater Supplies and Groundwater Basin Yield

Upper Santa Clara River Groundwater Basin, East Subbasin

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Santa Clarita Valley Municipal Water Purveyors

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Consulting Engineers

GSI Water Solutions, Inc.,

August, 2009

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Table 6-1 Los Angeles County Flood Control District Stormwater Runoff Recharge Projects

Acronyms and Abbreviations

afy	acre-feet per year
AWRM	Alternative Water Resources Management program
CCCC	California Climate Change Center
CLWA	Castaic Lake Water Agency
CMIP3	Climate Model Intercomparison Project 3
DPH	California Department of Health Services
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
ET	evapotranspiration
GCM	global climate model
GFDL	Geophysical Fluid Dynamics Laboratory
gpm	gallons per minute
in/yr	inches per year
IPCC	Intergovernmental Panel on Climate Change
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District
LARWQCB	Los Angeles Regional Water Quality Control Board
LLNL	Lawrence Livermore National Laboratory
LSCE	Luhdorff & Scalmanini Consulting Engineers
mg/L	milligrams per liter
mgd	million gallons per day
MOU	Memorandum of Understanding
NCAR	National Center for Atmospheric Research
NCWD	Newhall County Water District
NLF	Newhall Land & Farming Company
PCM1	Parallel Climate Model
Purveyors	Upper Basin Water Purveyors
RCS	Richard C. Slade and Associates, LLC
SCVSD	Santa Clarita Valley Sanitation District of Los Angeles County

SCWD	Santa Clarita Water Division of CLWA
SRES	Special Report on Emissions Scenarios
SWP	State Water Project
SWRM	Surface Water Routing Model
TMDL	Total Maximum Daily Loads
UWMP	Urban Water Management Plan
VWC	Valencia Water Company
WCRP	World Climate Research Programme
WHR	Wayside Honor Rancho
WRP	water reclamation plant
UCAR	University Corporation for Atmospheric Research
WRP	water reclamation plant

I. Introduction

In 2003, the retail water Purveyors in the Santa Clarita Valley (herein the Purveyors[1]) commissioned efforts to develop, calibrate and utilize a numerical groundwater model for purposes of analyzing the sustainability of local groundwater as a component of overall water supply in the Valley. At that time, the question of groundwater sustainability was complemented by a question about whether part of overall groundwater pumping could be employed to achieve containment and removal of perchlorate contamination in the deeper aquifer, the Saugus Formation, beneath the Valley. The results of those modeling efforts concluded that a certain groundwater operating plan (rates and distributions of groundwater pumping under varying local hydrologic conditions) would be expected to produce long-term sustainable groundwater conditions, and that a certain focused part of overall pumping would be expected to both extract perchlorate-contaminated groundwater (for use after treatment) and contain the migration of perchlorate-impacted groundwater. The development and calibration of the numerical groundwater flow model is described in *Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration* (CH2M Hill, April 2004). Application of the model for extraction and containment of perchlorate-impacted groundwater is described in *Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property* (CH2M Hill, December 2004). And application of the model for analysis of basin yield, including sustainability of groundwater pumping consistent with that employed in the perchlorate containment analysis, is documented in *Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California* (CH2M Hill and LSCE, August 2005).

The groundwater system in the Santa Clarita Valley, located in northwestern Los Angeles County, is identified by the California Department of Water Resources (DWR) as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07) and lies within the DWR-designated Upper Santa Clara River Hydrologic Area [Figure 1-1]. Groundwater in the basin is pumped from a shallow Alluvial Aquifer and from deeper groundwater resources that are present in an older, underlying unit called the Saugus Formation. Most groundwater pumping is by the Purveyors for municipal uses (in the range of approximately 23,000 to 33,000 acre-feet per year (afy) in recent years), with some continuing pumping by private landowners, primarily for irrigation uses (approximately 13,000 to 17,000 afy in recent years). The Purveyors also have access to other sources of water to supplement groundwater for municipal supply, including imported State Water Project (SWP) water, groundwater banking outside the basin, recycled water, short-term water exchanges, and dry-year water purchase programs. Those sources are described in the Purveyors' current *2005 Urban Water Management Plan* (Black & Veatch, et al., November 2005) and in a series of annual *Santa Clarita Valley Water Reports*, most recently for 2007 (LSCE, April 2008).

The water supply and water resource management practices of the Purveyors call for maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal

[1] The Santa Clarita Valley Purveyors are comprised of Los Angeles County Waterworks District 36, Newhall County Water District, Santa Clarita Water Division of the Castaic Lake Water Agency (formerly Santa Clarita Water Company, acquired by CLWA in 1999), and Valencia Water Company.

availability of these supplies, and limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus Formation pumping during years when supplemental imported water supplies are significantly reduced because of drought conditions. These local management practices have been called the local groundwater operating plan; that term has been adopted in this report to identify the previously analyzed operating plan (the 2004 Operating Plan) and subsequent iterations analyzed herein (the 2008 Operating Plan, the 2008 Operating Plan with Pumping Redistribution, and a Potential Operating Plan).

1.1 Background

The numerical groundwater model was originally developed as part of the work scope contained in an August 2001 Memorandum of Understanding (MOU) that was adopted by the Purveyors and the United Water Conservation District, located downstream in Ventura County. That MOU was a commitment by the Purveyors to expand on previous analyses of groundwater conditions such that the adequacy of the local groundwater supply could be better understood and questions about surface water and groundwater resources could be more readily addressed. The MOU initiated a collaborative and integrated approach to data collection; database management; evaluating groundwater conditions and the sustainability of the Purveyors' operating plan; groundwater flow modeling; annual reporting on basin conditions; and technical reporting focused on geologic and hydrologic aspects of the overall stream-aquifer system.

In 2003, subsequent to the MOU, Castaic Lake Water Agency (CLWA) prepared and adopted a formal Groundwater Management Plan (CLWA, 2003), which includes 14 elements intended to achieve four management objectives, or goals, for the groundwater basin. Those four management objectives include development of local groundwater for water supply; avoidance of overdraft and associated undesirable effects; preservation of groundwater quality; and preservation of interrelated surface water resources. The intent of the Groundwater Management Plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, specifically avoidance of overdraft (Element 3 of the Plan), no degradation of quality (Element 6 of the Plan), and no adverse impacts to surface waters (Element 2 of the Plan). The Plan identified these objectives and elements as being accomplished via continued conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Element 5 of the Plan) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Elements 1 and 2 of the Plan).

The Purveyors initially agreed in the MOU, and the Purveyors subsequently committed in the Groundwater Management Plan, to develop and use a numerical groundwater flow model for the sustainability evaluation of the local groundwater operating plan. Prior to that, the available data showed that no long-term lowering of the water table or degradation of water quality had occurred during the 50 to 60 years of recorded historical groundwater development in the valley, and the various studies and water planning efforts performed up to that time had resulted in a local groundwater operating plan that placed future pumping of the Alluvial Aquifer in the same range as historical pumping. However, although the MOU recognized a need to formally analyze the Alluvial Aquifer, it identified that the primary question to be evaluated with the model would be the operational yield of the Saugus Formation, given that the Purveyors' operating plan called for dry-year pumping from that aquifer at rates higher than had historically

been pumped. For that reason, the MOU identified that the model would evaluate the effect of the current groundwater operating plan on groundwater conditions in both the Alluvial Aquifer and the Saugus Formation over a multi-year wet/dry cycle. The operational yield was defined in the MOU as an operating plan for the local groundwater basin that would allow continued pumping from the Alluvial Aquifer and Saugus Formation while assuring that groundwater supplies would be adequately replenished from one wet/dry cycle to the next.

As introduced above, a groundwater operating plan was formally analyzed with the groundwater model as part of the perchlorate containment analysis in 2004, and then specifically as the focus of basin yield analysis in 2005. In summary, that plan was as follows:

- Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the basin. Under the operating plan, pumping ranges between 30,000 and 40,000 afy during normal and above-normal rainfall years but, because of operational constraints in the eastern part of the basin, is reduced to between 30,000 and 35,000 afy during locally dry years.

- Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly imported water from the SWP system. For the Saugus Formation, the operating plan consists of pumping between 7,500 and 15,000 afy during average-year to wet-year conditions within the SWP system. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 afy during a dry year, and increases to between 21,000 and 25,000 afy if SWP deliveries are reduced for two consecutive years, and between 21,000 and 35,000 afy if SWP deliveries are reduced for three consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 afy, to further enhance the effectiveness of natural recharge processes that would recover water levels and groundwater storage volumes in the Saugus Formation, as has been historically experienced.

Simulated groundwater basin response to groundwater pumping in accordance with the 2004 Operating Plan, over a long-term period of varying hydrologic conditions, was concluded to be sustainable based on a two-part definition of sustainability, which is continued in the updated analysis reported herein, as follows:

- lack of chronic, or sustained, depletion of groundwater storage, as indicated by projected groundwater levels, over a reasonable range of wet, normal, and dry hydrologic conditions

- maintenance of surface water flows in the western portion of the basin (which are partially maintained by groundwater discharge) and surface water outflow to downstream basins over the same range of hydrologic conditions

The primary conclusion from the modeling analysis of the 2004 Operating Plan was that it would not cause detrimental short-or long-term effects to the groundwater and surface water resources in the Valley and was, therefore, sustainable. In summary, the groundwater basin could be

expected to respond to the 2004 Operating Plan in a manner similar to what had been experienced over approximately the preceding 50 years: Use of water from the Alluvium, slightly decreased during locally drier periods, was projected to result in small to large fluctuations in Alluvial Aquifer groundwater levels from the middle to the eastern part of the basin, followed by full to near-full recovery in wet years or periods of years. Different from historically experienced conditions is in the Saugus Formation, where greater Saugus pumping during periods of significantly reduced imported water supplies was projected to cause larger fluctuations in groundwater levels during such pumping, with full to near-full recovery of Saugus water levels in subsequent years when the availability of imported water supplies was expected to return to normal.

After completion of the sustainability analysis, the 2004 Operating Plan was incorporated in the Purveyors' collective 2005 Urban Water Management Plan (UWMP) to reflect the groundwater component of overall water supplies available to meet current and projected water requirements over the planning horizon of the UWMP.

1.2 Scope of Updated Analysis

In 2008, partly in preparation for the next UWMP in 2010, and in part because of recent events that are expected to impact the future reliability of the principal supplemental water supply for Santa Clarita Valley, i.e., from the State Water Project, the Purveyors concluded that an updated analysis was needed to further assess groundwater development potential and possible augmentation of the groundwater operating plan. Near-term reductions in SWP water deliveries to CLWA are possible because of an August 2007 court ruling that is expected to reduce exports from the Bay-Delta by approximately 30 percent in the immediate future. Additionally, the National Marine Fisheries Service (NMFS) released its Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project on June 4, 2009. The proposed regulatory actions will further restrict Delta export operations of the State Water Project, however, studies have not been completed quantifying impacts on SWP reliability. The duration of reductions are unknown and depend on a number of factors, including whether DWR can construct alternative facilities in the future to make up for reductions. Additionally, DWR is evaluating the potential magnitude of longer-term future reductions in SWP deliveries because of potential effects of global climate change.

A second consideration in conducting an updated analysis of the basin is that global climate change could alter local rainfall and associated recharge patterns, thus affecting local groundwater supplies, i.e. the yield of the basin. Finally, the Los Angeles County Flood Control District (LACFCD) is planning a number of small flood control projects in the Santa Clarita Valley; estimated amounts of conservation/groundwater recharge potential are being included for each of the individual projects in the overall LACFCD planning, and the Purveyors have interest in whether that potential could appreciably augment the yield of the basin.

In light of the above, the scope of the updated basin yield analysis, reported herein, includes the following:

- consider potential increased utilization of groundwater for regular (wet/normal) and/or dry-year water supply, including distribution of the yield by reach of the Santa Clara River alluvium and its various tributaries;

- consider potential augmentation of basin yield via initiation of artificial groundwater recharge using stormwater runoff in selected areas of the basin as being planned by LACFCD; and

- quantitatively or qualitatively, depending on the availability of technical reference material, describe general impacts of climate change on the groundwater basin and its yield.

1.3 Report Organization

To address the scope of the updated basin yield analysis outlined above, the remainder of this report is organized as follows:

Chapter 2 discusses the extension of the numerical groundwater flow model from its previous calibration period of 1980 through 2004 to add three years and thus extend calibration through 2007; this section also describes some limited model recalibration after extension of the model through 2007.

Chapter 3 describes the operating plans that were developed for updated analysis of basin yield, and the process that was used to simulate basin response to those plans and to evaluate the results.

Chapter 4 discusses the results of the simulated basin response to the 2008 and Potential groundwater operating plans, including the sustainability and achievability of the plans.

Chapter 5 describes climate change considerations, the selection of a range of potential climate change impacts on local hydrologic conditions, and the simulated effects of those resultant hydrologic conditions on the sustainability and achievability of the 2008 groundwater operating plan.

Chapter 6 describes the potential groundwater recharge projects being planned by LACFCD and discusses the potential benefit to the yield of the basin.

Chapter 7 summarizes the conclusions derived from the overall updated basin yield analysis, and the implications of those conclusions for long-term groundwater supply and groundwater management in the Santa Clarita Valley.

References and Appendices follow Section 7. The Appendices include a description of the Santa Clarita Valley numerical groundwater flow model, description of the updated model calibration, hydrographs to illustrate simulated basin response to the operating plans, and discussion of climate projections and their incorporation in the analyses reported herein.

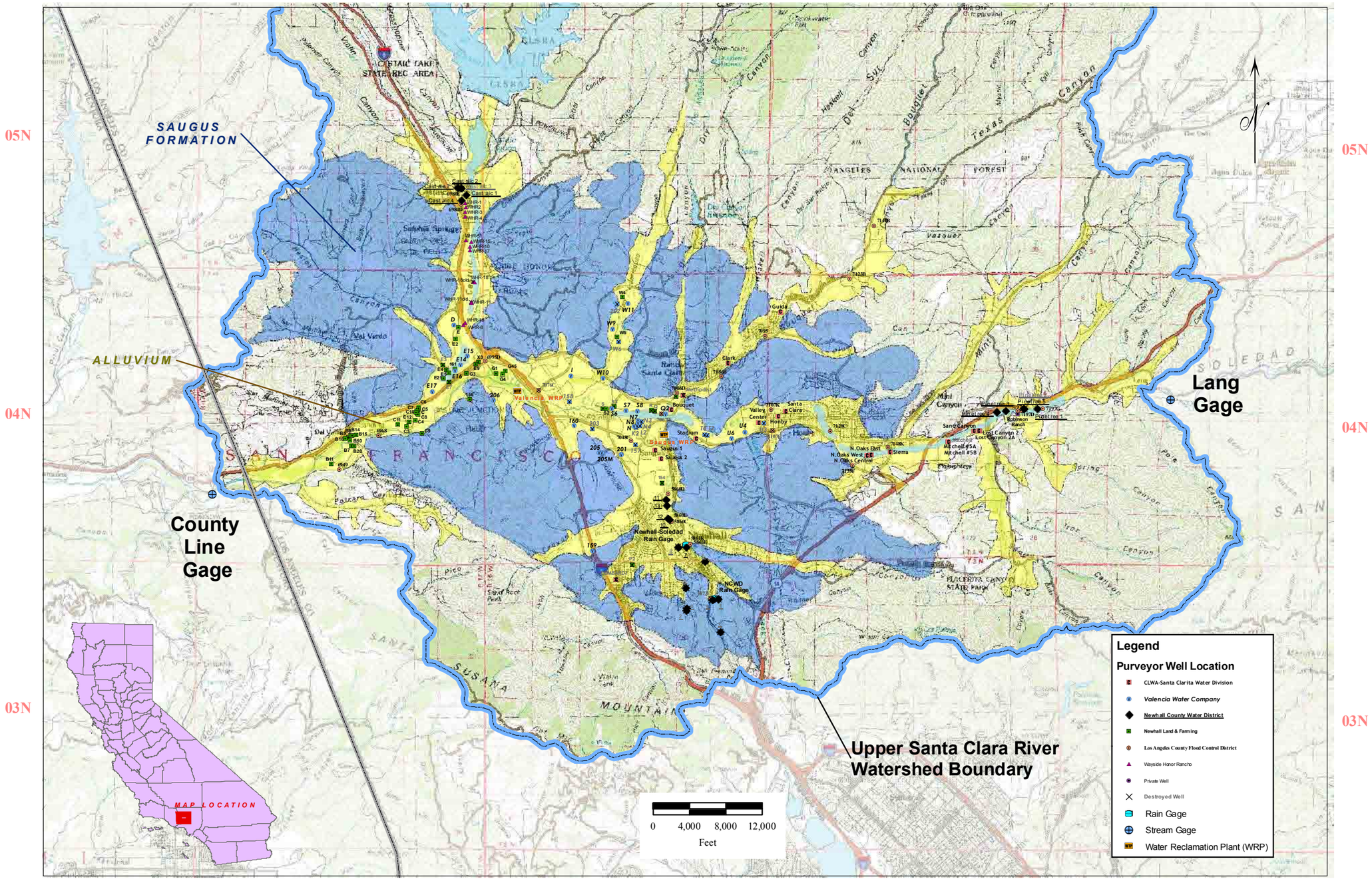

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Figure 1-1
Basin Location Map
Upper Santa Clara River Valley Groundwater Basin, East Subbasin

II. Updated Model Calibration

2.1 Model Description

The Santa Clarita Valley groundwater flow model is a three-dimensional, numerical model that uses the MicroFEM® finite-element software (Hemker and de Boer, 2003). The model covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation (Figure 3-1). The model's construction and calibration are summarized in Appendix A and discussed in detail in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a).

The model simulates groundwater conditions within an area that largely coincides with the Santa Clara River Valley Groundwater Basin, East Subbasin, delineated by DWR. This area extends from the Lang stream gage at the eastern end of the valley to the County Line stream gage area in the west. The model is based on a finite-element mesh consisting of seven layers, with 17,103 nodes and 32,496 elements in each layer (Figure 2-1). The upper model layer simulates the Alluvial Aquifer and also the upper portion of the Saugus Formation where the Alluvial Aquifer is not present. The underlying layers simulate the underlying freshwater Saugus Formation and its Sunshine Ranch Member. Figure 2-2 shows the model layering in three cross-sectional views.

The boundary conditions in the model consist of the following:

- Specified flux boundaries for the following:
  - precipitation
  - irrigation
  - recharge from ephemeral streams
  - pumping
  - underflow from beneath Castaic Dam

- Head-dependent flux boundaries for the following:
  - groundwater discharges to the perennial reach of the Santa Clara River
  - residual drainage of groundwater to the Santa Clara River in the ephemeral reach under high water table conditions
  - evapotranspiration (ET) by phreatophyte plants, which extract groundwater from the shallow water table that lies along riparian river corridors

- Constant-head boundaries for the following:
  - subsurface inflow in the Alluvial Aquifer at the eastern end of the valley, at the Lang gage[1]

[1] A constant-head boundary was established in the groundwater model at this location using recent field conditions that were observed after the model calibration report (CH2M HILL, 2004a) was published. This change improved the groundwater model's calibration in the Alluvial Aquifer in the upper reaches of Soledad Canyon and did not appreciably change the calibration quality elsewhere. See CH2M HILL (2005) for further details.

- subsurface outflow in the Alluvial Aquifer at the western end of the valley, at the County Line gage

Groundwater recharge rates are estimated using precipitation records, streamflow records, watershed maps, topographic maps, and aerial photography. These recharge rates are calculated using a detailed Surface Water Routing Model (SWRM), which was written specifically to provide time-dependent, spatially varying recharge rates as input to the groundwater model. The SWRM relies on streamflow records at the Lang and County Line gages; historical records of rainfall data from the NCWD rain gage (see Figure 1-1), spatial variations in rainfall across the basin, the rates and locations of future WRP discharges to the Santa Clara River, and irrigation from agricultural and urban water uses.

The depths from which production wells obtain water are defined in the groundwater model from well construction records. The rates and locations of pumping are based on the Purveyors' operating plan for the basin and on the surveyed location of each production well.

2.2 Calibration Update Approach

The calibration update process consisted of transient modeling that simulated monthly variations in pumping from, and recharge to, the Alluvial Aquifer and the Saugus Formation during the period January 2005 through December 2007. As with the original calibration effort, simulation results were compared to measured fluctuations in groundwater elevations and streamflows in the Santa Clara River.

Hydrologic input data for the calibration update simulation are tabulated in Appendix B and were as follows:

- Groundwater pumping data were provided by the Purveyors for each production well. Appendix Tables B-1 and B-2 show annual pumping for the Alluvial Aquifer and Saugus Formation, respectively, from 1980 through 2007. As with the initial model calibration effort, the monthly distribution of pumping was defined from information on the monthly distribution of urban and agricultural water demands, as listed in Appendix Table B-3.
- Groundwater recharge was defined using the SWRM, which was written specifically for the groundwater model during the original model development effort (see Appendix C of CH2M HILL, 2004a). The SWRM defined recharge from applied water use (i.e., irrigation)[2]; direct precipitation within the model domain (see Appendix Table B-4); Santa Clara River flows into the valley as measured at the Lang stream gage (see Appendix Table B-5); SWRM-estimated stormwater inflows into the model domain along ephemeral streams that are tributaries to the Santa Clara River; measured volumes of treated water discharge into the Santa Clara River from two Los Angeles County Sanitation District (LACSD) water reclamation plants (WRPs) (see Appendix Tables B-6

[2] Infiltration of applied water was simulated in the same locations as in the original model calibration effort, and at the 1999 rates described in the model development report (CH2M HILL, 2004a). These rates were 24.7 inches per year (in/yr) for irrigated agricultural land, 2.2 in/yr for residential areas, and 1.0 in/yr for retail/industrial lands and golf courses.

and B-7); and water released from Castaic Lagoon into Castaic Creek by DWR (see Appendix Table B-8).

- Coefficients for the riverbed leakage term at each river node vary over time in the model. For the years 2005 through 2007, the calibration update process initially used the same values as used for 1992, 1996, and 1989, respectively. These values were then adjusted as necessary during the calibration update process.

The quality of the model's calibration was evaluated as follows:

- Simulated groundwater elevation trends were compared with data collected at production wells where long-term records of groundwater elevations are available. These wells are referred to herein as target wells. As discussed in the model development report (CH2M HILL, 2004a), the calibration goal at target wells was to simulate groundwater elevations that were higher than the pumping elevations and as close as possible to the static elevations. Therefore, the hydrographs show the model-simulated groundwater elevations, the measured static groundwater elevations, and, for production wells, the measured pumping groundwater elevations. Additionally, the comparison of time-varying simulated and measured groundwater elevations was equally focused on the slopes of the hydrographs, not just the absolute values of the groundwater elevations at any given time.
- The groundwater budget was evaluated to compare simulation results with measured flows in the Santa Clara River at the west end of the basin (at the County Line gage; see Appendix Table B-9); and estimated volumes of groundwater discharge to the Santa Clara River (see Appendix Table B-10).

2.3 Results from the Calibration Update Process

The initial simulation of conditions during 2005 through 2007 produced findings that were deemed to require adjustments to the model's calibration of portions of the Alluvial Aquifer prior to conducting the predictive modeling necessary for the basin yield update analysis. Specifically, the results from the initial calibration update indicated that, from 2005 through 2007, the model simulated:

- too much groundwater level recovery in Castaic Valley at NCWD's Castaic wellfield during the high streamflow event of early 2005
- too much decline in groundwater levels in lower San Francisquito Canyon (at VWC's W9 and W11 wells)
- groundwater levels that were too high in lower Bouquet Canyon (at SCWD's Clark well) and below the mouth of Bouquet Canyon (at VWC's S6, S7, and S8 wells)

It was also noted that, the model simulated too little groundwater level decline immediately prior to 2005 in the eastern-most portions of the Alluvial Aquifer along the Santa Clara River (at and east of the mouth of Mint Canyon). Additionally, it was determined that, for NCWD's Pinetree wellfield, the groundwater level database contained incorrect reference elevations, which are

used to convert groundwater depths to groundwater elevations. As a result, it was concluded that the original calibration effort (during 2004) had compared simulation results with database-derived groundwater elevation values that were lower than the actual elevations of the water table throughout the entire simulation period (January 1980 to the present).

As a result of these findings, efforts were undertaken to improve the model's calibration quality in the eastern-most portion of the Alluvial Aquifer and in the tributary canyons noted above. This focused re-calibration process resulted in changes to the hydraulic conductivity in certain areas and riverbed leakage coefficients along certain reaches of Castaic Creek and the eastern reaches of the Santa Clara River. These changes were:

- increasing the hydraulic conductivity from 105 feet/day to between 250 and 500 feet/day in San Francisquito Canyon

- increasing the hydraulic conductivity from 245 feet/day to 300 feet/day in lower Bouquet Canyon

- introducing a zone of reduced hydraulic conductivity (250 feet/day) along the Santa Clara River at the mouth of Mint Canyon, to better simulate the hydraulic gradient between SCWD's Sierra and Mitchell wells

- reducing the hydraulic conductivity by 50 percent along the Santa Clara River from just east of NCWD's Pinetree wellfield upstream to the Lang gage at the eastern end of the valley (from 300 to 150 feet/day) and also in two nearby tributaries (Tick Canyon and Bee Canyon, from 150 to 75 feet/day)

- raising the Castaic Creek riverbed leakage coefficients during the high-flow events of 2001 and late 2004/early 2005

- raising the riverbed leakage coefficients in San Francisquito and Bouquet Canyons during and after the high-flow event of late 2004/early 2005

- raising the riverbed leakage coefficients for the reach of the Santa Clara River near SCWD's North Oaks and Sierra wells during the high-flow event of late 2004/early 2005

- revising the rainfall-runoff-recharge relationship for the basin. This relationship is based on a power-function equation developed by Turner (1986). As shown in Figure 2-3, the coefficients were revised slightly in a manner that, when compared with the original calibration (CH2M HILL, 2004a), generates slightly more recharge when annual precipitation is above normal. This increase in recharge ranges from about 0.25 inches to 1 inch for annual rainfall between 21 and 40 inches at the NCWD gage. For the wettest year on record at the NCWD gage (48.33 inches in calendar year 1983), annual recharge is 22.5 and 23.8 inches in the 2004 and 2008 calibrations, respectively, which is a difference of about 1.3 inches.

Appendix B contains groundwater elevation hydrographs comparing the model-simulated groundwater elevations with static and pumping groundwater elevations at the many production wells in the valley. Model simulation results are shown both for the original calibration (CH2M HILL, 2004a) and the updated calibration. The hydrographs are organized according to the primary subareas for the Alluvial Aquifer (see Figure 2-4 for the locations of these subareas) and by Purveyor for the Saugus Formation. The hydrographs show notable improvements in calibration quality in Castaic Valley, San Francisquito Canyon, and Bouquet Canyon. However, little improvement could be achieved at VWC's S-series wells without degrading the calibration quality in nearby wells (such as VWC's N-series wells). Along the Santa Clara River, substantial improvements to the model's simulation of drought periods in the Alluvial Aquifer were achieved at NCWD's Pinetree wellfield, and to a lesser extent at other wells further west (for example, SCWD's North Oaks, Sierra, and Honby wells).

In the Saugus Formation, the model simulates the trends in groundwater elevations quite well at each Saugus production well. The trends (hydrograph slopes) are particularly close in the NCWD wellfield (NCWD production wells 11, 12, and 13). Farther downgradient, the model tends to slightly over-predict groundwater elevations in SCWD's two production wells. However, the model closely simulates the groundwater elevation trends at these two wells, which is the primary consideration for evaluating the quality of the transient calibration process in the Saugus Formation. Groundwater elevations and trends are well-simulated at VWC's Saugus production wells (including the recently constructed VWC-206).

Appendix B also contains hydrographs comparing the simulated and measured values of 1) total river flow and 2) groundwater discharge to the river for the Santa Clara River at the County Line gage, where the river exits the valley and flows into Ventura County.[3] The hydrographs show that the model adequately replicates seasonal and year-to-year cycles of low and high river flows. Additionally, the model simulates temporal cycles in groundwater discharge to the river in a manner that is generally consistent with the cycles reflected in the estimates made from available stream gage data. As discussed in prior model development reports (CH2M HILL, 2004a and 2005), it is likely that differences between modeled and measured hydrographs for total river flow and groundwater discharges result from uncertainties in both the model and the County Line gage data, particularly during periods of low river flows.

[3] The "measured" groundwater discharges to the river are estimates that were derived from a hydrograph separation process, described by CH2M HILL (2004). This process estimated the monthly groundwater discharge to the river by examining the daily streamflow data at the County Line gage, the daily and monthly precipitation at local rain gages, monthly flows into Castaic Creek from Castaic Lagoon, and monthly flows into the Santa Clara River from the Saugus and Valencia WRPs.

III. Modeling Approach for Analyzing Basin Yield

3.1 Modeling Approach

The process of designing the modeling analysis to evaluate the sustainability and achievability of a given operating plan consisted of the following five activities:

- Selecting a period over which to simulate groundwater conditions under each operating plan, including:
    - defining a sequence of varying local hydrology (rainfall, streamflows, and groundwater recharge) on a month-to-month basis throughout the simulation period
    - defining a sequence of varying availability of imported water supplies, as defined from availability studies of the State Water Project (SWP), on a month-to-month basis throughout the simulation period
- Defining pumping rates and schedules for each production well in the valley, including consideration of the varying local hydrology and SWP water availability
- Running the model to calculate time-varying (monthly) groundwater elevations and groundwater discharge terms throughout the multi-year simulation period
- Evaluating the modeling results by examining forecasted time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the effects of the operating plan in the Alluvial Aquifer, the Saugus Formation, and the Santa Clara River

These activities are described in further detail below.

3.2 Simulation Period

The locations and temporal variation in pumping from the Alluvial Aquifer were defined in the model from the operating plan and from historical records of the year-to-year variability in local hydrology. Simulated pumping from the Saugus Formation was defined from the operating plan, historical pumping records, and operational constraints and historical patterns of SWP water supply availability.

3.2.1 Original Simulation Period

Because the operating plan for the Saugus Formation is linked to the hydrology and operational constraints for the SWP system, the year-to-year variability in Saugus Formation pumping is, to a great extent, dependent on the hydrology outside the valley (i.e., in northern California). As discussed in the original basin yield analysis report (CH2M HILL and LSCE, 2005), local hydrology affects the availability of Alluvial Aquifer groundwater, but is not always a good

indicator of local pumping conditions in the Saugus Formation, because local droughts and SWP droughts do not necessarily coincide with each other. Consequently, it was decided that the model would need to be run over several decades to capture the year-to-year differences between local hydrology and SWP hydrology and water availability, as well as the less frequent times when both systems experience similar hydrologic conditions (as occurred periodically during the 1960s and in 1994). Historical records were then analyzed to identify a simulation period that would be long enough to capture the variety of year-to-year and longer-term trends in local hydrology and imported water availability.

The original basin yield analysis was conducted using a synthetic 78-year period that replicated the historical hydrology from 1980 through 2003, followed by a replication of historical hydrology from 1950 through 2003. This synthetic time period simulated 24 years of reduced pumping from the Alluvial Aquifer, including two 3-year periods and one 4-year period of reduced pumping. For the Saugus Formation, this synthetic time period contained 18 "drought years" in which imported water volumes were sufficiently low to result in increased pumping from the Saugus Formation. These 18 years included two droughts lasting 2 years and two droughts lasting 3 years.

3.2.2 Current Simulation Period and Associated Hydrology

As introduced in Section 1.2, the update of the basin yield analysis was conducted in part because of the possibility of near-term reductions in SWP water deliveries to CLWA. The most recent analysis of the SWP's delivery reliability (DWR, 2008) includes year-to-year projections of delivery volumes under various development conditions, assuming both a repeat of historical climate and the potential effects of climate change. The analyses that are based on historical climate are reported for the climate that occurred from 1922 through 2003. These year-to-year projections had not been completed and published at the time of the original basin yield analysis in 2004 and 2005. Because these new analyses are now available, the basin yield update analysis simulated the historical record of climate and corresponding SWP delivery volumes for an 86-year period beginning in 1922 and ending in 2007, rather than using a synthetic time period. This 86-year period is characterized by:

- 14 years when deliveries are 35 percent or less of maximum Table A amounts, including 3 years when the deliveries do not exceed 10 percent of the Table A amounts

- Two droughts lasting 6 years (1929 through 1934, and 1987 through 1992)

Under the groundwater operating plan for the Santa Clarita Valley, the SWP delivery volume in any given year affects the amount of groundwater pumping that occurs from the Saugus Formation during that year. The amount of groundwater pumping from the Alluvial Aquifer is controlled by local hydrology, as determined by the amount of rainfall that occurs within the watershed during a given year. Figure 3-1 shows the historical pattern of annual rainfall on a calendar year basis from 1922 through 2007 at the Newhall-Soledad rain gage, which has the longest rainfall record of any location within the watershed. Values for 1922 through 1930 are estimated from RCS (2002). RCS personnel have since indicated that the source of data to 1931 is an unofficial record obtained in 2001 from a former California State Climatologist. The figure

also shows the average and median values of rainfall for the period 1931 through 2007 (18.16 and 15.82 inches per year, respectively). The estimated rainfall values from 1922 through 1930 were not included in the calculations of the average and median values. The figure shows that annual rainfall at the Newhall-Soledad rain gage since 1922 has ranged from about 4.1 inches in the driest years (in 1947 and 1972) to as much as 42.1 inches in the wettest years (1941 and 1978). 52 of the 86 years of record were characterized by below-average rainfall, and 36 years were particularly dry years characterized by rainfall values below 13.5 inches/year, which is 85 percent of the long-term median rainfall.

For annual rainfall at the Newhall-Soledad rain gage, Figure 3-2 shows the cumulative departure since 1922 from the 1931-2007 average rainfall. The cumulative departure refers to the cumulative (accumulated) amount of rainfall deficit or rainfall surplus over time, compared with long-term average rainfall. The slope of the cumulative departure plot is indicative of whether a given time period is characterized by generally dry conditions (downward slope), near-normal conditions (flat), or wetter-than-normal conditions (upward slope). The figure shows the following patterns in the local rainfall cycle:

- Generally dry conditions (downward-trending slope) after 1922 and continuing through 1935

- Generally wet conditions (upward-trending slope) from 1938 through 1944

- Thirty years of generally dry conditions (downward-trending slope) from 1947 through 1976, except for modestly wet conditions from 1965 through 1970

- Generally wet conditions (upward-trending slope) from 1977 through 2005, interrupted by drought conditions from 1984 through 1991 and from 1999 through 2004

An additional noteworthy feature of the cumulative departure plot is the 48-inch rainfall deficit that occurred from 1947 through 1951, which was not fully captured in the original basin yield analysis, but is modeled in its entirety in this updated analysis. The total rainfall deficit from 1947 through 1976 was approximately 86 inches (from a cumulative 31 inches above average in 1946 to a cumulative 55 inches below average in 1976). After 1976, the cumulative departure returned to a slightly positive value because of significant rainfall events in 1978, 1980, and 1983.

Table 3-1 shows the sequence of normal-year versus dry-year pumping conditions for the Alluvial Aquifer, as derived from the local rainfall records, and for the Saugus Formation as derived from the availability of SWP water. For the Alluvial Aquifer, the pumping year type is assumed to lag the local hydrology by one year. An examination of historical rainfall data and Alluvial Aquifer pumping patterns shows such a lag occurred in several years during the past two decades. The table shows dry-year pumping occurring in 55 years from the Alluvial Aquifer and 15 years from the Saugus Formation. During the 86-year simulation period, there are nine periods when dry-year pumping from the Alluvial Aquifer lasts more than two consecutive years, and two periods have dry-year Saugus pumping lasting more than one year. The longest dry-year pumping periods last for 7 years in the Alluvial Aquifer and 4 years in the Saugus Formation.

During the predominantly dry period from 1922 through 1978, only 16 of these 57 years (28 percent) were years in which normal pumping would have occurred from the Alluvial Aquifer.

3.3 2008 Operating Plan

Following are a general description of the 2008 Operating Plan and discussions of how pumping is distributed spatially and over time in the Alluvial Aquifer and the Saugus Formation under this plan. This plan was analyzed for its long-term sustainability by using the groundwater flow model to simulate the plan under the historical hydrology dating back to 1922. Actual historical pumping at the operating plan rates and for the current basin-wide network of production wells dates back only to the mid-1990s. Prior to that time, less pumping occurred in some years, while in other years pumping was limited to the western portion of the valley. Consequently, the modeling analysis was conducted in a manner to allow evaluation of how the basin might respond to the current operating plan and the current network of production wells, as might occur if past multi-decadal cycles of local and SWP hydrology (such as those measured as far back as 1922) were to repeat themselves in the future.

3.3.1 General Description of 2008 Operating Plan

As discussed in Section 1.1, the 2008 Operating Plan for the local groundwater basin is as follows:

- Pumping from the Alluvial Aquifer ranges between 30,000 and 40,000 afy during normal and above-normal rainfall years but, because of operational constraints in the eastern part of the basin, is reduced to between 30,000 and 35,000 afy during locally dry years. Table 3-2 shows the sequence of historical rainfall cycles and associated pumping from the Alluvial Aquifer, based on this operating plan and the 86-year simulation period that reflects historical rainfall in the valley from 1922 through 2007.

- Pumping from the Saugus Formation ranges between 7,500 and 15,000 afy during average-year to wet-year conditions within the SWP system. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 afy during a dry year, and increases to between 21,000 and 25,000 afy if SWP allocation is reduced to about 35 percent or less of the maximum Table A amount for two consecutive years, and between 21,000 and 35,000 afy if SWP allocation is reduced to about 35 percent or less of the maximum Table A amount for three consecutive years. Table 3-3 shows the sequence of SWP water availability and associated pumping from the Saugus Formation, based on this operating plan and the 86-year simulation period that reflects historical hydrology in the SWP system from 1922 through 2007.

Pumping rates for Purveyor-owned wells were assigned in accordance with the groundwater operating plan for the Santa Clarita Valley, which defines ranges of valley-wide annual pumping, given the water supply needs of the Purveyors. Pumping rates at individual wells were also assigned using the recent and planned production schedules for each well, information on the depths and lengths of the intake sections (open intervals) of each well, and by incorporating current plans addressing two other specific issues affecting Purveyor pumping:

- The presence of ammonium perchlorate in parts of the Saugus Formation and the Alluvial Aquifer

- Intermittent planned pumping from the Saugus Formation for the purpose of meeting regulatory objectives for chloride concentrations in the Santa Clara River.

These two issues and the details of how pumping was specified in the modeling analysis of the current operating plan are discussed further in Sections 3.3.2 and 3.3.3 below.

3.3.2 Alluvial Aquifer Pumping

Simulated pumping rates under the 2008 Operating Plan for production wells completed in the Alluvial Aquifer are listed in Table 3-4. The table provides this information for 8 wells owned by NCWD, 13 wells owned by SCWD, 15 wells owned by VWC, 16 wells owned by NLF, and private wells owned by Robinson Ranch and Wayside Honor Rancho. Most Alluvial Aquifer wells were specified to operate at similar rates regardless of year type, except in the eastern portion of the basin. Wells in this area (the Robinson Ranch well, the four Pinetree wells owned by NCWD, and 11 wells owned by SCWD) were assumed to have lower pumping capacities during dry years than non-drought years because of historically experienced lower groundwater elevations during dry periods.

The 2008 Operating Plan for the Alluvial Aquifer accounts for historical perchlorate detections in two alluvial wells, as the result of contamination emanating from the former Whittaker-Bermite property.

- In 2002, an Alluvial production well owned by SCWD (SCWD-Stadium) was shut down because of the detection of perchlorate. SCWD has recently drilled a replacement well (Valley Center) further to the east, north-northeast of the Whittaker-Bermite property.

- In March 2005, an Alluvial production well owned by VWC (VWC-Q2) was shut down because of perchlorate detection. After returning the well to service with wellhead treatment in October 2005, followed by nearly two years of operation with wellhead treatment, during which there was no detection of perchlorate, Valencia was authorized by the California Department of Public Health (DPH) to discontinue treatment. Well Q2 has since been operated without treatment and there has been no detection of perchlorate since discontinuation of wellhead treatment. Consequently, Well Q2 is included in the 2008 Operating Plan.

The 2008 Operating Plan for the Alluvial Aquifer also accounts for known private pumping at wells owned by the Newhall Land & Farming Company (NLF) for agricultural water supply; wells owned by Los Angeles County Water District No. 36 that provide potable water to the Wayside Honor Rancho; and a well in eastern Soledad Canyon owned by Robinson Ranch that is used for golf course irrigation. In the future, portions of the current pumping by NLF are planned to be converted to pumping by Valencia Water Company to supply potable water to the future Newhall Ranch development. However, for the purposes of the groundwater modeling analysis,

this pumping volume is indicated in Table 3-4 as continuing to be conducted by NLF, to reflect current ownership and current operating conditions. The planned change from agricultural to municipal supply is expected to result in only locally small changes in pumping locations (new municipal wells in close proximity to existing agricultural wells that will then be abandoned), resulting in practically similar spatial distribution of pumping and thus similar conditions as simulated in the 2008 Operating Plan.

The water management practices of the Purveyors also recognize ongoing Alluvial Aquifer pumping for other smaller private domestic and related pumping. For the last ten years of formal annual water report preparation in the Santa Clarita Valley, those reports have included estimates of the latter private pumping. Based on limited data provided by private well owners as part of the overall Groundwater Management Plan effort, it is estimated that small private pumping is within 500 afy, or approximately one percent of typical Alluvial Aquifer pumping by the Purveyors and other known private well owners (including agricultural pumpers) combined. However, the small private wells are not explicitly modeled in the basin yield analysis described herein because their locations and operations are not known, and their operation creates a pumping stress that is essentially negligible at the scale of the overall groundwater model. Ultimately, as discussed throughout this report, the intent is to maintain overall pumping, including private pumping, within the operating plan to result in sustainable groundwater conditions to support the combination of municipal (Purveyor), agricultural, and private groundwater use on an ongoing basis. Thus, private well owners in the basin, like the large municipal and agricultural pumpers, can expect groundwater supplies to continue to be available as they have been in the past, with some fluctuations in water levels through wet and dry periods, but no long-term depletion of supply.

3.3.3 Saugus Aquifer Pumping

Simulated pumping rates under the 2008 Operating Plan for production wells completed in the Saugus Formation are listed in Table 3-5. The table provides this information for two wells owned by NCWD, two wells owned by SCWD, six wells owned by VWC, and a private well at the Palmer golf course, located just north of Hasley Canyon. Pumping rates at specific Saugus Formation production wells were assigned for each type of year (normal, dry year 1, dry year 2, and dry year 3) using information on the capacity, recent and planned use, and location of each well[1]. Significant aspects of the pumping rate selection at each well are as follows:

- Pumping from most existing Saugus Formation production wells was based on recent and planned use of these wells, as defined by the Purveyors. The simulation included increased dry-year pumping from the Saugus Formation in the western portion of the basin, where it is anticipated that future wells will be installed.

- Each Saugus Formation production well has an intake section (open interval) that is significantly longer in vertical extent than the thicknesses of the individual layers that represent the Saugus Formation in the groundwater flow model. Consequently, the

[1] Table 3-5 only lists wells that are anticipated to be operating in the future. Existing wells that are not listed in this table (such as NCWD-7, NCWD-10, and NCWD-11) are currently not in service and, therefore, are not expected to provide significant quantities of water in the future.

Saugus pumping rates were assigned to multiple layers in the model by considering the depths of the intake section of each well and the transmissivity of each model layer. Table 3-6 shows the allocation of pumping in each model layer for each Saugus Formation production well, along with the intake sections of each well and the model-simulated transmissivity in each layer at each well location.

The 2008 Operating Plan for the Saugus Formation accounts for historical perchlorate detections and the resulting containment and remedial response activities that are being constructed at this time. In 1997, two Saugus Formation production wells owned by SCWD (wells SCWD-Saugus1 and SCWD-Saugus2), one Saugus Formation production well owned by NCWD (well NCWD-11), and one former Saugus Formation production well owned by VWC (well VWC-157) were removed from service because perchlorate was detected in groundwater at these wells[2]. Under oversight by the California Department of Toxic Substances Control (DTSC), and with ultimate approval by DPH, in accordance with its Policy 97-005 (for restoration of water supply from "severely impaired" water sources), the Purveyors developed a remedial strategy that will entail pumping of two impacted wells for containment of perchlorate migration; treatment and subsequent use of the pumped water for water supply; and installation of replacement wells in non-impacted portions of the basin to restore the remainder of groundwater supply impacted by perchlorate. A noteworthy detail of these activities is that the groundwater flow model was used to identify the design of a pumping scheme that would meet the Purveyors' objectives for perchlorate containment in the Saugus Formation (CH2M HILL, 2004b). The final containment plan specifies that wells SCWD-Saugus1 and SCWD-Saugus 2 operate at an instantaneous pumping rate of 1,200 gallons per minute (gpm) at each well (for a combined total of 2,400 gpm from the two wells). The annual pumping volume of 1,772 afy per well shown in Table 3-5 is based on this rate and also on the assumption that pumping will occur continuously, except for up to four weeks per year for maintenance purposes. Construction of facilities and pipelines necessary to implement the containment program and to restore inactivated well capacity, to be followed by operational start-up, are currently scheduled to occur in 2009.

The 2008 Operating Plan for the Saugus Formation also accounts for intermittent pumping from the Saugus Formation that is expected to occur for the purpose of meeting regulatory objectives for chloride in the Santa Clara River. This pumping program is one component of an Alternative Water Resources Management (AWRM) program to be implemented by the Santa Clarita Valley Sanitation District of Los Angeles County (SCVSD, a division of the Los Angeles County Sanitation District [LACSD]), the Purveyors, and other parties for the purpose of meeting Total Maximum Daily Loads (TMDLs) for chloride in the Santa Clara River in western Los Angeles County and eastern Ventura County. The AWRM program was finalized in the form of a Memorandum of Understanding (MOU) dated October 2008. Under the AWRM program, CLWA will develop a plan to provide imported water to replace Saugus Formation groundwater that will be pumped to provide supplemental water for the AWRM program. The supplemental pumped groundwater from the Saugus Formation will be released to the Santa Clara River near the Los Angeles County / Ventura County line to improve water quality conditions in the river

[2]As part of the ongoing implementation of perchlorate containment and restoration of impacted capacity, well VWC-157 was abandoned in January 2005 and replaced by new well VWC-206. Thus, this analysis includes planned pumping from replacement well VWC-206.

and to allow for attainment of the AWRM's stated water quality objectives for the river. Under the AWRM, the supplemental water will be directed to the river during years of extreme drought conditions in the SWP, defined as time periods when chloride concentrations equal or exceed 80 milligrams per liter (mg/L) in SWP water (Geomatrix, 2008; LARWQCB, 2008). Pumping under this program is planned to occur from well VWC-206 and from two future wells that will be drilled near VWC-206. This supplemental pumping is factored into the annual pumping volumes listed in Table 3-5. The pumping rates listed in Table 3-5 for the individual Saugus Formation wells will occur regardless of whether a portion of a given year's pumping is being directed to the AWRM program. Any volume of pumping directed to the AWRM program in a given year will be made up with imported water supplies, rather than from increased pumping of Alluvial or other Saugus groundwater. Technical analyses indicate that this pumping could occur in about 24 percent of all years, with total pumping occurring at rates ranging from less than 1 million gallons per day (mgd) to as much as 8 mgd (Geomatrix, 2008).

3.3.4 Monthly Allocation of Pumping

The model simulations that evaluated the operating plan were conducted by modeling groundwater recharge and pumping on a monthly basis. Consequently, the annual pumping volumes specified in the groundwater operating plan were converted to monthly values at each well for modeling purposes. The allocation of pumping, by month, for agricultural and urban production wells in both the Alluvial Aquifer and the Saugus Formation is listed in Table 3-7. Separate monthly distributions were used because agricultural demands are for exclusively outdoor uses, whereas urban demands are for both indoor and outdoor uses. As discussed in the model development report (CH2M HILL, 2004a), the monthly distribution of agricultural pumping was derived from crop consumptive use requirements published by the California Irrigation Management Information Service. The monthly distribution of urban demand was determined by examining historical monthly flow records for the two water reclamation plants (WRPs) that are present in the valley, and also by examining the distributions of monthly water consumption recorded by the Purveyors within their service areas during the past several years.

3.3.5 Total Available Potable Water Supply Under the 2008 Operating Plan

For the 2008 Operating Plan and the 1922-2007 simulation period, Table 3-8 lists the annual volumes of water available from each potable water source (Alluvial Aquifer, Saugus groundwater, and SWP imports), along with their combined total. The combined pumping from the Alluvial Aquifer and the Saugus Formation averages 51,400 afy and ranges between 47,335 and 73,577 under the 2008 Operating Plan. Year-by-year pumping from each aquifer is shown in Figure 3-3, along with total groundwater pumping.

Figure 3-4 compares total groundwater pumping with SWP water supply availability and the resulting total volume of water from a combination of local groundwater and imported SWP water (not including other water supplies, for example, purchased water, water banked in other groundwater basins, etc.). The total water supply from those two sources is as low as 64,858 afy during the driest years in the SWP system, when SWP deliveries are below 10,000 afy. For the 86-year simulation period, the total available supply from local groundwater and imported SWP water averages about 110,000 afy and can exceed 140,000 afy in the wettest years.

3.4 2008 Operating Plan with Pumping Redistribution

The 2008 Operating Plan with Pumping Redistribution was developed in response to model simulation results (discussed in Section 4 of this report) that identified a potential lack of achievability in maintaining alluvial pumping in the eastern portion of the basin, due to decline in groundwater levels below the intake sections of wells. The model simulations of the 2008 operating plan indicated that such declines, and the associated potential lack of achievability, could occur during periods which experience prolonged dry conditions, such as occurred from the mid-1940s through the mid-1970s, when there were few years of significantly greater-than-average rainfall. For this three-decade period, the model simulation found the 2008 Operating Plan to not be achievable in the most eastern part of the basin, the "Above Mint Canyon" subarea. However, it was also recognized that achievability might be accomplished by redistributing some pumping to other areas, specifically to reduce pumping stress in the far east and replace it with increased pumping farther west in the basin. This redistribution may not be necessary during other historical periods that were characterized by intermittent years of significant rainfall, streamflow, and associated groundwater recharge (such as occurred periodically from the late 1970s through 2005).

This variation of the 2008 Operating Plan was examined as follows. Recognizing that SCWD is in the midst of constructing new or replacement wells (e.g. to replace its perchlorate-impacted Stadium well) to the west of the "Above Mint Canyon" subarea, a redistribution of some SCWD pumping, as analyzed in the 2008 Operating Plan, was crafted whereby 1,600 afy of pumping was moved from three SCWD wells in the "Above Mint Canyon" subarea (near the mouth of Sand Canyon) to the replacement SCWD Santa Clara and Bouquet wells, located in the "Above Saugus WRP" and "Bouquet Canyon" subareas, respectively. Table 3-9 shows the resulting pumping plan for each Alluvial well under this redistribution scheme.

Besides the pumping redistribution in these Alluvial wells, all other aspects of Alluvial and Saugus pumping remains unchanged from the 2008 Operating Plan.

3.5 Potential Future Operating Plan

A third operating plan was analyzed at the request of the Purveyors. This plan is referred to herein as the Potential Operating Plan and contemplates increased utilization of groundwater during both regular (wet/normal) years and dry years. Target pumping volumes and locations under this plan were provided by the Purveyors and are summarized in Table 3-10 for the Alluvial Aquifer and Table 3-11 for the Saugus Formation. Under this plan, Alluvial Aquifer pumping would be on the order of 47,500 afy in normal/wet years and would be reduced to about 41,500 afy following two or more years of below-normal rainfall locally. Saugus Formation pumping would be on the order of 16,350 afy during years of normal SWP water availability and would increase to over 39,500 afy in the third year of reduced SWP water availability.

Consequently, total groundwater pumping under this plan would be almost 64,000 afy during normal years (compared with about 51,000 afy in the 2008 Operating Plan) and could be as high as about 87,000 afy during the highest pumping years (compared with about 73,500 afy in the 2008 Operating Plan). Figure 3-5 shows the fluctuation during the 86-year simulation period in

total groundwater pumping under this Potential Operating Plan, as well as the fluctuations in total Alluvial pumping and total Saugus pumping. Figure 3-6 compares the year-to-year pumping volumes, as well as the 86-year total pumping, for the potential plan and the 2008 plan. Total groundwater pumping during the 86-year simulation period would be about 1 million acre-feet, or about 80 percent, higher under the Potential Operating Plan.

The Potential Operating Plan differs from the 2008 Operating Plan only in the amount of groundwater being extracted. Both plans assume the same amount of SWP water availability. As shown in Table 3-12 and Figure 3-7, under the Potential Operating Plan, the total contemplated volume of available potable water supply from a combination of local groundwater and imported SWP water (not including other water supplies, for example, purchased water, water banked in other groundwater basins, etc.) ranges between about 77,000 afy and 156,000 afy, and averages nearly 122,000 afy for the 86-year simulation period. This represents an approximate 10 percent increase in water supply from those two sources during average and wet years, compared with the 2008 Operating Plan. During years of reduced SWP imports, the Potential Operating Plan contemplates almost 20 percent more potable water availability from local groundwater and imported SWP water during the driest years, compared with the 2008 Operating Plan.

3.6 Simulation of Other Local Hydrologic Processes

In addition to groundwater pumping, infiltration from irrigation (from urban and agricultural lands), precipitation, and streamflows (stormwater and WRP discharges) were also modeled. These other local hydrologic processes were defined using the Surface Water Routing Model (SWRM), which is described in Appendix C to the model development and calibration report (CH2M HILL, 2004a). The procedures used to derive these terms were the same as in the original basin yield analysis (CH2M HILL and LSCE, 2005) and are described in the following sections.

3.6.1 Recharge from Urban Irrigation

Under existing land use and water use conditions, the estimated long-term infiltration rates of applied irrigation water beneath urban areas, under full build-out conditions in the valley, were estimated to be 1.0 in/yr for industrial and retail lands, 2.2 in/yr for residential developments and parks, and 4.6 in/yr for golf courses (CH2M HILL, 2004a; CH2M HILL and LSCE, 2005). These rates were applied during each year (and each month) of the 86-year simulation period. The areas over which these rates were applied were larger than under current conditions. The areas were defined from recent land use data and LACSD mapping of projected future land uses in the rest of the Santa Clarita Valley under full build-out conditions[3] (CH2M HILL and LSCE, 2005).

[3]LACSD land use mapping indicates that, including Newhall Ranch, approximately 14,000 acres of currently undeveloped land will be urbanized in the future within the model simulation area. Additional urbanization will also occur in areas that are within the watershed, but outside the model's boundaries.

3.6.2 Recharge from Agricultural Irrigation

As discussed in the *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002), irrigation of lands owned by NLF results in existing agricultural return flows. The source of most irrigation water is groundwater pumping from the Alluvial Aquifer, with some limited pumping occurring from one Saugus Formation well (NLF-156) prior to 2008, when this well was taken out of service. Under full Valley build-out conditions, the currently irrigated lands will no longer be irrigated because their water source will be used as part of the water supply for Newhall Ranch. Therefore, under full build-out conditions, no agricultural irrigation will occur within the area simulated by the model.

3.6.3 Precipitation Recharge

Infiltration from direct precipitation within the model domain was defined using data from the Newhall-Soledad and NCWD rain gages, an isohyet map of rainfall throughout the watershed, and the Turner (1986) power-function equation that describes the relationship between annual rainfall and annual groundwater recharge within the valley. Details concerning the derivation of precipitation infiltration rates from these data are contained in Appendix C to the model development and calibration report (CH2M HILL, 2004a). Table 3-13 lists the simulated monthly precipitation at the NCWD rain gage for the 86-year model period[4].

3.6.4 Stormwater Flows and Recharge from Streams

For each month of the simulation, the SWRM calculated the amounts of stormwater flow and groundwater recharge in all streams, plus the amount of flow and groundwater recharge arising from projected future WRP discharges to the Santa Clara River (including from the future Newhall WRP, which will service the planned Newhall Ranch development). For the Santa Clara River, the volume of streamflow was defined from measured and estimated streamflow data at the Lang gage (Table 3-14). For Castaic Creek, the volume of streamflow was defined from historical DWR operations and consideration of the hydrologic year type (Table 3-15). For the remaining Santa Clara River tributaries, streamflow volumes were defined by the SWRM using monthly rainfall data and the Turner (1986) relationship between rainfall, ET, and the subsequent yield from each watershed.

3.6.5 WRP Discharges to the Santa Clara River

Treated water is discharged to the Santa Clara River from the two WRPs that are present in the Valley. The Saugus WRP discharges to the river immediately above the mouth of the South Fork Santa Clara River, and the Valencia WRP discharges to the river just west of Interstate 5. The planned Newhall WRP will discharge to the river just east of the Los Angeles / Ventura County line for limited durations in the winter months.

[4]The simulated monthly precipitation was defined from measurements at the NCWD rain gage from 1979 through 2003, as well as by combining the isohyet map with measurements at the Newhall-Soledad rain gage from prior to 1979.

Under full Valley build-out conditions, future flows into and from WRPs will be higher than historical flows because of increased development and the associated increase in indoor water use volumes. Additionally, a portion of the future treated water will be reclaimed, as described in CLWA's recycled water master plan (Kennedy/Jenks Consultants, 2002). In the original basin yield analysis work (CH2M HILL and LSCE, 2005), future inflows to the Saugus and Valencia WRPs were estimated from projected future water demands and from comparisons of historical water use and measured inflows to both WRPs. Table 3-16 shows the derivation of urban water demands outside the Newhall Ranch development (which will be served by a new, separate WRP). Table 3-17 shows the total amount of treated water generated by the Saugus and Valencia WRPs, and the amount of this water that is reclaimed and discharged to the river, by month. These values are the same as were used in the original basin yield analysis work. The values in Table 3-17 assume that the reclaimed water volume will be no more than 16,000 afy, to maintain existing flow volumes in the Santa Clara River. For the Newhall Ranch WRP, discharges to the river will be 286 afy, occurring primarily in December and January, when demands for reclaimed water are at their seasonal low. The total combined volumes of treated water discharged to the Santa Clara River under full Valley build-out conditions (including Newhall Ranch) are summarized, by month, in Table 3-18. These rates, which were used in the original basin yield analysis, were carried forward and used in each year of the 86-year simulation for the basin yield update analysis.

3.6.6 Monthly Assignment and Tracking of Surface Water Budget

The month-by-month assignment of the rates and locations of surface water infiltration to the underlying Alluvial Aquifer system was performed by the SWRM using the procedures described in Section C.8.5 of Appendix C to the model development and calibration report (CH2M HILL, 2004a). Streambed infiltration capacities for the last 28 years of the 86-year simulation period (calendar years 1980 through 2007) were the same as those used in the calibrated model. For the prior 58 years (1922 through 1979), the monthly streambed infiltration capacity values for a given year were selected by using one of the calibration years as a prototype year. Rainfall and streamflow records were used to identify the best prototype year and to subsequently specify the corresponding streambed infiltration rates.

For each month of the 86-year simulation period, the SWRM also tracked the volume of surface water that does not infiltrate to groundwater from a given stream because of gaining stream conditions (i.e., rejected stream leakage). This rejected stream leakage was calculated to remain as surface water in the Santa Clara River and to eventually exit the model domain at the west end of the Valley, at the County Line gage.

3.7 Running the Model and Evaluating Results

As discussed in the previous sections, the modeling evaluations were performed by simulating conditions on a monthly basis for the 86-year simulation period. The first step in this process consisted of running the SWRM to calculate the monthly distribution of recharge to the Alluvial Aquifer system (from rainfall, streamflow, irrigation, and WRP discharges) and recharge to the Saugus Formation (from rainfall and irrigation) in areas where the Alluvial Aquifer is not

present. The output from the SWRM consisted of monthly files that assigned recharge to each node in the model grid.

The model was then run using monthly time steps, in which pumping and recharge terms were varied each month. For each sub-interval of time, the model was run by solving the groundwater flow equations for a given month, using a convergence criterion of 0.005 foot for groundwater elevations and a water budget convergence criterion of 2 cubic feet per day. The model results were then evaluated by generating time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the potential effects of the groundwater operating plan across the basin. The hydrographs were used to evaluate whether the operating plan is consistent with the objective of operating the basin in a manner that maintains long-term stability in groundwater levels and river flows. This analysis and its findings are presented in the following Chapter 4.

Table 3-1

Alluvial and Saugus Formation Pumping Patterns for the Simulation of 1922-2007 Historical Hydrology

Calendar Year	Local Rainfall (inches)[a]	SWP Water Availability[b]	Simulated Pumping Conditions	
			Alluvium	Saugus
1922	~ 32	89%	Normal	Normal
1923	~ 14	76%	Normal	Normal
1924	~ 8	10%	Dry Year 1	Dry Year 1
1925	~ 7	40%	Dry Year 2	Normal
1926	~ 26	53%	Dry Year 3	Normal
1927	~ 24	89%	Normal	Normal
1928	~ 10	50%	Normal	Normal
1929	~ 12	18%	Dry Year 1	Dry Year 1
1930	~ 12	49%	Dry Year 2	Normal
1931	24.41	27%	Dry Year 3	Dry Year 2
1932	13.73	32%	Normal	Dry Year 3
1933	20.52	48%	Dry Year 1	Dry Year 4
1934	18.05	32%	Dry Year 2	Dry Year 5
1935	12.21	81%	Dry Year 3	Normal
1936	20.47	76%	Dry Year 4	Normal
1937	17.92	78%	Dry Year 5	Normal
1938	32.75	82%	Dry Year 6	Normal
1939	11.27	79%	Normal	Normal
1940	21.37	77%	Dry Year 1	Normal
1941	42.14	61%	Dry Year 2	Normal
1942	7.10	77%	Normal	Normal
1943	37.03	76%	Dry Year 1	Normal
1944	24.63	71%	Normal	Normal
1945	14.56	75%	Normal	Normal
1946	21.71	77%	Normal	Normal
1947	4.16	56%	Normal	Normal
1948	9.13	63%	Dry Year 1	Normal
1949	9.93	31%	Dry Year 2	Dry Year 1
1950	6.84	60%	Dry Year 3	Normal
1951	12.42	85%	Dry Year 4	Normal
1952	34.19	63%	Dry Year 5	Normal
1953	4.88	80%	Normal	Normal
1954	15.82	77%	Dry Year 1	Normal
1955	13.91	28%	Dry Year 2	Dry Year 1
1956	14.21	87%	Dry Year 3	Normal
1957	22.85	62%	Dry Year 4	Normal
1958	23.14	73%	Dry Year 5	Normal
1959	9.81	84%	Normal	Normal
1960	11.64	35%	Dry Year 1	Dry Year 1
1961	8.82	57%	Dry Year 2	Normal
1962	21.22	72%	Dry Year 3	Normal
1963	12.79	82%	Dry Year 4	Normal
1964	10.09	53%	Dry Year 5	Normal
1965	32.28	69%	Dry Year 6	Normal
1966	14.57	79%	Normal	Normal
1967	23.23	72%	Dry Year 1	Normal
1968	6.90	80%	Dry Year 2	Normal
1969	32.42	64%	Dry Year 3	Normal
1970	23.19	79%	Normal	Normal
1971	13.75	80%	Normal	Normal
1972	4.15	41%	Dry Year 1	Normal
1973	19.79	75%	Dry Year 2	Normal
1974	18.04	77%	Dry Year 3	Normal
1975	10.92	78%	Dry Year 4	Normal
1976	14.02	63%	Dry Year 5	Normal
1977	20.87	6%	Dry Year 6	Dry Year 3
1978	42.17	87%	Dry Year 7	Normal
1979	21.47	76%	Normal	Normal
1980	27.00	66%	Normal	Normal
1981	13.42	76%	Normal	Normal
1982	20.20	71%	Dry Year 1	Normal
1983	39.07	60%	Normal	Normal
1984	12.86	78%	Normal	Normal
1985	8.37	77%	Dry Year 1	Normal
1986	18.02	56%	Dry Year 2	Normal
1987	14.45	68%	Normal	Normal
1988	16.92	12%	Dry Year 1	Dry Year 1
1989	7.56	76%	Dry Year 2	Normal
1990	6.98	9%	Dry Year 3	Dry Year 2
1991	17.21	18%	Dry Year 4	Dry Year 3
1992	32.03	26%	Dry Year 5	Dry Year 4
1993	32.72	90%	Normal	Normal
1994	10.27	51%	Normal	Normal
1995	29.15	72%	Dry Year 1	Normal
1996	15.88	83%	Normal	Normal
1997	13.35	75%	Normal	Normal
1998	30.73	73%	Normal	Normal
1999	8.96	83%	Normal	Normal
2000	14.04	84%	Normal	Normal
2001	22.24	28%	Dry Year 1	Dry Year 1
2002	7.90	52%	Dry Year 2	Normal
2003	15.70	71%	Dry Year 3	Normal
2004	22.79	65%	Dry Year 4	Normal
2005	37.15	90%	Normal	Normal
2006	13.89	100%	Normal	Normal
2007	5.78	60%	Dry Year 1	Normal

aFrom records at Newhall-Soledad rain gage (Station No. FC32CE). Pumping year type lags local rainfall by one year. Dry year pumping occurs when rainfall in prior year is 12.5 inches or less, and may continue until after a year with high rainfall (well above normal) has occurred.

[b]Values for 1922-2003 are from Table B.3 in DWR (2008) and are for SWP Table A Deliveries under current (2007) conditions. Values in 2004 through 2007 are actual historical deliveries during those years.

TABLE 3-2

Local Hydrology and 2008 Operating Plan for the Alluvial Aquifer

Calendar Year	Local Rainfall (inches)[a]	Year Type	Alluvial Aquifer Pumping under the Groundwater Operating Plan (afy)
1922	~ 32	Normal	35,000-40,000
1923	~ 14	Normal	35,000-40,000
1924	~ 8	Dry Year 1	30,000-35,000
1925	~ 7	Dry Year 2	30,000-35,000
1926	~ 26	Dry Year 3	30,000-35,000
1927	~ 24	Normal	35,000-40,000
1928	~ 10	Normal	35,000-40,000
1929	~ 12	Dry Year 1	30,000-35,000
1930	~ 12	Dry Year 2	30,000-35,000
1931	24.41	Dry Year 3	30,000-35,000
1932	13.73	Normal	35,000-40,000
1933	20.52	Dry Year 1	30,000-35,000
1934	18.05	Dry Year 2	30,000-35,000
1935	12.21	Dry Year 3	30,000-35,000
1936	20.47	Dry Year 4	30,000-35,000
1937	17.92	Dry Year 5	30,000-35,000
1938	32.75	Dry Year 6	30,000-35,000
1939	11.27	Normal	35,000-40,000
1940	21.37	Dry Year 1	30,000-35,000
1941	42.14	Dry Year 2	30,000-35,000
1942	7.10	Normal	35,000-40,000
1943	37.03	Dry Year 1	30,000-35,000
1944	24.63	Normal	35,000-40,000
1945	14.56	Normal	35,000-40,000
1946	21.71	Normal	35,000-40,000
1947	4.16	Normal	35,000-40,000
1948	9.13	Dry Year 1	30,000-35,000
1949	9.93	Dry Year 2	30,000-35,000
1950	6.84	Dry Year 3	30,000-35,000
1951	12.42	Dry Year 4	30,000-35,000
1952	34.19	Dry Year 5	30,000-35,000
1953	4.88	Normal	35,000-40,000
1954	15.82	Dry Year 1	30,000-35,000
1955	13.91	Dry Year 2	30,000-35,000
1956	14.21	Dry Year 3	30,000-35,000
1957	22.85	Dry Year 4	30,000-35,000
1958	23.14	Dry Year 5	30,000-35,000
1959	9.81	Normal	35,000-40,000
1960	11.64	Dry Year 1	30,000-35,000
1961	8.82	Dry Year 2	30,000-35,000
1962	21.22	Dry Year 3	30,000-35,000
1963	12.79	Dry Year 4	30,000-35,000
1964	10.09	Dry Year 5	30,000-35,000
1965	32.28	Dry Year 6	30,000-35,000
1966	14.57	Normal	35,000-40,000
1967	23.23	Dry Year 1	30,000-35,000
1968	6.90	Dry Year 2	30,000-35,000
1969	32.42	Dry Year 3	30,000-35,000
1970	23.19	Normal	35,000-40,000
1971	13.75	Normal	35,000-40,000
1972	4.15	Dry Year 1	30,000-35,000
1973	19.79	Dry Year 2	30,000-35,000
1974	18.04	Dry Year 3	30,000-35,000
1975	10.92	Dry Year 4	30,000-35,000
1976	14.02	Dry Year 5	30,000-35,000
1977	20.87	Dry Year 6	30,000-35,000
1978	42.17	Dry Year 7	30,000-35,000
1979	21.47	Normal	35,000-40,000
1980	27.00	Normal	35,000-40,000
1981	13.42	Normal	35,000-40,000
1982	20.20	Dry Year 1	30,000-35,000
1983	39.07	Normal	35,000-40,000
1984	12.86	Normal	35,000-40,000
1985	8.37	Dry Year 1	30,000-35,000
1986	18.02	Dry Year 2	30,000-35,000
1987	14.45	Normal	35,000-40,000
1988	16.92	Dry Year 1	30,000-35,000
1989	7.56	Dry Year 2	30,000-35,000
1990	6.98	Dry Year 3	30,000-35,000
1991	17.21	Dry Year 4	30,000-35,000
1992	32.03	Dry Year 5	30,000-35,000
1993	32.72	Normal	35,000-40,000
1994	10.27	Normal	35,000-40,000
1995	29.15	Dry Year 1	30,000-35,000
1996	15.88	Normal	35,000-40,000
1997	13.35	Normal	35,000-40,000
1998	30.73	Normal	35,000-40,000
1999	8.96	Normal	35,000-40,000
2000	14.04	Normal	35,000-40,000
2001	22.24	Dry Year 1	30,000-35,000
2002	7.90	Dry Year 2	30,000-35,000
2003	15.70	Dry Year 3	30,000-35,000
2004	22.79	Dry Year 4	30,000-35,000
2005	37.15	Normal	35,000-40,000
2006	13.89	Normal	35,000-40,000
2007	5.78	Dry Year 1	30,000-35,000

aFrom records at Newhall-Soledad rain gage (Station No. FC32CE). Pumping year type lags local rainfall by one year. Dry year pumping occurs when rainfall in prior year is 12.5 inches or less, and may continue until after a year with high rainfall (well above normal) has occurred.

afy = acre-feet per year

TABLE 3-3

SWP Deliveries and 2008 Operating Plan for the Saugus Formation

Calendar Year	Historical SWP Hydrology	SWP Water Delivery from the California Bay-Delta	Design of Updated Basin Analysis		
		Percent of Maximum Table A Deliveries (Current Conditions)	Saugus Pumping: Year Type	Saugus Operating Plan Pumping Volume (afy)	
1922	Above Normal	89%	Normal	11,000	
1923	Below Normal	76%	Normal	11,000	
1924	Critical	10%	Dry Year 1	15,000	Mild Single Dry Year
1925	Dry	40%	Normal	11,000	
1926	Dry	53%	Normal	11,000	
1927	Wet	89%	Normal	11,000	
1928	Above Normal	50%	Normal	11,000	
1929	Critical	18%	Dry Year 1	15,000	
1930	Dry	49%	Normal	11,000	6-Year Drought (1929-1934) and 4-Year Drought (1931-1934)
1931	Critical	27%	Dry Year 2	25,000	
1932	Dry	32%	Dry Year 3	35,000	
1933	Critical	48%	Dry Year 4	35,000	
1934	Critical	32%	Dry Year 5	35,000	
1935	Below Normal	81%	Normal	11,000	
1936	Below Normal	76%	Normal	11,000	
1937	Below Normal	78%	Normal	11,000	
1938	Wet	82%	Normal	11,000	
1939	Dry	79%	Normal	11,000	
1940	Above Normal	77%	Normal	11,000	
1941	Wet	61%	Normal	11,000	
1942	Wet	77%	Normal	11,000	
1943	Wet	76%	Normal	11,000	
1944	Dry	71%	Normal	11,000	
1945	Below Normal	75%	Normal	11,000	
1946	Below Normal	77%	Normal	11,000	
1947	Dry	56%	Normal	11,000	
1948	Below Normal	63%	Normal	11,000	
1949	Dry	31%	Dry Year 1	15,000	Mild Single Dry Year
1950	Below Normal	60%	Normal	11,000	
1951	Above Normal	85%	Normal	11,000	
1952	Wet	63%	Normal	11,000	
1953	Wet	80%	Normal	11,000	
1954	Above Normal	77%	Normal	11,000	
1955	Dry	28%	Dry Year 1	15,000	Mild Single Dry Year
1956	Wet	87%	Normal	11,000	
1957	Above Normal	62%	Normal	11,000	
1958	Wet	73%	Normal	11,000	
1959	Below Normal	84%	Normal	11,000	
1960	Dry	35%	Dry Year 1	15,000	Mild Single Dry Year
1961	Dry	57%	Normal	11,000	
1962	Below Normal	72%	Normal	11,000	
1963	Wet	82%	Normal	11,000	
1964	Dry	53%	Normal	11,000	
1965	Wet	69%	Normal	11,000	
1966	Below Normal	79%	Normal	11,000	
1967	Wet	72%	Normal	11,000	
1968	Below Normal	80%	Normal	11,000	
1969	Wet	64%	Normal	11,000	
1970	Wet	79%	Normal	11,000	
1971	Wet	80%	Normal	11,000	
1972	Below Normal	41%	Normal	11,000	
1973	Above Normal	75%	Normal	11,000	
1974	Wet	77%	Normal	11,000	
1975	Wet	78%	Normal	11,000	
1976	Critical	63%	Normal	11,000	2-year Drought (1976-1977); Single Critical Dry Year (1977)
1977	Critical	6%	Dry Year 3	35,000	
1978	Above Normal	87%	Normal	11,000	
1979	Below Normal	76%	Normal	11,000	
1980	Above Normal	66%	Normal	11,000	
1981	Dry	76%	Normal	11,000	
1982	Wet	71%	Normal	11,000	
1983	Wet	60%	Normal	11,000	
1984	Wet	78%	Normal	11,000	
1985	Dry	77%	Normal	11,000	
1986	Wet	56%	Normal	11,000	
1987	Dry	68%	Normal	11,000	
1988	Critical	12%	Dry Year 1	15,000	
1989	Dry	76%	Normal	11,000	6-Year Drought (1987-1992)
1990	Critical	9%	Dry Year 2	25,000	
1991	Critical	18%	Dry Year 3	35,000	
1992	Critical	26%	Dry Year 4	35,000	
1993	Above Normal	90%	Normal	11,000	
1994	Critical	51%	Normal	11,000	
1995	Wet	72%	Normal	11,000	
1996	Wet	83%	Normal	11,000	
1997	Wet	75%	Normal	11,000	
1998	Wet	73%	Normal	11,000	
1999	Wet	83%	Normal	11,000	
2000	Above Normal	84%	Normal	11,000	
2001	Dry	28%	Dry Year 1	15,000	Mild Single Dry Year
2002	Dry	52%	Normal	11,000	
2003	Above Normal	71%	Normal	11,000	
2004	Below Normal / Dry	65%	Normal	11,000	
2005	Wet / Above Normal	90%	Normal	11,000	
2006	Wet / Wet	100%	Normal	11,000	
2007	Dry / Critical	60%	Normal	11,000	

[b]Values for 1922-2003 are from Table B.3 in DWR (2008) and are for SWP Table A Deliveries under current (2007) conditions.
Values in 2004 through 2007 are actual historical deliveries during those years. afy = acre-feet per year

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Well Name	Alluvial Subarea	2005 Operating Plan Normal	2005 Operating Plan Dry	2008 Operating Plan Normal	2008 Operating Plan Dry Yr 1	2008 Operating Plan Dry Yr 2+	Comments
NCWD-Castaic 1	Castaic Valley	385	345	350	300	250	
NCWD-Castaic 2	Castaic Valley	166	125	100	100	100	
NCWD-Castaic 4	Castaic Valley	100	45	100	0	0	
NCWD-Castaic 7	Castaic Valley			300	200	200	Assume similar pumping as at NCWD-Castaic3 during early 1980s
NCWD-Pinetree 1	Above Mint Canyon	164	0	150	0	0	
NCWD-Pinetree 3	Above Mint Canyon	545	525	350	300	300	
NCWD-Pinetree 4	Above Mint Canyon	300	0	300	200	200	
NCWD-Pinetree 5	Above Mint Canyon			300	200	200	
NCWD Total		**1,660**	**1,040**	**1,950**	**1,300**	**1,250**	
NLF-161	Below Valencia WRP	485	485	1,000	1,000	1,000	
NLF-B10	Below Valencia WRP	344	344	500	350	350	
NLF-B11	Below Valencia WRP	232	232	100	200	200	
NLF-B14	Below Valencia WRP			300	1,000	1,000	
NLF-B20	Below Valencia WRP	584	584	350	500	500	Pumping was assigned to former B7 well in 2005 analysis.
NLF-B5	Below Valencia WRP	1,582	1,582	2,400	1,900	1,900	
NLF-B6	Below Valencia WRP	1,766	1,766	1,100	1,100	1,100	
NLF-C	Below Valencia WRP	1,373	1,373	1,100	1,000	1,000	
NLF-C3	Below Valencia WRP	192	192	100	200	200	
NLF-C4	Below Valencia WRP	809	809	200	450	450	
NLF-C5	Below Valencia WRP	850	850	900	850	850	
NLF-C7	Below Valencia WRP	1,107	1,107	350	300	300	
NLF-C8	Below Valencia WRP	594	594	400	400	400	
NLF-E5	Below Valencia WRP	750	750	100	150	150	
NLF-E9	Below Valencia WRP	814	814	900	350	350	
NLF-G45	Below Valencia WRP	390	390	350	400	400	
NLF Total		**11,872**	**11,872**	**10,150**	**10,150**	**10,150**	
SCWD-Clark	Bouquet Canyon	782	700	700	700	700	
SCWD-Guida	Bouquet Canyon	1,320	1,230	1,300	1,250	1,200	
SCWD-Honby	Above Saugus WRP	696	870	1,000	850	700	
SCWD-Lost Canyon 2	Above Mint Canyon	741	640	700	700	650	
SCWD-Lost Canyon 2A	Above Mint Canyon	1,034	590	700	650	600	
SCWD-Mitchell #5A	Above Mint Canyon	0	0	500	350	200	
SCWD-Mitchell #5B	Above Mint Canyon	557	0	800	550	300	
SCWD-N. Oaks Central	Above Mint Canyon	822	1,640	850	800	700	
SCWD-N. Oaks East	Above Mint Canyon	1,234	485	800	750	700	
SCWD-N. Oaks West	Above Mint Canyon	898	0	800	750	700	
SCWD-Sand Canyon	Above Mint Canyon	930	195	1,000	600	200	
SCWD-Sierra	Above Mint Canyon	846	0	1,100	900	700	
SCWD-Valley Center	Above Saugus WRP	800	800	800	800	800	Pumping transferred from former well SCWD-Stadium
SCWD Total		**10,660**	**7,150**	**11,050**	**9,650**	**8,150**	
VWC-D	Castaic Valley	690	690	880	880	880	
VWC-E15	Below Valencia WRP			800	800	800	
VWC-N	Below Saugus WRP	620	620	650	650	650	
VWC-N7	Below Saugus WRP	1,160	1,160	1,160	1,160	1,160	
VWC-N8	Below Saugus WRP	1,160	1,160	1,160	1,160	1,160	
VWC-Q2	Below Saugus WRP	985	985	1,100	1,100	1,100	
VWC-S6	Below Saugus WRP	865	865	1,000	1,000	1,000	
VWC-S7	Below Saugus WRP	865	865	500	500	500	
VWC-S8	Below Saugus WRP	865	865	500	500	500	
VWC-T7	Above Saugus WRP	920	920	750	750	750	Pumping transferred from former wells VWC-T2 and VWC-T4
VWC-U4	Above Saugus WRP	935	935	800	800	800	
VWC-U6	Above Saugus WRP	825	825	800	800	800	Pumping transferred from former well VWC-U3
VWC-W10	San Francisquito Canyon	865	865	1,000	1,000	1,000	Pumping was assigned to former W6 well in 2005 analysis.
VWC-W11	San Francisquito Canyon	600	600	800	800	800	
VWC-W9	San Francisquito Canyon	350	350	950	950	950	
VWC Total		**11,705**	**11,705**	**12,850**	**12,850**	**12,850**	
Robinson Ranch	Above Mint Canyon	932	400	600	550	450	
WHR	Castaic Valley	1,600	1,600	2,000	2,000	2,000	
Purveyor Alluvial Usage		**24,025**	**19,895**	**25,850**	**23,800**	**22,250**	**2008 Operating Plan:**
Other Alluvial Usage		**14,404**	**13,872**	**12,750**	**12,700**	**12,600**	**35,000 to 40,000 AF/yr in normal and wet years**
Total Alluvial Pumping		**38,429**	**33,767**	**38,600**	**36,500**	**34,850**	**30,000 to 35,000 AF/yr in dry years**

Notes:

All pumping volumes are listed in units of acre-feet per year (afy).

Wells that are not listed are assumed to not be pumping in the future.

NLF = Newhall Land & Farming Company

NCWD = Newhall County Water District

SCWD = Santa Clarita Division of Castaic Lake Water Agency

VWC = Valencia Water Company

WHR = Wayside Honor Rancho, whose wells are owned by the Los Angeles County Waterworks District No. 36

"Other Alluvial Usage" consists of pumping by NLF, WHR, and Robinson Ranch. An additional 500 afy of pumping by other private well owners is not included in this table.

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Owner	Well Name	Non-Drought Years	Drought Year 1	Drought Year 2	Drought Year 3
NCWD	12	1,765	2,494	2,494	2,494
	13	1,765	2,494	2,494	2,494
Total Pumping (NCWD Wells)		**3,530**	**4,988**	**4,988**	**4,988**
SCWD	Saugus1	1,772	1,772	1,772	1,772
	Saugus2	1,772	1,772	1,772	1,772
Total Pumping (SCWD Wells)		**3,544**	**3,544**	**3,544**	**3,544**
Private	Palmer Golf Course	500	500	500	500
Total Pumping (Future Golf)		**500**	**500**	**500**	**500**
VWC	159	50	50	50	50
	160 (Municipal)	500	830	830	830
	160 (Val. Ctry Club)	500	500	500	500
	201	300	300	3,777	3,777
	205	1,211	2,945	4,038	4,038
	206	1,175	2,734	3,500	3,500
	207	1,175	2,734	3,500	3,500
Total Pumping (VWC Wells)		**4,911**	**10,093**	**16,195**	**16,195**
	Future 1	0	0	0	3,250
	Future 2	0	0	0	3,250
	Future 3	0	0	0	3,250
Total Pumping (Future Wells)		**0**	**0**	**0**	**9,750**
Total Pumping (All Saugus Wells)		**12,485**	**19,125**	**25,227**	**34,977**

Notes:

All pumping volumes are listed in units of acre-feet per year (afy).

Wells that are not listed are assumed to not be pumping in the future.

NLF Newhall Land & Farming Company

NCWD Newhall County Water District

SCWD Santa Clarita Division of Castaic Lake Water Agency

VWC Valencia Water Company

TABLE 3-6

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
NCWD-12	2	485	1,280	15	10	150	8.8
	3			500	2	1,000	58.5
	4			280	2	560	32.7
NCWD-13	2	420	750	80	10	800	61.5
	3			250	2	500	38.5
SCWD-Saugus1	2	490	1,620	10	10	100	1.8
	3			500	6.5	3,250	59.9
	4			500	4	2,000	36.8
	5			20	4	80	1.5
SCWD-Saugus2	2	490	1,591	10	10	100	1.7
	3			500	6.5	3,250	56.9
	4			500	4	2,000	35.0
	5			91	4	364	6.4
Palmer Golf Course	2			250	1	250	20.0
	3			500	1	500	40.0
	4			500	1	500	40.0
VWC-159	3	662	1,900	338	0.025	8.45	27.3
	4			500	0.025	12.5	40.4
	5			400	0.025	10	32.3
VWC-160	3	950	2,000	50	6.5	325	7.6
	4			500	4	2,000	46.2
	5			500	4	2,000	46.2
VWC-201	3	540	1,670	460	6.5	2,990	52.7
	4			500	4	2,000	35.3
	5			170	4	680	12.0
VWC-205	3	820	1,930	180	6.5	1,170	23.9
	4			500	4	2,000	40.9
	5			430	4	1,720	35.2
VWC-206	3	500	2,000	500	6.5	3,250	44.8
	4			500	4	2,000	27.6
	5			500	4	2,000	27.6
VWC-207*	3	500	2,000	500	6.5	3,250	44.8
	4			500	4	2,000	27.6
	5			500	4	2,000	27.6
Future Wells Near VWC-206 (Assumed)	3	500	2,000	500	6.5	3,250	44.8
	4			500	4	2,000	27.6
	5			500	4	2,000	27.6

Notes:

* VWC-207 well construction information was not available at the time of this investigation and therefore the allocation of pumping was assumed to be similar to VWC-206.

Existing wells NCWD-7, NCWD-10, and NCWD-11 are assumed to no longer operate in the future.

Kh = horizontal hydraulic conductivity
ft/day = feet per day

T = transmissivity
ft^2/day = square feet per day

Table

Allocation of Pumping, by Month, for Agricultural and Urban Production Wells

Month	Percent of Annual Water Use, Agricultural	Percent of Annual Water Use, Urban	Percent of May through October Water Use, Urban
January	3.75	5.2	
February	5.1	3.7	
March	6.6	5.2	
April	9.1	6.6	
May	10.55	8.7	13.2
June	11.4	10.4	15.8
July	14.1	13	19.7
August	12.95	13.6	20.6
September	10.2	10.9	16.6
October	7.5	9.3	14.1
November	5	7.1	
December	3.75	6.3	
Total	**100**	**100**	**100**

TABLE 3-8

Total Groundwater and SWP Supplies for 2008 Groundwater Operating Plan (Not Including Recycled Water and Other Water Supplies, e.g. Purchased or Banked Water)

Model Year	Based on Historical Year	SWP Hydrology [a]	SWP Allocations [b] (%)	SWP Deliveries (afy)	Simulated Pumping From Alluvial Aquifer (afy)	Simulated Pumping From Saugus Formation (afy)	Total Groundwater Pumping (afy)	SWP + Groundwater (afy)
1	1922	Above Normal	89%	82,227	38,600	12,485	51,085	133,312
2	1923	Below Normal	76%	70,699	38,600	12,485	51,085	121,784
3	1924	Critical	10%	8,960	36,500	19,125	55,625	64,585
4	1925	Dry	40%	36,784	34,850	12,485	47,335	84,119
5	1926	Dry	53%	48,929	34,850	12,485	47,335	96,264
6	1927	Wet	89%	82,786	38,600	12,485	51,085	133,871
7	1928	Above Normal	50%	46,079	38,600	12,485	51,085	97,164
8	1929	Critical	18%	16,858	36,500	19,125	55,625	72,483
9	1930	Dry	49%	45,379	34,850	12,485	47,335	92,714
10	1931	Critical	27%	24,732	34,850	25,227	60,077	84,809
11	1932	Dry	32%	29,204	38,600	34,977	73,577	102,781
12	1933	Critical	48%	44,339	36,500	34,977	71,477	115,816
13	1934	Critical	32%	29,424	34,850	34,977	69,827	99,251
14	1935	Below Normal	81%	74,625	34,850	12,485	47,335	121,960
15	1936	Below Normal	76%	69,911	34,850	12,485	47,335	117,246
16	1937	Below Normal	78%	72,037	34,850	12,485	47,335	119,372
17	1938	Wet	82%	75,970	34,850	12,485	47,335	123,305
18	1939	Dry	79%	72,883	38,600	12,485	51,085	123,968
19	1940	Above Normal	77%	70,837	36,500	12,485	48,985	119,822
20	1941	Wet	61%	56,535	34,850	12,485	47,335	103,870
21	1942	Wet	77%	70,890	38,600	12,485	51,085	121,975
22	1943	Wet	76%	70,599	36,500	12,485	48,985	119,584
23	1944	Dry	71%	65,569	38,600	12,485	51,085	116,654
24	1945	Below Normal	75%	69,041	38,600	12,485	51,085	120,126
25	1946	Below Normal	77%	71,596	38,600	12,485	51,085	122,681
26	1947	Dry	56%	51,794	38,600	12,485	51,085	102,879
27	1948	Below Normal	63%	58,403	36,500	12,485	48,985	107,388
28	1949	Dry	31%	28,443	34,850	19,125	53,975	82,418
29	1950	Below Normal	60%	55,099	34,850	12,485	47,335	102,434
30	1951	Above Normal	85%	78,272	34,850	12,485	47,335	125,607
31	1952	Wet	63%	57,855	34,850	12,485	47,335	105,190
32	1953	Wet	80%	74,381	38,600	12,485	51,085	125,466
33	1954	Above Normal	77%	71,652	36,500	12,485	48,985	120,637
34	1955	Dry	28%	25,439	34,850	19,125	53,975	79,414
35	1956	Wet	87%	80,155	34,850	12,485	47,335	127,490
36	1957	Above Normal	62%	56,957	34,850	12,485	47,335	104,292
37	1958	Wet	73%	67,806	34,850	12,485	47,335	115,141
38	1959	Below Normal	84%	77,554	38,600	12,485	51,085	128,639
39	1960	Dry	35%	32,679	36,500	19,125	55,625	88,304
40	1961	Dry	57%	52,756	34,850	12,485	47,335	100,091
41	1962	Below Normal	72%	66,287	34,850	12,485	47,335	113,622
42	1963	Wet	82%	76,230	34,850	12,485	47,335	123,565
43	1964	Dry	53%	49,474	34,850	12,485	47,335	96,809
44	1965	Wet	69%	64,021	34,850	12,485	47,335	111,356
45	1966	Below Normal	79%	73,083	38,600	12,485	51,085	124,168
46	1967	Wet	72%	66,920	36,500	12,485	48,985	115,905
47	1968	Below Normal	80%	73,794	34,850	12,485	47,335	121,129
48	1969	Wet	64%	58,766	34,850	12,485	47,335	106,101
49	1970	Wet	79%	72,904	38,600	12,485	51,085	123,989
50	1971	Wet	80%	74,236	38,600	12,485	51,085	125,321
51	1972	Below Normal	41%	38,213	36,500	12,485	48,985	87,198
52	1973	Above Normal	75%	69,052	34,850	12,485	47,335	116,387
53	1974	Wet	77%	71,257	34,850	12,485	47,335	118,592
54	1975	Wet	78%	72,018	34,850	12,485	47,335	119,353
55	1976	Critical	63%	58,273	34,850	12,485	47,335	105,608
56	1977	Critical	6%	5,428	34,850	34,977	69,827	75,255
57	1978	Above Normal	87%	80,556	34,850	12,485	47,335	127,891
58	1979	Below Normal	76%	70,013	38,600	12,485	51,085	121,098
59	1980	Above Normal	66%	60,652	38,600	12,485	51,085	111,737
60	1981	Dry	76%	69,997	38,600	12,485	51,085	121,082
61	1982	Wet	71%	65,809	36,500	12,485	48,985	114,794
62	1983	Wet	60%	55,886	38,600	12,485	51,085	106,971
63	1984	Wet	78%	72,233	38,600	12,485	51,085	123,318
64	1985	Dry	77%	71,579	36,500	12,485	48,985	120,564
65	1986	Wet	56%	51,344	34,850	12,485	47,335	98,679
66	1987	Dry	68%	63,232	38,600	12,485	51,085	114,317
67	1988	Critical	12%	10,665	36,500	19,125	55,625	66,290
68	1989	Dry	76%	70,061	34,850	12,485	47,335	117,396
69	1990	Critical	9%	8,056	34,850	25,227	60,077	68,133
70	1991	Critical	18%	16,313	34,850	34,977	69,827	86,140
71	1992	Critical	26%	24,330	34,850	34,977	69,827	94,157
72	1993	Above Normal	90%	83,055	38,600	12,485	51,085	134,140
73	1994	Critical	51%	47,101	38,600	12,485	51,085	98,186
74	1995	Wet	72%	66,992	36,500	12,485	48,985	115,977
75	1996	Wet	83%	76,979	38,600	12,485	51,085	128,064
76	1997	Wet	75%	69,401	38,600	12,485	51,085	120,486
77	1998	Wet	73%	67,316	38,600	12,485	51,085	118,401
78	1999	Wet	83%	76,976	38,600	12,485	51,085	128,061
79	2000	Above Normal	84%	77,238	38,600	12,485	51,085	128,323
80	2001	Dry	28%	26,050	36,500	19,125	55,625	81,675
81	2002	Dry	52%	48,382	34,850	12,485	47,335	95,717
82	2003	Above Normal	71%	65,873	34,850	12,485	47,335	113,208
83	2004	Below Normal / Dry	Actual was 65%	60,125	34,850	12,485	47,335	107,460
84	2005	Wet / Above Normal	Actual was 90%	83,250	38,600	12,485	51,085	134,335
85	2006	Wet / Wet	Actual was 100%	92,500	38,600	12,485	51,085	143,585
86	2007	Dry / Critical	Actual was 60%	55,500	36,500	12,485	48,985	104,485

[a] Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest

[b] From Table B.3 in *The State Water Project Delivery Reliability Report 2007* (DWR, August 2008). This is for current (2007) conditions as defined in the DWR report. In any given year, the allocation may be made up, in part, of carryover water from the prior year.

afy = acre-feet per year SWP = State Water Project

Table

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Well Name	Alluvial Subarea	Original 2008 Operating Plan Normal	Dry Yr 1	Dry Yr 2	Redistributed 2008 Operating Plan Normal	Dry Yr 1	Dry Yr 2	Comments
NCWD-Pinetree 1	Above Mint Canyon	150	0	0	150	0	0	
NCWD-Pinetree 3	Above Mint Canyon	350	300	300	350	300	300	
NCWD-Pinetree 4	Above Mint Canyon	300	200	200	300	200	200	
NCWD-Pinetree 5	Above Mint Canyon	300	200	200	300	200	200	
Robinson Ranch	Above Mint Canyon	600	550	450	600	550	450	
SCWD-Sand Canyon	**Above Mint Canyon**	**1,000**	**600**	**200**	**200**	**150**	**0**	**Reduce these three wells by 1,600 afy in order to**
SCWD-Lost Canyon 2	**Above Mint Canyon**	**700**	**700**	**650**	**300**	**150**	**0**	**offset increased pumping at the SCWD-Santa Clara and**
SCWD-Lost Canyon 2A	**Above Mint Canyon**	**700**	**650**	**600**	**300**	**150**	**0**	**SCWD-Bouquet wells in the "Above Saugus WRP" area.**
SCWD-Mitchell 5A	Above Mint Canyon	500	350	200	500	350	200	
SCWD-Mitchell 5B	Above Mint Canyon	800	550	300	800	550	300	
SCWD-N. Oaks Central	Above Mint Canyon	850	800	700	850	800	700	
SCWD-N. Oaks East	Above Mint Canyon	800	750	700	800	750	700	
SCWD-N. Oaks West	Above Mint Canyon	800	750	700	800	750	700	
SCWD-Sierra	Above Mint Canyon	1,100	900	700	1,100	900	700	
Mint Canyon Total		**8,950**	**7,300**	**5,900**	**7,350**	**5,800**	**4,450**	
SCWD-Honby	Above Saugus WRP	1,000	850	700	1,000	850	700	
SCWD-Santa Clara	Above Saugus WRP	800	800	800	800	800	800	
SCWD-Valley Center	**Above Saugus WRP**	**0**	**0**	**0**	**800**	**800**	**800**	**Pumps 800 afy moved from the "Above Mint Canyon" area.**
SCWD-Bouquet	**Above Saugus WRP**	**0**	**0**	**0**	**800**	**800**	**800**	**Pumps 800 afy moved from the "Above Mint Canyon" area.**
VWC-T7	Above Saugus WRP	750	750	750	750	750	750	
VWC-U4	Above Saugus WRP	800	800	800	800	800	800	
VWC-U6	Above Saugus WRP	800	800	800	800	800	800	
Above Saugus WRP Total		**4,150**	**4,000**	**3,850**	**5,750**	**5,600**	**5,450**	
VWC-N	Below Saugus WRP	650	650	650	650	650	650	
VWC-N7	Below Saugus WRP	1,160	1,160	1,160	1,160	1,160	1,160	
VWC-N8	Below Saugus WRP	1,160	1,160	1,160	1,160	1,160	1,160	
VWC-Q2	Below Saugus WRP	1,100	1,100	1,100	1,100	1,100	1,100	
VWC-S6	Below Saugus WRP	1,000	1,000	1,000	1,000	1,000	1,000	
VWC-S7	Below Saugus WRP	500	500	500	500	500	500	
VWC-S8	Below Saugus WRP	500	500	500	500	500	500	
Below Saugus WRP Total		**6,070**	**6,070**	**6,070**	**6,070**	**6,070**	**6,070**	
NLF-161	Below Valencia WRP	1,000	1,000	1,000	1,000	1,000	1,000	
NLF-B10	Below Valencia WRP	500	350	350	500	350	350	
NLF-B11	Below Valencia WRP	100	200	200	100	200	200	
NLF-B14	Below Valencia WRP	300	1,000	1,000	300	1,000	1,000	
NLF-B20	Below Valencia WRP	350	500	500	350	500	500	
NLF-B5	Below Valencia WRP	2,400	1,900	1,900	2,400	1,900	1,900	
NLF-B6	Below Valencia WRP	1,100	1,100	1,100	1,100	1,100	1,100	
NLF-C	Below Valencia WRP	1,100	1,000	1,000	1,100	1,000	1,000	
NLF-C3	Below Valencia WRP	100	200	200	100	200	200	
NLF-C4	Below Valencia WRP	200	450	450	200	450	450	
NLF-C5	Below Valencia WRP	900	850	850	900	850	850	
NLF-C7	Below Valencia WRP	350	300	300	350	300	300	
NLF-C8	Below Valencia WRP	400	400	400	400	400	400	
NLF-E5	Below Valencia WRP	100	150	150	100	150	150	
NLF-E9	Below Valencia WRP	900	350	350	900	350	350	
NLF-G45	Below Valencia WRP	350	400	400	350	400	400	
VWC-E15	Below Valencia WRP	800	800	800	800	800	800	
Below Valencia WRP Total		**10,950**	**10,950**	**10,950**	**10,950**	**10,950**	**10,950**	
SCWD-Clark	Bouquet Canyon	700	700	700	700	700	700	
SCWD-Guida	Bouquet Canyon	1,300	1,250	1,200	1,300	1,250	1,200	
Bouquet Canyon Total		**2,000**	**1,950**	**1,900**	**2,000**	**1,950**	**1,900**	
VWC-W10	San Francisquito Canyon	1,000	1,000	1,000	1,000	1,000	1,000	
VWC-W11	San Francisquito Canyon	800	800	800	800	800	800	
VWC-W9	San Francisquito Canyon	950	950	950	950	950	950	
San Francisquito Canyon Total		**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	
NCWD-Castaic 1	Castaic Valley	350	300	250	350	300	250	
NCWD-Castaic 2	Castaic Valley	100	100	100	100	100	100	
NCWD-Castaic 4	Castaic Valley	100	0	0	100	0	0	
NCWD-Castaic 7	Castaic Valley	300	200	200	300	200	200	
VWC-D	Castaic Valley	880	880	880	880	880	880	
WHR	Castaic Valley	2,000	2,000	2,000	2,000	2,000	2,000	
Castaic Valley Total:		**3,730**	**3,480**	**3,430**	**3,730**	**3,480**	**3,430**	
Total Alluvial Pumping		**38,600**	**36,500**	**34,850**	**38,600**	**36,600**	**35,000**	**Current Operating Plan:**
								35,000 to 40,000 AF/yr in normal and wet years
								30,000 to 35,000 AF/yr in dry years

Notes:

All pumping volumes are listed in acre-feet per year (afy).

Wells that are not listed are assumed to not be pumping in the future.

NLF Newhall Land & Farming Company

NCWD Newhall County Water District

SCWD Santa Clarita Division of Castaic Lake Water Agency

VWC Valencia Water Company

WHR Wayside Honor Rancho, whose wells are owned by the Los Angeles County Waterworks District No. 36

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Well Name	Alluvial Subarea	Potential Operating Plan Normal	Dry Yr 1	Dry Yr 2+	Comments
NCWD-Castaic 1	Castaic Valley	450	400	400	100 to 150 afy more than 2008 operating plan.
NCWD-Castaic 2	Castaic Valley	300	200	100	0 to 200 afy more than 2008 operating plan.
NCWD-Castaic 4	Castaic Valley	150	100	50	50 to 100 afy more than 2008 operating plan.
NCWD-Castaic 7	Castaic Valley	1,800	1,800	1,800	1500 to 1600 afy more than 2008 operating plan.
NCWD-Pinetree 1	Above Mint Canyon	200	200	200	50 to 200 afy more than 2008 operating plan.
NCWD-Pinetree 3	Above Mint Canyon	450	450	450	100 to 150 afy more than 2008 operating plan.
NCWD-Pinetree 4	Above Mint Canyon	300	300	200	0 to 100 afy more than 2008 operating plan.
NCWD-Pinetree 5	Above Mint Canyon	300	300	200	0 to 100 afy more than 2008 operating plan.
NCWD Total		**3,950**	**3,750**	**3,400**	**Total is 2,000 to 2,450 afy more than in the 2008 operating plan.**
NLF-B14	Below Valencia WRP	650	650	650	Future agricultural supply for Newhall Land & Farming Co.
NLF-B15	Below Valencia WRP	650	650	650	Future agricultural supply for Newhall Land & Farming Co.
NLF-B16	Below Valencia WRP	650	650	650	Future agricultural supply for Newhall Land & Farming Co.
NLF-C10	Below Valencia WRP	650	650	650	Future agricultural supply for Newhall Land & Farming Co.
NLF-C11	Below Valencia WRP	650	650	650	Future agricultural supply for Newhall Land & Farming Co.
NLF-C12	Below Valencia WRP	650	650	650	Future agricultural supply for Newhall Land & Farming Co.
NLF-E21	Castaic Valley	650	650	650	Future agricultural supply for Newhall Land & Farming Co.
NLF Total		**4,550**	**4,550**	**4,550**	**Total is 5,600 afy less than in the 2008 operating plan.**
SCWD-Clark	Bouquet Canyon	800	750	700	0 to 100 afy more than 2008 operating plan.
SCWD-Guida	Bouquet Canyon	1,500	1,400	1,300	100 to 200 afy more than 2008 operating plan.
SCWD-Honby	Above Saugus WRP	1,200	1,000	700	0 to 200 afy more than 2008 operating plan.
SCWD-Lost Canyon 2	Above Mint Canyon	850	800	700	50 to 150 afy more than 2008 operating plan.
SCWD-Lost Canyon 2A	Above Mint Canyon	800	700	600	0 to 100 afy more than 2008 operating plan.
SCWD-Mitchell #5A	Above Mint Canyon	900	550	200	0 to 400 afy more than 2008 operating plan.
SCWD-Mitchell #5B	Above Mint Canyon	1,000	900	800	200 to 500 afy more than 2008 operating plan.
SCWD-N. Oaks Central	Above Mint Canyon	1,400	800	800	0 to 550 afy more than 2008 operating plan.
SCWD-N. Oaks East	Above Mint Canyon	1,000	800	600	50 to 200 afy more than 2008 operating plan.
SCWD-N. Oaks West	Above Mint Canyon	1,000	800	600	50 to 200 afy more than 2008 operating plan.
SCWD-Sand Canyon	Above Mint Canyon	1,300	1,000	600	300 to 400 afy more than 2008 operating plan.
SCWD-Sierra	Above Mint Canyon	1,400	1,100	800	100 to 300 afy more than 2008 operating plan.
SCWD-Santa Clara	Above Saugus WRP	950	950	950	Future well.
SCWD-Valley Center	Above Saugus WRP	1,200	1,000	800	800 gpm (2008 plan) + 0 to 400 afy additional pumping.
SCWD-Bouquet	Above Saugus WRP	1,200	1,100	1,100	Future well.
SCWD Total		**16,500**	**13,650**	**11,250**	**Total is 3,100 to 5,450 afy more than in the 2008 operating plan.**
VWC-D	Castaic Valley	880	880	880	Same as 2008 operating plan.
VWC-E14	Castaic Valley	1,175	1,175	1,175	Future operations for Newhall Ranch.
VWC-E15	Castaic Valley	800	800	800	Same as 2008 operating plan.
VWC-E16	Castaic Valley	1,175	1,175	1,175	Future operations for Newhall Ranch.
VWC-E17	Castaic Valley	1,175	1,175	1,175	Future operations for Newhall Ranch.
VWC-G1	Below Valencia WRP	1,175	1,175	1,175	Future operations for Newhall Ranch.
VWC-G3	Below Valencia WRP	1,175	1,175	1,175	Future operations for Newhall Ranch.
VWC-G4	Below Valencia WRP	1,175	1,175	1,175	Future operations for Newhall Ranch.
VWC-N	Below Saugus WRP	650	650	650	Same as 2008 operating plan.
VWC-N7	Below Saugus WRP	1,160	1,160	1,160	Same as 2008 operating plan.
VWC-N8	Below Saugus WRP	1,160	1,160	1,160	Same as 2008 operating plan.
VWC-Q2	Below Saugus WRP	1,100	1,100	1,100	Same as 2008 operating plan.
VWC-S6	Below Saugus WRP	1,000	1,000	1,000	Same as 2008 operating plan.
VWC-S7	Below Saugus WRP	500	500	500	Same as 2008 operating plan.
VWC-S8	Below Saugus WRP	500	500	500	Same as 2008 operating plan.
VWC-T7	Above Saugus WRP	750	750	750	Same as 2008 operating plan.
VWC-U4	Above Saugus WRP	800	800	800	Same as 2008 operating plan.
VWC-U6	Above Saugus WRP	800	800	800	Same as 2008 operating plan.
VWC-W10	San Francisquito Canyon	1,000	1,000	1,000	Same as 2008 operating plan.
VWC-W11	San Francisquito Canyon	800	800	800	Same as 2008 operating plan.
VWC-W9	San Francisquito Canyon	950	950	950	Same as 2008 operating plan.
VWC Total		**19,900**	**19,900**	**19,900**	**VWC and NLF total is 1,450 afy more than in the 2008 operating plan.**
Robinson Ranch	Above Mint Canyon	600	550	450	Same as 2008 operating plan.
WHR	Castaic Valley	2,000	2,000	2,000	Same as 2008 operating plan.
Purveyor Alluvial Usage		**40,350**	**37,300**	**34,550**	**2008 Operating Plan:**
Other Alluvial Usage		**7,150**	**7,100**	**7,000**	**35,000 to 40,000 afy in normal and wet years**
Total Alluvial Pumping		**47,500**	**44,400**	**41,550**	**30,000 to 35,000 afy in dry years**

Notes:

All pumping volumes are listed in units of acre-feet per year (afy).

Wells that are not listed are assumed to not be pumping in the future.

NLF = Newhall Land & Farming Company

NCWD = Newhall County Water District

SCWD = Santa Clarita Division of Castaic Lake Water Agency

VWC = Valencia Water Company

WHR = Wayside Honor Rancho, whose wells are owned by the Los Angeles County Waterworks District No. 36

"Other Alluvial Usage" consists of pumping by NLF, WHR, and Robinson Ranch. An additional 500 afy of pumping by other private well owners is not included in this table.

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Owner	Well Name	Non-Drought Years	Drought Year 1	Drought Year 2	Drought Year 3
NCWD	12	1,765	2,494	2,494	2,494
	13	1,765	2,494	2,494	2,494
	Future well	1,765	2,494	2,494	2,494
Total Pumping (NCWD Wells)		**5,295**	**7,482**	**7,482**	**7,482**
SCWD	Saugus1	1,772	1,772	1,772	1,772
	Saugus2	1,772	1,772	1,772	1,772
	Future well	1,800	1,800	1,800	1,800
Total Pumping (SCWD Wells)		**5,344**	**5,344**	**5,344**	**5,344**
LA County Water District 36	Future well	300	300	300	300
Total Pumping (LACWD 36)		**300**	**300**	**300**	**300**
Private (Palmer)	Future Golf Course	500	500	500	500
Total Pumping (Future Golf)		**500**	**500**	**500**	**500**
VWC	159	50	50	50	50
	160 (Municipal)	500	830	830	830
	160 (Val. Ctry Club)	500	500	500	500
	201	300	300	3,777	3,777
	205	1,211	2,945	4,038	4,038
	206	1,175	2,734	3,500	3,500
	207	1,175	2,734	3,500	3,500
Total Pumping (VWC Wells)		**4,911**	**10,093**	**16,195**	**16,195**
	Future 1	0	0	0	3,250
	Future 2	0	0	0	3,250
	Future 3	0	0	0	3,250
Total Pumping (Future Wells)		**0**	**0**	**0**	**9,750**
Total Pumping (All Saugus Wells)		**16,350**	**23,719**	**29,821**	**39,571**

Notes:

All pumping volumes are listed in units of acre-feet per year (afy).

Wells that are not listed are assumed to not be pumping in the future.

NLF Newhall Land & Farming Company

NCWD Newhall County Water District

SCWD Santa Clarita Division of Castaic Lake Water Agency

VWC Valencia Water Company

TABLE 3-12

Total Groundwater and SWP Supplies for Potential Groundwater Operating Plan (Not Including Recycled Water and Other Water Supplies, e.g. Purchased or Banked Water)

Model Year	Based on Historical Year	SWP Hydrology [a]	SWP Allocations [b] (%)	SWP Deliveries (afy)	Simulated Pumping From Alluvial Aquifer (afy)	Simulated Pumping From Saugus Formation (afy)	Total Groundwater Pumping (afy)	SWP + Groundwater (afy)
1	1922	Above Normal	89%	82,227	47,500	16,350	63,850	146,077
2	1923	Below Normal	76%	70,699	47,500	16,350	63,850	134,549
3	1924	Critical	10%	8,960	44,400	23,719	68,119	77,079
4	1925	Dry	40%	36,784	41,550	16,350	57,900	94,684
5	1926	Dry	53%	48,929	41,550	16,350	57,900	106,829
6	1927	Wet	89%	82,786	47,500	16,350	63,850	146,636
7	1928	Above Normal	50%	46,079	47,500	16,350	63,850	109,929
8	1929	Critical	18%	16,858	44,400	23,719	68,119	84,977
9	1930	Dry	49%	45,379	41,550	16,350	57,900	103,279
10	1931	Critical	27%	24,732	41,550	29,821	71,371	96,103
11	1932	Dry	32%	29,204	47,500	39,571	87,071	116,275
12	1933	Critical	48%	44,339	44,400	39,571	83,971	128,310
13	1934	Critical	32%	29,424	41,550	39,571	81,121	110,545
14	1935	Below Normal	81%	74,625	41,550	16,350	57,900	132,525
15	1936	Below Normal	76%	69,911	41,550	16,350	57,900	127,811
16	1937	Below Normal	78%	72,037	41,550	16,350	57,900	129,937
17	1938	Wet	82%	75,970	41,550	16,350	57,900	133,870
18	1939	Dry	79%	72,883	47,500	16,350	63,850	136,733
19	1940	Above Normal	77%	70,837	44,400	16,350	60,750	131,587
20	1941	Wet	61%	56,535	41,550	16,350	57,900	114,435
21	1942	Wet	77%	70,890	47,500	16,350	63,850	134,740
22	1943	Wet	76%	70,599	44,400	16,350	60,750	131,349
23	1944	Dry	71%	65,569	47,500	16,350	63,850	129,419
24	1945	Below Normal	75%	69,041	47,500	16,350	63,850	132,891
25	1946	Below Normal	77%	71,596	47,500	16,350	63,850	135,446
26	1947	Dry	56%	51,794	47,500	16,350	63,850	115,644
27	1948	Below Normal	63%	58,403	44,400	16,350	60,750	119,153
28	1949	Dry	31%	28,443	41,550	23,719	65,269	93,712
29	1950	Below Normal	60%	55,099	41,550	16,350	57,900	112,999
30	1951	Above Normal	85%	78,272	41,550	16,350	57,900	136,172
31	1952	Wet	63%	57,855	41,550	16,350	57,900	115,755
32	1953	Wet	80%	74,381	47,500	16,350	63,850	138,231
33	1954	Above Normal	77%	71,652	44,400	16,350	60,750	132,402
34	1955	Dry	28%	25,439	41,550	23,719	65,269	90,708
35	1956	Wet	87%	80,155	41,550	16,350	57,900	138,055
36	1957	Above Normal	62%	56,957	41,550	16,350	57,900	114,857
37	1958	Wet	73%	67,806	41,550	16,350	57,900	125,706
38	1959	Below Normal	84%	77,554	47,500	16,350	63,850	141,404
39	1960	Dry	35%	32,679	44,400	23,719	68,119	100,798
40	1961	Dry	57%	52,756	41,550	16,350	57,900	110,656
41	1962	Below Normal	72%	66,287	41,550	16,350	57,900	124,187
42	1963	Wet	82%	76,230	41,550	16,350	57,900	134,130
43	1964	Dry	53%	49,474	41,550	16,350	57,900	107,374
44	1965	Wet	69%	64,021	41,550	16,350	57,900	121,921
45	1966	Below Normal	79%	73,083	47,500	16,350	63,850	136,933
46	1967	Wet	72%	66,920	44,400	16,350	60,750	127,670
47	1968	Below Normal	80%	73,794	41,550	16,350	57,900	131,694
48	1969	Wet	64%	58,766	41,550	16,350	57,900	116,666
49	1970	Wet	79%	72,904	47,500	16,350	63,850	136,754
50	1971	Wet	80%	74,236	47,500	16,350	63,850	138,086
51	1972	Below Normal	41%	38,213	44,400	16,350	60,750	98,963
52	1973	Above Normal	75%	69,052	41,550	16,350	57,900	126,952
53	1974	Wet	77%	71,257	41,550	16,350	57,900	129,157
54	1975	Wet	78%	72,018	41,550	16,350	57,900	129,918
55	1976	Critical	63%	58,273	41,550	16,350	57,900	116,173
56	1977	Critical	6%	5,428	41,550	39,571	81,121	86,549
57	1978	Above Normal	87%	80,556	41,550	16,350	57,900	138,456
58	1979	Below Normal	76%	70,013	47,500	16,350	63,850	133,863
59	1980	Above Normal	66%	60,652	47,500	16,350	63,850	124,502
60	1981	Dry	76%	69,997	47,500	16,350	63,850	133,847
61	1982	Wet	71%	65,809	44,400	16,350	60,750	126,559
62	1983	Wet	60%	55,886	47,500	16,350	63,850	119,736
63	1984	Wet	78%	72,233	47,500	16,350	63,850	136,083
64	1985	Dry	77%	71,579	44,400	16,350	60,750	132,329
65	1986	Wet	56%	51,344	41,550	16,350	57,900	109,244
66	1987	Dry	68%	63,232	47,500	16,350	63,850	127,082
67	1988	Critical	12%	10,665	44,400	23,719	68,119	78,784
68	1989	Dry	76%	70,061	41,550	16,350	57,900	127,961
69	1990	Critical	9%	8,056	41,550	29,821	71,371	79,427
70	1991	Critical	18%	16,313	41,550	39,571	81,121	97,434
71	1992	Critical	26%	24,330	41,550	39,571	81,121	105,451
72	1993	Above Normal	90%	83,055	47,500	16,350	63,850	146,905
73	1994	Critical	51%	47,101	47,500	16,350	63,850	110,951
74	1995	Wet	72%	66,992	44,400	16,350	60,750	127,742
75	1996	Wet	83%	76,979	47,500	16,350	63,850	140,829
76	1997	Wet	75%	69,401	47,500	16,350	63,850	133,251
77	1998	Wet	73%	67,316	47,500	16,350	63,850	131,166
78	1999	Wet	83%	76,976	47,500	16,350	63,850	140,826
79	2000	Above Normal	84%	77,238	47,500	16,350	63,850	141,088
80	2001	Dry	28%	26,050	44,400	23,719	68,119	94,169
81	2002	Dry	52%	48,382	41,550	16,350	57,900	106,282
82	2003	Above Normal	71%	65,873	41,550	16,350	57,900	123,773
83	2004	Below Normal / Dry	Actual was 65%	60,125	41,550	16,350	57,900	118,025
84	2005	Wet / Above Normal	Actual was 90%	83,250	47,500	16,350	63,850	147,100
85	2006	Wet / Wet	Actual was 100%	92,500	47,500	16,350	63,850	156,350
86	2007	Dry / Critical	Actual was 60%	55,500	44,400	16,350	60,750	116,250

[a] Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest

[b] From Table B.3 in *The State Water Project Delivery Reliability Report 2007* (DWR, August 2008). This is for current (2007) conditions as defined in the DWR report. In any given year, the allocation may be made up, in part, of carryover water from the prior year.

afy = acre-feet per year SWP = State Water Project

TABLE 3-13

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 86-year Simulation

Model Year	Historical Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	1922	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
2	1923	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
3	1924	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
4	1925	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
5	1926	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
6	1927	5.84	10.76	3.38	2.56	0.00	0.00	0.00	0.00	0.00	0.22	3.18	1.30	27.24
7	1928	1.55	0.51	0.38	0.05	0.12	0.01	0.00	0.00	0.02	0.00	3.01	5.85	11.50
8	1929	4.17	2.21	0.20	2.05	0.00	0.00	0.00	0.00	0.00	0.00	4.96	0.07	13.66
9	1930	4.17	2.21	0.20	2.05	0.00	0.00	0.00	0.00	0.00	0.00	4.96	0.07	13.66
10	1931	4.10	6.45	0.00	2.29	0.97	0.02	0.00	3.78	0.06	0.14	3.30	7.53	28.65
11	1932	4.81	9.42	0.18	0.46	0.21	0.00	0.00	0.00	0.08	0.06	0.00	0.89	16.11
12	1933	16.04	0.00	0.05	0.34	1.04	0.31	0.00	0.08	0.00	0.22	0.05	5.95	24.08
13	1934	6.54	2.93	0.11	0.00	0.02	0.59	0.00	0.00	0.01	2.17	2.25	6.56	21.18
14	1935	4.45	2.50	3.41	1.95	0.00	0.00	0.00	0.06	0.08	0.12	0.95	0.81	14.33
15	1936	0.06	8.40	1.84	0.36	0.00	0.00	0.06	0.00	0.01	2.45	0.01	10.82	24.02
16	1937	3.34	6.79	6.16	0.21	0.33	0.00	0.00	0.00	0.00	0.00	0.00	4.19	21.03
17	1938	0.62	12.79	11.37	0.84	0.05	0.12	0.00	0.00	0.15	0.07	0.01	12.40	38.43
18	1939	3.80	1.91	2.05	0.27	0.12	0.00	0.00	0.00	3.60	0.22	0.34	0.90	13.23
19	1940	3.29	6.25	1.43	2.12	0.00	0.00	0.00	0.00	0.00	1.29	0.07	10.62	25.08
20	1941	3.92	19.84	10.82	5.82	0.00	0.00	0.00	0.01	0.00	2.45	0.35	6.23	49.45
21	1942	0.14	0.88	1.64	2.73	0.00	0.00	0.00	0.68	0.00	0.93	0.23	1.09	8.33
22	1943	19.90	4.59	7.80	1.04	0.00	0.00	0.00	0.00	0.00	0.15	0.33	9.63	43.45
23	1944	1.20	16.38	3.76	0.54	0.01	0.00	0.00	0.00	0.00	0.00	5.82	1.20	28.90
24	1945	0.14	4.11	3.13	0.19	0.00	0.00	0.00	0.00	0.00	1.33	0.45	7.75	17.09
25	1946	0.19	2.42	5.95	0.61	0.00	0.00	0.00	0.00	0.00	0.75	10.87	4.69	25.48
26	1947	0.47	0.42	1.28	0.56	0.14	0.00	0.00	0.08	0.05	0.04	0.00	1.84	4.88
27	1948	0.00	1.87	3.49	1.56	0.00	0.09	0.00	0.00	0.00	0.14	0.00	3.57	10.71
28	1949	2.83	1.06	2.18	0.02	1.35	0.00	0.00	0.00	0.00	0.00	1.36	2.85	11.65
29	1950	2.58	1.69	1.27	0.86	0.01	0.00	0.00	0.00	0.32	0.36	0.73	0.21	8.03
30	1951	2.96	0.93	1.16	1.69	0.09	0.00	0.00	0.05	0.00	0.49	1.33	5.88	14.57
31	1952	17.68	0.61	10.30	1.80	0.00	0.00	0.00	0.00	0.12	0.00	4.52	5.09	40.12
32	1953	0.80	0.02	0.21	1.64	0.69	0.00	0.00	0.00	0.00	0.00	2.32	0.04	5.73
33	1954	6.38	3.36	4.86	0.12	0.00	0.00	0.00	0.00	0.00	0.00	2.38	1.47	18.56
34	1955	5.69	1.69	0.21	3.38	1.91	0.00	0.00	0.00	0.00	0.00	1.43	2.01	16.32
35	1956	7.55	1.00	0.00	5.90	1.82	0.00	0.11	0.00	0.00	0.15	0.00	0.15	16.68
36	1957	7.22	2.71	3.05	1.16	1.06	0.25	0.00	0.00	0.00	2.68	0.40	8.30	26.81
37	1958	2.11	10.42	5.82	7.18	0.00	0.00	0.00	0.00	0.04	1.35	0.23	0.00	27.15
38	1959	3.70	5.47	0.00	0.59	0.00	0.00	0.00	0.00	0.08	0.00	0.00	1.68	11.51
39	1960	4.17	2.21	0.20	2.05	0.00	0.00	0.00	0.00	0.00	0.00	4.96	0.07	13.66
40	1961	1.88	0.00	0.76	0.33	0.09	0.00	0.07	0.00	0.11	0.00	4.12	2.99	10.35
41	1962	3.86	19.44	1.53	0.00	0.02	0.00	0.00	0.00	0.00	0.05	0.00	0.00	24.90
42	1963	0.99	3.63	4.10	2.23	0.06	0.43	0.00	0.00	0.77	0.50	2.29	0.01	15.01
43	1964	2.95	0.00	1.88	2.41	0.04	0.12	0.00	0.00	0.00	0.52	1.47	2.48	11.84
44	1965	0.25	0.07	1.65	9.14	0.00	0.02	0.26	0.16	0.95	0.00	17.49	7.89	37.88
45	1966	1.42	1.55	0.33	0.00	0.09	0.00	0.00	0.00	0.09	0.11	7.56	5.95	17.10

TABLE 3-13

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 86-year Simulation

Model Year	Historical Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
46	1967	6.76	0.22	3.23	5.41	0.19	0.00	0.00	0.00	0.50	0.00	9.36	1.58	27.26
47	1968	0.86	0.93	2.91	0.97	0.07	0.00	0.00	0.38	0.00	0.39	0.35	1.24	8.10
48	1969	19.53	13.89	0.82	1.16	0.05	0.05	0.18	0.00	0.00	0.00	2.32	0.05	38.04
49	1970	0.94	6.63	4.33	0.00	0.00	0.00	0.00	0.00	0.00	0.13	8.86	6.33	27.21
50	1971	1.23	1.41	0.48	0.94	0.15	0.00	0.00	0.00	0.47	0.50	0.38	10.57	16.14
51	1972	0.00	0.12	0.00	0.02	0.05	0.05	0.00	0.06	0.00	0.05	3.45	1.08	4.87
52	1973	5.19	11.74	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.15	1.83	1.03	23.22
53	1974	10.58	0.02	4.30	0.06	0.00	0.00	0.02	0.00	0.00	1.17	0.12	4.89	21.17
54	1975	0.28	3.02	6.04	2.96	0.00	0.00	0.00	0.00	0.00	0.39	0.04	0.09	12.81
55	1976	0.00	7.39	1.47	0.46	0.15	0.35	0.01	0.00	3.40	0.22	2.09	0.90	16.45
56	1977	5.75	0.12	2.15	0.00	5.27	0.00	0.00	2.68	0.02	0.05	0.06	8.40	24.49
57	1978	10.74	13.23	17.10	2.72	0.00	0.00	0.00	0.00	1.23	0.01	2.70	1.76	49.49
58	1979	12.44	3.20	6.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.89	1.19	23.75
59	1980	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
60	1981	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
61	1982	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
62	1983	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
63	1984	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
64	1985	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
65	1986	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
66	1987	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
67	1988	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
68	1989	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
69	1990	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
70	1991	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
71	1992	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
72	1993	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
73	1994	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
74	1995	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
75	1996	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
76	1997	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
77	1998	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
78	1999	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
79	2000	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
80	2001	5.84	10.76	3.38	2.56	0.00	0.00	0.00	0.00	0.00	0.22	3.18	1.30	27.24
81	2002	1.55	0.51	0.38	0.05	0.12	0.01	0.00	0.00	0.02	0.00	3.01	5.85	11.50
82	2003	0.00	9.03	2.38	2.35	1.70	0.00	0.02	0.00	0.00	1.10	0.63	2.57	19.78
83	2004	0.65	8.07	0.37	0.20	0.00	0.00	0.00	0.00	0.00	4.79	0.64	8.54	23.26
84	2005	17.06	16.69	2.70	1.42	0.45	0.00	0.00	0.00	0.17	1.91	0.59	0.14	41.13
85	2006	3.27	3.78	5.68	4.22	0.99	0.00	0.00	0.00	0.00	0.42	0.05	0.83	19.24
86	2007	1.66	1.38	0.17	0.71	0.00	0.00	0.00	0.00	1.32	0.25	0.50	2.67	8.66

All precipitation values are listed in units of inches.

TABLE 3-14

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 86-year Simulation

Model Year	Historical Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Prototype Year
1	1922	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115	1992
2	1923	117	117	65	31	12	0	0	0	0	0	258	516	1,116	2000
3	1924	212	276	230	46	46	5	0	0	0	27	36	147	1,025	1990
4	1925	50	111	60	25	6	0	0	0	102	94	34	18	499	1989
5	1926	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175	1980
6	1927	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188	2001
7	1928	50	111	60	25	6	0	0	0	102	94	34	18	499	2002
8	1929	68	67	70	69	70	68	65	65	60	58	316	164	1,140	1960
9	1930	68	67	70	69	70	68	65	65	60	58	316	164	1,140	1960
10	1931	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188	2001
11	1932	117	117	65	31	12	0	0	0	0	0	258	516	1,116	1987
12	1933	0	30	0	0	0	0	0	0	0	25	0	1,652	1,707	2004
13	1934	222	209	506	117	77	68	0	0	0	0	12	25	1,236	1988
14	1935	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104	1995
15	1936	0	30	0	0	0	0	0	0	0	25	0	1,652	1,707	2004
16	1937	222	209	506	117	77	68	0	0	0	0	12	25	1,236	1988
17	1938	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104	1995
18	1939	7,355	2,668	597	265	120	55	27	5	32	73	132	141	11,468	Half of 1993
19	1940	0	30	0	0	0	0	0	0	0	25	0	1,652	1,707	2004
20	1941	13,686	11,359	11,699	2,378	1,458	721	322	120	77	128	179	206	42,333	2005
21	1942	50	111	60	25	6	0	0	0	102	94	34	18	499	1989
22	1943	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074	1998
23	1944	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104	1995
24	1945	517	346	140	85	33	5	4	50	66	240	566	809	2,859	1997
25	1946	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104	1995
26	1947	332	250	131	90	50	22	32	6	0	0	11	58	983	1972
27	1948	50	111	60	25	6	0	0	0	102	94	34	18	499	2002
28	1949	50	111	60	25	6	0	0	0	102	94	34	18	499	2002
29	1950	83	198	184	126	105	83	51	54	56	53	43	42	1,078	1950
30	1951	49	40	66	91	98	84	79	72	57	71	47	53	807	1951
31	1952	9,629	636	7,091	2,114	895	326	153	138	86	97	178	313	21,656	1952
32	1953	300	282	271	237	165	134	102	86	85	83	74	68	1,888	1953
33	1954	145	278	404	356	181	108	110	99	91	90	80	75	2,017	1954
34	1955	103	156	157	128	153	99	78	76	74	68	66	62	1,220	1955
35	1956	69	85	130	137	139	98	86	80	77	76	67	69	1,113	1956
36	1957	67	55	78	90	93	80	78	78	76	79	66	71	910	1957
37	1958	66	329	743	4,550	825	283	130	108	95	145	146	116	7,536	1958
38	1959	246	351	189	127	111	92	84	86	83	69	68	68	1,575	1959
39	1960	68	67	70	69	70	68	65	65	60	58	316	164	1,140	1960
40	1961	124	91	38	38	36	32	28	33	22	19	19	119	597	1961
41	1962	139	1,904	791	449	329	169	97	82	80	84	82	82	4,287	1962
42	1963	85	142	145	131	104	86	79	74	66	65	62	58	1,096	1963
43	1964	69	50	51	62	66	54	53	53	54	45	43	41	640	1964
44	1965	30	23	25	46	43	36	31	34	37	35	1,305	3,300	4,944	1965
45	1966	1,765	1,014	778	450	308	115	68	54	45	63	91	523	5,274	1966

TABLE 3-14

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 86-year Simulation

Model Year	Historical Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Prototype Year
46	1967	757	489	1,028	2,295	1,880	729	212	104	89	73	255	487	8,397	1967
47	1968	300	247	276	180	72	32	32	30	25	133	208	851	2,384	1968
48	1969	13,797	2,856	1,005	489	320	147	98	98	46	318	392	399	19,966	1969
49	1970	461	550	1,168	465	290	169	74	60	58	27	501	1,338	5,161	1970
50	1971	614	524	556	397	262	167	70	25	5	30	200	420	3,270	1971
51	1972	332	250	131	90	50	22	32	6	0	0	11	58	983	1972
52	1973	153	1,717	950	471	226	71	18	12	8	3	8	44	3,679	1973
53	1974	608	229	392	190	129	49	17	6	0	3	19	87	1,728	1974
54	1975	53	90	228	181	104	31	15	3	0	0	0	0	704	1975
55	1976	0	110	63	39	33	12	0	0	1	0	0	0	258	1976
56	1977	28	7	28	19	60	5	0	0	0	0	0	0	147	1977
57	1978	744	9,486	11,412	1,696	2,736	1,154	418	209	101	264	422	86	28,730	1978
58	1979	1,254	433	1,113	506	246	190	178	111	125	90	120	558	4,925	1979
59	1980	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175	1980
60	1981	594	98	339	240	107	18	18	12	338	321	258	394	2,739	1981
61	1982	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188	1982
62	1983	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855	1983
63	1984	0	596	405	240	143	166	228	411	154	220	904	578	4,044	1984
64	1985	483	461	274	215	77	0	0	0	12	179	221	301	2,224	1985
65	1986	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744	1986
66	1987	117	117	65	31	12	0	0	0	0	0	258	516	1,116	1987
67	1988	222	209	506	117	77	68	0	0	0	0	12	25	1,236	1988
68	1989	50	111	60	25	6	0	0	0	102	94	34	18	499	1989
69	1990	212	276	230	46	46	5	0	0	0	27	36	147	1,025	1990
70	1991	162	775	879	736	145	142	14	0	45	69	62	263	3,291	1991
71	1992	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115	1992
72	1993	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937	1993
73	1994	388	493	497	319	163	80	20	7	37	102	193	941	3,239	1994
74	1995	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104	1995
75	1996	666	896	730	315	151	46	7	0	54	154	307	510	3,836	1996
76	1997	517	346	140	85	33	5	4	50	66	240	566	809	2,859	1997
77	1998	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074	1998
78	1999	92	85	204	224	197	107	80	46	52	54	31	80	1,252	1999
79	2000	117	117	65	31	12	0	0	0	0	0	258	516	1,116	1987
80	2001	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188	1982
81	2002	50	111	60	25	6	0	0	0	102	94	34	18	499	1989
82	2003	666	896	730	315	109	0	0	0	0	0	0	0	2,715	1996 and 2003
83	2004	0	30	0	0	0	0	0	0	0	25	0	1,652	1,707	2004
84	2005	13,686	11,359	11,699	2,378	1,458	721	322	120	77	128	179	206	42,333	2005
85	2006	418	352	510	920	381	69	0	0	0	0	0	0	2,650	2006
86	2007	1	57	30	20	0	0	0	0	0	3	8	6	125	2007

All simulated streamflow volumes are listed in units of acre-feet (af).

TABLE 3-15

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 86-year Simulation

Model Year	Historical Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Prototype Year
1	1922	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450	1992
2	1923	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086	2000
3	1924	0	0	0	0	0	0	0	0	0	0	0	0	0	1990
4	1925	0	0	0	0	0	0	0	0	0	0	0	0	0	1989
5	1926	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805	1980
6	1927	0	389	1,218	0	0	0	0	0	0	0	0	0	1,607	2001
7	1928	0	0	0	0	0	0	0	0	0	0	0	0	0	2002
8	1929	0	0	0	0	0	0	0	0	0	0	0	0	0	2002
9	1930	0	0	0	0	0	0	0	0	0	0	0	0	0	1984
10	1931	0	389	1,218	0	0	0	0	0	0	0	0	0	1,607	2001
11	1932	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641	1986
12	1933	0	59	1,004	0	0	0	0	0	0	0	0	60	1,123	2004
13	1934	0	0	809	341	900	0	0	0	0	0	0	0	2,050	1988
14	1935	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611	1995
15	1936	0	59	1,004	0	0	0	0	0	0	0	0	60	1,123	2004
16	1937	0	0	809	341	900	0	0	0	0	0	0	0	2,050	1988
17	1938	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611	1995
18	1939	0	70	93	1,516	951	318	171	169	407	0	0	171	3,863	Half of 1993
19	1940	0	59	1,004	0	0	0	0	0	0	0	0	60	1,123	2004
20	1941	32,391	37,514	12,993	3,613	2,891	90	1,657	32	0	0	0	0	91,181	2005
21	1942	0	0	0	0	0	0	0	0	0	0	0	0	0	1989
22	1943	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802	1998
23	1944	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611	1995
24	1945	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884	1997
25	1946	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611	1995
26	1947	0	0	0	0	0	0	0	0	0	0	0	0	0	1989
27	1948	0	0	0	0	0	0	0	0	0	0	0	0	0	2002
28	1949	0	0	0	0	0	0	0	0	0	0	0	0	0	2002
29	1950	0	0	0	0	0	0	0	0	0	0	0	0	0	2007
30	1951	0	0	0	0	0	0	0	0	0	0	0	0	0	1984
31	1952	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725	1993
32	1953	0	0	0	0	0	0	0	0	0	0	0	0	0	1989
33	1954	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632	1996
34	1955	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641	1986
35	1956	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853	1987
36	1957	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
37	1958	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
38	1959	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282	1994
39	1960	0	0	0	0	0	0	0	0	0	0	0	0	0	1984
40	1961	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830	1999
41	1962	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
42	1963	0	0	0	0	0	0	0	0	0	0	0	0	0	1984
43	1964	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282	1994
44	1965	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450	1992
45	1966	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853	1987

TABLE 3-15

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 86-year Simulation

Model Year	Historical Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Prototype Year
46	1967	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
47	1968	0	0	0	0	0	0	0	0	0	0	0	0	0	2007
48	1969	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725	1993
49	1970	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
50	1971	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641	1986
51	1972	0	0	0	0	0	0	0	0	0	0	0	0	0	1989
52	1973	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
53	1974	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641	1986
54	1975	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282	1994
55	1976	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853	1987
56	1977	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
57	1978	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928	1983
58	1979	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
59	1980	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805	1980
60	1981	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641	1986
61	1982	0	0	0	0	0	667	842	735	0	0	0	0	2,244	1982
62	1983	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928	1983
63	1984	0	0	0	0	0	0	0	0	0	0	0	0	0	1984
64	1985	0	0	0	0	0	0	0	0	0	0	0	0	0	1985
65	1986	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641	1986
66	1987	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853	1987
67	1988	0	0	809	341	900	0	0	0	0	0	0	0	2,050	1988
68	1989	0	0	0	0	0	0	0	0	0	0	0	0	0	1989
69	1990	0	0	0	0	0	0	0	0	0	0	0	0	0	1990
70	1991	0	0	0	0	0	0	0	0	0	0	0	66	66	1991
71	1992	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450	1992
72	1993	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725	1993
73	1994	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282	1994
74	1995	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611	1995
75	1996	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632	1996
76	1997	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884	1997
77	1998	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802	1998
78	1999	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830	1999
79	2000	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086	2000
80	2001	0	389	1,218	0	0	0	0	0	0	0	0	0	1,607	2001
81	2002	0	0	0	0	0	0	0	0	0	0	0	0	0	2002
82	2003	0	0	0	2,286	418	315	0	0	0	0	0	0	3,019	2003
83	2004	0	59	1,004	0	0	0	0	0	0	0	0	60	1,123	2004
84	2005	32,391	37,514	12,993	3,613	2,891	90	1,657	32	0	0	0	0	91,181	2005
85	2006	1,403	2,185	2,648	5,906	3,395	2,307	0	0	0	0	0	0	17,844	2006
86	2007	0	0	0	0	0	0	0	0	0	0	0	0	0	2007

All simulated water releases are listed in units of acre-feet (af).

Table

Water Demands and Indoor Water Use under Full Build-out Conditions (Excluding Newhall Ranch)

Year 2000 Actual (afy)	Full Build-out Conditions (afy)	Comments
Annual Urban Water Use Outside Newhall Ranch		
60,988	123,038	Year 2000 value is retail purveyor demand plus other demands in Table II-6 of the *2004 Santa Clarita Valley Water Report* (LSCE, 2005a). Year 2045 value is from Table 2.5-4 of the *Newhall Ranch Draft Additional Analysis* (Impact Sciences, Inc., 2001). Consists of 89,805 AF/yr Development Monitoring System[a] demand, plus 55,995 AF/yr additional urban demand, minus 14,480 AF/yr conservation, minus 5,193 AF/yr agricultural uses and 3,089 AF/yr "other" uses. Does not include 4,500 AF/yr for aquifer storage and recovery or 17,680 AF/yr of demand for the Newhall Ranch Specific Plan.
Annual Indoor Water Use Outside Newhall Ranch (Equal to LACSD WRP Influent Volumes)		
18,723	40,313 (average year)	The year 2000 volume is from the Saugus and Valencia WRPs for the period January 2000 through December 2000. The long-term current generated effluent volume is based on the influent volume estimated from water balance calculations performed for the chloride mass balance analysis. The effluent volume is 32.8 percent of the total urban water production of 123,038 AF/yr, which includes other uses.

[a]Development Monitoring System water demands are demands associated with future build-out of developments identified in Los Angeles County's Development Monitoring System for the Santa Clarita Valley.

Table

Treated Water Discharges from the Saugus and Valencia WRPs to the Santa Clara River under Full Build-out Conditions

Month	Treated Water Volume (2000)[a]	Treated Water Volume (Full Build-out Conditions)[b]	Percent of Annual Outdoor Demand	Reclaimed Volume under Full Build-out Conditions (Before Maintaining Existing Streamflows)	Reclaimed Volume under Full Build-out Conditions (After Maintaining Existing Streamflows)	WRP Discharges to River under Full Build-out Conditions[c]	Month
January	1,503	3,237	3.75	637	637	2,600	January
February	1,443	3,106	5.1	867	867	2,239	February
March	1,528	3,290	6.6	1,122	1,122	2,168	March
April	1,505	3,240	9.1	1,547	1,547	1,693	April
May	1,569	3,379	10.55	1,794	1,794	1,585	May
June	1,543	3,322	11.4	1,938	1,781	1,541	June
July	1,606	3,459	14.1	2,397	1,854	1,605	July
August	1,649	3,550	12.95	2,202	1,902	1,648	August
September	1,593	3,430	10.2	1,734	1,734	1,696	September
October	1,631	3,512	7.5	1,275	1,275	2,237	October
November	1,546	3,329	5	850	850	2,479	November
December	1,607	3,459	3.75	637	637	2,822	December
Total Annual	**18,723**	**40,313**	**100**	**17,000**	**16,000**	**24,313**	**Total Annual**

[a]Values shown are the actual volumes of treated water discharged to the Santa Clara River from the Saugus and Valencia WRPs during calendar year 2000. (See also Table 3-16.)

[b]Values shown are the combined treated water volumes estimated to be produced by the Saugus and Valencia WRPs for full build-out conditions in the Santa Clarita Valley. These values do not include the future Newhall Ranch WRP, which will be operated by LACSD.

[c]Values shown do not include discharges of treated water to the river from the future Newhall Ranch WRP. These volumes are 10 acre-feet in November, 138 acre-feet in December, and 138 acre-feet in January. During the other nine months of the year, this WRP will not discharge treated water to the river (see the *Newhall Ranch Draft Additional Analysis* [Impact Sciences, Inc., 2001] for further details). The combined total discharge from the Saugus, Valencia, and Newhall Ranch WRPs is summarized in Table 3-18.

Note: All volumes are in acre-feet.

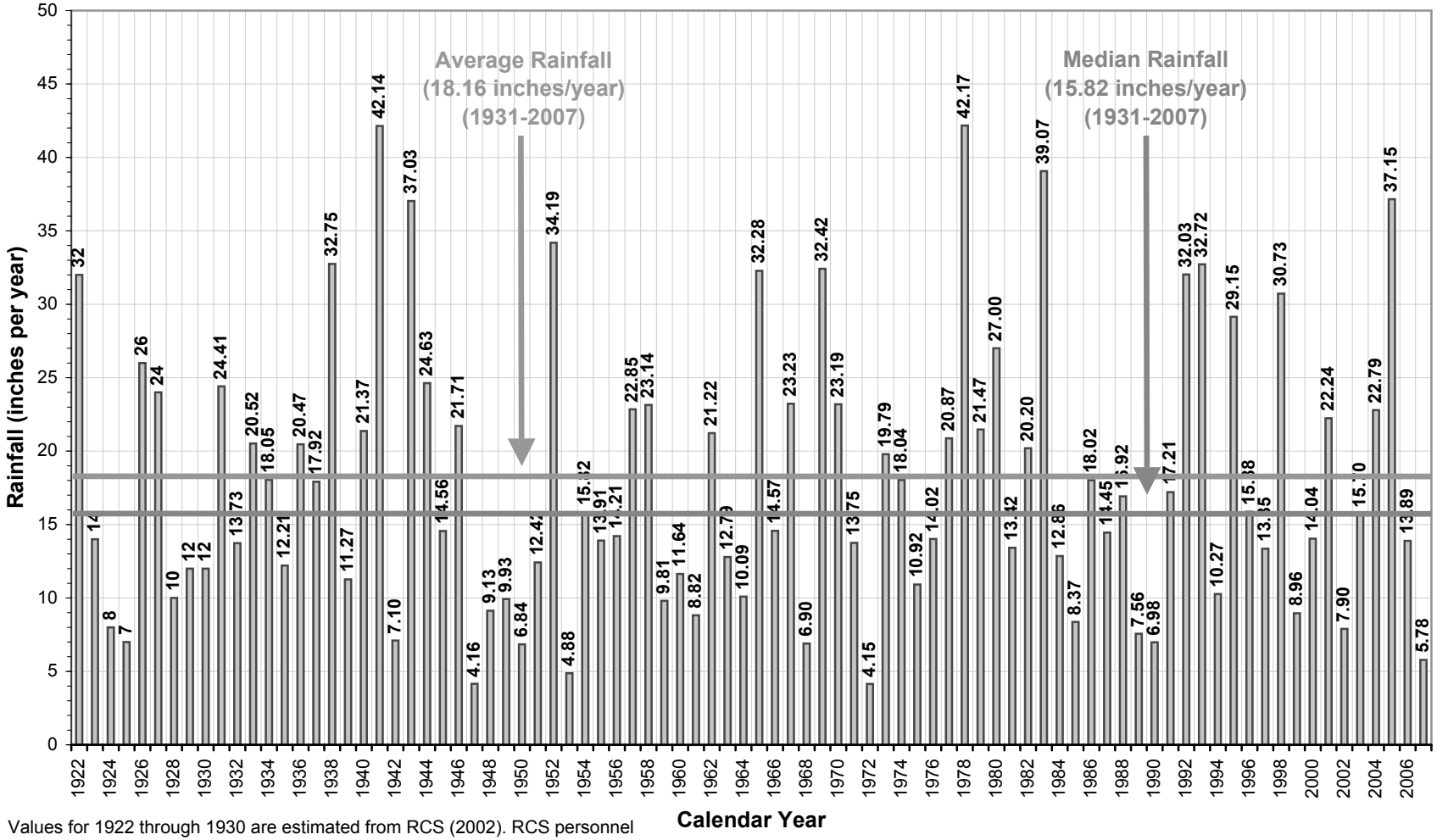
Table

Simulated Monthly Treated Wastewater Discharges from Santa Clarita Valley WRPs under Full Build-out Conditions

WRP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Saugus	493	487	500	490	503	466	457	508	586	555	514	596	**6,155**
Valencia	2,107	1,752	1,668	1,203	1,082	1,075	1,148	1,140	1,110	1,682	1,965	2,226	**18,158**
Newhall	138	0	0	0	0	0	0	0	0	0	10	138	**286**
Total	**2,738**	**2,239**	**2,168**	**1,693**	**1,585**	**1,541**	**1,605**	**1,648**	**1,696**	**2,237**	**2,489**	**2,960**	**24,599**

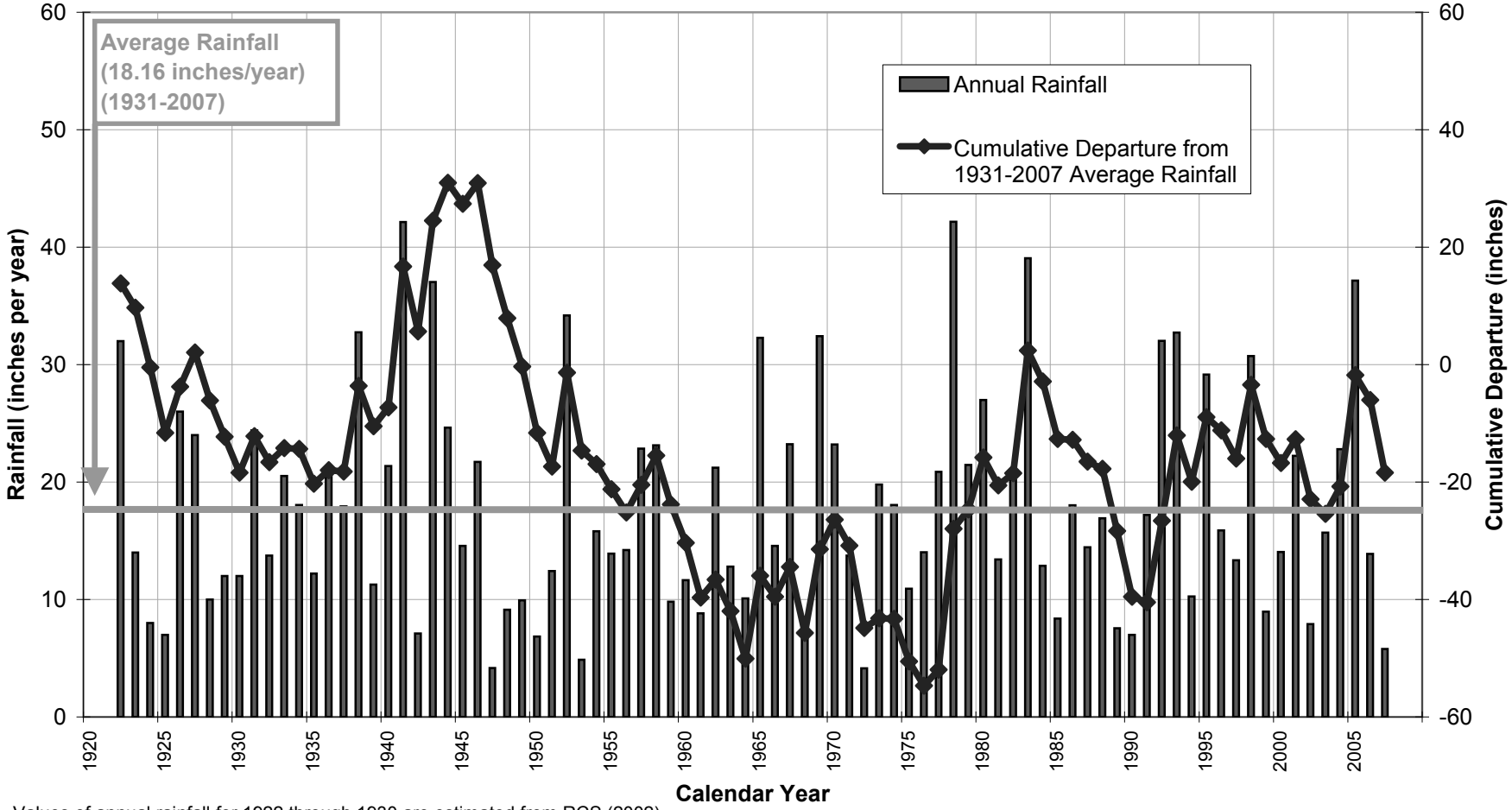
Note: All volumes are in acre-feet.

Figure 3-1
Annual Rainfall
(Newhall-Soledad Rain Gage)



Values for 1922 through 1930 are estimated from RCS (2002). RCS personnel have since indicated that the source of data to 1931 is an unofficial record obtained in 2001 from a former California State Climatologist.

Figure 3-2
Annual Rainfall and Cumulative Departure from Average Rainfall
(Newhall-Soledad Rain Gage)



Values of annual rainfall for 1922 through 1930 are estimated from RCS (2002). RCS personnel have since indicated that the source of data to 1931 is an unofficial record obtained in 2001 from a former California State Climatologist.

Figure 3-3
Simulated Groundwater Pumping for 2008 Groundwater Operating Plan

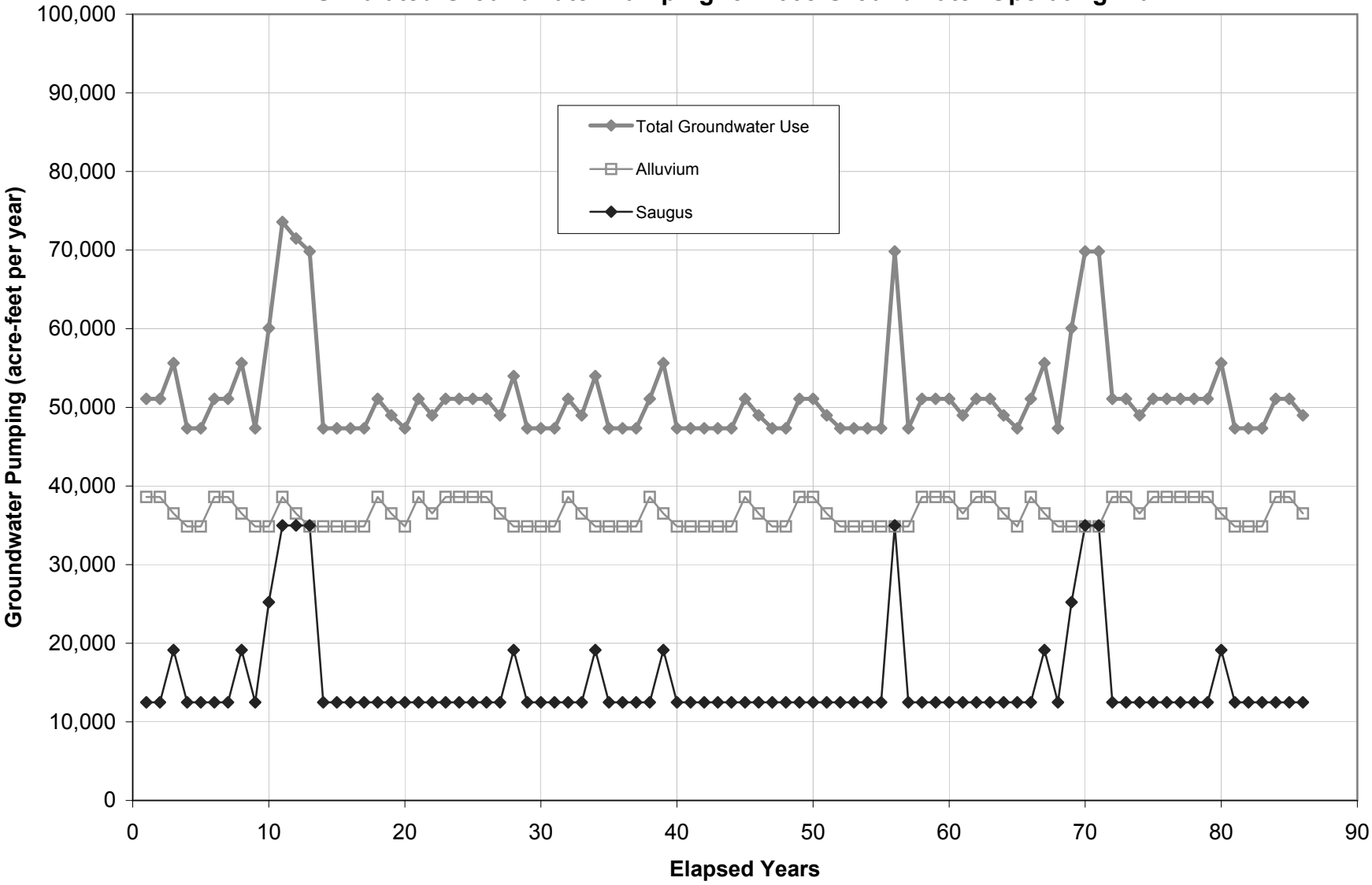


Figure 3-4
Simulated Water Supplies For 2008 Groundwater Operating Plan (Excluding Recycled Water)

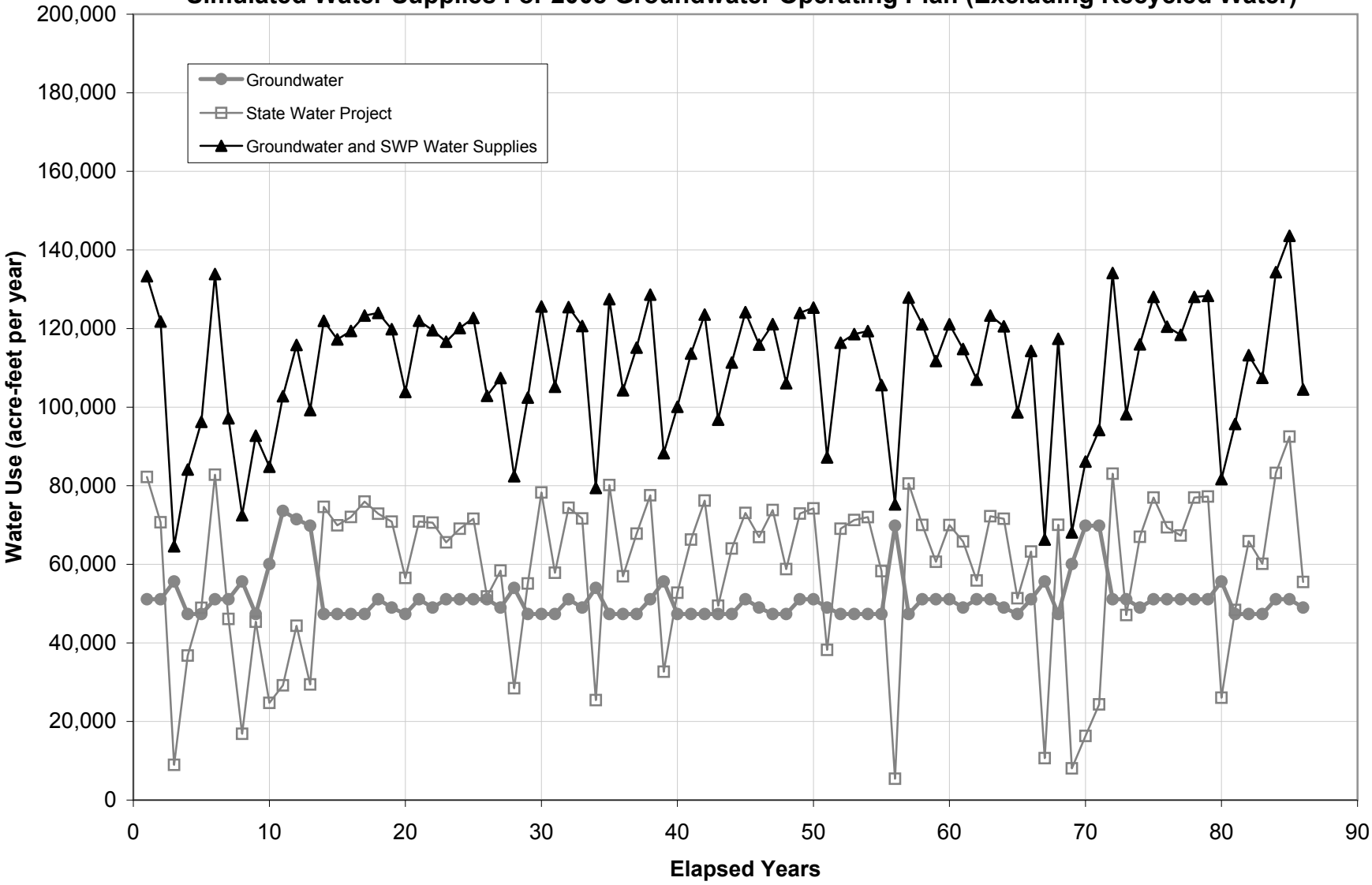


Figure 3-5
Simulated Groundwater Pumping For Potential Groundwater Operating Plan

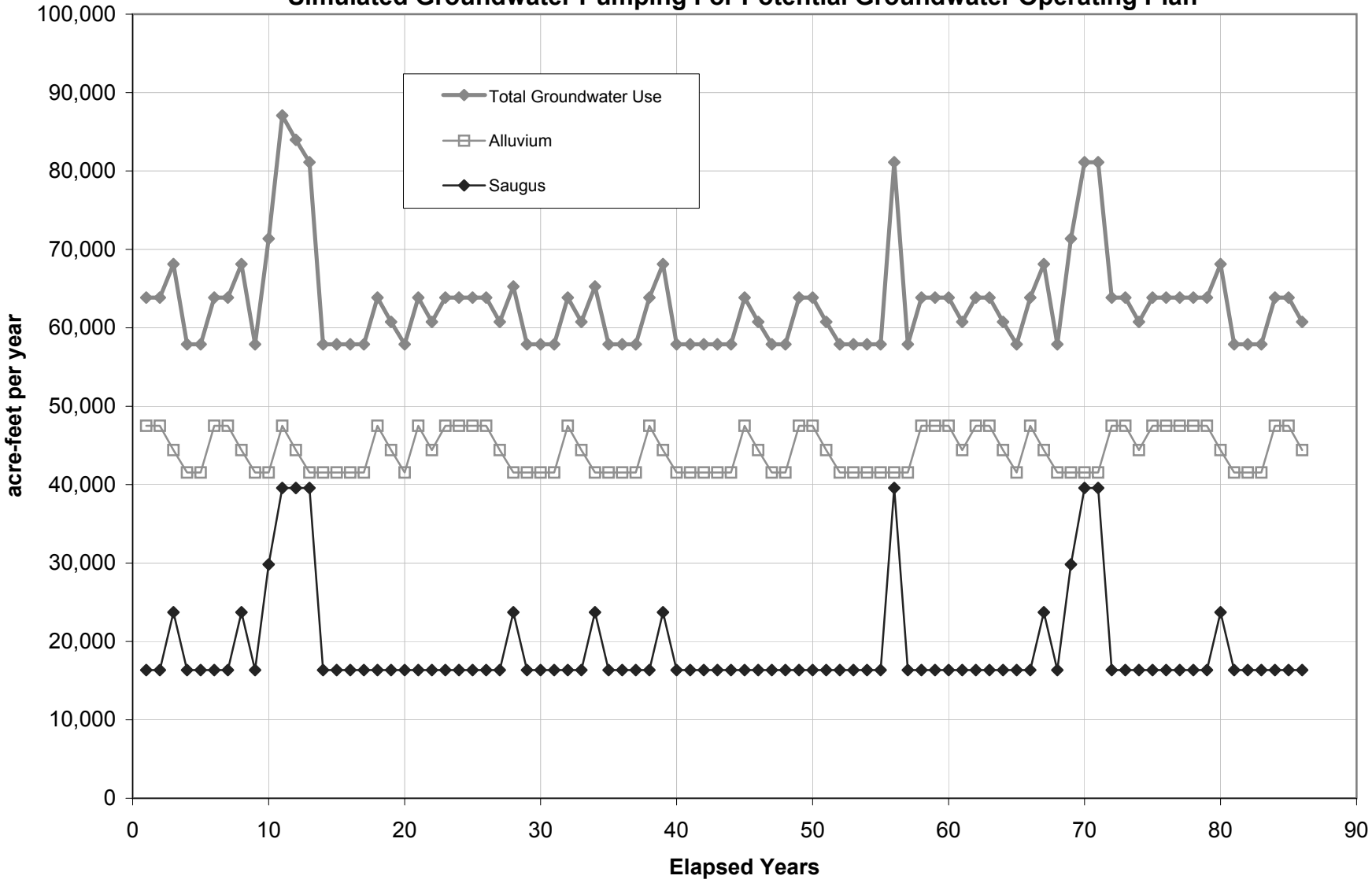


Figure 3-6
Simulated Groundwater Pumping For 2008 and Potential Groundwater Operating Plans

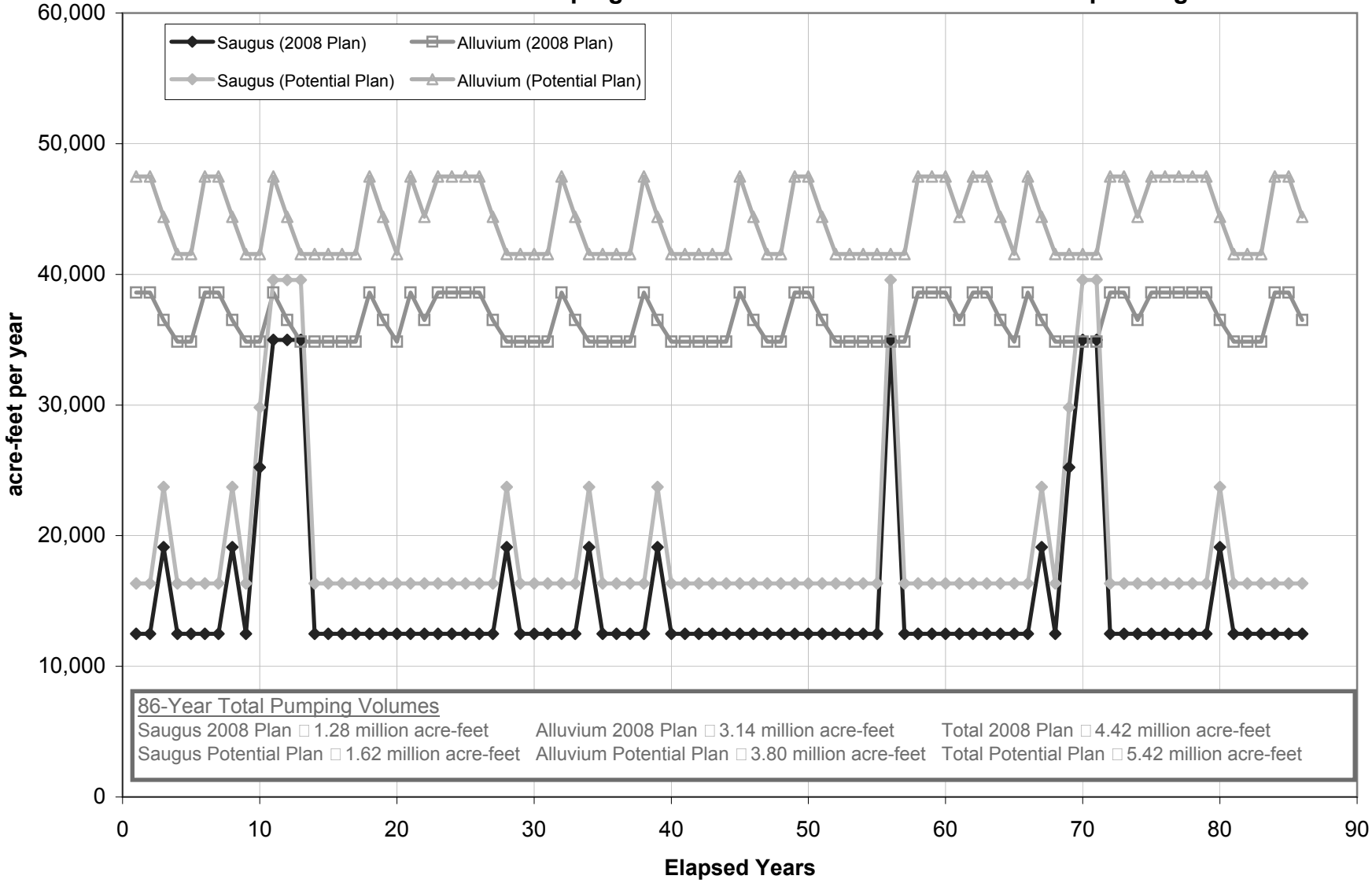
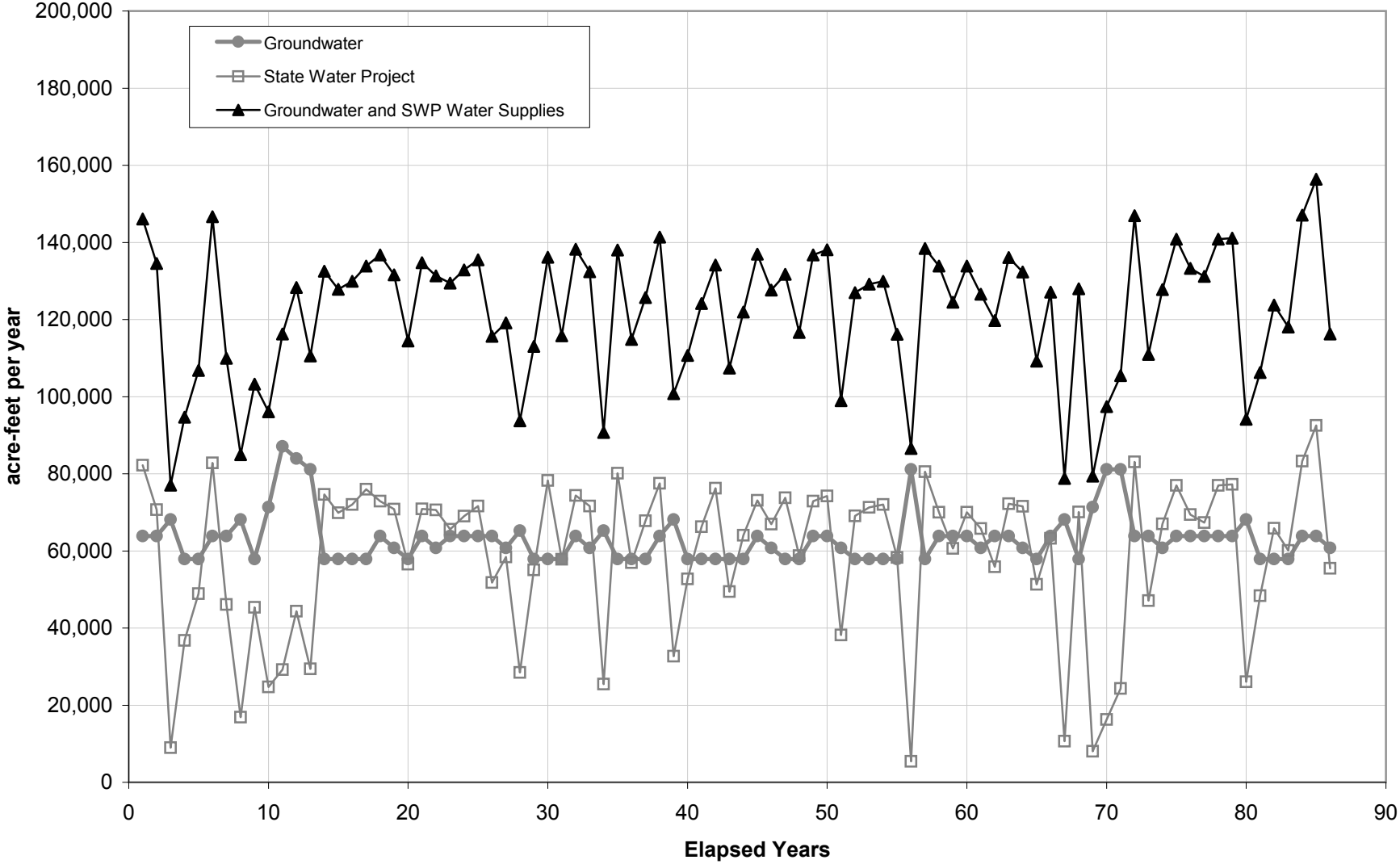


Figure 3-7
Simulated Water Supplies For Potential Groundwater Operating Plan
(Excluding Recycled Water)



IV. Sustainability of Operating Plans

This section of the report presents and discusses time-series plots (hydrographs) of simulated groundwater elevations, groundwater budget terms, and Santa Clara River flows for the 86-year modeling period. The results for the 2008 Operating Plan, the 2008 Operating Plan with Pumping Redistribution, and the future Potential Operating Plan are presented and discussed together.

4.1 Groundwater Elevations

As introduced above, groundwater elevation trends are considered to be the key indicator of long-term sustainability of an operating plan. A sustainable plan is characterized by the absence of long-term declines in groundwater levels or, if declines occur initially, subsequent long-term stabilization of groundwater levels. Concurrent with sustainability considerations, i.e. groundwater resource response to a certain level of pumping, is whether an operating plan is physically achievable. An achievable plan is one in which target pumping capacities and long-term (monthly and/or annual) target pumping volumes can be expected to be pumped without exceeding practical well and pump performance. Achievability of the plan at a given well can be evaluated by comparing groundwater elevations and trends against historical levels and against the depths in the aquifer to which the well is open (i.e., the depth interval for the well screen or the perforated steel casing).

Sections 4.1.1 through 4.1.3 discuss sustainability and achievability of the 2008 Operating Plan, the 2008 Operating Plan with Pumping Redistribution, and the Potential Operating Plan, respectively. Hydrographs illustrating basin response to each operating plan at each production well location in the Valley are contained in Appendix C.

4.1.1 2008 Operating Plan

Selected groundwater elevation hydrographs for different portions of the Alluvial Aquifer are presented on Figures 4-1 through 4-8. Each figure presents hydrographs for wells that are considered representative of conditions in the following alluvial subareas:

- Along the Santa Clara River, below the Valencia WRP (well VWC-E15)
- Along the Santa Clara River, below the Saugus WRP (well VWC-S8)
- Along the Santa Clara River, above the Saugus WRP (well VWC-T7)
- Along the Santa Clara River, at and above Mint Canyon (wells SCWD-Sierra and NCWD-Pinetree1)
- Castaic Valley (well NCWD-Castaic7)
- San Francisquito Canyon (well VWC-W11)
- Bouquet Canyon (well SCWD-Clark)

Each set of hydrographs in Figures 4-1 through 4-8 shows the simulated monthly groundwater elevations for both operating plans, as well as three sets of historical groundwater elevations

from 1980-2007 (static [non-pumping] groundwater elevations, groundwater elevations measured during pumping, and the model's simulation of historical conditions from 1980-2007).

Key findings from the simulated hydrographs for the 2008 Operating Plan are as follows:

The model simulates distinct multi-year periods of overall declining or overall increasing groundwater elevations resulting from cycles of below-normal and above-normal rainfall periods. This variation is consistent with historical observations of the relationship between rainfall and groundwater level fluctuations (CH2M HILL, 2004a; CH2M HILL and LSCE, 2005) and is particularly pronounced in much of the Alluvial Aquifer.

The 2008 Operating Plan is sustainable, but not fully achievable, in the Alluvial Aquifer as configured. Specifically:

- Alluvial Aquifer wells in each subarea do not show sustained long-term declines in groundwater elevations. Groundwater elevations decline notably in some areas during drought periods, but eventually recover in response to significant rainfall/recharge events that occur periodically, marking the end of a given drought cycle.

- The 2008 plan is achievable in most Alluvial Aquifer subareas in that the groundwater elevations remain similar to historical groundwater elevations, do not drop appreciably into the open intervals of the wells or, at wells such as SCWD-Clark, where groundwater levels are already within the open interval, are only modestly below levels observed in recent years. This means that groundwater levels in most areas are not expected to pose operational difficulties that would significantly reduce the pumping capacities of individual wells.

- However, a notable exception is in the "Above Mint Canyon" subarea, where groundwater elevations are simulated to be within the open intervals of wells during most of the simulation period. In some instances, the simulated groundwater elevations are predicted to drop below the bottom of the well, meaning that the pumping rates programmed into the model at, and prior to, that time are not expected to be physically achievable. As shown by the hydrographs, the 2008 Operating Plan is predicted to not be fully achievable in the "Above Mint Canyon" subarea under the types of drought cycles such as were observed from the mid-1920s through the late 1930s and from the mid-1940s through the mid-1970s.

- It is important to note that, because the model simulates more pumping than can physically be achieved in the "Above Mint Canyon" alluvial subarea during drought periods, actual groundwater elevations will be higher at the ends of the drought cycles than predicted by the model (because actual pumping will have to be less than what is simulated by the model). This in turn means that the relatively low groundwater elevations depicted on the hydrographs between 1976 and the early 1990s are lower than will actually occur. It also means that, while pumping at the rates contemplated in the 2008 Operating Plan may not be achievable, some lower extraction rates can likely be achieved in the "Above Mint Canyon" area, with the possibility that reductions in this

area could be offset by increased pumping in other parts of the basin. This idea is supported by a group of focused test simulations that were conducted during the course of evaluating the 2008 Operating Plan. Results are discussed in the following Section 4.1.2.

Figures 4-9 through 4-11 contain groundwater elevation hydrographs for three representative wells in the Saugus Formation (SCWD-Saugus1 just south of Bouquet Junction; NCWD-13 further to the south, along the South Fork Santa Clara River; and VWC-206 near the Valencia WRP). The principal observations from these hydrographs are:

- Groundwater elevations show long-term stability under the 2008 Operating Plan, with no sustained declines being evident. At each well, the groundwater elevations under this operating plan are slightly below the historical static elevations that were observed from 1980 through 2007, reflecting greater use of Saugus wells under the 2008 Operating Plan than has occurred historically (in particular, greater use of SCWD-Saugus1 and SCWD-Saugus2, which will begin pumping under the perchlorate containment plan described in Section 3.3.3). Nonetheless, the groundwater elevations are at or above historically recorded pumping elevations, and notably above the top of the open interval of each well, indicating that the 2008 Operating Plan should be achievable at each well and sustainable in the long-run.

4.1.2 2008 Operating Plan with Pumping Redistribution

During the prolonged dry period from the mid-1940s through the mid-1970s, when there were few years of significantly greater-than-average rainfall, the 2008 Operating Plan might have been achievable if pumping in the "Above Mint Canyon" alluvial subarea had been lower than the pumping volume contemplated in the 2008 Operating Plan. This reduction would not have been necessary during other historical periods that were characterized by intermittent years of significant rainfall, streamflow, and associated groundwater recharge (such as occurred periodically from the late 1970s through 2005).

This possibility was examined as follows. Recognizing that SCWD is in the midst of constructing new or replacement wells (e.g. to replace its perchlorate-impacted Stadium well) to the west of the "Above Mint Canyon" subarea, a potential redistribution of some SCWD pumping, as analyzed in the 2008 Operating Plan, was crafted whereby 1,600 afy of pumping was moved from three SCWD wells in the "Above Mint Canyon" subarea (near the mouth of Sand Canyon) to the replacement SCWD Santa Clara and Bouquet wells, located in the "Above Saugus WRP" and "Bouquet Canyon" subareas, respectively (Table 3-9). The resultant impact on groundwater levels to the west was nearly insignificant, indicating no adverse effect on either sustainability or achievability of groundwater at a higher pumping rate in those subareas (Figures 4-12 through 4-15). However, in the "Above Mint Canyon" area to the east, while there was appreciable improvement, in places up to 20 feet of higher groundwater levels through prolonged dry periods, the redistribution of 1,600 afy from this alluvial subarea is not predicted to significantly improve operating conditions at most of the production wells in this area, as groundwater levels are still predicted to decline close to, or below, the open intervals of many of the existing production wells under the historical hydrologic conditions observed from the mid-1940s through the mid-1970s (see Figures 4-12 through 4-15).

The preceding "redistribution" analysis suggests that the Purveyors can expect that the "Above Mint Canyon" subarea will suffer from significantly depressed groundwater levels through extended dry periods that will, in turn, physically limit the amount of groundwater pumping in that area, most notably from the SCWD wells in that subarea. The "redistribution" analysis indicates that increased pumping to the west, to offset reduced pumping in the "Above Mint Canyon" area, is both sustainable and achievable. The residual "Above Mint Canyon" pumping (a total of 4,450 afy in multiple dry years; 3,300 afy by SCWD, 700 afy by NCWD, and 450 afy by Robinson Ranch) in the 2008 Operating Plan does not appear to be fully achievable through those dry periods. Implications are likely to be in the following range of possibilities. One possibility is that additional redistribution can be achieved by further increasing pumping to the west; that would tend to keep the total groundwater supply near the upper end (35,000 afy) of the dry-year range in the Operating Plan (Section 3.3.1). Model results of limited redistribution above indicate the probability that such can be accomplished with small decreases in groundwater levels that will not have an adverse effect on overall sustainability and achievability. A second possibility is that pumping is not increased to the west, even if pumping is reduced in the "Above Mint Canyon" area; in that case, the total achievable pumping in dry periods would be near the lower end (30,000 afy) of the dry-year range in the Operating Plan. Additionally, in this second case, because of the absence of episodic recharge events during such a prolonged period, pumping during or after years of near-normal rainfall may also require reduction to this same low end of the range in the Operating Plan (30,000 afy).

In summary, the 2008 Operating Plan, as originally crafted, would utilize groundwater in a sustainable manner, but is not expected to be fully achievable due to depressed groundwater levels at the eastern end of the basin, i.e. in the "Above Mint Canyon" area, through extended dry periods. As pumping in that area declines due to depressed groundwater levels, total Alluvial pumping can be expected to remain within the overall dry-period range in the 2008 Operating Plan (30,000 to 35,000 afy). With redistribution of pumping to the west, Alluvial pumping can be achieved toward the upper end of that range. However, without pumping redistribution to the west, Alluvial pumping can be expected to decrease toward the lower end of that range during most years until an episodic rainfall and recharge event occurs that substantially recharges the aquifer in the "Above Mint Canyon" area.

4.1.3 Potential Operating Plan

The Potential Operating Plan is not sustainable or achievable in the Alluvial Aquifer as configured. Although there are local areas where groundwater conditions would appear sustainable, overall the Potential Operating Plan is not sustainable or achievable because several of the Alluvial Aquifer subareas show groundwater elevations that are distinctly lower during most of the 86-year simulation period than under the 2008 Operating Plan, and show a continued decline over time (Figures 4-1 through 4-8).

The Potential Operating Plan shows modest long-term declines in Saugus Formation groundwater elevations at each Saugus production well, as indicated by comparing the relatively high groundwater elevations in the mid-1940s (following the drought of the mid-1920s through late 1930s) with the relatively high, but slightly lower, groundwater elevations of the mid-1980s

(following the drought of the mid-1940s through mid-1970s). The hydrographs in Figures 4-9 through 4-11 indicate that pumping during the next several decades from the Saugus Formation under the Potential Operating Plan would likely be achievable, but the long-term decline indicates that the Potential Operating Plan may not be sustainable beyond the next several decades.

4.2 Groundwater Recharge, Discharge, and Storage

The sustainability of each operating plan can also be evaluated by examining trends in groundwater recharge and groundwater discharge during the 86-year simulation period. The magnitudes of individual groundwater recharge mechanisms at any given time are the same for the 2008 Operating Plan and the Potential Operating Plan, because recharge is an input to the model and is not affected by groundwater pumping. However, the groundwater discharge terms are different for the two plans because of the different groundwater pumping rates and the corresponding differences between the two plans in how they affect groundwater levels and, therefore, the magnitudes of the various components of groundwater discharge.

Figure 4-16 compares the magnitudes and trends in groundwater recharge and groundwater discharge for the 2008 Operating Plan. The figure shows that groundwater recharge rates vary greatly from year to year because of year-to-year variations in precipitation and stormwater generation within the groundwater basin and in the contiguous upstream watersheds. In contrast, total groundwater discharge is much less variable from year to year, with variations arising from increased pumping during drought years and increased evapotranspiration and groundwater discharge to the Santa Clara River during wet years. The groundwater discharge plot shows no obvious downward trend over time in groundwater discharges to streams or other discharge terms, and total discharges are do not show a continued downward trend over time. This indicates that the 2008 Operating Plan is sustainable in the long-term, a conclusion that is consistent with the examination of the groundwater elevation hydrographs discussed previously in Section 4.1.1.

Figure 4-17 compares the groundwater discharge terms for the 2008 and Potential Operating Plans. The figure shows that total groundwater discharges and discharges to streams are lower under the Potential Operating Plan than under the 2008 Operating Plan. The discharges to streams appear to decline gradually over time under the Potential Operating Plan, whereas these discharges appear more stable under the 2008 plan after the 1940s and early 1950s. This difference in groundwater discharge trends between the two operating plans is also evident in a plot showing the cumulative change in groundwater storage over time during the 86-year simulation period (Figure 4-18). The cumulative change in groundwater storage is a measure of the longer-term trends in the amount of groundwater in storage, and is plotted on a monthly basis. The 2008 Operating Plan shows a recovery of groundwater storage volumes beginning in the late 1970s, after the droughts of prior years. While the Potential Operating Plan also shows some recovery in the late 1970s, the curve as a whole remains lower in value after the 1940s than during the first two decades of the simulation.

In summary, the differences between the two operating plans' groundwater discharge trends and groundwater storage trends during the 86-year simulation period is consistent with the observed

trends in groundwater elevations and the associated conclusions about sustainability discussed above.

4.3 River Flows

Figure 4-19 shows the total flows estimated by the model for the Santa Clara River at the County Line gage, which is located at the western end of the Valley. The figure contains both a linear plot and a semi-logarithmic plot, to better illustrate the flows during low-flow periods. As shown by both plots, total flow in the river at the County Line varies considerably over time. This variation occurs because of temporal variations in rainfall, streamflow, and groundwater discharges to the river.

The influences of the local hydrology and the groundwater operating plans on the Santa Clara River are also shown by Figure 4-20, which displays the model-calculated volumes of monthly groundwater discharge to the river. Groundwater discharges to the river occur along the river reach lying downstream of the mouth of San Francisquito Canyon. The figure shows that the groundwater discharge rates to the river also vary over time, both seasonally and over multi-year periods. For the 2008 Operating Plan, the model simulates no groundwater discharge to the river at certain times during the droughts of the mid-1930s and the mid-1940s to mid-1970s. In contrast, the Potential Operating Plan not only results in smaller discharges to the river at most times, but also results in many more months of no groundwater discharge to the river compared with the 2008 Operating Plan.

As discussed by CH2M HILL (2004a), the river baseflow (flow other than from stormwater runoff) gage has increased at the County Line since water imports into the Valley began in 1980. Figure 4-21 shows the historically recorded monthly flow during the driest month of each year since 1950 and compares this flow with the driest-month flow predicted to occur each year under the 2008 and Potential Operating Plans. The plot shows that under the local, ambient hydrologic conditions observed from 1922 through 1979, the 2008 Operating Plan would have maintained river flows at levels higher than were actually recorded during those years (prior to the importation of water). The Potential Operating Plan also would have maintained higher river flow in most years, with a few years (1969, 1972, and 1975) showing similar driest-month river flows as were historically recorded. This indicates that both operating plans, and in particular the 2008 Operating Plan, will maintain river flows at higher levels than occurred prior to urbanization of the Valley.

4.4 Relationship of Simulation Results to Future Conditions

The curves presented on Figures 4-1 through 4-21 provide a general indication of the types of fluctuations in groundwater conditions that could be expected to occur in the future in the Santa Clarita Valley over a period of many years under the two operating plans. However, these curves have been derived using an assumed sequence of local hydrologic conditions that is based on the sequence of rainfall and streamflow volumes that were measured during the past several decades. In the future, the year-to-year volumes and trends in rainfall and streamflow could vary from those observed in the past because of 1) changes in the timing and magnitude of multi-decadal cycles of drought and wetter-than-normal conditions such as those that have been observed in the

past; and/or 2) because of global-scale changes in climate. The latter topic and its potential effect on the sustainability of the 2008 Operating Plan are discussed in the following Chapter 5 of this report.

Ta le

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er Santa lara i er roun ater asin, ast Subbasin, os ngeles ount , alifornia

Well Name	Alluvial Subarea	Original 2008 Operating Plan			Re-Distributed 2008 Operating Plan			Comments
		Normal	Dry Yr 1	Dry Yr 2+	Normal	Dry Yr 1	Dry Yr 2+	
NCWD-Pinetree 1	Above Mint Canyon	150	0	0	150	0	0	
NCWD-Pinetree 3	Above Mint Canyon	350	300	300	350	300	300	
NCWD-Pinetree 4	Above Mint Canyon	300	200	200	300	200	200	
NCWD-Pinetree 5	Above Mint Canyon	300	200	200	300	200	200	
Robinson Ranch	Above Mint Canyon	600	550	450	600	550	450	
SCWD-Sand Canyon	**Above Mint Canyon**	**1,000**	**600**	**200**	**200**	**150**	**0**	**Reduce these three wells by 1,600 afy in order to**
SCWD-Lost Canyon 2	**Above Mint Canyon**	**700**	**700**	**650**	**300**	**150**	**0**	**offset increased pumping at the SCWD-Santa Clara and**
SCWD-Lost Canyon 2A	**Above Mint Canyon**	**700**	**650**	**600**	**300**	**150**	**0**	**SCWD-Bouquet wells in the "Above Saugus WRP" area.**
SCWD-Mitchell #5A	Above Mint Canyon	500	350	200	500	350	200	
SCWD-Mitchell #5B	Above Mint Canyon	800	550	300	800	550	300	
SCWD-N. Oaks Central	Above Mint Canyon	850	800	700	850	800	700	
SCWD-N. Oaks East	Above Mint Canyon	800	750	700	800	750	700	
SCWD-N. Oaks West	Above Mint Canyon	800	750	700	800	750	700	
SCWD-Sierra	Above Mint Canyon	1,100	900	700	1,100	900	700	
Mint Canyon Total		**8,950**	**7,300**	**5,900**	**7,350**	**5,800**	**4,450**	
SCWD-Honby	Above Saugus WRP	1,000	850	700	1,000	850	700	
SCWD-Santa Clara	Above Saugus WRP	800	800	800	800	800	800	
SCWD-Valley Center	**Above Saugus WRP**	**0**	**0**	**0**	**800**	**800**	**800**	**Pumps 800 afy moved from the "Above Mint Canyon" area.**
SCWD-Bouquet	**Above Saugus WRP**	**0**	**0**	**0**	**800**	**800**	**800**	**Pumps 800 afy moved from the "Above Mint Canyon" area.**
VWC-T7	Above Saugus WRP	750	750	750	750	750	750	
VWC-U4	Above Saugus WRP	800	800	800	800	800	800	
VWC-U6	Above Saugus WRP	800	800	800	800	800	800	
Above Saugus WRP Total		**4,150**	**4,000**	**3,850**	**5,750**	**5,600**	**5,450**	
VWC-N	Below Saugus WRP	650	650	650	650	650	650	
VWC-N7	Below Saugus WRP	1,160	1,160	1,160	1,160	1,160	1,160	
VWC-N8	Below Saugus WRP	1,160	1,160	1,160	1,160	1,160	1,160	
VWC-Q2	Below Saugus WRP	1,100	1,100	1,100	1,100	1,100	1,100	
VWC-S6	Below Saugus WRP	1,000	1,000	1,000	1,000	1,000	1,000	
VWC-S7	Below Saugus WRP	500	500	500	500	500	500	
VWC-S8	Below Saugus WRP	500	500	500	500	500	500	
Below Saugus WRP Total		**6,070**	**6,070**	**6,070**	**6,070**	**6,070**	**6,070**	
NLF-161	Below Valencia WRP	1,000	1,000	1,000	1,000	1,000	1,000	
NLF-B10	Below Valencia WRP	500	350	350	500	350	350	
NLF-B11	Below Valencia WRP	100	200	200	100	200	200	
NLF-B14	Below Valencia WRP	300	1,000	1,000	300	1,000	1,000	
NLF-B20	Below Valencia WRP	350	500	500	350	500	500	
NLF-B5	Below Valencia WRP	2,400	1,900	1,900	2,400	1,900	1,900	
NLF-B6	Below Valencia WRP	1,100	1,100	1,100	1,100	1,100	1,100	
NLF-C	Below Valencia WRP	1,100	1,000	1,000	1,100	1,000	1,000	
NLF-C3	Below Valencia WRP	100	200	200	100	200	200	
NLF-C4	Below Valencia WRP	200	450	450	200	450	450	
NLF-C5	Below Valencia WRP	900	850	850	900	850	850	
NLF-C7	Below Valencia WRP	350	300	300	350	300	300	
NLF-C8	Below Valencia WRP	400	400	400	400	400	400	
NLF-E5	Below Valencia WRP	100	150	150	100	150	150	
NLF-E9	Below Valencia WRP	900	350	350	900	350	350	
NLF-G45	Below Valencia WRP	350	400	400	350	400	400	
VWC-E15	Below Valencia WRP	800	800	800	800	800	800	
Below Valencia WRP Total		**10,950**	**10,950**	**10,950**	**10,950**	**10,950**	**10,950**	
SCWD-Clark	Bouquet Canyon	700	700	700	700	700	700	
SCWD-Guida	Bouquet Canyon	1,300	1,250	1,200	1,300	1,250	1,200	
Bouquet Canyon Total		**2,000**	**1,950**	**1,900**	**2,000**	**1,950**	**1,900**	
VWC-W10	San Francisquito Canyon	1,000	1,000	1,000	1,000	1,000	1,000	
VWC-W11	San Francisquito Canyon	800	800	800	800	800	800	
VWC-W9	San Francisquito Canyon	950	950	950	950	950	950	
San Francisquito Canyon Total		**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	**2,750**	
NCWD-Castaic 1	Castaic Valley	350	300	250	350	300	250	
NCWD-Castaic 2	Castaic Valley	100	100	100	100	100	100	
NCWD-Castaic 4	Castaic Valley	100	0	0	100	0	0	
NCWD-Castaic 7	Castaic Valley	300	200	200	300	200	200	
VWC-D	Castaic Valley	880	880	880	880	880	880	
WHR	Castaic Valley	2,000	2,000	2,000	2,000	2,000	2,000	
Castaic Valley Total:		**3,730**	**3,480**	**3,430**	**3,730**	**3,480**	**3,430**	
Total Alluvial Pumping		**38,600**	**36,500**	**34,850**	**38,600**	**36,600**	**35,000**	**Current Operating Plan:** **35,000 to 40,000 AF/yr in normal and wet years** **30,000 to 35,000 AF/yr in dry years**

Notes:
All pumping volumes are listed in acre-feet per year (afy).
Wells that are not listed are assumed to not be pumping in the future.
NLF = Newhall Land & Farming Company
NCWD = Newhall County Water District
SCWD = Santa Clarita Division of Castaic Lake Water Agency
VWC = Valencia Water Company
WHR = Wayside Honor Rancho, whose wells are owned by the Los Angeles County Waterworks District No. 36

Figure 4-1: VWC-E15 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Alluvial Aquifer Below Valencia WRP)

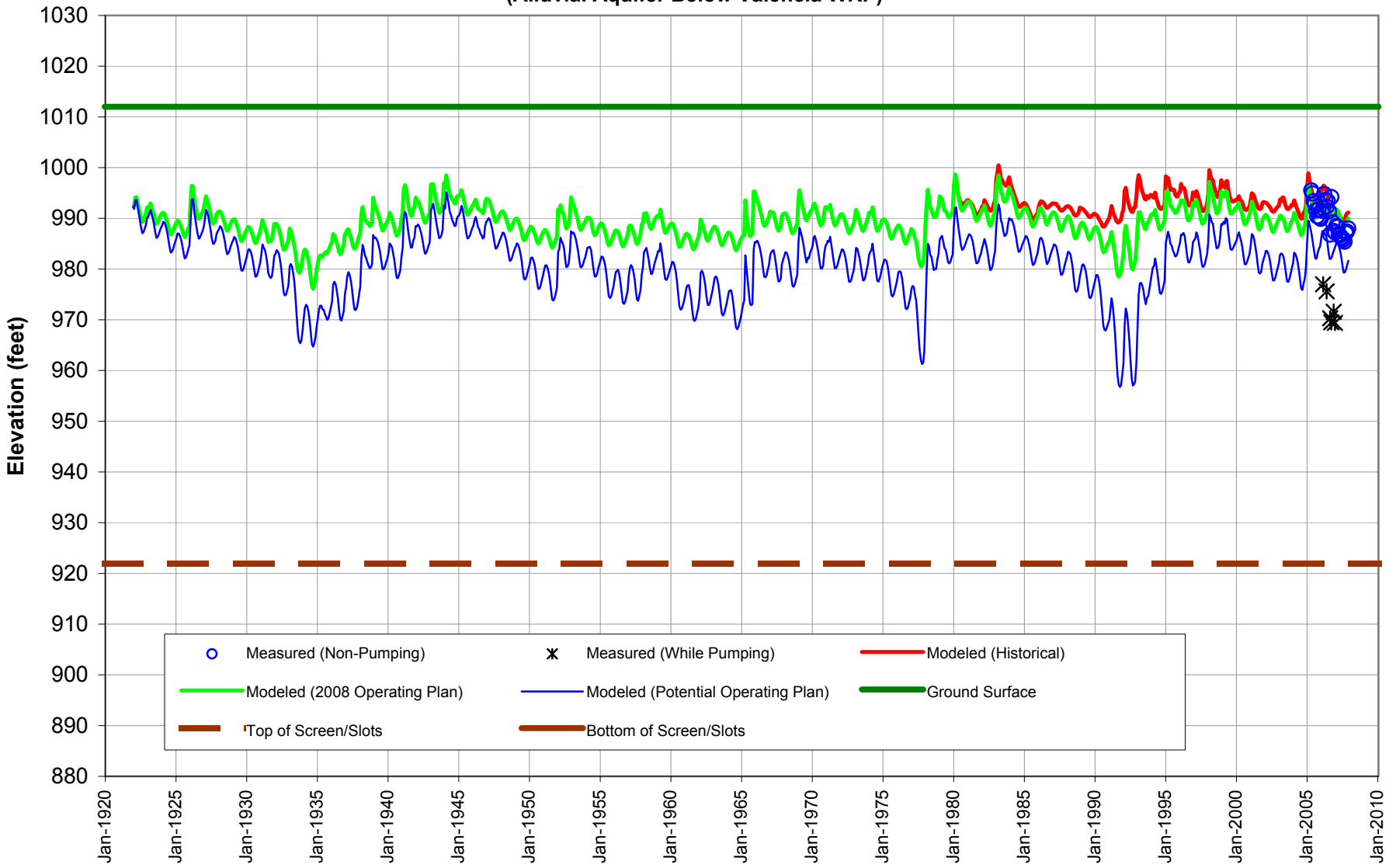


Figure 4-2: VWC-S8 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Alluvial Aquifer Below Saugus WRP)

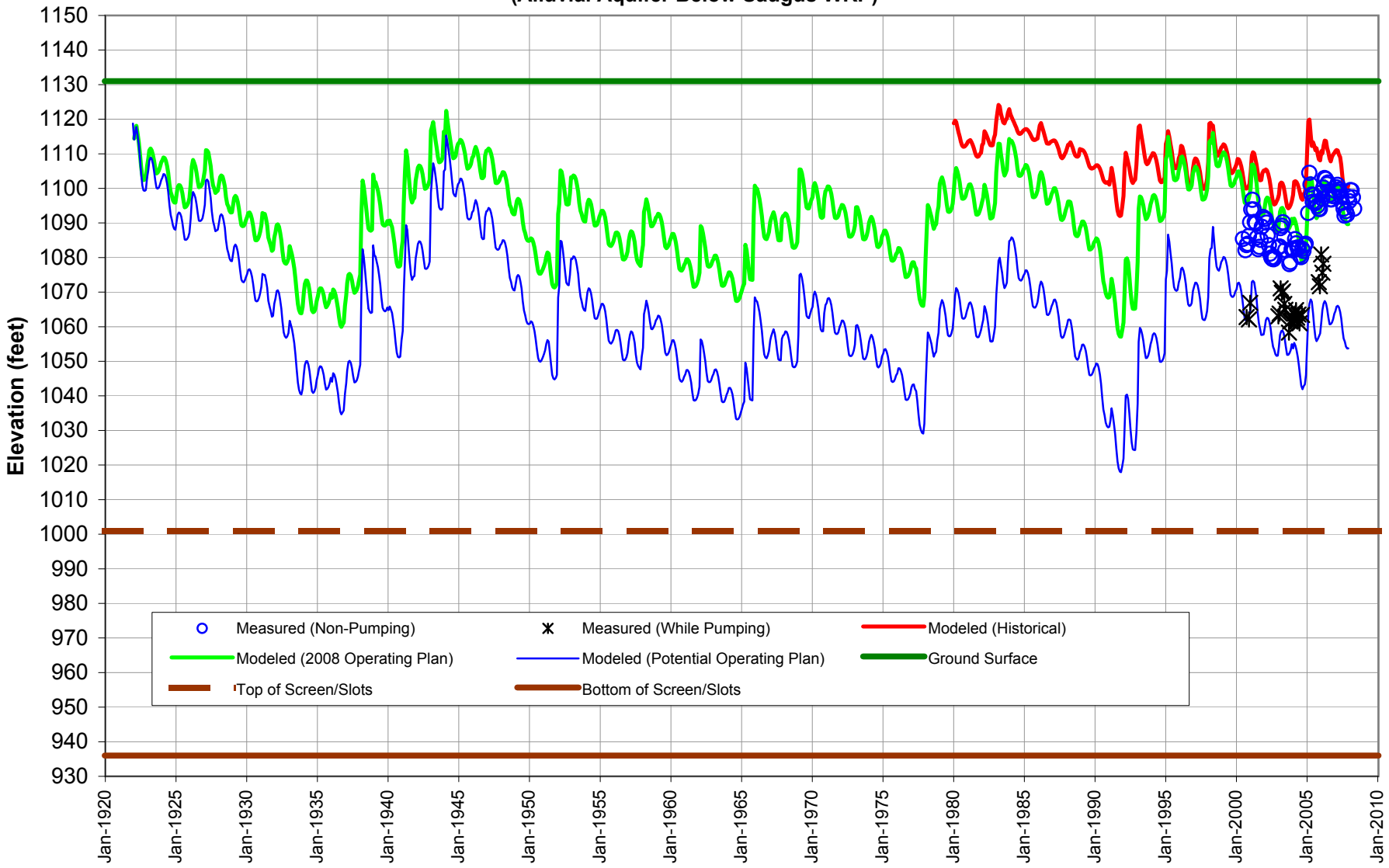


Figure 4-3: VWC-T7 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Alluvial Aquifer Above Saugus WRP)

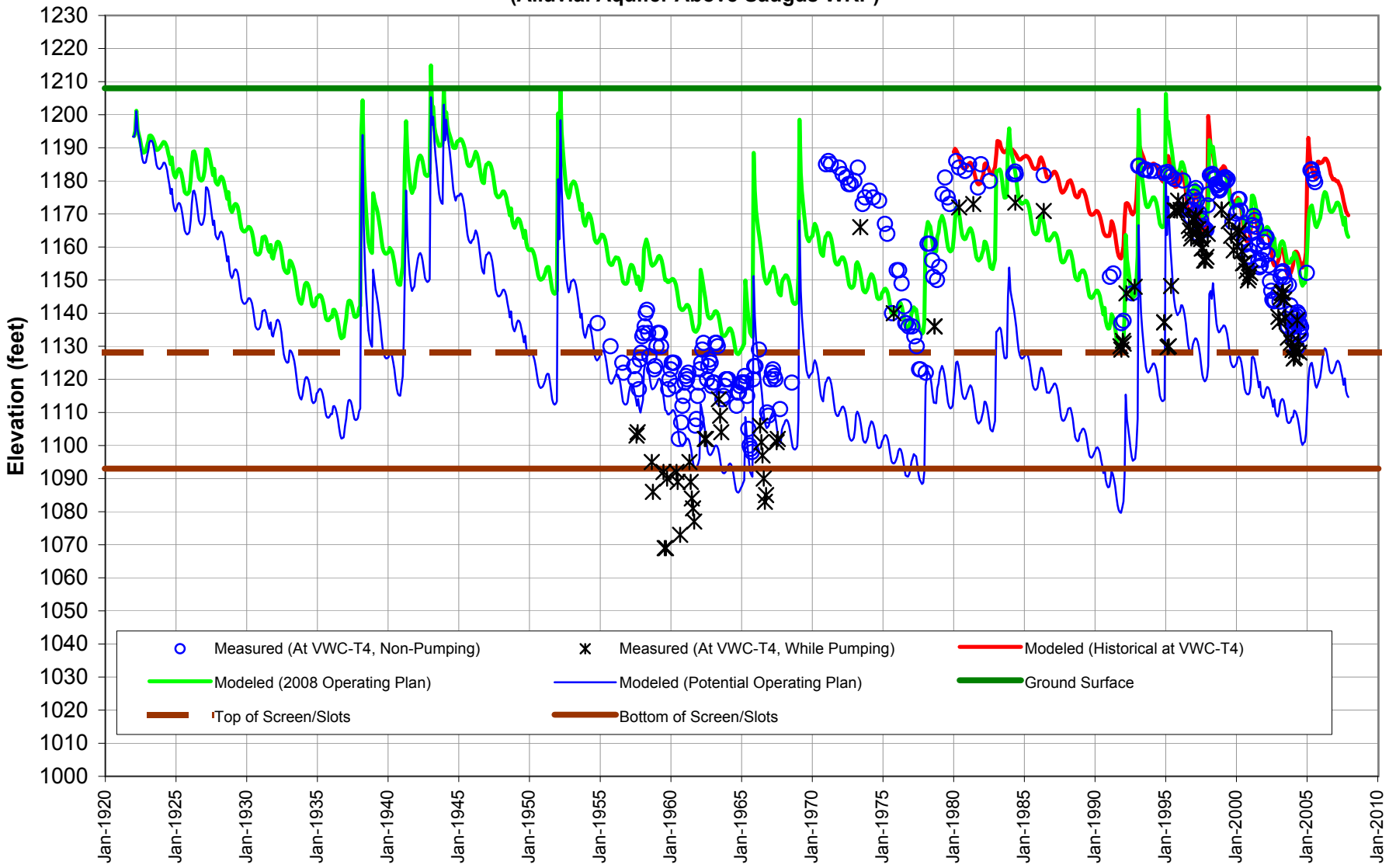


Figure 4-4: SCWD - Sierra Modeled Groundwater Elevations for 2008 and Potential Operating Plans
(Alluvial Aquifer Along Santa Clara River, At and Above Mint Canyon)

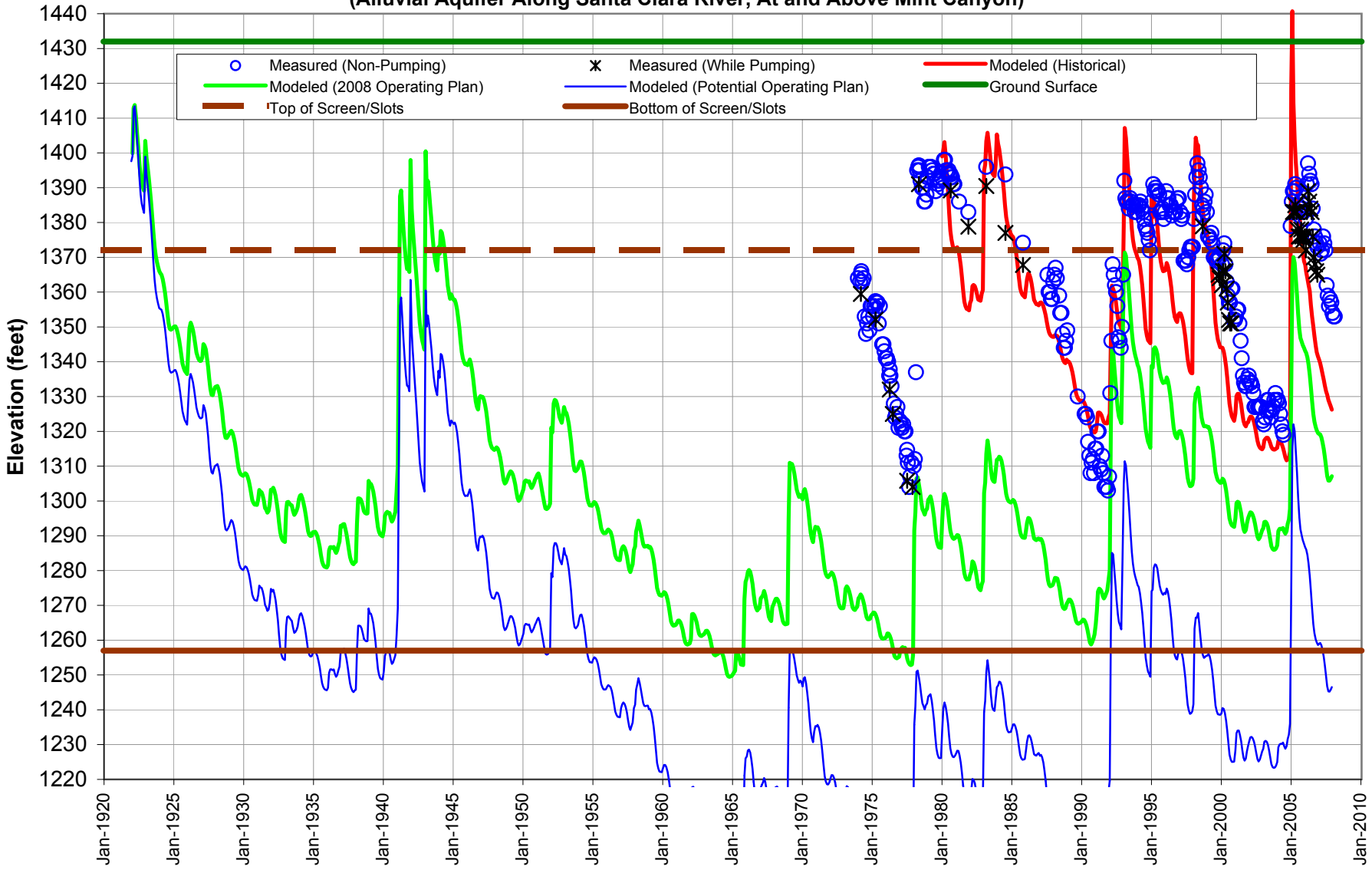


Figure 4-5: NCWD - Pinetree 1 Modeled Groundwater Elevations for 2008 and Potential Operating Plans
(Alluvial Aquifer Along Santa Clara River, At and Above Mint Canyon)

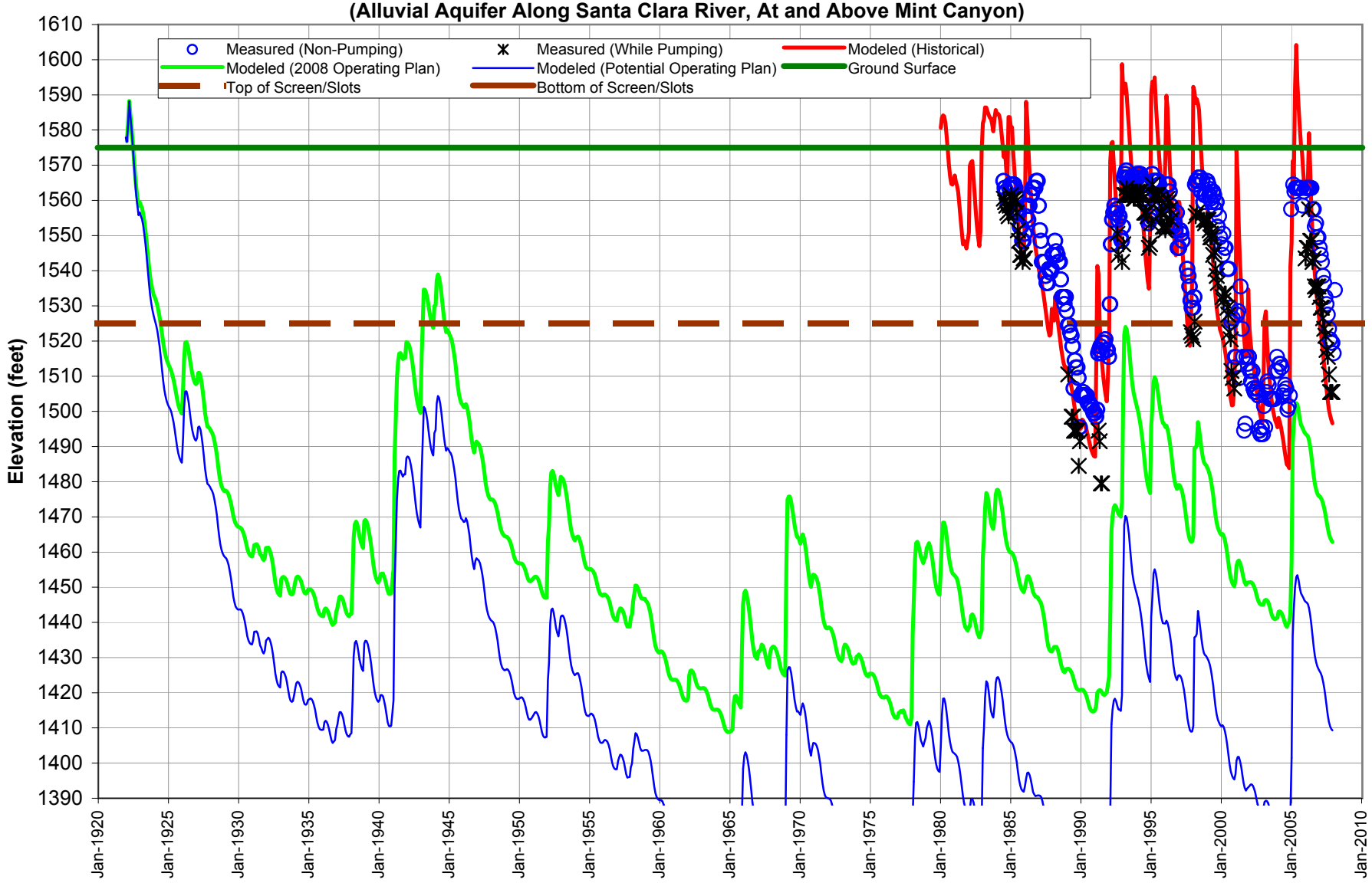


Figure 4-6: NCWD - Castaic 7 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Alluvial Aquifer in Castaic Valley)

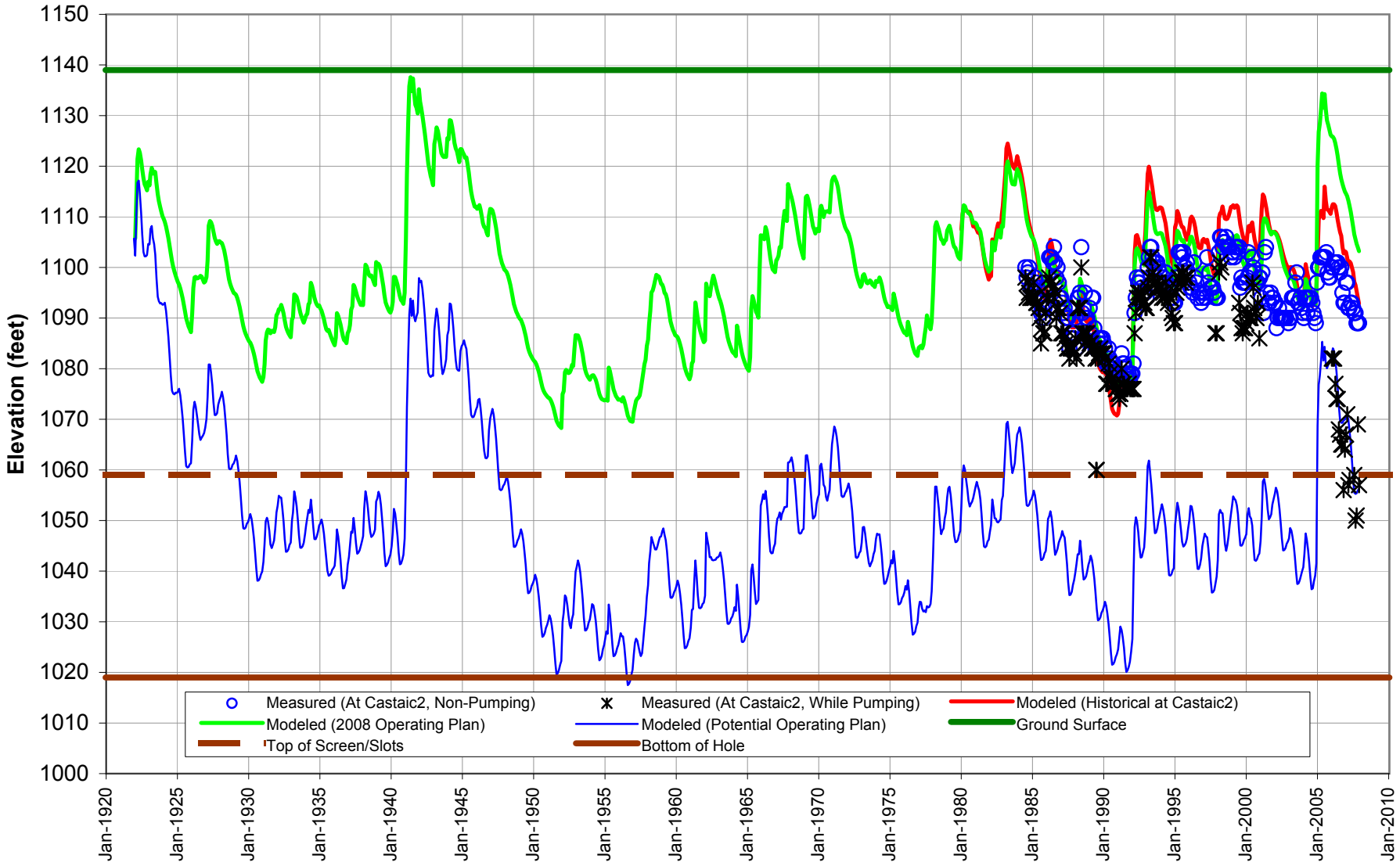


Figure 4-7: VWC-W11 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Alluvial Aquifer in San Francisquito Canyon)

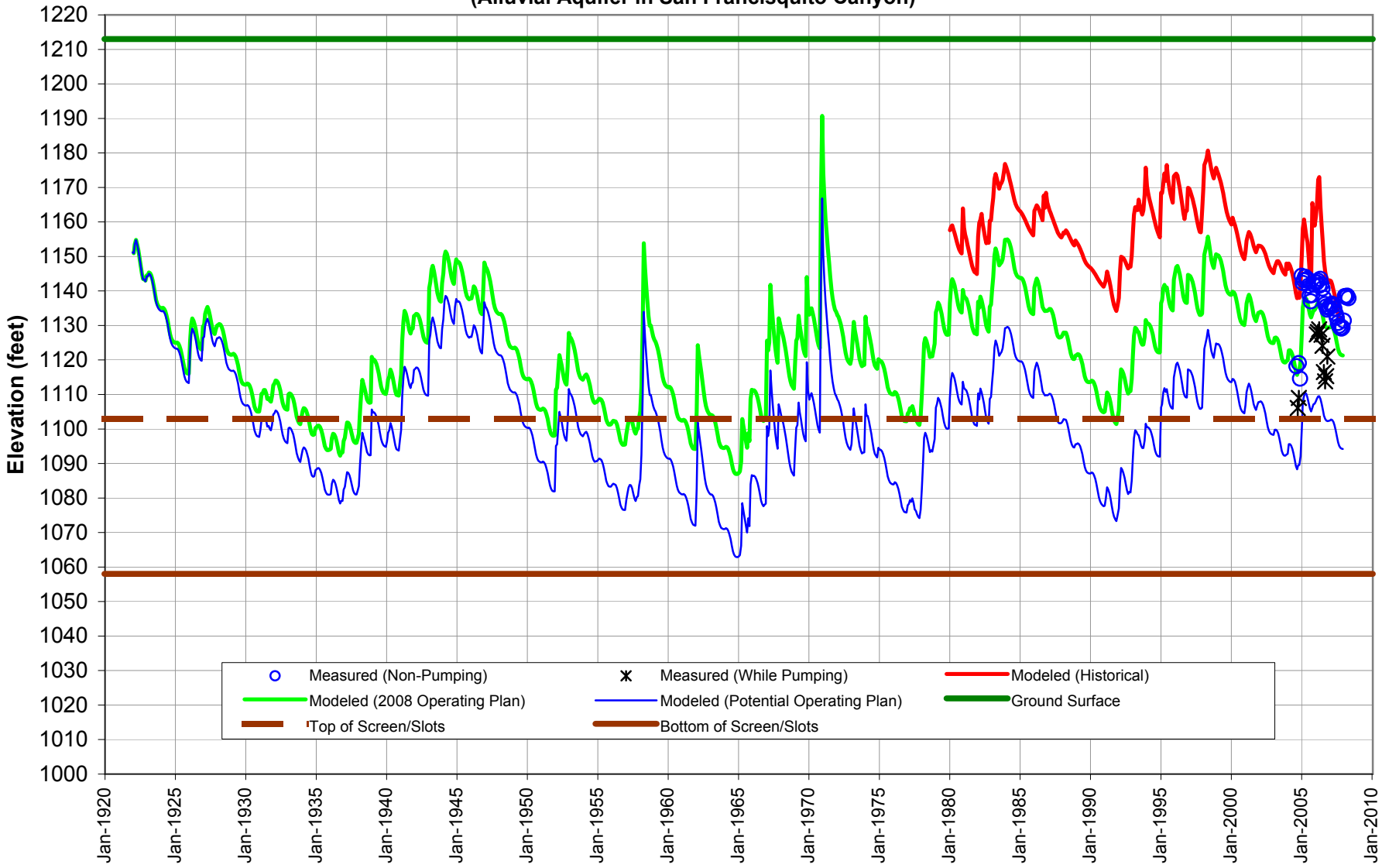


Figure 4-8: SCWD - Clark Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Alluvial Aquifer in Bouquet Canyon)

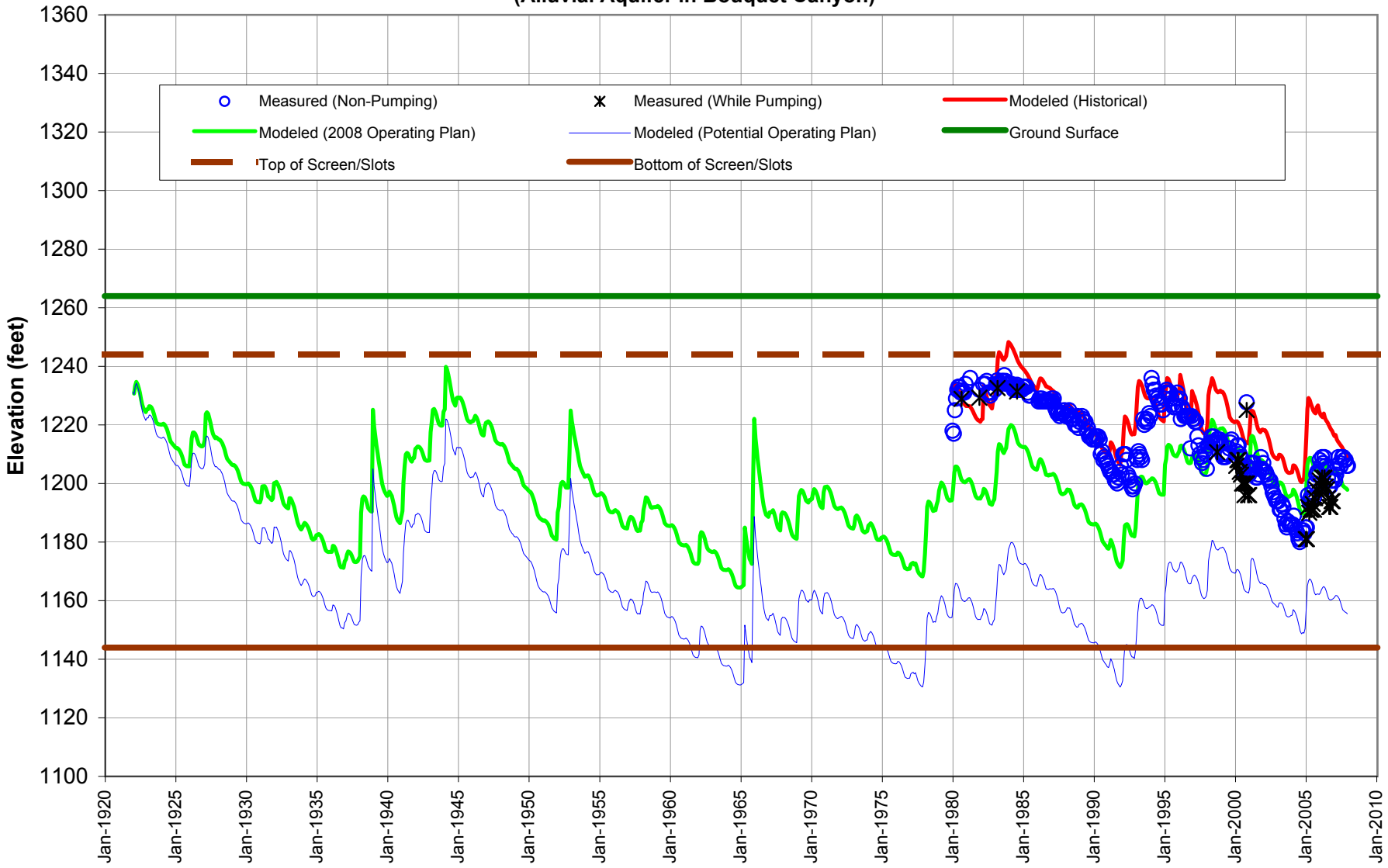


Figure 4-9: SCWD-Saugus1 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Saugus Formation)

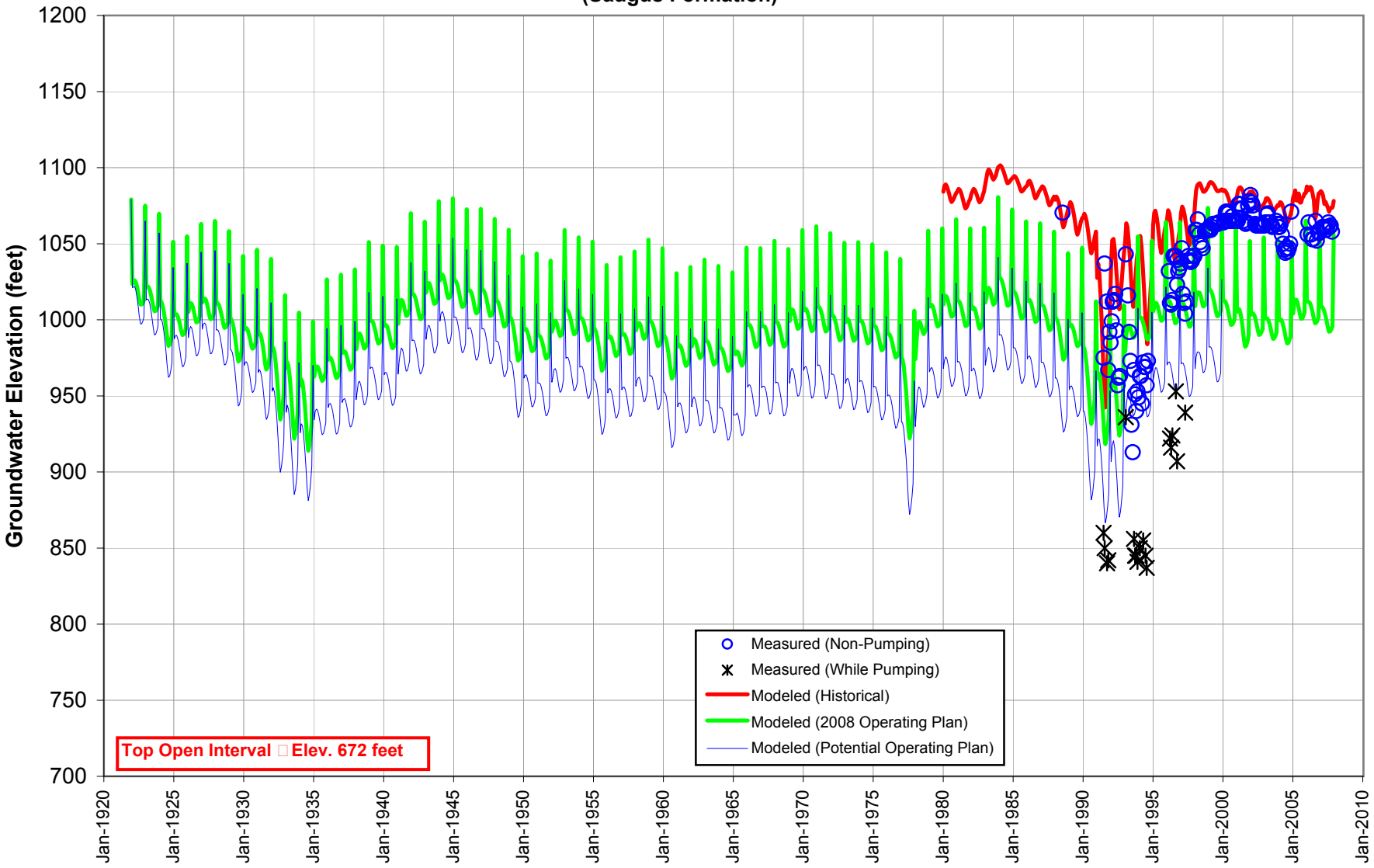


Figure 4-10: VWC-206 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Saugus Formation)

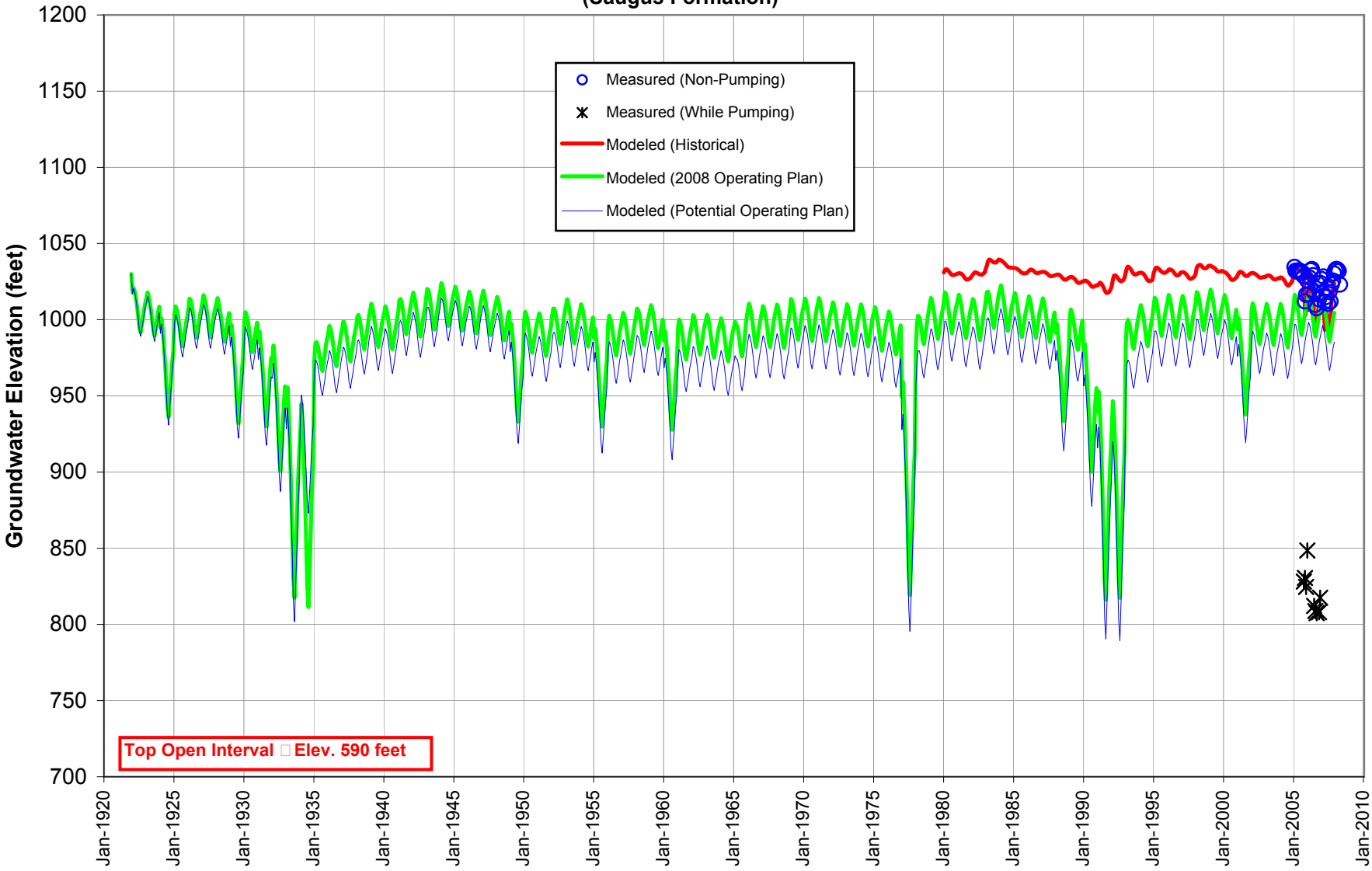


Figure 4-11: NCWD-13 Modeled Groundwater Elevations for 2008 and Potential Operating Plans (Saugus Formation)

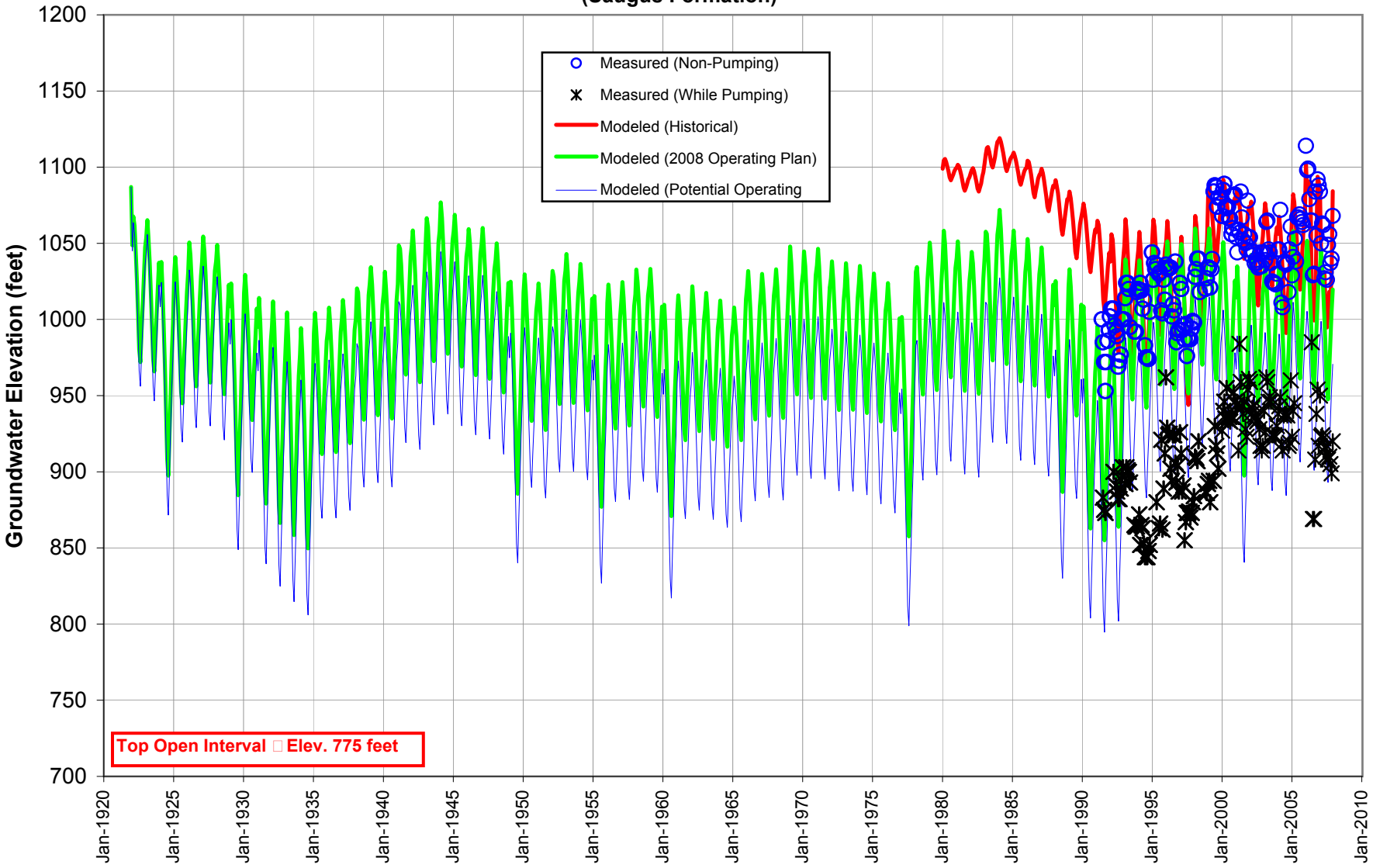


Figure 4-12: VWC-T7 Modeled Groundwater Elevations for Initial and Modified 2008 Operating Plans (Alluvial Aquifer Above Saugus WRP)

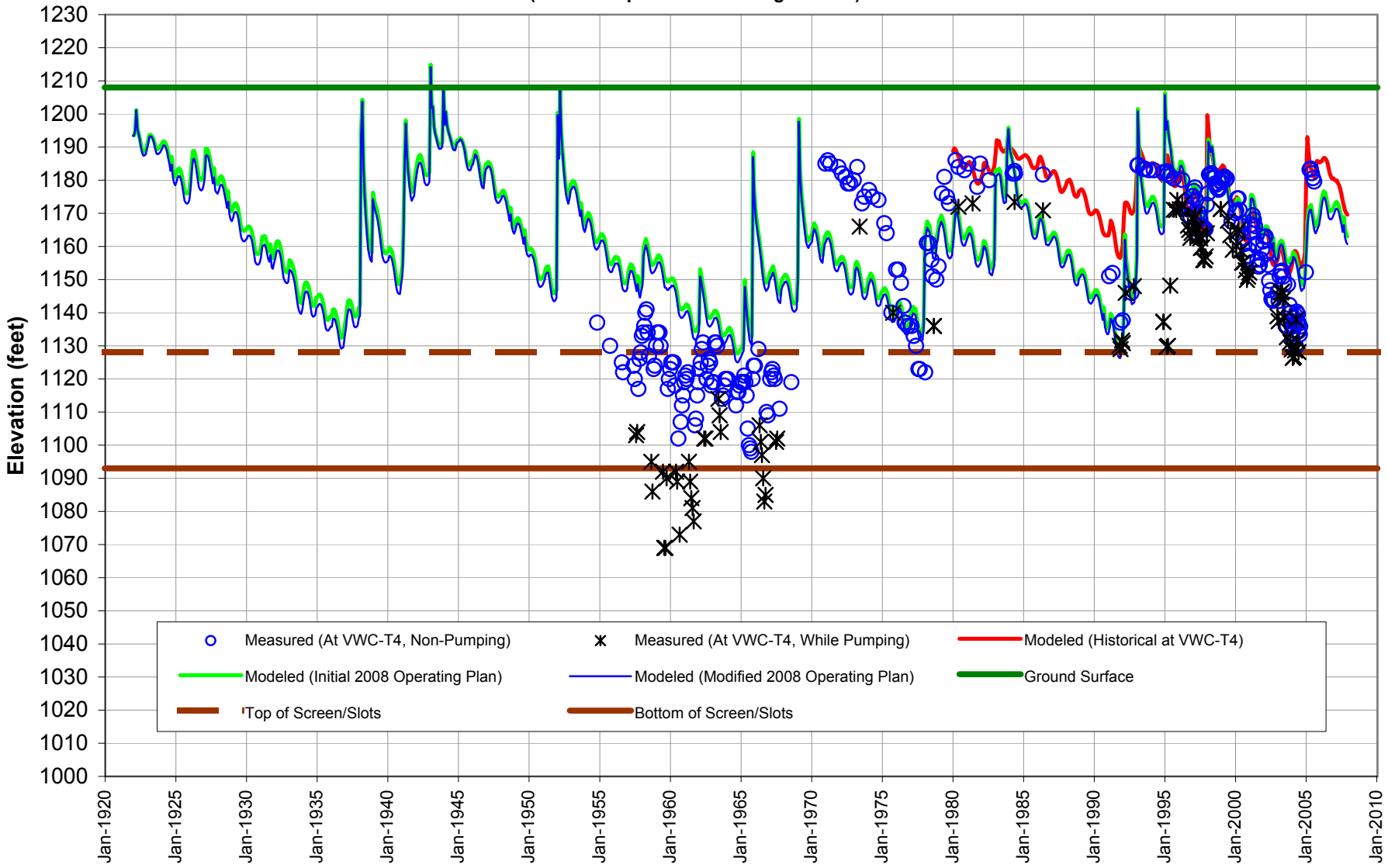


Figure 4-13: SCWD-Clark Modeled Groundwater Elevations for Initial and Modified 2008 Operating Plans (Alluvial Aquifer in Bouquet Canyon)

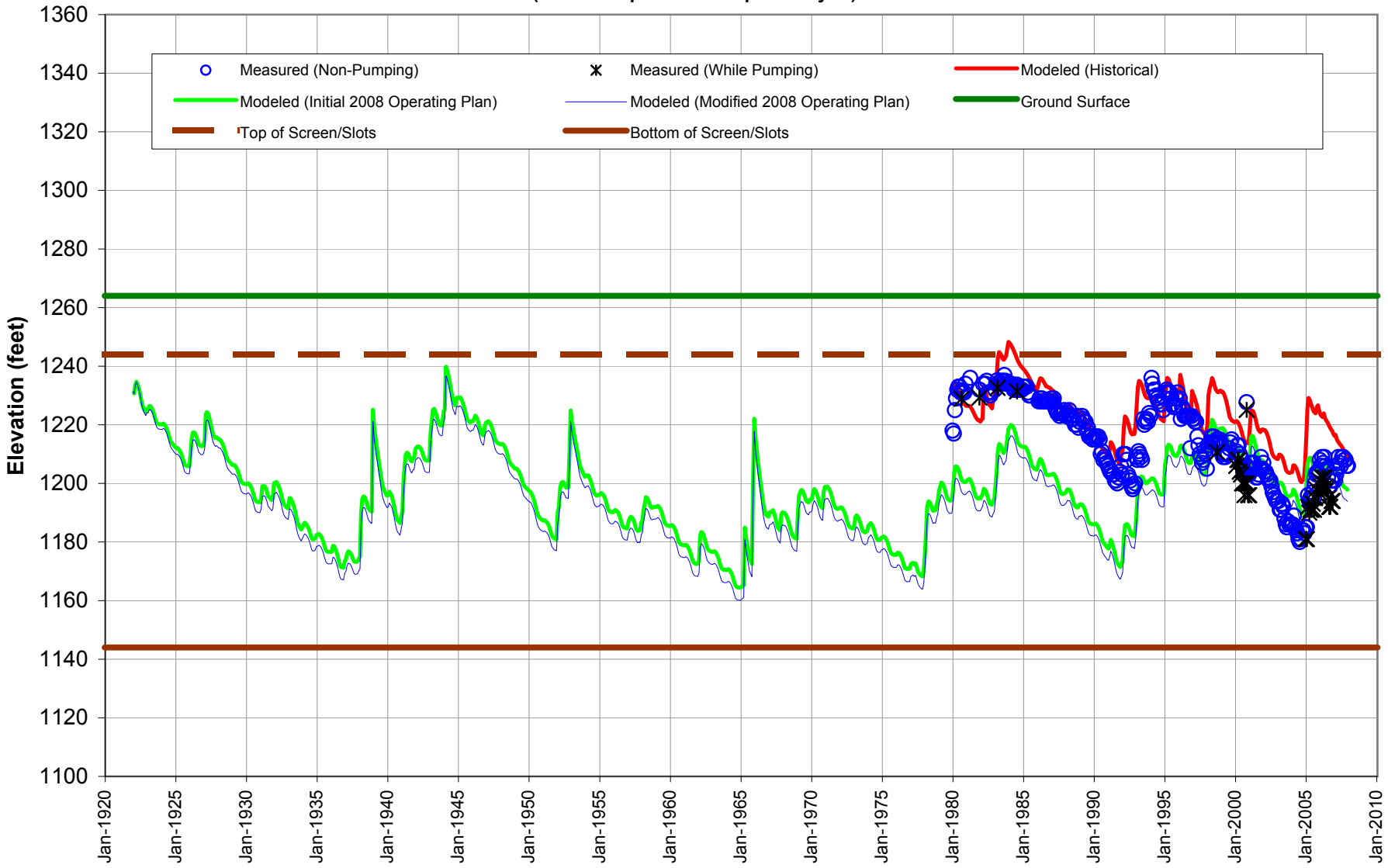


Figure 4-14: SCWD-Sierra Modeled Groundwater Elevations for Initial and Modified 2008 Operating Plans
(Alluvial Aquifer Along Santa Clara River, At and Above Mint Canyon)

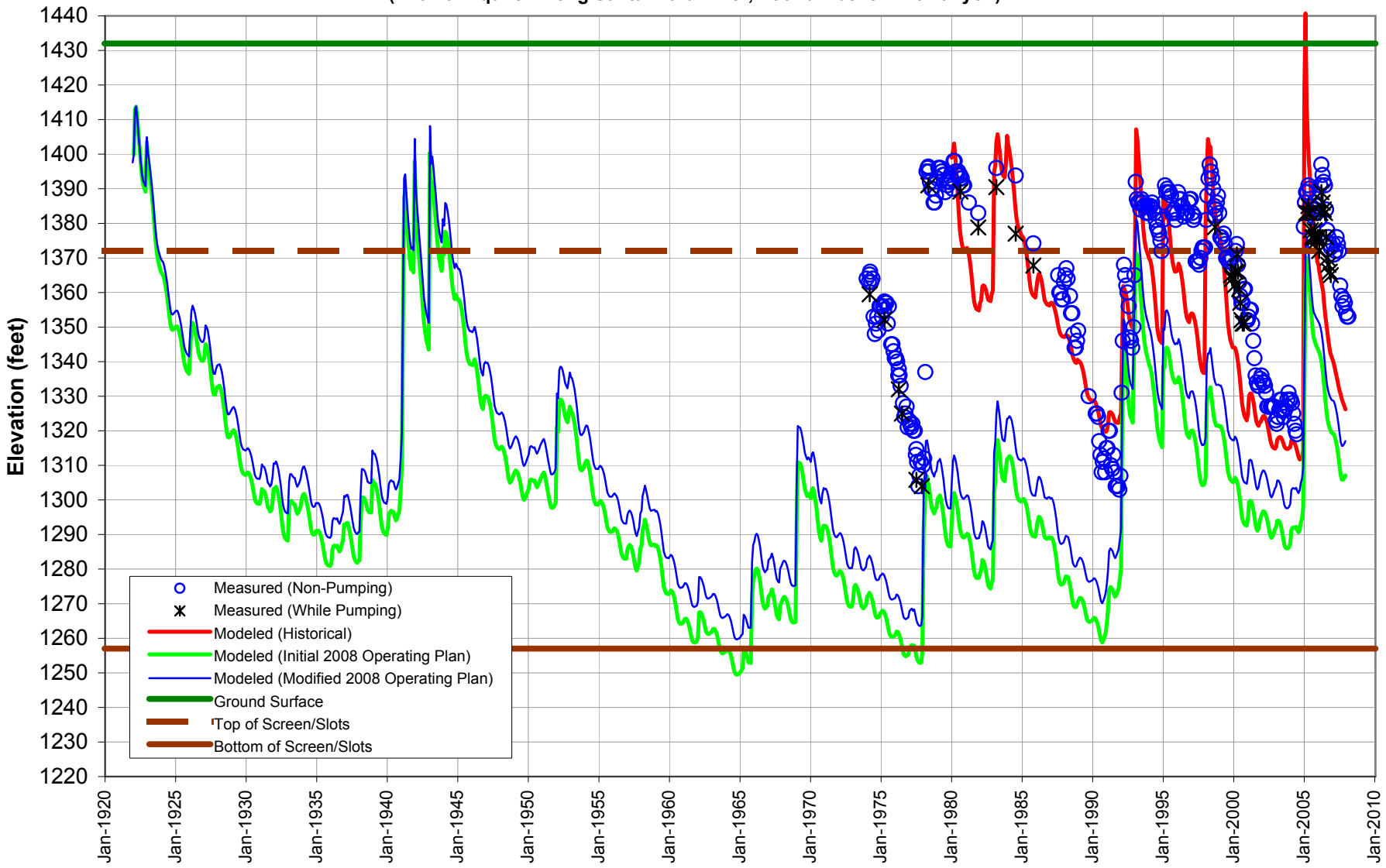


Figure 4-15: NCWD-Pinetree3 Modeled Groundwater Elevations for Initial and Modified 2008 Operating Plans
(Alluvial Aquifer Along Santa Clara River, At and Above Mint Canyon)

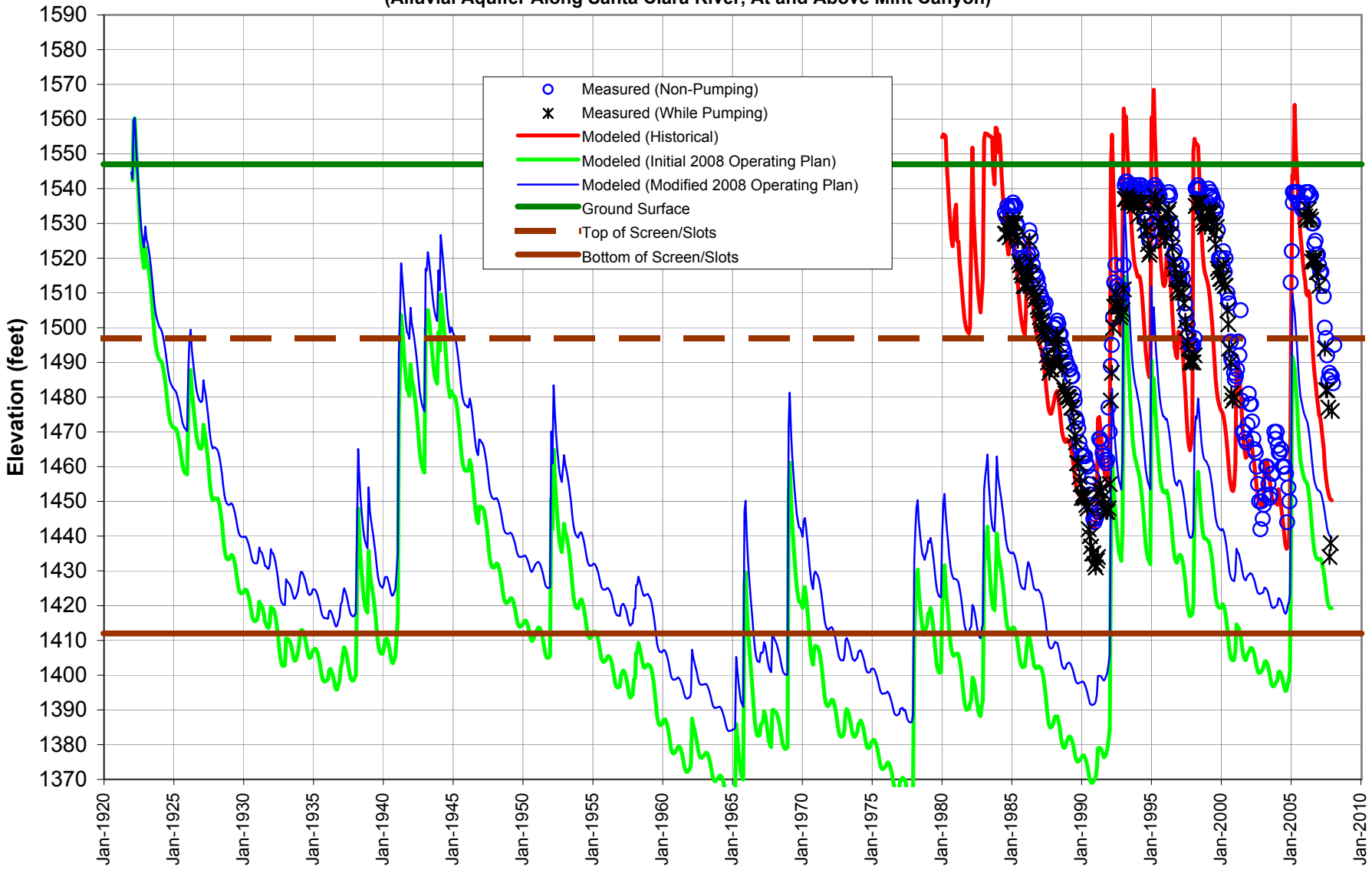
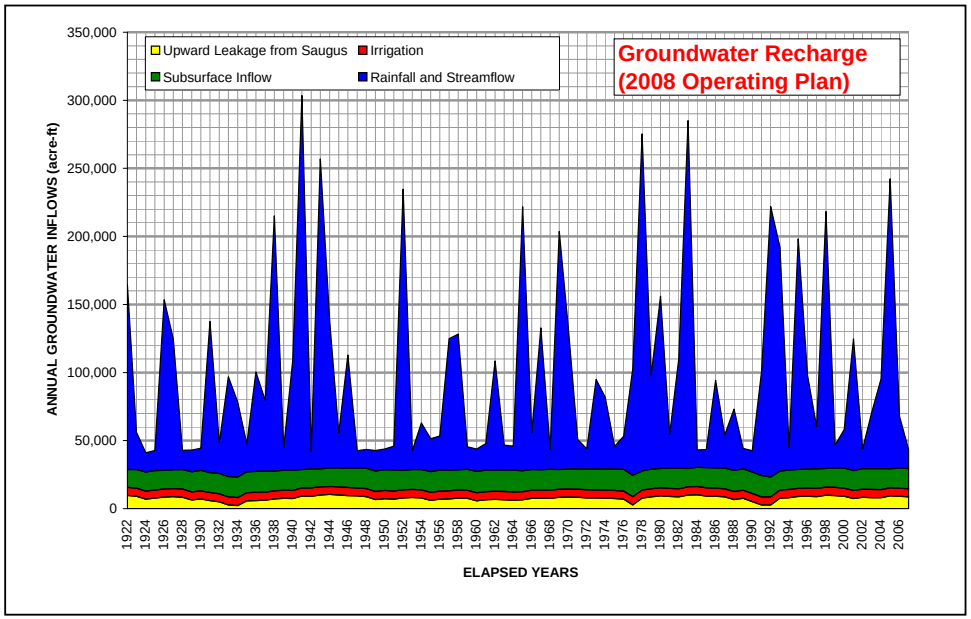
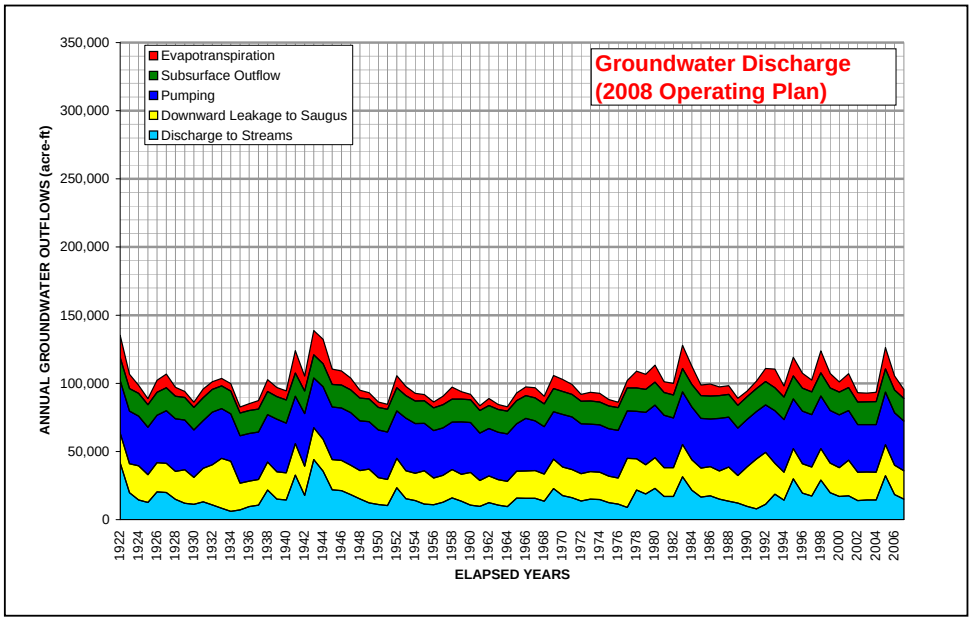


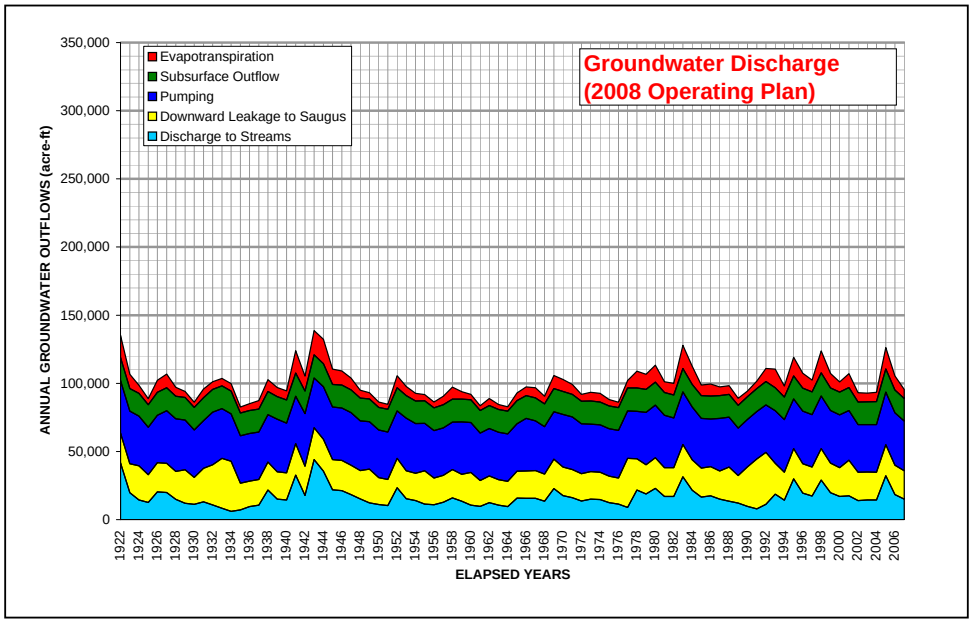
Figure 4-16: Comparison of Simulated Trends in Groundwater Recharge and Discharge Terms for the 2008 Operating Plan Under Historical Hydrology

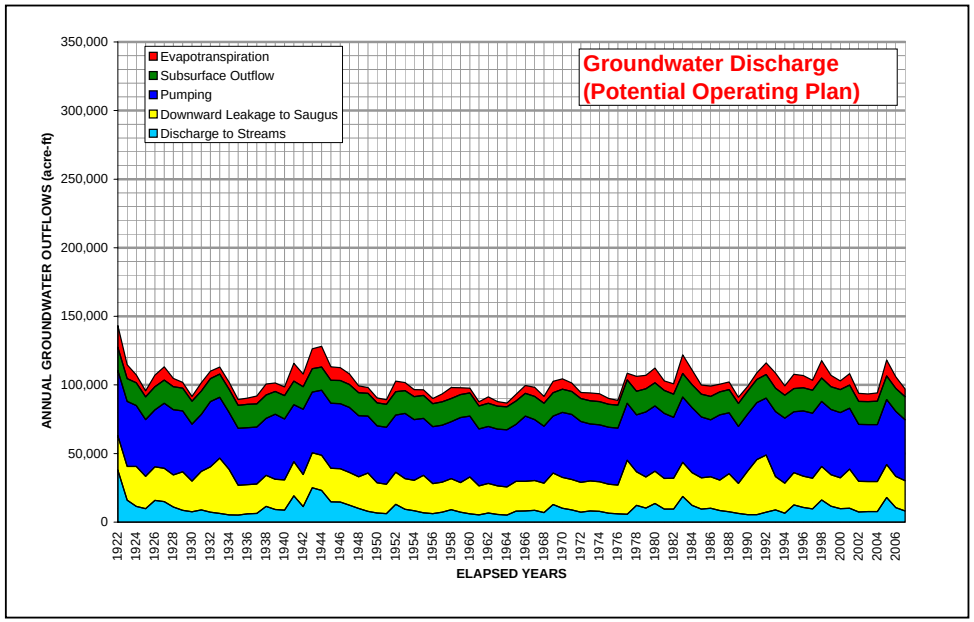




Figures_Section4_Part3_WaterBudget.xls/Figure4-16

Figure 4-17: Comparison of Simulated Trends in Groundwater Discharge Terms for the 2008 and Potential Operating Plans Under Historical Hydrology





Figures_Section4_Part3_WaterBudget.xls/Figure4-17

Figure 4-18: Cumulative Change in Groundwater Storage Volume

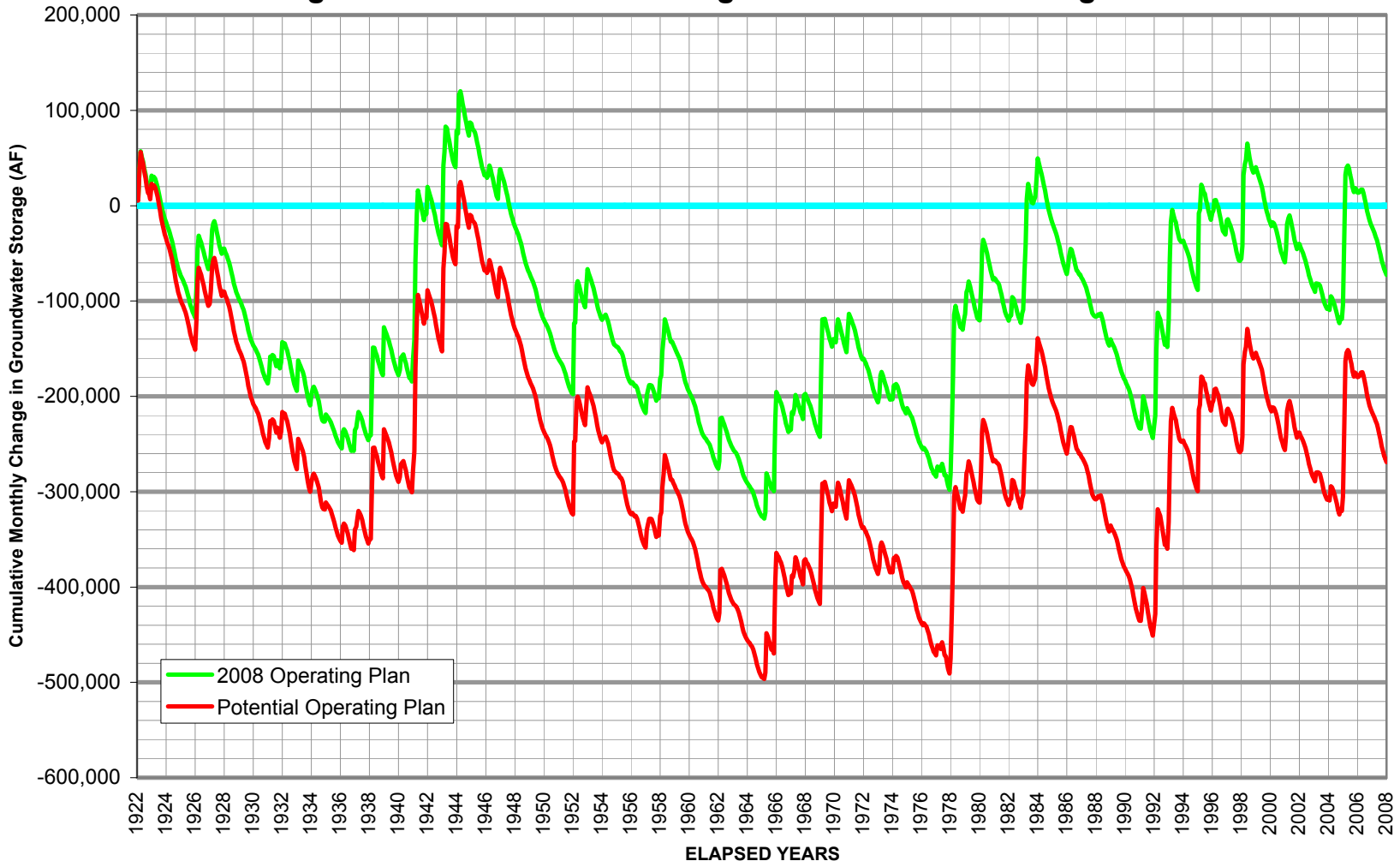
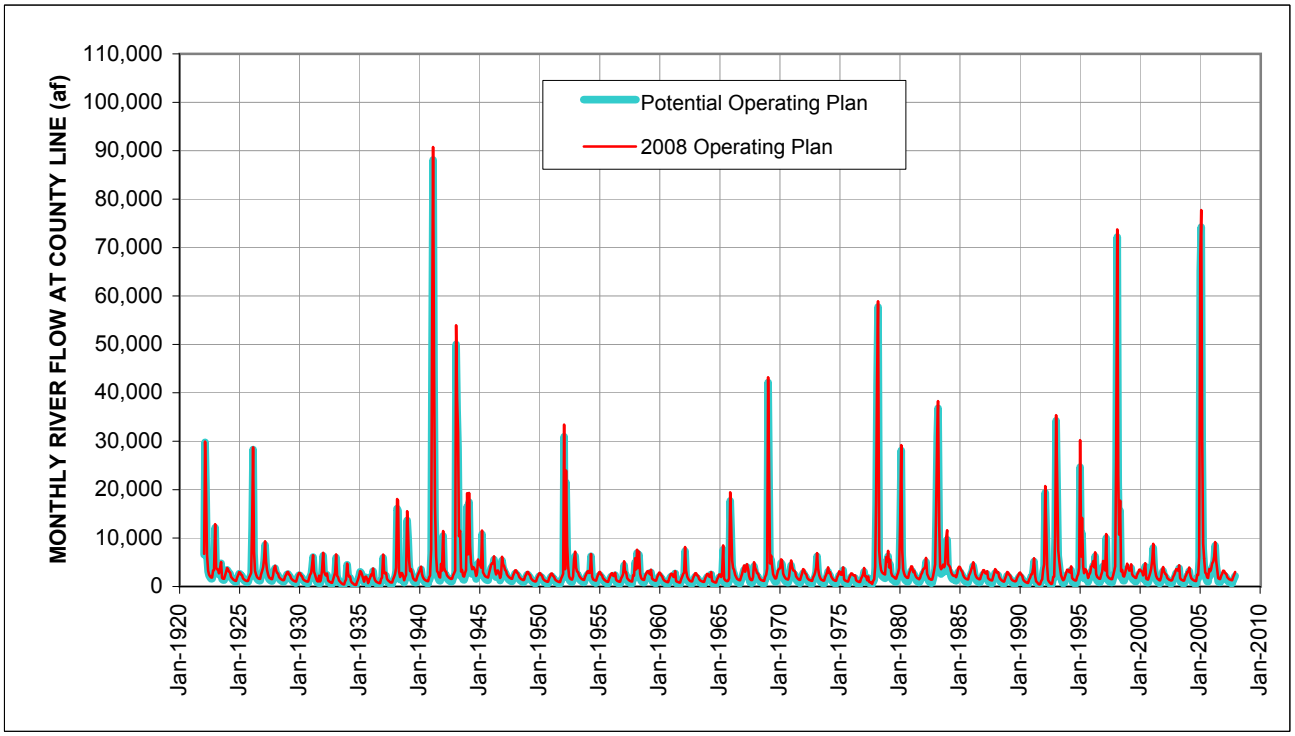


Figure 4-19
Simulated Monthly Flow in the Santa Clara River at the County Line
For the 2008 and Potential Operating Plans Under Historical Hydrology



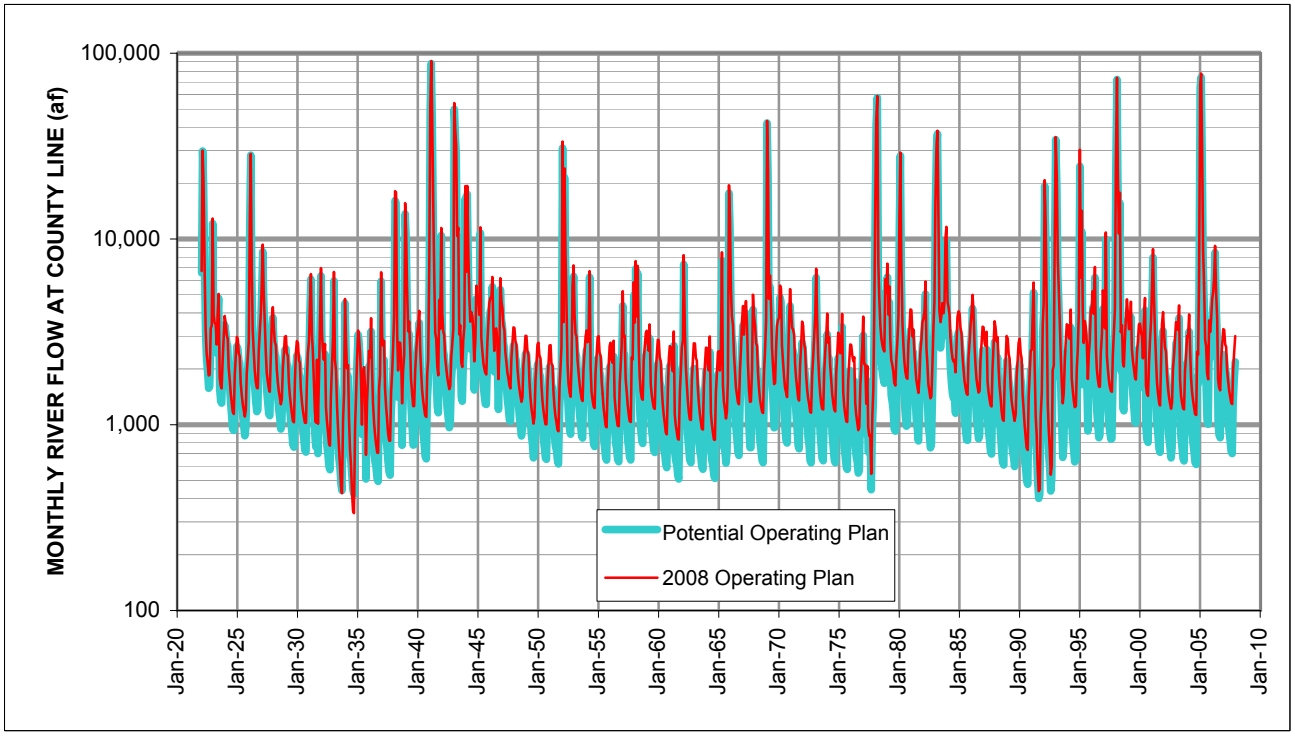


Figure 4-20
Modeled and Estimated Monthly Groundwater Discharges to the Perennial Reach of the Santa Clara River (from Round Mountain to Blue Cut)

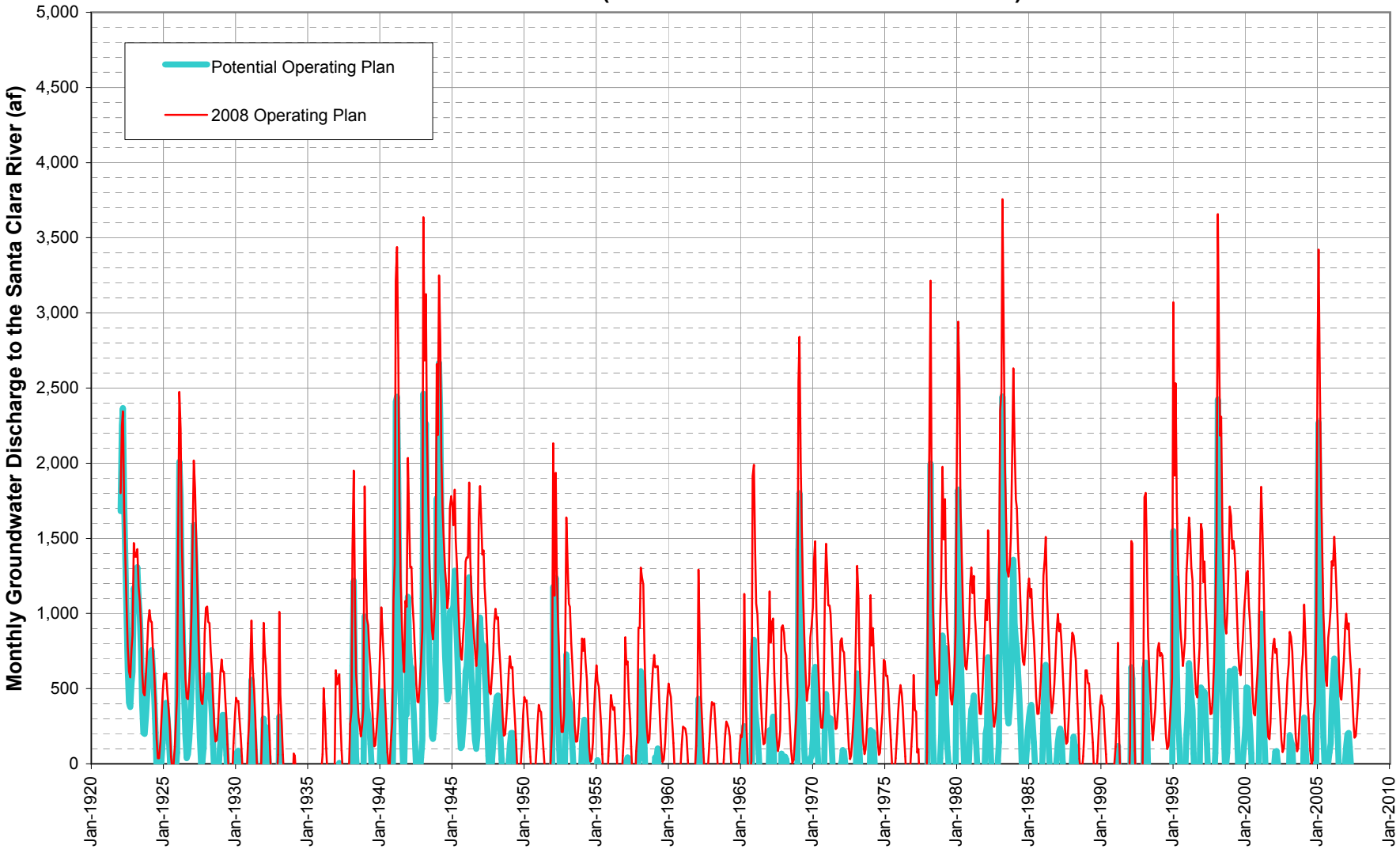
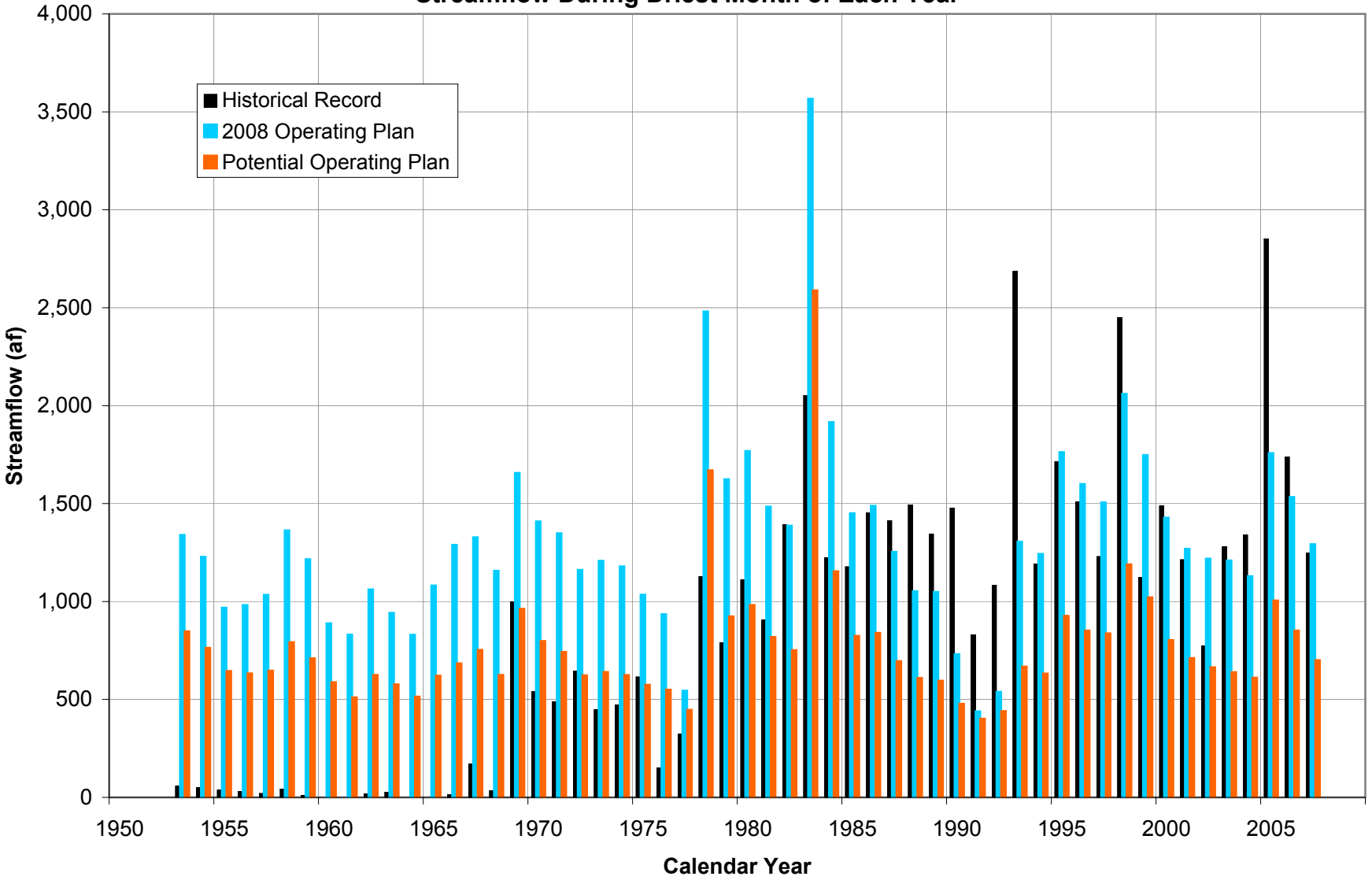


Figure 4-21
Streamflow During Driest Month of Each Year



V. Climate Change Considerations

This section of the report describes an analysis of the potential impacts of climate change on the 2008 Operating Plan for the Santa Clarita Valley. The analysis simulates a group of different potential future groundwater recharge events arising from a suite of published spatial-temporal distributions of future rainfall, as derived from global climate models that in turn have been scaled to watershed scales throughout California, including at the scale of the Santa Clarita Valley. The rainfall distributions, which are also known as rainfall projections, account for a variety of possible changes in global climate and have been published by climatologists conducting research and modeling of possible changes in climate arising from historic and potential future greenhouse gas emissions.

Following are discussions of the objectives of the analysis, a description of the technical approach that was used to simulate potential climate change effects on the local groundwater system in the Santa Clarita Valley, and the results of the modeling evaluation as they pertain to the 2008 Operating Plan. An overview of the current understanding regarding potential climate change in southern California is contained in Appendix D, along with details regarding the projections of future rainfall that were used in the groundwater model to evaluate potential climate change effects on local groundwater.

5.1 Objectives

As recently noted by California's state climatologist (Anderson, 2009), the scientific community's research on global climate processes "includes the expectation that climate will be changing over the course of the next century to an extent that these changes must be accounted for in the water resources planning process". The need to understand and plan for climate change was recognized in 2007 by the Purveyors who, in commissioning the updated basin yield analysis specified that this study should include an evaluation of the potential significance of climate change on local groundwater supplies.

As discussed below in Section 5.2, there are many different climate models, each with its own strengths and limitations. Additionally, the international scientific community has formally identified multiple scenarios for future greenhouse gas emissions. Each scenario has different assumptions about the magnitude and timing of these emissions. Consequently, absolute predictions regarding future climatic conditions and subsequent effect on local groundwater are not possible. Instead, the primary objective of the analysis reported herein is to quantitatively, or qualitatively, describe general impacts of climate change on the groundwater basin and its yield. As the work has progressed, this general objective has focused on understanding whether the yield of the basin, operated in accordance with the 2008 Operating Plan, might be different for future climate change scenarios than for the historical rainfall patterns under which the 2008 Operating Plan was evaluated in Chapter 4. The general objective and the more specific objective together seek to understand the sensitivity of the aquifer and the 2008 Operating Plan to climate change, rather than to make predictions about future climate and groundwater conditions.

5.2 Approach

The analysis was conducted by selecting a small number of published projections regarding possible future patterns of monthly rainfall over time between now and the year 2099. An 86-year time period from 2010 through 2095 was then simulated with the groundwater model, using monthly variations in groundwater recharge that were derived from the monthly projections of future rainfall patterns under a given climate change scenario. Details regarding this process are summarized below and described in greater detail in Appendix D.

5.2.1 Evaluation and Selection of Climate Change Scenarios

Nine of 112 published climate projections were studied for potential use in the Santa Clarita groundwater model. The nine projections that were studied are the same group of projections (models) that were evaluated by DWR in its most recent report on the reliability of State Water Project water deliveries (DWR, 2008).

The nine rainfall projections were studied for their ability to reasonably replicate recent historical rainfall at the Newhall-Soledad rain gage. More importantly, the projections were studied to ascertain the degree to which they show different or similar trends and magnitudes of rainfall at various times (during the Purveyor's UWMP planning time frame [20 to 25 years], and beyond that time frame); and the degree to which they project generally dry, wet, or average conditions over the long-term (through the next 86-year period). This trend evaluation was conducted by examining the cumulative departure of rainfall on a monthly basis for each projection, compared with the 1931-2007 long-term average rainfall. Figure 5-1 displays the cumulative departure from mean precipitation, beginning in 2010, for the nine projections that were studied and for the three projections that were selected for evaluating potential climate-change impacts on groundwater in the Santa Clarita Valley. The figure shows that the nine projections exhibit a broad range in the cumulative departure over time, with an increase in the range of predicted values as time goes on. This increase with time arises in part from differences between the emissions scenarios beginning in about the year 2030, as well as from the general increase in predictive uncertainty that exists in each climate model as it projects into the future the many physical processes that affect climate.

The three projections that were evaluated using the groundwater model were selected because they display a variety of rainfall cycles during the UWMP planning horizon and beyond. In particular:

- Over the course of the UWMP planning horizon, projection #1 shows considerable fluctuation and is generally wetter than normal, while projections #6 and #9 show less fluctuation and are generally drier than normal.

- Afterwards, the three projections show a variety of trends. Projection #1 shows a sustained long-term progressive drying of the climate, with rainfall generally below the historical average. Projection #9 shows the opposite trend: sustained long-term progressive wetting of the climate with more rainfall than the historical average.

Projection #6 shows wet conditions immediately after the UWMP planning horizon, then fluctuating cycles of below-normal and above-normal rainfall, with no net departure from historical average rainfall by the end of the projection time frame.

5.2.2 Simulation Period

An 86-year period beginning in 2010 and continuing through the year 2095 was evaluated with the model, using the local monthly rainfall projections specific to each of these years to define groundwater recharge terms and Alluvial Aquifer pumping patterns. The same pattern of Saugus Formation pumping that was used for the 2008 Operating Plan (representing SWP water availability from 1922 through 2007) was utilized in conjunction with the 2010-2095 simulation of conditions in the Alluvial Aquifer to assess the basin's response to a combination of pumping dictated by local and SWP hydrologic conditions plus runoff/recharge in the Valley resulting from local rainfall conditions.

5.2.3 Hydrologic Processes for Climate Change Scenarios

Four separate hydrologic processes were varied in the groundwater flow model for each climate change scenario. The four processes and the methods by which they were varied were as follows.

- **Groundwater pumping pattern -** Different approaches were taken for the Alluvium versus the Saugus.

  The sequence of normal-year versus dry-year pumping from the alluvium was defined from the prior year's rainfall, as contained in the particular climate projection being evaluated. Tables 5-1 through 5-3 list the alluvial year types for each of the three climate runs that were evaluated.

  The Saugus pumping pattern and pumping rates were specified to be the same as for the 1922-2007 period that was evaluated for the 2008 Operating Plan. Tables 5-4 through 5-6 compare the Saugus pumping pattern with the pumping pattern for the Alluvial Aquifer.

- **Infiltration of direct precipitation** - The month-by-month rainfall from a given climate projection was used by the SWRM to calculate this term for the uppermost layer in the model grid. This is calculated at each node in the grid.

- **Infiltration from stormwater generated within the watershed and from Santa Clara River flows entering the eastern end of the Valley (at the Lang gage) -** For a given future year, these terms were estimated by first identifying one or more similar rainfall years in the historic record, which were treated as prototypical years for the purpose of defining annual and monthly streamflow at each stream node. If more than one year was identified as a possible prototype for a given future year, then the prototypical year was selected by further considering whether hydrologic conditions were generally dry or generally wet. Infiltration from streamflow during a given year was then calculated by the SWRM model from the prototypical year's monthly flow rates and monthly riverbed infiltration rates.

- **Infiltration from water released by DWR from Castaic Lagoon to Castaic Creek -** The prototype-year method was used to identify this term, using the same general procedure as described above for Santa Clara River flows at the Lang gage.

5.3 2008 Operating Plan under Climate Change Scenarios

Hydrographs of simulated groundwater levels, at the locations of each production well, are included in Appendix E to show the simulated response of the groundwater system to the three modeled rainfall projections. Extracted from the complete set in Appendix E, Figures 5-2 through 5-9 are illustrative groundwater elevation hydrographs for each Alluvial Aquifer subarea, using the same set of representative wells as shown for the sustainability discussions in Chapter 4. Figures 5-10 through 5-12 are groundwater elevation hydrographs for the three representative Saugus Formation production wells discussed in Chapter 4.

Based on simulated aquifer response to a combination of pumping in accordance with the 2008 Operating Plan and the range of climate change hydrology, the potential effects of climate change on the yield of the local groundwater basin and the associated availability of groundwater as part of the Valley's overall water supply can be summarized as follows. In all cases, it should be noted that specific short-term patterns of precipitation, as projected by the climate models, significantly influence the potential sustainability of overall groundwater yield and/or the achievability, i.e. the physical ability to extract groundwater at the operating plan rates, of the operating plan in certain subareas of the overall basin.

5.3.1 Drying Climate Trend (Climate Scenario 1)

In the short term, i.e. through the horizon of current UWMP planning, a long-term drying trend in the local climate would not be expected to result in unsustainable groundwater conditions, but could result in unachievable pumping in the "Above Mint Canyon" area at the rates specified in the 2008 Operating Plan. Beyond that planning horizon, the prevailing trend of drier climate would be expected to result in a general long-term lowering of groundwater levels in most of the basin, indicative that pumping in accordance with the 2008 Operating Plan would not be considered sustainable. Directly related to the latter long-term lowering of groundwater levels, the prevailing trend of drier climate would be expected to result in groundwater levels sufficiently lowered in several parts of the basin (e.g. at and above Mint Canyon, below the Saugus WRP, and in Bouquet and San Francisquito Canyon) that the wells in those areas would no longer support the pumping rates in the 2008 Operating Plan. On a long-term basis, then, the drying climate trend analyzed herein would be expected to result in a smaller local groundwater supply over time.

5.3.2 Wetter Climate Trend (Climate Scenario 9)

A tendency toward wetter local hydrologic conditions would logically suggest that the 2008 Operating Plan, considered sustainable through historical hydrologic conditions, would continue to be sustainable. Simulated basin response supports that expectation. Ironically, however, primarily as a result of the specific patterns of precipitation as projected by this climate model,

near-term conditions through the UWMP planning horizon, could appear to be unsustainable, i.e. general declining trend in groundwater levels. Subsequent wetter conditions ultimately lead to the long-term appearance of groundwater sustainability at the pumping rates in the 2008 Operating Plan.

Over both the short term (UWMP planning horizon) and the long term simulated herein, the wetter climate trend appears to result in local issues with regard to achievability of 2008 Operating Plan pumping, commonly in the eastern part of the basin at and above Mint Canyon, and also in San Francisquito Canyon in the near term.

For the most part, the wetter climate trend analyzed herein would be expected to result in a sustainable local groundwater supply at the rates in the 2008 Operating Plan, albeit with some short-term challenges to physically extracting full pumping rates in the eastern part of the basin.

5.3.3 Average Climate Trend (Climate Scenario 6)

A climate tendency toward general continuation of a climate similar, on average, to historically experienced conditions would logically suggest that the 2008 Operating Plan, considered sustainable through historical hydrologic conditions, would continue to be sustainable. Simulated basin response supports that expectation. Similar also to expected response under historical hydrologic conditions, there would be expected challenges to the achievability of the 2008 Operating Plan, notably in the near-term UWMP planning horizon, under a climate "change" that continues long-term average historical precipitation. In summary, a "climate change" that results in essential continuation of long-term average precipitation would be expected to result in a sustainable local groundwater supply at the rates in the 2008 Operating Plan, with basically the same local issues relative to actual pumping capability as derived from the analysis of that operating plan through historical hydrologic conditions.

5.4 Climate Change Summary

Examination of the three simulated climate change scenarios was undertaken to provide a level of quantification to the possible impact of climate change on local groundwater basin yield and availability of groundwater as part of overall water supply to the Valley. In light of the range of global climate model output that was considered for development of the local scenarios analyzed herein, it is obvious that there is neither a unique result that can be expected to become a representative hydrologic condition in the Valley, nor is there a unique result that can be expected in terms of basin yield and associated sustainable groundwater supply as an outcome of climate change. Obviously, the Valley does not get to "choose" a future climate scenario, but rather will have to manage within whatever future patterns of rainfall actually occur over time, whether the future rainfall exhibit wet-dry cycles that are similar to or different from historically recorded conditions. Perhaps most useful in the consideration of climate change effects analyzed herein is with respect to results over the UWMP planning horizon of 20 to 25 years. For the range of relatively wet to relatively dry conditions analyzed herein, all three scenarios suggest that the 2008 Operating Plan can be considered sustainable and, with the same local exceptions as simulated through a repetition of historical hydrology (e.g. mainly at and above Mint Canyon), achievable over the UWMP planning horizon. Beyond that horizon, greater uncertainty

exists because the global climate models use different emissions scenarios and also become increasingly uncertain over time because of predictive uncertainty pertaining to the forward-looking representation of the many physical processes that affect climate into the future. As a result, for time periods beyond the UWMP planning horizon, some models predict long-term drying and subsequent sustained declines in groundwater levels, which would result in a smaller local groundwater supply over time, while other models predict hydrologic conditions similar to or wetter than those that have been historically observed, in which case the 2008 Operating Plan can be considered sustainable, albeit with some local issues relative to actual pumping capability at certain times (mainly in the Alluvium at the eastern end of the Valley).

Table 5-1

Climate Projection #1 (Global Climate Model GFDL_cm2_0.1_sresB1)

Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 86-year Simulation

Model Year	Calendar Year	Local Rainfall (inches)[a]	Year Type	Alluvial Aquifer Pumping under the Groundwater Operating Plan (AF/yr)
1	2010	18.27	Normal	35,000-40,000
2	2011	19.17	Normal	35,000-40,000
3	2012	43.26	Normal	35,000-40,000
4	2013	20.63	Normal	35,000-40,000
5	2014	13.96	Normal	35,000-40,000
6	2015	11.24	Normal	35,000-40,000
7	2016	13.80	Dry Year 1	30,000-35,000
8	2017	22.80	Dry Year 2	30,000-35,000
9	2018	15.37	Normal	35,000-40,000
10	2019	23.75	Normal	35,000-40,000
11	2020	45.78	Normal	35,000-40,000
12	2021	38.53	Normal	35,000-40,000
13	2022	43.23	Normal	35,000-40,000
14	2023	25.37	Normal	35,000-40,000
15	2024	24.15	Normal	35,000-40,000
16	2025	9.65	Normal	35,000-40,000
17	2026	20.35	Dry Year 1	30,000-35,000
18	2027	15.10	Normal	35,000-40,000
19	2028	17.37	Normal	35,000-40,000
20	2029	22.37	Normal	35,000-40,000
21	2030	14.77	Normal	35,000-40,000
22	2031	14.56	Normal	35,000-40,000
23	2032	9.17	Dry Year 1	30,000-35,000
24	2033	31.25	Dry Year 2	30,000-35,000
25	2034	31.80	Normal	35,000-40,000
26	2035	10.36	Normal	35,000-40,000
27	2036	12.98	Dry Year 1	30,000-35,000
28	2037	13.51	Dry Year 2	30,000-35,000
29	2038	28.59	Dry Year 3	30,000-35,000
30	2039	16.63	Normal	35,000-40,000
31	2040	12.83	Normal	35,000-40,000
32	2041	20.67	Dry Year 1	30,000-35,000
33	2042	16.41	Normal	35,000-40,000
34	2043	9.38	Normal	35,000-40,000
35	2044	24.67	Dry Year 1	30,000-35,000
36	2045	29.24	Normal	35,000-40,000
37	2046	17.91	Normal	35,000-40,000
38	2047	10.47	Normal	35,000-40,000
39	2048	15.97	Dry Year 1	30,000-35,000
40	2049	19.69	Dry Year 2	30,000-35,000
41	2050	27.84	Dry Year 3	30,000-35,000
42	2051	12.19	Normal	35,000-40,000
43	2052	20.08	Dry Year 1	30,000-35,000
44	2053	14.02	Normal	35,000-40,000
45	2054	33.91	Dry Year 1	30,000-35,000
46	2055	19.94	Normal	35,000-40,000
47	2056	14.32	Normal	35,000-40,000
48	2057	14.01	Normal	35,000-40,000
49	2058	28.83	Dry Year 1	30,000-35,000
50	2059	35.10	Normal	35,000-40,000
51	2060	11.01	Normal	35,000-40,000
52	2061	9.40	Dry Year 1	30,000-35,000
53	2062	20.34	Dry Year 2	30,000-35,000
54	2063	10.66	Dry Year 3	30,000-35,000
55	2064	9.63	Dry Year 4	30,000-35,000
56	2065	17.94	Dry Year 5	30,000-35,000
57	2066	18.07	Dry Year 6	30,000-35,000
58	2067	13.68	Dry Year 7	30,000-35,000
59	2068	7.10	Dry Year 8	30,000-35,000
60	2069	20.97	Dry Year 9	30,000-35,000
61	2070	14.49	Dry Year 10	30,000-35,000
62	2071	17.87	Dry Year 11	30,000-35,000
63	2072	20.27	Dry Year 12	30,000-35,000
64	2073	11.02	Dry Year 13	30,000-35,000
65	2074	23.74	Dry Year 14	30,000-35,000
66	2075	20.98	Normal	35,000-40,000
67	2076	8.79	Normal	35,000-40,000
68	2077	12.56	Dry Year 1	30,000-35,000
69	2078	21.59	Dry Year 2	30,000-35,000
70	2079	30.22	Dry Year 3	30,000-35,000
71	2080	12.53	Normal	35,000-40,000
72	2081	21.67	Dry Year 1	30,000-35,000
73	2082	17.97	Normal	35,000-40,000
74	2083	36.13	Normal	35,000-40,000
75	2084	32.25	Normal	35,000-40,000
76	2085	18.51	Normal	35,000-40,000
77	2086	20.78	Normal	35,000-40,000
78	2087	30.97	Normal	35,000-40,000
79	2088	8.45	Normal	35,000-40,000
80	2089	32.79	Dry Year 1	30,000-35,000
81	2090	34.48	Normal	35,000-40,000
82	2091	18.49	Normal	35,000-40,000
83	2092	7.60	Normal	35,000-40,000
84	2093	21.56	Dry Year 1	30,000-35,000
85	2094	16.99	Normal	35,000-40,000
86	2095	21.56	Normal	35,000-40,000

[a]The values from the global climate model were extrapolated to the location of the Newhall County Water District Rain Gage.

Table 5-2

Climate Projection #6 (Global Climate Model NCAR_PCM1.3_sresA2)

Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 86-year Simulation

Model Year	Calendar Year	Local Rainfall (inches)[a]	Year Type	Alluvial Aquifer Pumping under the Groundwater Operating Plan (AF/yr)
1	2010	17.22	Normal	35,000-40,000
2	2011	13.37	Normal	35,000-40,000
3	2012	16.14	Dry Year 1	30,000-35,000
4	2013	16.53	Dry Year 2	30,000-35,000
5	2014	15.33	Dry Year 3	30,000-35,000
6	2015	40.92	Dry Year 4	30,000-35,000
7	2016	20.24	Normal	35,000-40,000
8	2017	19.50	Normal	35,000-40,000
9	2018	10.68	Normal	35,000-40,000
10	2019	15.15	Dry Year 1	30,000-35,000
11	2020	24.58	Dry Year 2	30,000-35,000
12	2021	16.38	Normal	35,000-40,000
13	2022	22.64	Normal	35,000-40,000
14	2023	21.29	Normal	35,000-40,000
15	2024	13.37	Normal	35,000-40,000
16	2025	19.50	Dry Year 1	30,000-35,000
17	2026	12.05	Dry Year 2	30,000-35,000
18	2027	18.89	Dry Year 3	30,000-35,000
19	2028	11.56	Dry Year 4	30,000-35,000
20	2029	8.46	Dry Year 5	30,000-35,000
21	2030	16.41	Dry Year 6	30,000-35,000
22	2031	19.44	Dry Year 7	30,000-35,000
23	2032	18.66	Dry Year 8	30,000-35,000
24	2033	30.29	Dry Year 9	30,000-35,000
25	2034	42.86	Normal	35,000-40,000
26	2035	16.39	Normal	35,000-40,000
27	2036	17.74	Dry Year 1	30,000-35,000
28	2037	50.04	Dry Year 2	30,000-35,000
29	2038	35.50	Normal	35,000-40,000
30	2039	39.98	Normal	35,000-40,000
31	2040	28.83	Normal	35,000-40,000
32	2041	23.15	Normal	35,000-40,000
33	2042	22.57	Normal	35,000-40,000
34	2043	22.20	Normal	35,000-40,000
35	2044	16.25	Normal	35,000-40,000
36	2045	34.88	Normal	35,000-40,000
37	2046	20.82	Normal	35,000-40,000
38	2047	14.35	Normal	35,000-40,000
39	2048	12.06	Dry Year 1	30,000-35,000
40	2049	12.16	Dry Year 2	30,000-35,000
41	2050	11.37	Dry Year 3	30,000-35,000
42	2051	28.47	Dry Year 4	30,000-35,000
43	2052	26.84	Normal	35,000-40,000
44	2053	25.59	Normal	35,000-40,000
45	2054	15.97	Normal	35,000-40,000
46	2055	21.26	Normal	35,000-40,000
47	2056	23.32	Normal	35,000-40,000
48	2057	13.55	Normal	35,000-40,000
49	2058	23.32	Dry Year 1	30,000-35,000
50	2059	13.04	Normal	35,000-40,000
51	2060	22.71	Dry Year 1	30,000-35,000
52	2061	10.15	Normal	35,000-40,000
53	2062	20.52	Dry Year 1	30,000-35,000
54	2063	71.95	Dry Year 2	30,000-35,000
55	2064	33.61	Normal	35,000-40,000
56	2065	13.39	Normal	35,000-40,000
57	2066	25.96	Dry Year 1	30,000-35,000
58	2067	28.69	Normal	35,000-40,000
59	2068	18.22	Normal	35,000-40,000
60	2069	11.17	Normal	35,000-40,000
61	2070	18.25	Dry Year 1	30,000-35,000
62	2071	17.85	Dry Year 2	30,000-35,000
63	2072	19.30	Dry Year 3	30,000-35,000
64	2073	14.70	Normal	35,000-40,000
65	2074	9.82	Dry Year 1	30,000-35,000
66	2075	14.96	Dry Year 2	30,000-35,000
67	2076	29.84	Dry Year 3	30,000-35,000
68	2077	19.05	Normal	35,000-40,000
69	2078	45.70	Normal	35,000-40,000
70	2079	25.20	Normal	35,000-40,000
71	2080	31.12	Normal	35,000-40,000
72	2081	29.50	Normal	35,000-40,000
73	2082	27.59	Normal	35,000-40,000
74	2083	15.50	Normal	35,000-40,000
75	2084	8.74	Normal	35,000-40,000
76	2085	18.76	Dry Year 1	30,000-35,000
77	2086	13.07	Dry Year 2	30,000-35,000
78	2087	22.89	Dry Year 3	30,000-35,000
79	2088	50.06	Normal	35,000-40,000
80	2089	27.24	Normal	35,000-40,000
81	2090	12.53	Normal	35,000-40,000
82	2091	9.14	Dry Year 1	30,000-35,000
83	2092	10.81	Dry Year 2	30,000-35,000
84	2093	23.07	Dry Year 3	30,000-35,000
85	2094	12.91	Dry Year 4	30,000-35,000
86	2095	26.47	Dry Year 5	30,000-35,000

[a]The values from the global climate model were extrapolated to the location of the Newhall County Water District Rain Gage.

Table 5-3

Climate Projection #9 (Global Climate Model NCAR_PCM1.3_sresB1)

Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 86-year Simulation

Model Year	Calendar Year	Local Rainfall (inches)[a]	Year Type	Alluvial Aquifer Pumping under the Groundwater Operating Plan (AF/yr)
1	2010	22.14	Normal	35,000-40,000
2	2011	28.62	Normal	35,000-40,000
3	2012	18.21	Normal	35,000-40,000
4	2013	18.42	Normal	35,000-40,000
5	2014	17.85	Normal	35,000-40,000
6	2015	22.34	Normal	35,000-40,000
7	2016	17.51	Normal	35,000-40,000
8	2017	16.21	Normal	35,000-40,000
9	2018	11.56	Dry Year 1	30,000-35,000
10	2019	11.83	Dry Year 2	30,000-35,000
11	2020	37.62	Dry Year 3	30,000-35,000
12	2021	16.56	Normal	35,000-40,000
13	2022	15.17	Normal	35,000-40,000
14	2023	22.88	Normal	35,000-40,000
15	2024	13.18	Normal	35,000-40,000
16	2025	20.34	Dry Year 1	30,000-35,000
17	2026	26.96	Dry Year 2	30,000-35,000
18	2027	26.47	Normal	35,000-40,000
19	2028	18.04	Normal	35,000-40,000
20	2029	18.04	Normal	35,000-40,000
21	2030	16.49	Normal	35,000-40,000
22	2031	22.51	Dry Year 1	30,000-35,000
23	2032	22.84	Normal	35,000-40,000
24	2033	15.01	Normal	35,000-40,000
25	2034	13.40	Dry Year 1	30,000-35,000
26	2035	18.72	Dry Year 2	30,000-35,000
27	2036	26.43	Dry Year 3	30,000-35,000
28	2037	11.11	Normal	35,000-40,000
29	2038	12.97	Dry Year 1	30,000-35,000
30	2039	41.47	Dry Year 2	30,000-35,000
31	2040	18.62	Normal	35,000-40,000
32	2041	39.65	Normal	35,000-40,000
33	2042	33.75	Normal	35,000-40,000
34	2043	57.56	Normal	35,000-40,000
35	2044	14.63	Normal	35,000-40,000
36	2045	15.63	Dry Year 1	30,000-35,000
37	2046	15.41	Dry Year 2	30,000-35,000
38	2047	24.66	Dry Year 3	30,000-35,000
39	2048	53.80	Normal	35,000-40,000
40	2049	14.70	Normal	35,000-40,000
41	2050	9.79	Dry Year 1	30,000-35,000
42	2051	38.49	Dry Year 2	30,000-35,000
43	2052	19.57	Normal	35,000-40,000
44	2053	20.65	Normal	35,000-40,000
45	2054	10.40	Normal	35,000-40,000
46	2055	12.58	Dry Year 1	30,000-35,000
47	2056	17.80	Dry Year 2	30,000-35,000
48	2057	15.56	Dry Year 3	30,000-35,000
49	2058	45.18	Dry Year 4	30,000-35,000
50	2059	26.78	Normal	35,000-40,000
51	2060	23.78	Normal	35,000-40,000
52	2061	47.61	Normal	35,000-40,000
53	2062	28.90	Normal	35,000-40,000
54	2063	30.43	Normal	35,000-40,000
55	2064	18.15	Normal	35,000-40,000
56	2065	30.15	Normal	35,000-40,000
57	2066	13.65	Normal	35,000-40,000
58	2067	16.34	Dry Year 1	30,000-35,000
59	2068	10.60	Dry Year 2	30,000-35,000
60	2069	60.56	Dry Year 3	30,000-35,000
61	2070	20.56	Normal	35,000-40,000
62	2071	15.31	Normal	35,000-40,000
63	2072	33.67	Normal	35,000-40,000
64	2073	46.34	Normal	35,000-40,000
65	2074	33.69	Normal	35,000-40,000
66	2075	15.71	Normal	35,000-40,000
67	2076	14.36	Normal	35,000-40,000
68	2077	21.25	Dry Year 1	30,000-35,000
69	2078	37.14	Normal	35,000-40,000
70	2079	31.87	Normal	35,000-40,000
71	2080	8.14	Normal	35,000-40,000
72	2081	25.22	Dry Year 1	30,000-35,000
73	2082	32.82	Normal	35,000-40,000
74	2083	28.25	Normal	35,000-40,000
75	2084	7.23	Normal	35,000-40,000
76	2085	11.37	Dry Year 1	30,000-35,000
77	2086	27.47	Dry Year 2	30,000-35,000
78	2087	20.97	Normal	35,000-40,000
79	2088	16.12	Normal	35,000-40,000
80	2089	64.70	Normal	35,000-40,000
81	2090	21.30	Normal	35,000-40,000
82	2091	12.38	Normal	35,000-40,000
83	2092	22.06	Dry Year 1	30,000-35,000
84	2093	19.32	Normal	35,000-40,000
85	2094	20.91	Normal	35,000-40,000
86	2095	21.05	Normal	35,000-40,000

[a]The values from the global climate model were extrapolated to the location of the Newhall County Water District Rain Gage.

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Climate Projection #1 (Global Climate Model GFDL_cm2_0.1_sresB1)

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Model Year	Alluvium Year	Saugus Year	Year Name for Model Run	Simulated Pumping Conditions	
				Alluvium	Saugus
1	2010	1922	1922	Normal	Normal
2	2011	1923	1923	Normal	Normal
3	2012	1924	1924	Normal	Dry Year 1
4	2013	1925	1925	Normal	Normal
5	2014	1926	1926	Normal	Normal
6	2015	1927	1927	Normal	Normal
7	2016	1928	1928	Dry Year 1	Normal
8	2017	1929	1929	Dry Year 2	Dry Year 1
9	2018	1930	1930	Normal	Normal
10	2019	1931	1931	Normal	Dry Year 1
11	2020	1932	1932	Normal	Dry Year 2
12	2021	1933	1933	Normal	Dry Year 3
13	2022	1934	1934	Normal	Dry Year 4
14	2023	1935	1935	Normal	Normal
15	2024	1936	1936	Normal	Normal
16	2025	1937	1937	Normal	Normal
17	2026	1938	1938	Dry Year 1	Normal
18	2027	1939	1939	Normal	Normal
19	2028	1940	1940	Normal	Normal
20	2029	1941	1941	Normal	Normal
21	2030	1942	1942	Normal	Normal
22	2031	1943	1943	Normal	Normal
23	2032	1944	1944	Dry Year 1	Normal
24	2033	1945	1945	Dry Year 2	Normal
25	2034	1946	1946	Normal	Normal
26	2035	1947	1947	Normal	Normal
27	2036	1948	1948	Dry Year 1	Normal
28	2037	1949	1949	Dry Year 2	Dry Year 1
29	2038	1950	1950	Dry Year 3	Normal
30	2039	1951	1951	Normal	Normal
31	2040	1952	1952	Normal	Normal
32	2041	1953	1953	Dry Year 1	Normal
33	2042	1954	1954	Normal	Normal
34	2043	1955	1955	Normal	Dry Year 1
35	2044	1956	1956	Dry Year 1	Normal
36	2045	1957	1957	Normal	Normal
37	2046	1958	1958	Normal	Normal
38	2047	1959	1959	Normal	Normal
39	2048	1960	1960	Dry Year 1	Dry Year 1
40	2049	1961	1961	Dry Year 2	Normal
41	2050	1962	1962	Dry Year 3	Normal
42	2051	1963	1963	Normal	Normal
43	2052	1964	1964	Dry Year 1	Normal
44	2053	1965	1965	Normal	Normal
45	2054	1966	1966	Dry Year 1	Normal
46	2055	1967	1967	Normal	Normal
47	2056	1968	1968	Normal	Normal
48	2057	1969	1969	Normal	Normal
49	2058	1970	1970	Dry Year 1	Normal
50	2059	1971	1971	Normal	Normal
51	2060	1972	1972	Normal	Normal
52	2061	1973	1973	Dry Year 1	Normal
53	2062	1974	1974	Dry Year 2	Normal
54	2063	1975	1975	Dry Year 3	Normal
55	2064	1976	1976	Dry Year 4	Normal
56	2065	1977	1977	Dry Year 5	Dry Year 1
57	2066	1978	1978	Dry Year 6	Normal
58	2067	1979	1979	Dry Year 7	Normal
59	2068	1980	1980	Dry Year 8	Normal
60	2069	1981	1981	Dry Year 9	Normal
61	2070	1982	1982	Dry Year 10	Normal
62	2071	1983	1983	Dry Year 11	Normal
63	2072	1984	1984	Dry Year 12	Normal
64	2073	1985	1985	Dry Year 13	Normal
65	2074	1986	1986	Dry Year 14	Normal
66	2075	1987	1987	Normal	Normal
67	2076	1988	1988	Normal	Dry Year 1
68	2077	1989	1989	Dry Year 1	Normal
69	2078	1990	1990	Dry Year 2	Dry Year 2
70	2079	1991	1991	Dry Year 3	Dry Year 3
71	2080	1992	1992	Normal	Dry Year 4
72	2081	1993	1993	Dry Year 1	Normal
73	2082	1994	1994	Normal	Normal
74	2083	1995	1995	Normal	Normal
75	2084	1996	1996	Normal	Normal
76	2085	1997	1997	Normal	Normal
77	2086	1998	1998	Normal	Normal
78	2087	1999	1999	Normal	Normal
79	2088	2000	2000	Normal	Normal
80	2089	2001	2001	Dry Year 1	Dry Year 1
81	2090	2002	2002	Normal	Normal
82	2091	2003	2003	Normal	Normal
83	2092	2004	2004	Normal	Normal
84	2093	2005	2005	Dry Year 1	Normal
85	2094	2006	2006	Normal	Normal
86	2095	2007	2007	Normal	Normal

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Climate Projection #6 (Global Climate Model NCAR_PCM1.3_sresA2)

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Model Year	Alluvium Year	Saugus Year	Year Name for Model Run	Simulated Pumping Conditions	
				Alluvium	Saugus
1	2010	1922	1922	Normal	Normal
2	2011	1923	1923	Normal	Normal
3	2012	1924	1924	Dry Year 1	Dry Year 1
4	2013	1925	1925	Dry Year 2	Normal
5	2014	1926	1926	Dry Year 3	Normal
6	2015	1927	1927	Dry Year 4	Normal
7	2016	1928	1928	Normal	Normal
8	2017	1929	1929	Normal	Dry Year 1
9	2018	1930	1930	Normal	Normal
10	2019	1931	1931	Dry Year 1	Dry Year 1
11	2020	1932	1932	Dry Year 2	Dry Year 2
12	2021	1933	1933	Normal	Dry Year 3
13	2022	1934	1934	Normal	Dry Year 4
14	2023	1935	1935	Normal	Normal
15	2024	1936	1936	Normal	Normal
16	2025	1937	1937	Dry Year 1	Normal
17	2026	1938	1938	Dry Year 2	Normal
18	2027	1939	1939	Dry Year 3	Normal
19	2028	1940	1940	Dry Year 4	Normal
20	2029	1941	1941	Dry Year 5	Normal
21	2030	1942	1942	Dry Year 6	Normal
22	2031	1943	1943	Dry Year 7	Normal
23	2032	1944	1944	Dry Year 8	Normal
24	2033	1945	1945	Dry Year 9	Normal
25	2034	1946	1946	Normal	Normal
26	2035	1947	1947	Normal	Normal
27	2036	1948	1948	Dry Year 1	Normal
28	2037	1949	1949	Dry Year 2	Dry Year 1
29	2038	1950	1950	Normal	Normal
30	2039	1951	1951	Normal	Normal
31	2040	1952	1952	Normal	Normal
32	2041	1953	1953	Normal	Normal
33	2042	1954	1954	Normal	Normal
34	2043	1955	1955	Normal	Dry Year 1
35	2044	1956	1956	Normal	Normal
36	2045	1957	1957	Normal	Normal
37	2046	1958	1958	Normal	Normal
38	2047	1959	1959	Normal	Normal
39	2048	1960	1960	Dry Year 1	Dry Year 1
40	2049	1961	1961	Dry Year 2	Normal
41	2050	1962	1962	Dry Year 3	Normal
42	2051	1963	1963	Dry Year 4	Normal
43	2052	1964	1964	Normal	Normal
44	2053	1965	1965	Normal	Normal
45	2054	1966	1966	Normal	Normal
46	2055	1967	1967	Normal	Normal
47	2056	1968	1968	Normal	Normal
48	2057	1969	1969	Normal	Normal
49	2058	1970	1970	Dry Year 1	Normal
50	2059	1971	1971	Normal	Normal
51	2060	1972	1972	Dry Year 1	Normal
52	2061	1973	1973	Normal	Normal
53	2062	1974	1974	Dry Year 1	Normal
54	2063	1975	1975	Dry Year 2	Normal
55	2064	1976	1976	Normal	Normal
56	2065	1977	1977	Normal	Dry Year 1
57	2066	1978	1978	Dry Year 1	Normal
58	2067	1979	1979	Normal	Normal
59	2068	1980	1980	Normal	Normal
60	2069	1981	1981	Normal	Normal
61	2070	1982	1982	Dry Year 1	Normal
62	2071	1983	1983	Dry Year 2	Normal
63	2072	1984	1984	Dry Year 3	Normal
64	2073	1985	1985	Normal	Normal
65	2074	1986	1986	Dry Year 1	Normal
66	2075	1987	1987	Dry Year 2	Normal
67	2076	1988	1988	Dry Year 3	Dry Year 1
68	2077	1989	1989	Normal	Normal
69	2078	1990	1990	Normal	Dry Year 2
70	2079	1991	1991	Normal	Dry Year 3
71	2080	1992	1992	Normal	Dry Year 4
72	2081	1993	1993	Normal	Normal
73	2082	1994	1994	Normal	Normal
74	2083	1995	1995	Normal	Normal
75	2084	1996	1996	Normal	Normal
76	2085	1997	1997	Dry Year 1	Normal
77	2086	1998	1998	Dry Year 2	Normal
78	2087	1999	1999	Dry Year 3	Normal
79	2088	2000	2000	Normal	Normal
80	2089	2001	2001	Normal	Dry Year 1
81	2090	2002	2002	Normal	Normal
82	2091	2003	2003	Dry Year 1	Normal
83	2092	2004	2004	Dry Year 2	Normal
84	2093	2005	2005	Dry Year 3	Normal
85	2094	2006	2006	Dry Year 4	Normal
86	2095	2007	2007	Dry Year 5	Normal

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Climate Projection #9 (Global Climate Model NCAR_PCM1.3_sresB1)

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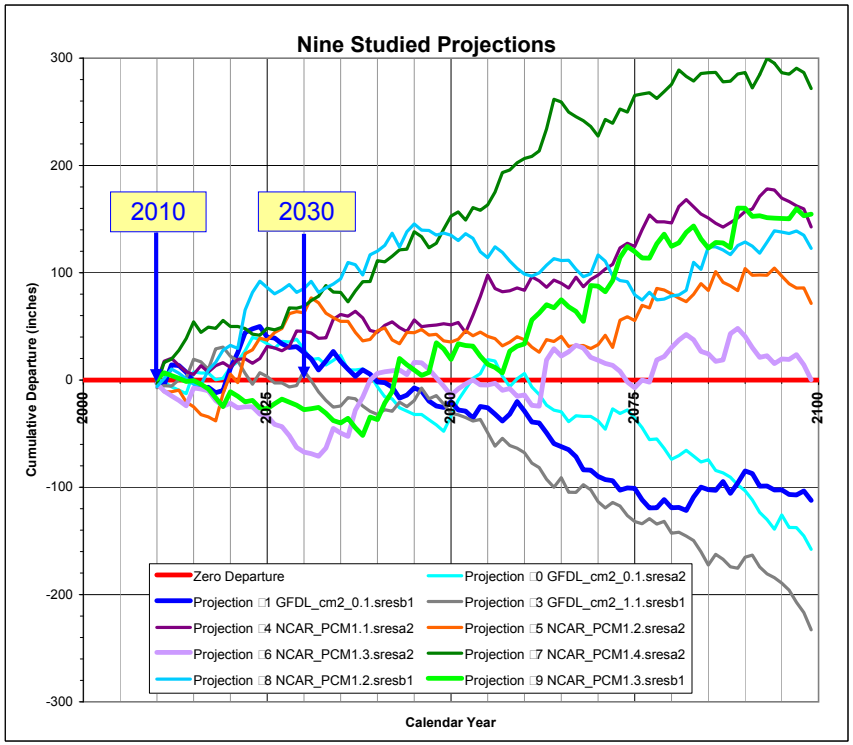
Model Year	Alluvium Year	Saugus Year	Year Name for Model Run	Simulated Pumping Conditions	
				Alluvium	Saugus
1	2010	1922	1922	Normal	Normal
2	2011	1923	1923	Normal	Normal
3	2012	1924	1924	Normal	Dry Year 1
4	2013	1925	1925	Normal	Normal
5	2014	1926	1926	Normal	Normal
6	2015	1927	1927	Normal	Normal
7	2016	1928	1928	Normal	Normal
8	2017	1929	1929	Normal	Dry Year 1
9	2018	1930	1930	Dry Year 1	Normal
10	2019	1931	1931	Dry Year 2	Dry Year 1
11	2020	1932	1932	Dry Year 3	Dry Year 2
12	2021	1933	1933	Normal	Dry Year 3
13	2022	1934	1934	Normal	Dry Year 4
14	2023	1935	1935	Normal	Normal
15	2024	1936	1936	Normal	Normal
16	2025	1937	1937	Dry Year 1	Normal
17	2026	1938	1938	Dry Year 2	Normal
18	2027	1939	1939	Normal	Normal
19	2028	1940	1940	Normal	Normal
20	2029	1941	1941	Normal	Normal
21	2030	1942	1942	Normal	Normal
22	2031	1943	1943	Dry Year 1	Normal
23	2032	1944	1944	Normal	Normal
24	2033	1945	1945	Normal	Normal
25	2034	1946	1946	Dry Year 1	Normal
26	2035	1947	1947	Dry Year 2	Normal
27	2036	1948	1948	Dry Year 3	Normal
28	2037	1949	1949	Normal	Dry Year 1
29	2038	1950	1950	Dry Year 1	Normal
30	2039	1951	1951	Dry Year 2	Normal
31	2040	1952	1952	Normal	Normal
32	2041	1953	1953	Normal	Normal
33	2042	1954	1954	Normal	Normal
34	2043	1955	1955	Normal	Dry Year 1
35	2044	1956	1956	Normal	Normal
36	2045	1957	1957	Dry Year 1	Normal
37	2046	1958	1958	Dry Year 2	Normal
38	2047	1959	1959	Dry Year 3	Normal
39	2048	1960	1960	Normal	Dry Year 1
40	2049	1961	1961	Normal	Normal
41	2050	1962	1962	Dry Year 1	Normal
42	2051	1963	1963	Dry Year 2	Normal
43	2052	1964	1964	Normal	Normal
44	2053	1965	1965	Normal	Normal
45	2054	1966	1966	Normal	Normal
46	2055	1967	1967	Dry Year 1	Normal
47	2056	1968	1968	Dry Year 2	Normal
48	2057	1969	1969	Dry Year 3	Normal
49	2058	1970	1970	Dry Year 4	Normal
50	2059	1971	1971	Normal	Normal
51	2060	1972	1972	Normal	Normal
52	2061	1973	1973	Normal	Normal
53	2062	1974	1974	Normal	Normal
54	2063	1975	1975	Normal	Normal
55	2064	1976	1976	Normal	Normal
56	2065	1977	1977	Normal	Dry Year 1
57	2066	1978	1978	Normal	Normal
58	2067	1979	1979	Dry Year 1	Normal
59	2068	1980	1980	Dry Year 2	Normal
60	2069	1981	1981	Dry Year 3	Normal
61	2070	1982	1982	Normal	Normal
62	2071	1983	1983	Normal	Normal
63	2072	1984	1984	Normal	Normal
64	2073	1985	1985	Normal	Normal
65	2074	1986	1986	Normal	Normal
66	2075	1987	1987	Normal	Normal
67	2076	1988	1988	Normal	Dry Year 1
68	2077	1989	1989	Dry Year 1	Normal
69	2078	1990	1990	Normal	Dry Year 2
70	2079	1991	1991	Normal	Dry Year 3
71	2080	1992	1992	Normal	Dry Year 4
72	2081	1993	1993	Dry Year 1	Normal
73	2082	1994	1994	Normal	Normal
74	2083	1995	1995	Normal	Normal
75	2084	1996	1996	Normal	Normal
76	2085	1997	1997	Dry Year 1	Normal
77	2086	1998	1998	Dry Year 2	Normal
78	2087	1999	1999	Normal	Normal
79	2088	2000	2000	Normal	Normal
80	2089	2001	2001	Normal	Dry Year 1
81	2090	2002	2002	Normal	Normal
82	2091	2003	2003	Normal	Normal
83	2092	2004	2004	Dry Year 1	Normal
84	2093	2005	2005	Normal	Normal
85	2094	2006	2006	Normal	Normal
86	2095	2007	2007	Normal	Normal

Figure 5-1: 2010-2098 Cumulative Departure from Average Annual Rainfall at Newhall-Soledad Rain Gage



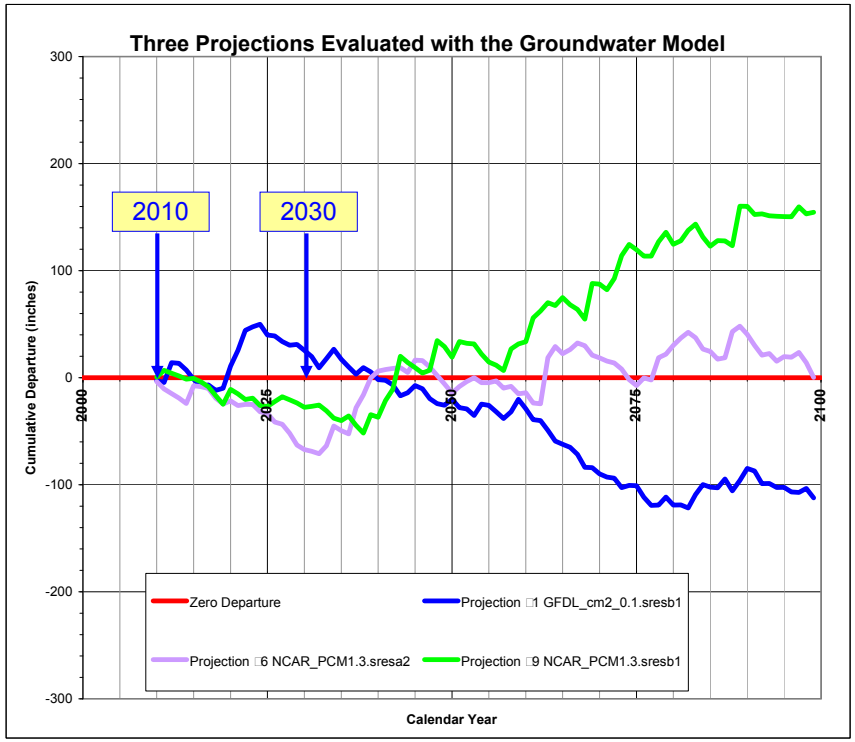


Figure 5-2: VWC-E15 Modeled Groundwater Elevations For Various Climate Projections (Alluvial Aquifer Below Valencia WRP)

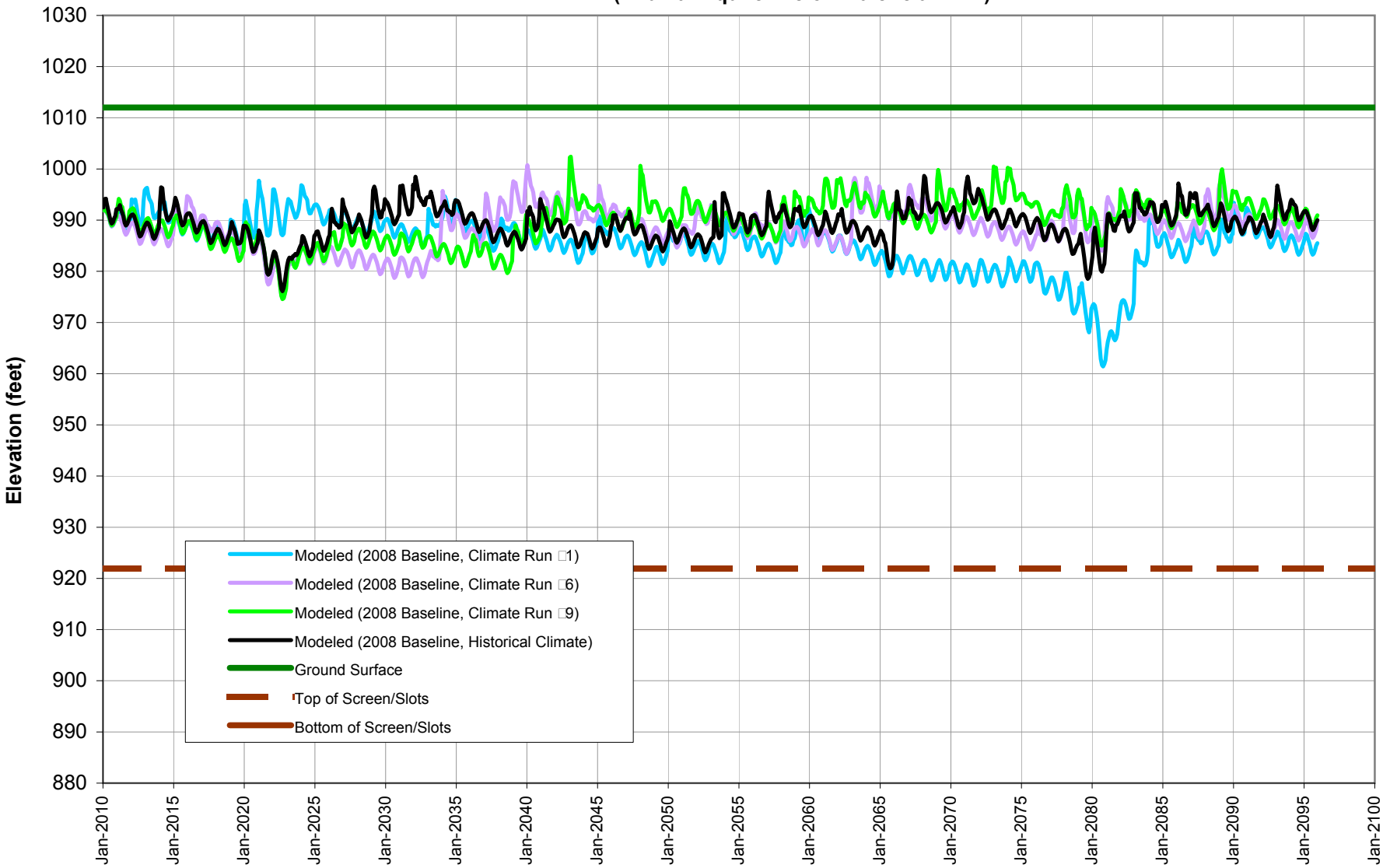


Figure 5-3: VWC-S8 Modeled Groundwater Elevations For Various Climate Projections (Alluvial Aquifer Below Saugus WRP)

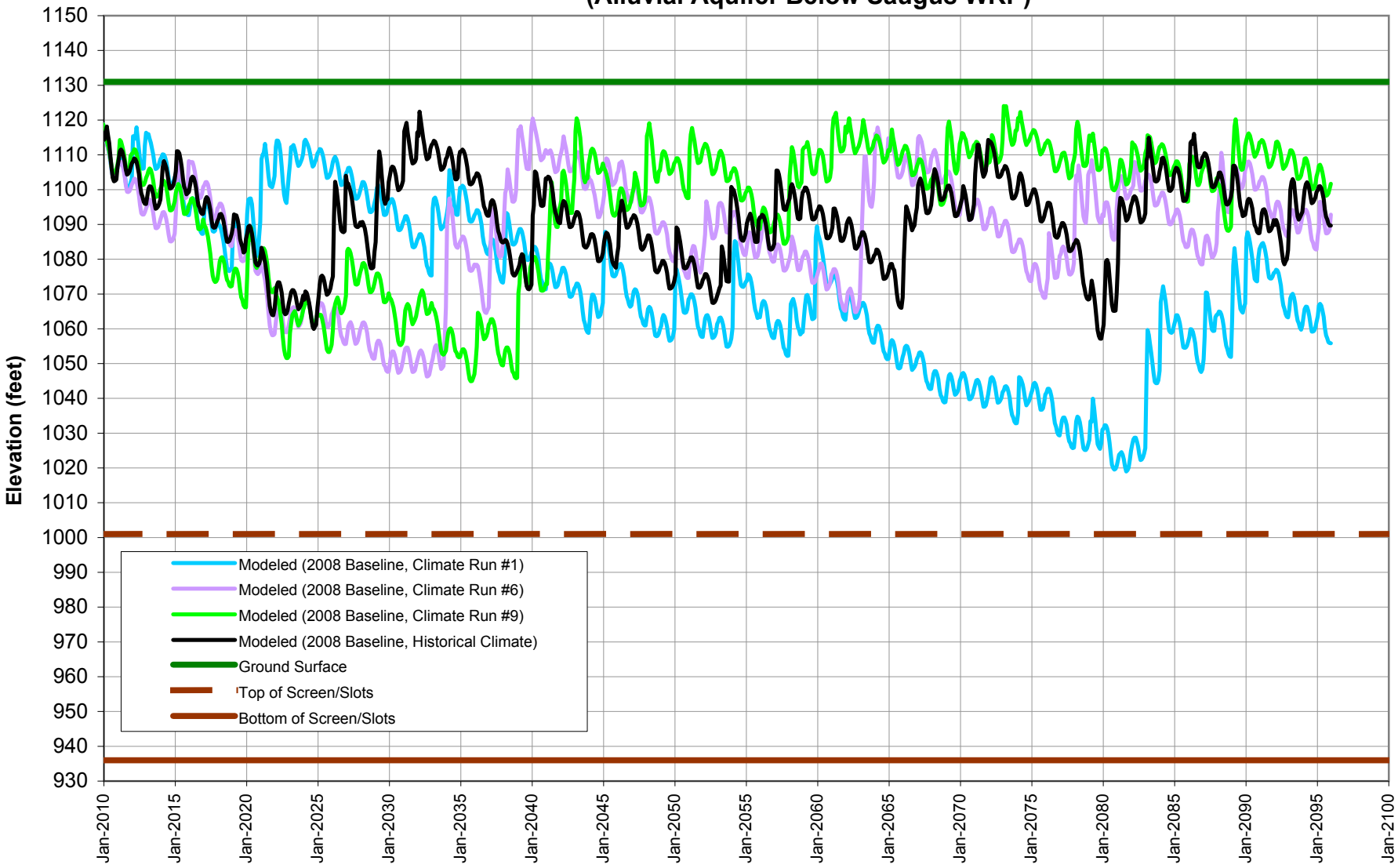


Figure 5-4: VWC-T7 Modeled Groundwater Elevations For Various Climate Projections (Alluvial Aquifer Below Saugus WRP)

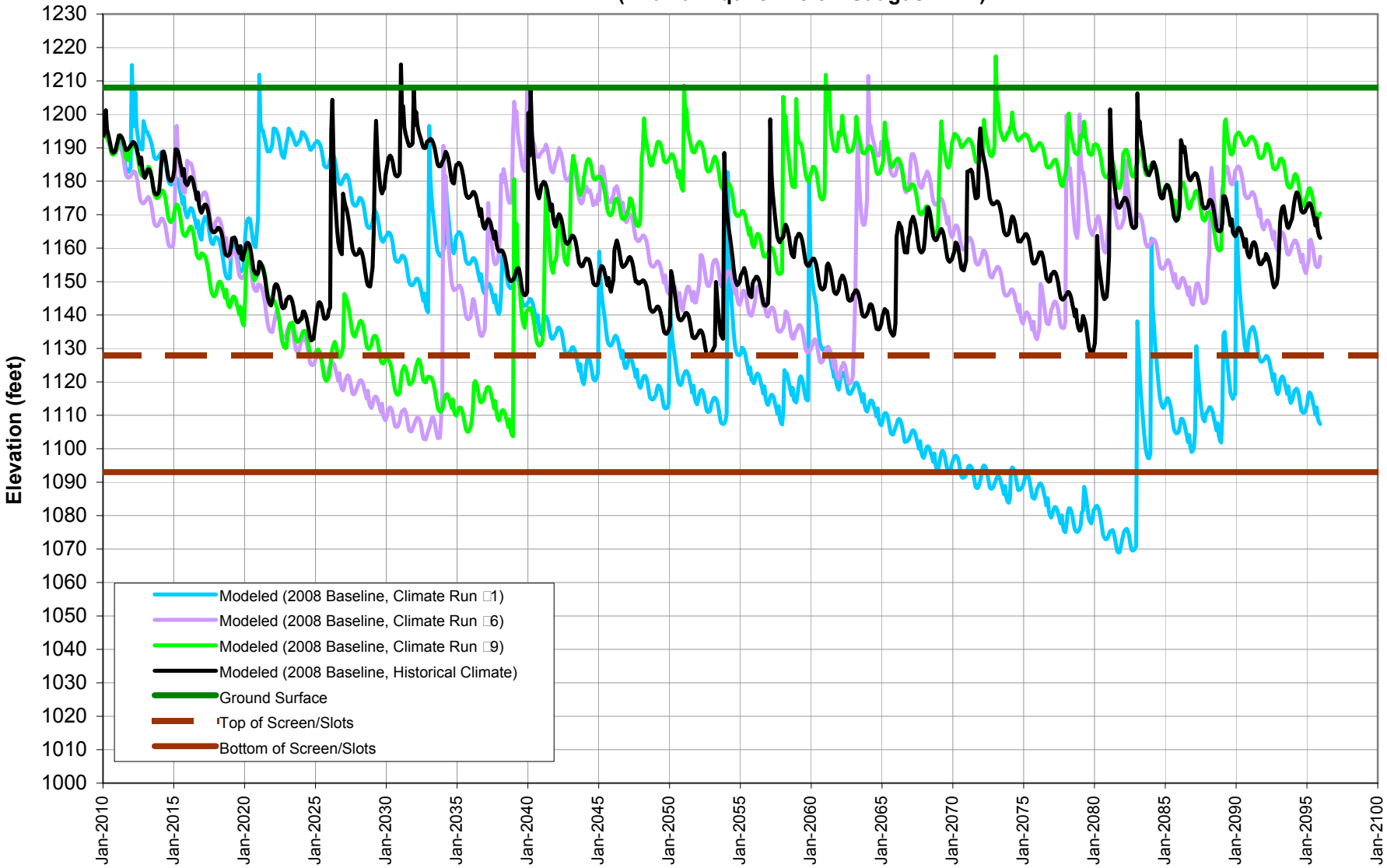


Figure 5-5: SCWD-Sierra Modeled Groundwater Elevations for Various Climate Projections (Alluvial Aquifer along Santa Clara River, At and Above Mint Canyon)

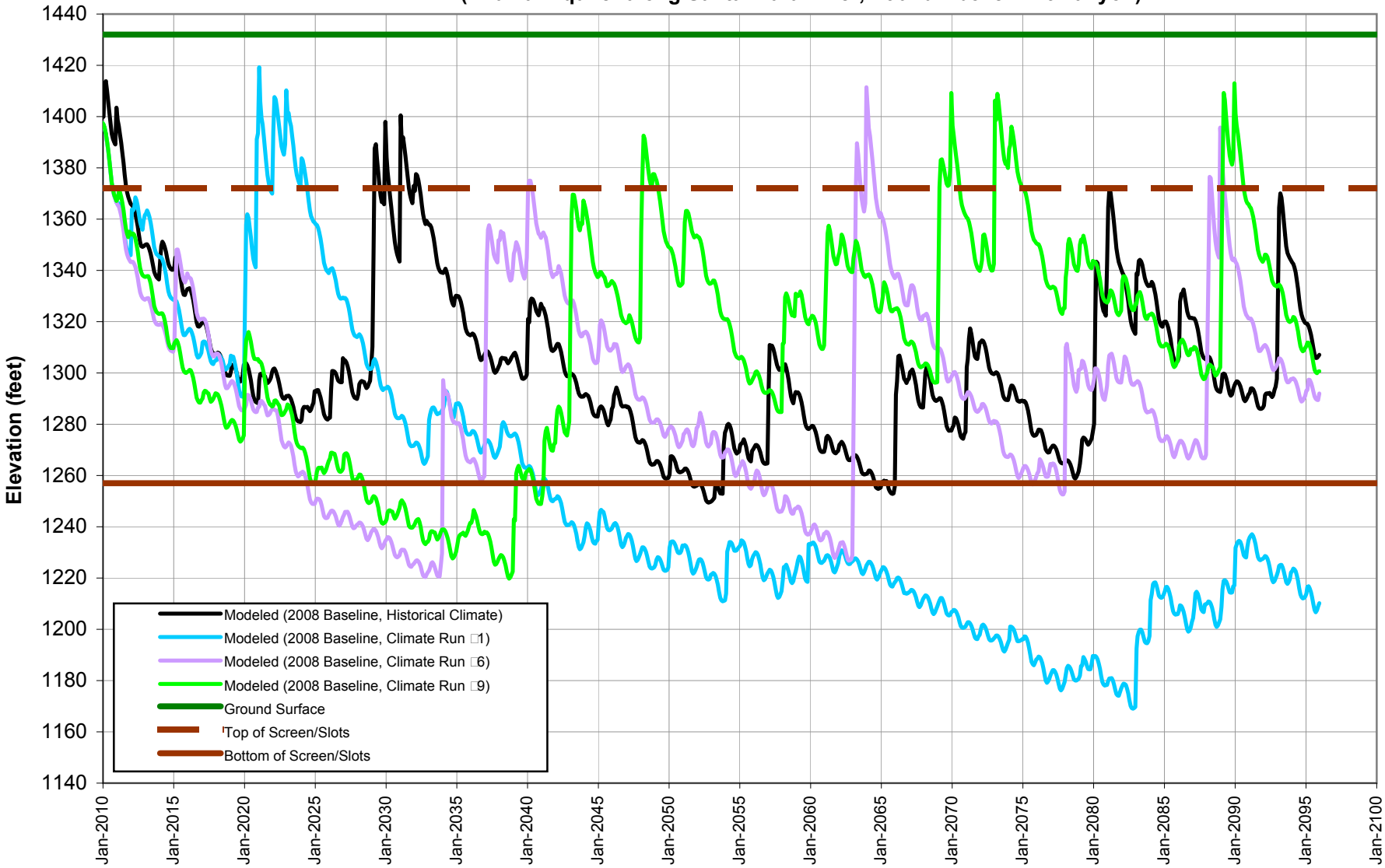


Figure 5-6: NCWD-Pinetree1 Modeled Groundwater Elevations For Various Climate Projections
(Alluvial Aquifer Along Santa Clara River, At and Above Mint Canyon)

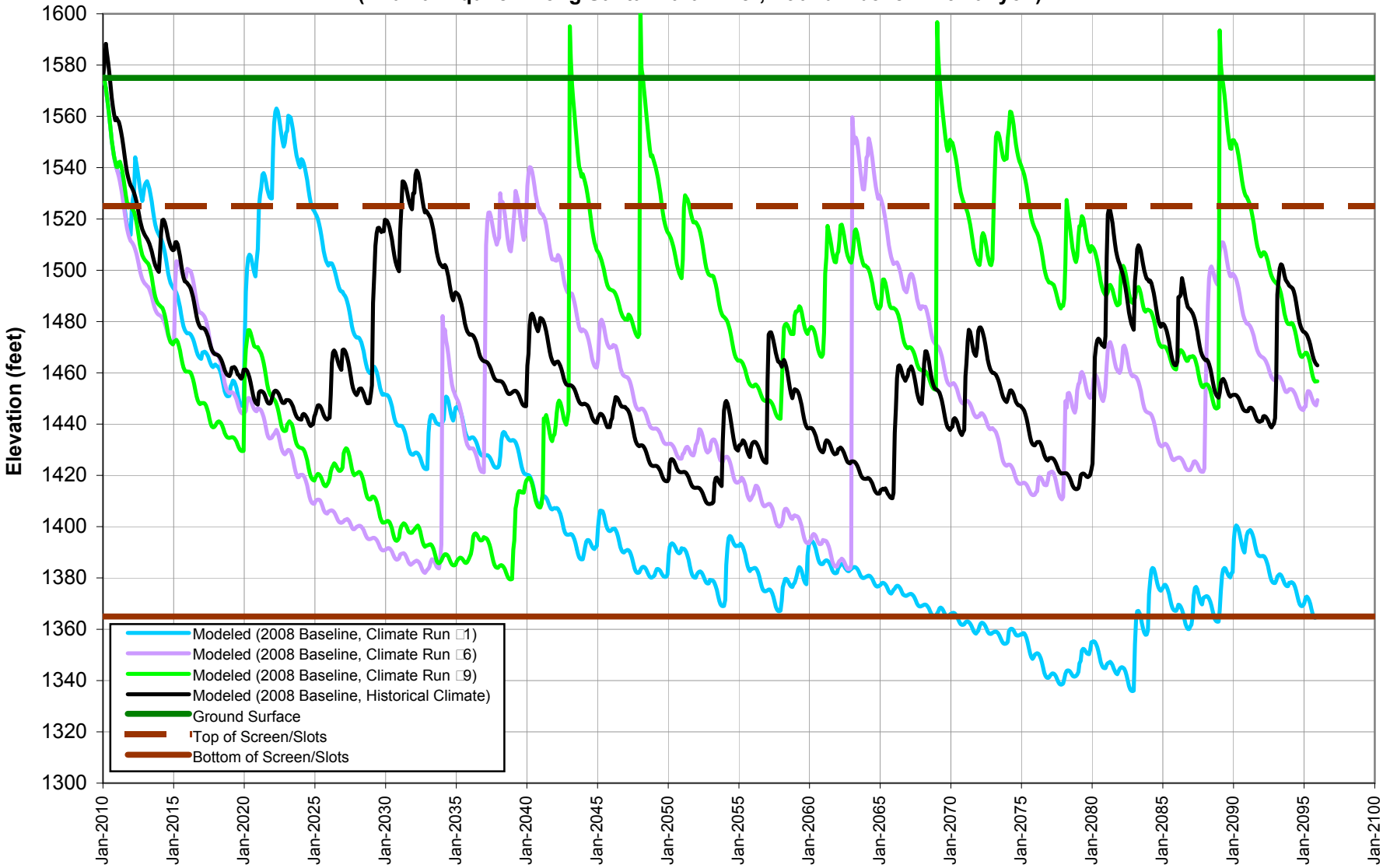


Figure 5-7: NCWD-Castaic7 Modeled Groundwater Elevations For Various Climate Projections (Alluvial Aquifer in Castaic Valley)

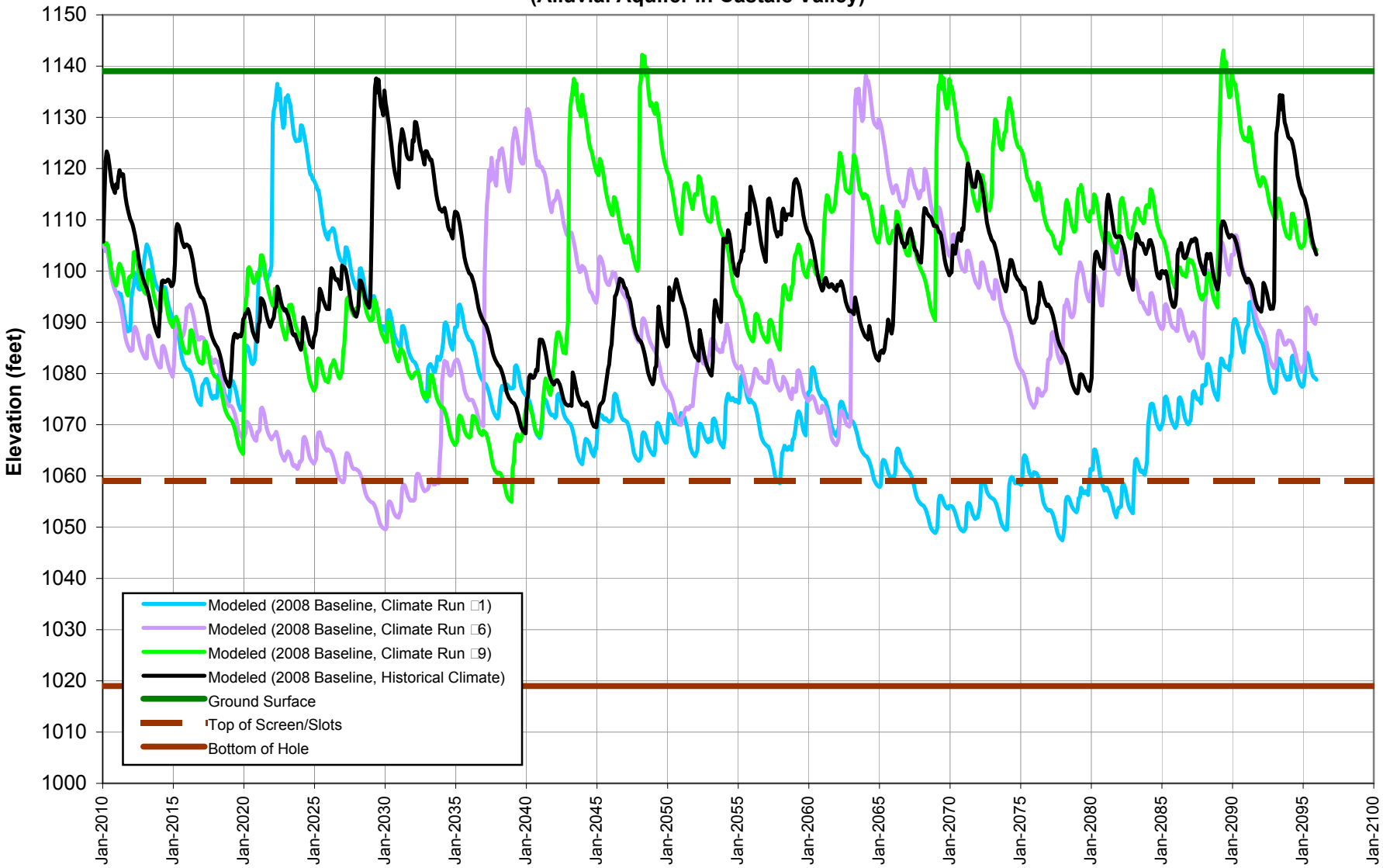


Figure 5-8: VWC-W11 Modeled Groundwater Elevations For Various Climate Projections (Alluvial Aquifer in San Francisquito Canyon)

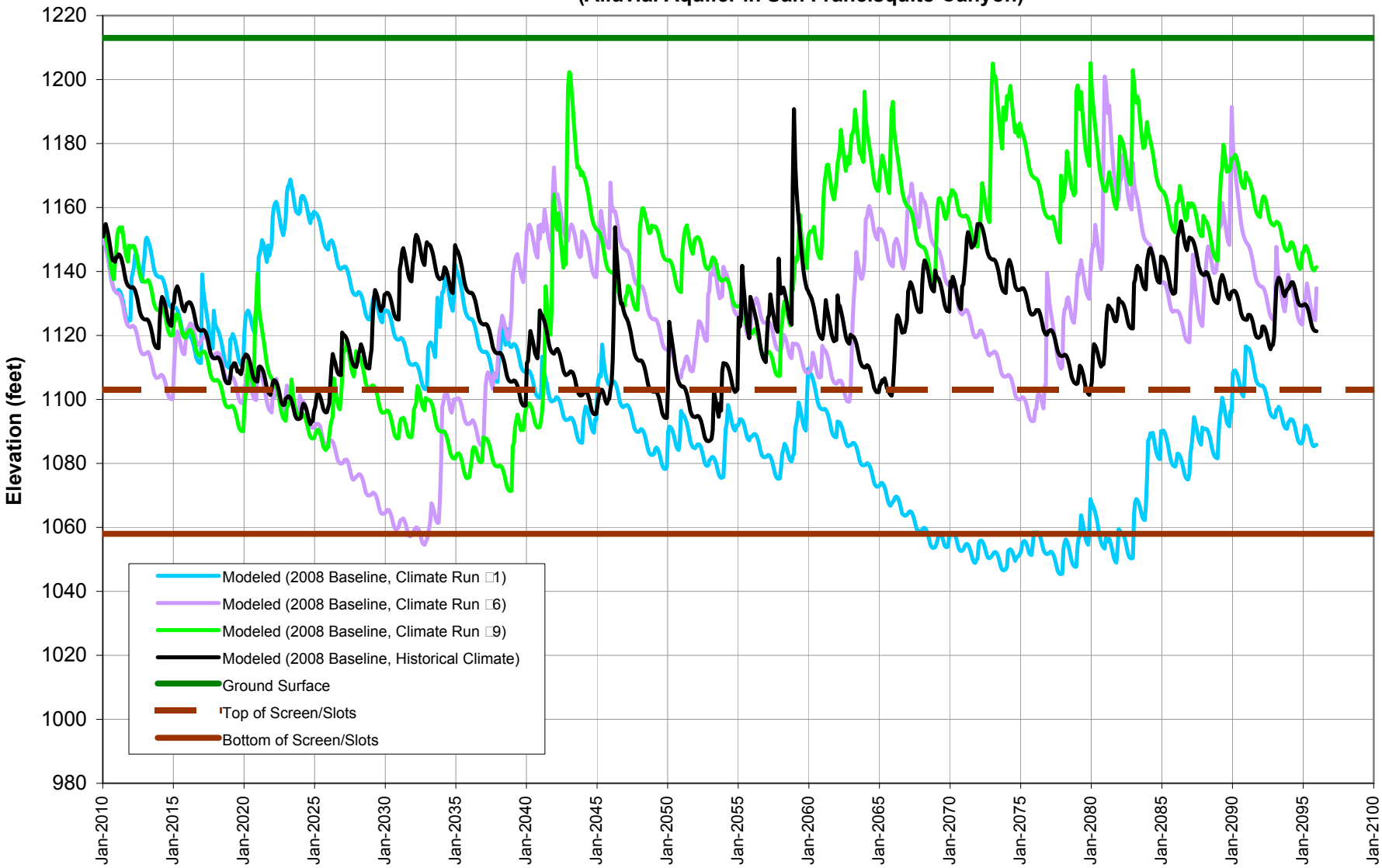


Figure 5-9: SCWD-Clark Modeled Groundwater Elevations for Various Climate Projections (Alluvial Aquifer in Bouquet Canyon)

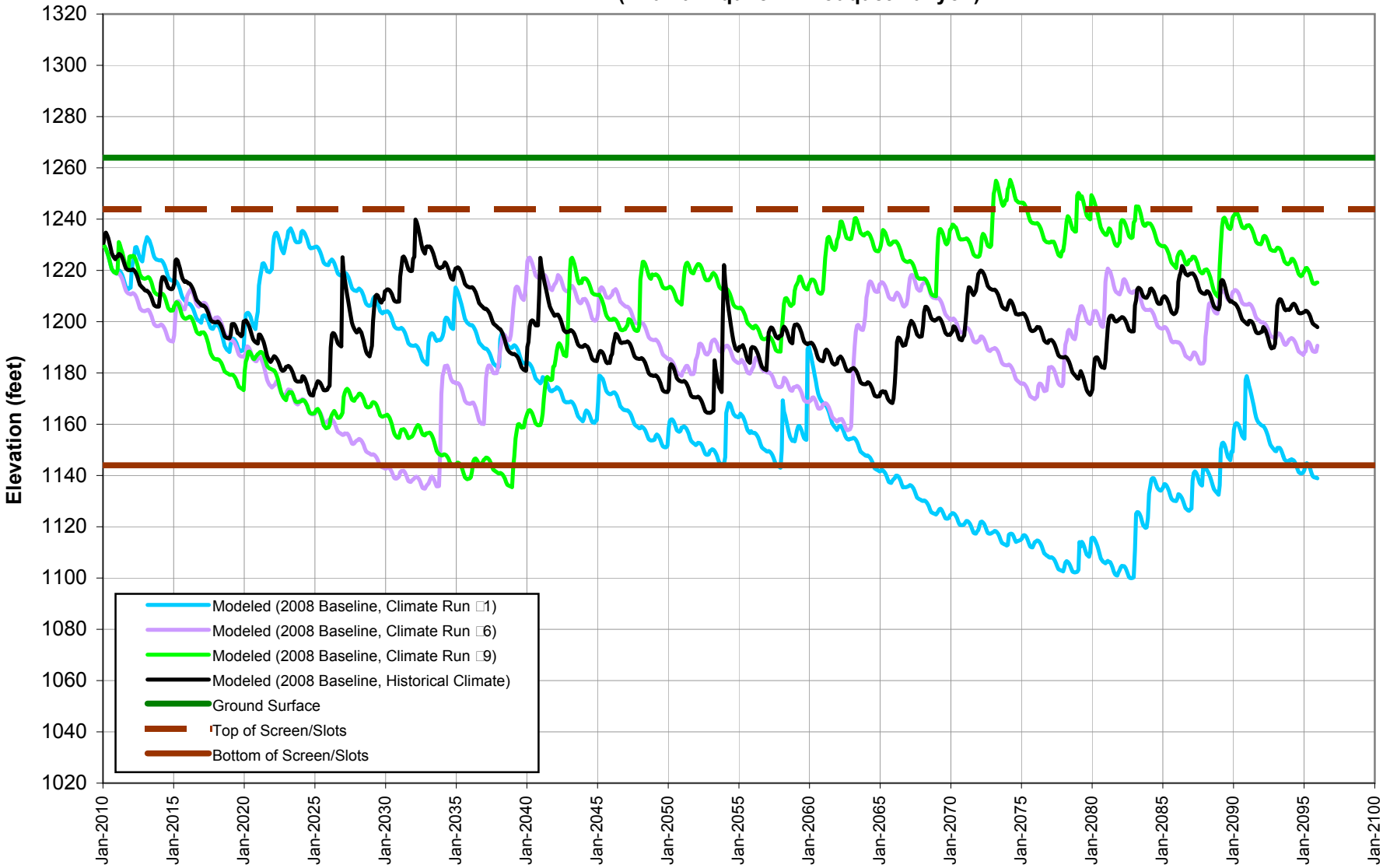


Figure 5-10: Groundwater Elevation Trends at SCWD-Saugus1 for the 2008 Operating Plan Under Historical Climate and Climate Projections 1, 6, and 9

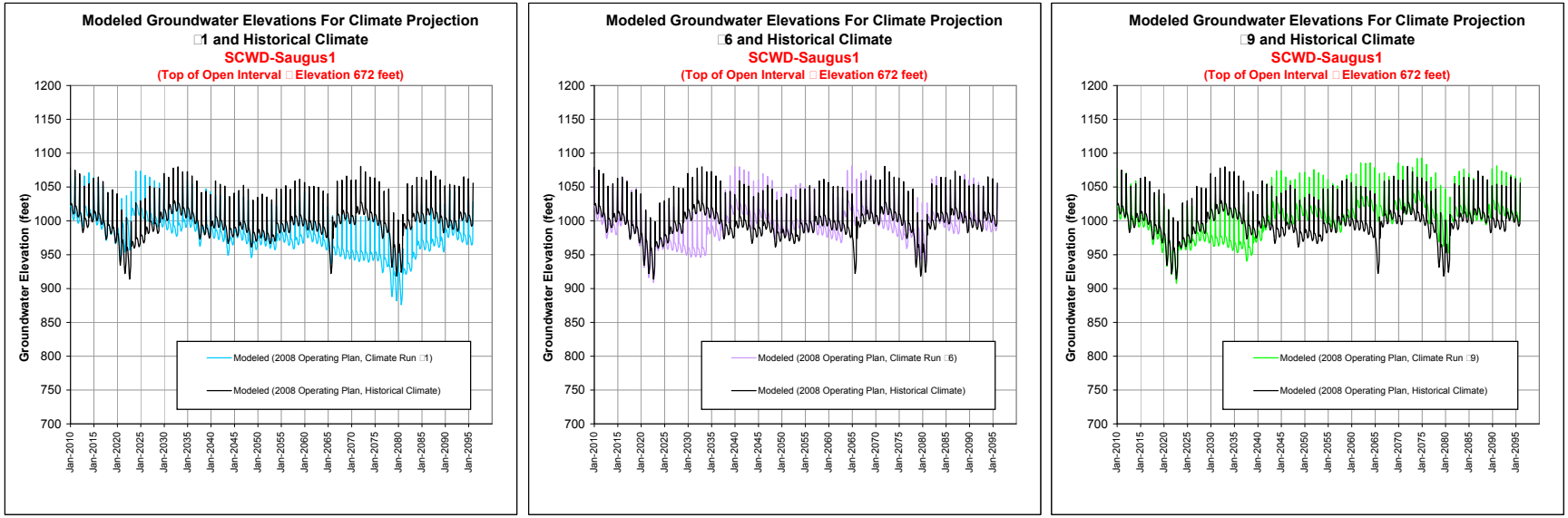


Figure 5-11: Groundwater Elevation Trends at VWC-206 for the 2008 Operating Plan Under Historical Climate and Climate Projections □1, □6, and □9

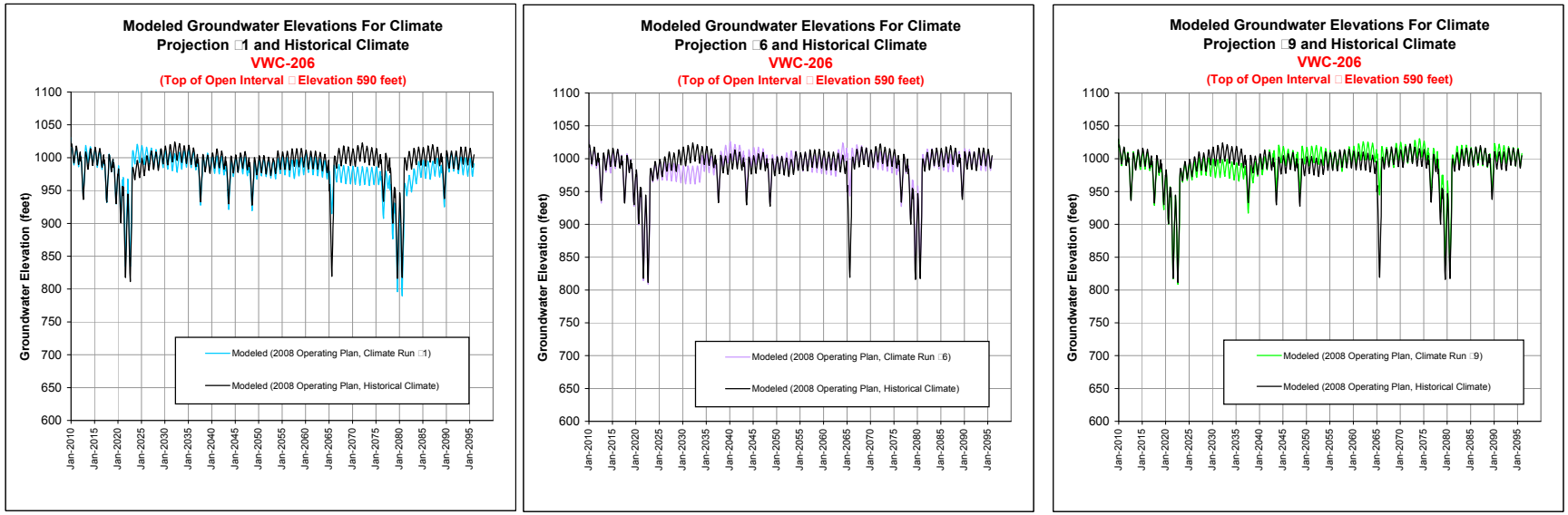
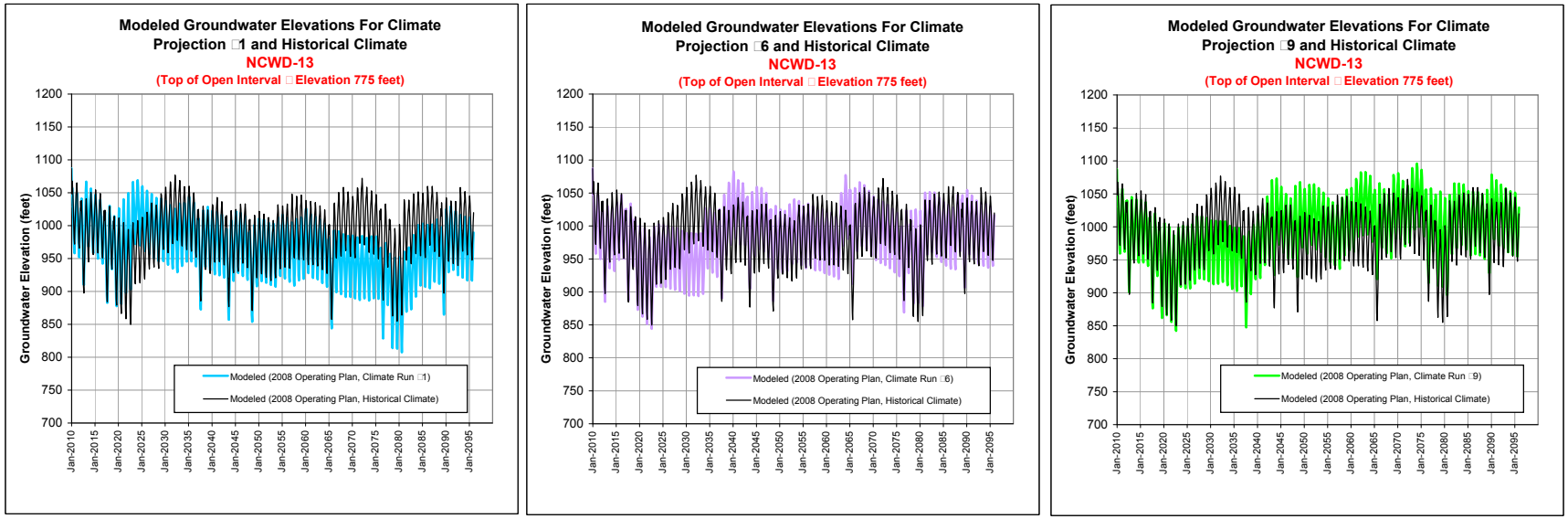


Figure 5-12: Groundwater Elevation Trends at NCWD-13 for the 2008 Operating Plan Under Historical Climate and Climate Projections □1, □6, and □9



VI. Local Artificial Recharge Projects

6.1 Los Angeles County Flood Control District Study

The Los Angeles County Flood Control District (LACFCD) prepared an unpublished water conservation plan that proposes constructing thirteen separate artificial recharge projects in the upper Santa Clara River Watershed. The focus of the plan is to capture or impede stormwater runoff to promote percolation to groundwater, specifically to the Alluvium located along the Santa Clara River. Although the plan acknowledged that there is a lack of runoff data to accurately predict the water conservation benefits of the projects, LACFCD estimated that, on average, a given year could be expected to have three storms that would be capable of producing enough stormwater runoff to fill the estimated storage capacities of each of the thirteen proposed projects. Therefore, to estimate the total water conservation benefit, LACFCD multiplied the total storage capacity of the thirteen projects by three. The total storage capacity and water conservation benefit of the thirteen projects combined were thus estimated to be 1,816 acre feet and 5,455 acre feet per year, respectively.

The plan subdivided the thirteen projects into three separate areas of the basin (Figure 6-1):

- six projects on the south fork of the Santa Clara River
- two projects in San Francisquito Canyon
- five projects on the main Santa Clara River System

Table 6-1 lists each project by subarea along with the LACFCD estimate of project capacity and water conservation benefit. The project locations relative to the Alluvial aquifer system by subarea are described below.

6.2 Project Locations Relative to Aquifer System

The six projects that would be located along the south fork of the Santa Clara River, as illustrated in Figure 6-1, consist of three rubber dam projects; two projects that divert water into spreading grounds; and a project that backs up flows behind a rubber dam for diversion into adjoining spreading grounds. The total capacity and estimated water conservation benefit of these six facilities are 496 acre feet and 1,475 acre feet per year, respectively. The riverbed of the south fork of the Santa Clara River lies along the eastern margin of the alluvial valley that the river occupies. In this area, the alluvium is thin and the Saugus Formation outcrops in the hills adjoining the river valley. Projects 1 through 5 are located in areas where groundwater pumping occurs from the Saugus Formation, but no Alluvial production wells are present because of the limited saturated thickness of the alluvium throughout this area. Project no. 6 is the furthest north (or downgradient) of the south fork projects and is located south of VWC's N7 and N8 Alluvial production wells in an area where the saturated thickness of the alluvium is much greater than further upstream where the other projects are located.

The two projects (no. 7 and 8 on Figure 6-1) proposed by LACFCD in San Francisquito Canyon would consist of spreading grounds along the unnamed ephemeral stream, tributary to the Santa

Clara River. The total capacity of the spreading grounds would be about 420 acre feet with a combined estimated water conservation benefit of 1,270 acre feet per year. The locations of the two spreading grounds are along the margins of the Alluvium north of Decoro Drive and Cooper Hill Drive where the alluvium is thin.

The five projects (no. 9 through 13 on Figure 6-1) proposed by LACFCD along the Santa Clara River extend from near the Saugus wastewater treatment plant eastward to areas just east of Newhall County Water District's Pinetree wells. These projects would include one rubber dam and four spreading grounds that are located along the margins of the Alluvium near outcrops of Saugus and bedrock formations in the hills adjoining the alluvial river valley. The five projects would have combined capacity of about 900 acre feet and an estimated total annual water conservation benefit of about 2,710 acre feet per year.

6.3 Conceptual Project Operation and Impacts

The purpose of the planned projects would be to capture stormwater runoff using inflatable rubber dams and to divert excess runoff into spreading grounds in order to recharge groundwater in the Alluvium in the immediate vicinity of each project site. The ability and related impact of the projects to effectively increase groundwater recharge in the Alluvium rather than to simply redistribute groundwater recharge is discussed in further detail below.

- **South Fork of the Santa Clara River.** Recharge projects in the South Fork of the Santa Clara River would be located primarily along the margins of the river valley where the Alluvium where this unit is thin. These project locations (nos. 1 through 5 on Figure 6-1) may not have sufficient alluvial thickness and available storage capacity during storm events to allow excess runoff captured by these projects to recharge groundwater at each project location. As a result, the excess stormwater runoff may not readily recharge groundwater and may be rejected due to the lack of available storage capacity in the vicinity of each project. Excess runoff captured by these projects would likely recharge groundwater elsewhere in the south fork of the Santa Clara River or near its mouth. Project locations 1 through 5 are proposed to be located in areas where groundwater production wells pump groundwater from the underlying Saugus Formation, rather than from the Alluvium. Consequently, even if some additional water were introduced to storage, little if any of the benefit would be able to be pumped at those project locations (again, there are no existing Alluvial production wells in the area and there is no likelihood of new production wells being constructed, all due to the lack of sufficient thickness of the Alluvium). Project location no. 6, the northernmost project in this area may have the potential to provide additional recharge to groundwater. However, due to the low storage capacity and estimated water conservation benefit, it would be difficult to differentiate between recharge from this project as compared to recharge under existing conditions, which already maintains sustainable groundwater conditions.

- **San Francisquito Canyon.** Project locations in San Francisquito Canyon would intercept stormwater runoff that would likely continue to recharge the Alluvium further downstream of the project locations; in essence, the projects would potentially

only redistribute stormwater recharge that currently has recharged the Alluvial aquifer in areas upstream of the Valencia waste water treatment plant (again, existing recharge already supports sustainable groundwater conditions in San Francisquito Canyon and immediately downstream in the main River area).

- **Santa Clara River** The project locations in the Santa Clara River area are very spread out with the easternmost project (no. 12) having the largest estimated capacity. However, Project no. 12 is located more than a mile east of Newhall County Water Districts Pinetree wells, and any stormwater runoff captured by this project would likely result in two different outcomes. One outcome is that the project would likely recharge groundwater in an area which currently has no production wells, and the water that is recharged would likely have recharged groundwater further downstream in the absence of the project. The second outcome is that the available storage in the alluvium in the area of the project would fill rapidly during a large stormwater runoff event, thereby limiting the amount of infiltration that can occur afterwards from the stormwater runoff captured by the project's spreading grounds. Three of the other four remaining projects (no. 10, 11, and 13) will likely encounter similar obstacles to Project no. 12 because of the similar surface and groundwater conditions that are present along the Santa Clara River between the Bouquet Canyon Bridge and the Lang gage (the eastern margin of the watershed). Project no. 9 (at the Bouquet Canyon Bridge) is similar in nature to Project no. 6 described above in that any benefit derived from the project might not be discernible from the conditions that would otherwise occur naturally in the absence of this and the other projects that are proposed along the Santa Clara River.

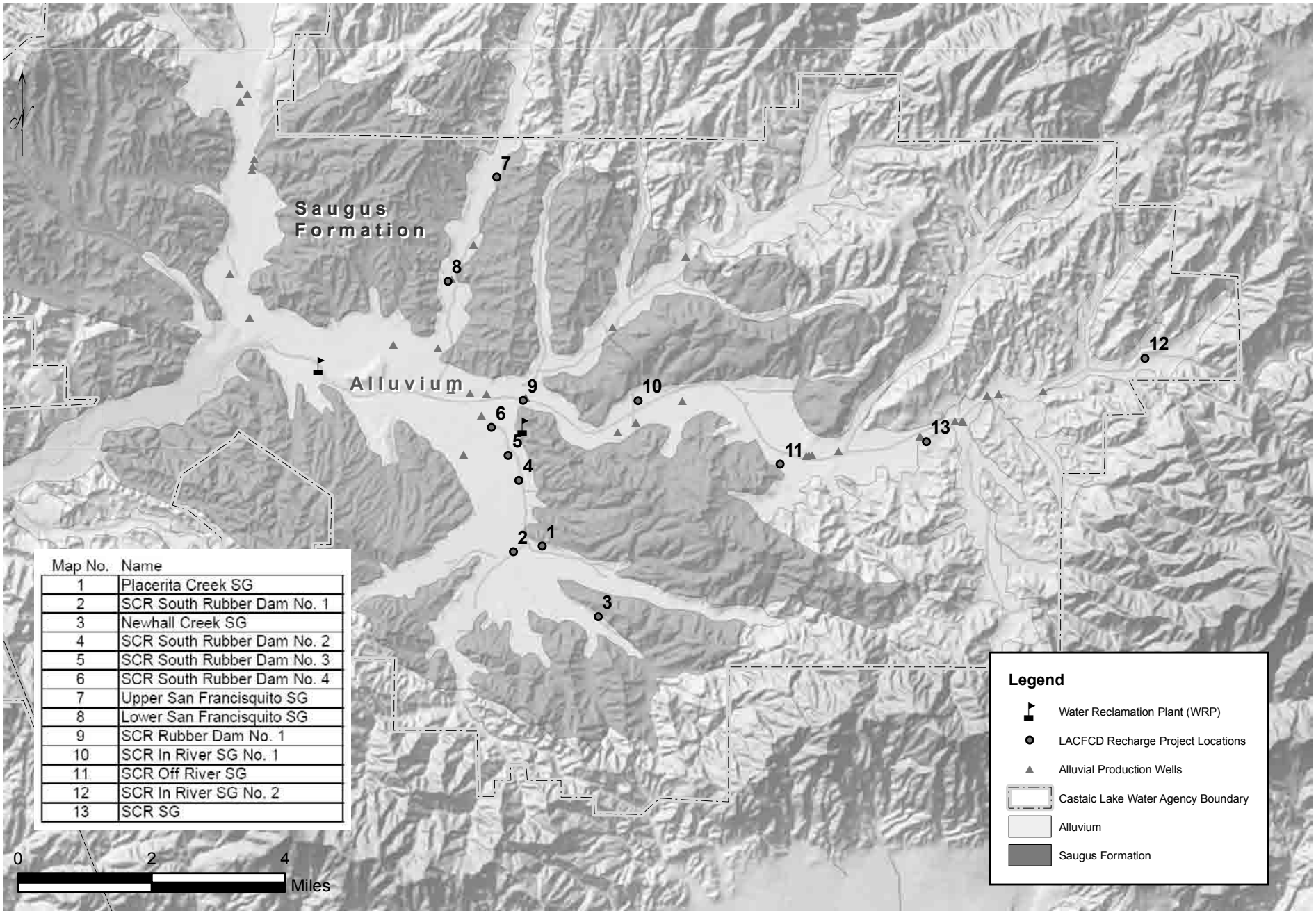
The overarching consideration with regard to the planned artificial recharge projects is that they might capture and "artificially recharge" water that already recharges the Alluvial aquifer system where it is of sufficient thickness to be developed as a groundwater supply. As evident from empirical observations and the simulations reported herein, the system "naturally" recharges to the point of sustaining groundwater pumping and, in the westerly end of the basin, to the point that stream recharge is rejected (and groundwater discharges to the stream). The small volumes of the various planned artificial recharge projects, and the arbitrarily estimated filling of those three times per year, do not represent "new" recharge; they likely represent some potential minor relocation of existing recharge.

Even if it were desirable to purposely relocate some existing recharge to one or more of the planned (LACFCD) locations, it would be difficult (possible but challenging) to redistribute the small amount of stream recharge and to then track the corresponding small effect of intercepting that water and removing it as a source of recharge as now occurs downstream. The results of the rest of the work reported herein, most notably that dealing with achievability of the 2008 Operating Plan, clearly suggest that artificial recharge could locally benefit certain areas, notably at and above Mint Canyon. However, such benefits would more logically develop from other water sources that would supplement natural recharge rather than simply redistribute it. The model used to simulate the basin response to the operating plans, under historic and potential climate change conditions, can readily simulate the effects and benefits of artificial recharge at selected locations using supplemental water.

Table

os ngeles Count Flood Control istrict
tor ater unoff ec arge ro ects

ec arge ro ect	torage Ca acit acre feet	nnual ater Conser ation enefit acre feet ear
anta Clara i er out For		
1	109	330
2	75	220
3	5	75
4	112	330
5	60	180
6	115	340
ubtotal		,
an Francis uito Can on		
7	230	700
8	190	570
ubtotal		,
anta Clara i er		
9	80	230
10	180	550
11	220	670
12	70	220
13	350	1040
ubtotal		,
rand Total	,	,



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 6-1
Locations of LACFCD Planned Recharge Projects
Upper Santa Clara River Valley Groundwater Basin, East Subbasin

VII. Conclusions

The primary objective of the updated analysis of groundwater basin yield in the Santa Clarita Valley was to evaluate the planned utilization of groundwater by the Purveyors, after their consideration of potential impacts on traditional supplemental water supplies from the State Water Project (SWP), and with recognition of ongoing pumping by others for agricultural and other private water supply, for sustainability of the groundwater resource and for physical ability to extract groundwater at desired rates. As has previously been utilized in this basin, consistent with groundwater management in other settings, sustainability is defined in terms of renewability (recharge) of groundwater as reflected by the following indicators:

- lack of chronic, or sustained, depletion of groundwater storage, as indicated by projected groundwater levels, over a reasonable range of wet, normal, and dry hydrologic conditions

- maintenance of surface water flows in the western portion of the basin (which are partially maintained by groundwater discharge) and surface water outflow to downstream basins over the same range of hydrologic conditions

Regarding maintenance of surface water flows, although the development and use of groundwater in a sustainable manner necessitates the inducement of recharge from surface water, sustainability in this case does not rely on inducing groundwater recharge by eliminating surface water flows. Rather, sustainability retains surface water outflows and may even increase them with the importation of supplemental water when contrasted to pre-SWP conditions. Regarding both indicators of sustainability, the range of analyzed hydrologic conditions is a long-term period that includes anticipated occurrences of the types of years and groups of year types that have historically occurred in the basin.

A second objective of the updated groundwater basin yield analysis was to investigate and describe potential impacts of expected climate change on the groundwater basin and its yield. A third objective was to consider potential augmentation of basin yield via potential artificial groundwater recharge using storm water runoff in selected areas of the basin as being planned by the Los Angeles County Flood Control District.

The primary objective was investigated by analyzing, with the numerical groundwater flow model of the basin, two groundwater operating plans: a 2008 Operating Plan to reflect currently envisioned pumping rates and distribution throughout the Valley, including fluctuations through wet/normal and dry years, to achieve a desired amount of water supply that, in combination with anticipated supplemental water supplies, can meet existing and projected water requirements in the Valley; and a Potential Operating Plan that envisions potentially increased utilization of groundwater during both wet/normal and dry years.

With regard to the respective operating plans, a first conclusion is that the 2008 Operating Plan will not cause detrimental short- or long-term effects to the groundwater and surface water resources in the Valley and is, therefore, sustainable. Consistent with actual operating experience and empirical observations of historical basin response to groundwater pumping, the

2008 Operating Plan can be expected to have local difficulty, in the Alluvium at the eastern end of the basin during locally dry periods, with achievement of all the Alluvial pumping in the 2008 Operating Plan. This condition is particularly evident if several decades of predominantly below-normal rainfall years were to occur in the future such as occurred during much of the five decades from the mid-1920s through the mid-1970s. In other words, while the basin as a whole can sustain the pumping embedded in the 2008 Operating Plan, local conditions in the Alluvium in the eastern end of the basin can be expected to repeat historical groundwater level declines during dry periods, necessitating a reduction in desired Alluvial aquifer pumping due to decreased well yield and associated actual pumping capacity. The modeling analysis conducted to date suggests that those reductions in pumping from the Alluvial aquifer can be made up by an equivalent amount of increased pumping in other parts of the basin without disrupting basin-wide sustainability or local pumping capacity in those other areas. For the Saugus Formation, the modeling analysis indicates that this aquifer can sustain the pumping from this unit that is imbedded the 2008 Operating Plan.

Simulation of the 2008 Operating Plan with Pumping Redistribution indicates that westerly redistribution of 1,600 afy of alluvial pumping from the eastern end of the basin would help, but not eliminate, the lack of achievability. The residual unachievable pumping in the east end of the basin, about 4,500 afy, could be redistributed to other areas of the basin with minimal impact on groundwater levels. In this case, total Alluvial pumping in the basin could remain near the upper end of the 2008 Operating Plan range of 30,000 to 35,000 afy. Conversely, absent any additional efforts to redistribute pumping, the total Alluvial pumping capacity during extended dry periods would likely shrink toward the lower end of the 2008 Operating Plan range, toward 30,000 afy.

Another conclusion with regard to the respective operating plans is that the Potential Operating Plan would result in lower groundwater levels, failure of the basin to fully recover (during wet hydrologic cycles) from depressed storage that occurs during dry periods, and generally declining trends in groundwater levels and storage. This conclusion is strongly suggested for the Alluvial aquifer by the modeling results, but the model also indicates that long-term lowering of groundwater levels could also occur in the Saugus Formation, with only partial water level recovery occurring in the Saugus. Thus, the Potential Operating Plan would not be sustainable over a long-term period. The simulated combination of lower and declining groundwater levels under the Potential Operating Plan also leads to a conclusion that such an operating plan could not be physically achieved in several areas within the basin.

Conclusions with regard to another of the objectives of the updated groundwater basin yield analysis include a recognition that the runoff conservation/groundwater recharge projects being planned by the Los Angeles County Flood Control District are a combination of individually small projects that are not yet fully analyzed in terms of potential new yield, are but unlikely to provide any substantial recharge that does not already occur. Additionally, these proposed projects are mostly located in areas of the basin where the alluvial aquifer is of insufficient thickness and storage (and is thus not developed for water supply) or where the alluvial aquifer already fully recharges when stream flows are naturally present.

Final conclusions related to the overall objectives of the updated groundwater basin yield analysis all relate to the potential impacts of climate change on the yield of the basin and the

related groundwater supply from the basin. While "conclusions" would probably be an inappropriate term to describe future conditions that cannot be projected with any degree of certainty, the results of simulating basin response to the 2008 Operating Plan, under a range of potential climate change result in two important observations.

- for the broad range of climate change possibilities that was analyzed, the 2008 Operating Plan would appear to be both sustainable and, with the same physical constraints to full pumping in the eastern part of the basin as have otherwise been experienced, achievable through the shorter term horizon associated with UWMP planning.

- the range of potential climate change impacts extends from a possible wet trend to a possible dry trend over the long term. The trends that range from an approximate continuation of historical average precipitation, to something wetter than that, would appear to result in continued sustainability of the 2008 Operating Plan, again with intermittent constraints on full pumping in the eastern part of the basin. The potential long-term dry trend arising out of climate change would be expected to decrease local recharge to the point that lower and declining groundwater levels would render the 2008 Operating Plan unsustainable.

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Appendix 5.21I

Literature Survey: Global Climate Change and its Effects on California's Water Supplies

Eyestone Environmental

February 2015

Global Climate Change and its Effects on California's Water Supplies

The purpose of this survey is to present the results of a scientific literature review that was conducted to determine the current state of knowledge on global climate change and its effects on water supplies. (The scientific literature summarized herein is available for public review and inspection upon reasonable request to the County of Los Angeles.) The survey concludes with the County's CEQA determination with respect to such issues.

1. Summaries of Relevant Scientific Literature

(a) Intergovernmental Panel on Climate Change (IPCC)

By way of introduction, the IPCC is the leading international body for the assessment of climate change. Established in 1988, the IPCC is a scientific, intergovernmental body under the auspices of the United Nations responsible for reviewing and assessing the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. Because of its very nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers.

IPCC Fifth Assessment Report
(IPCC 2014)

This report evaluates and considers how impacts and risks related to climate change can be reduced and managed thru adaptation and mitigation. (IPCC 2014, Summary for Policymakers, p. 3.) The primary findings of this report are located in the Summary for Policymakers, which contains three sections. Section A characterizes observed impacts, vulnerability and exposure, and adaptive responses to date. Section B examines future risks and potential benefits. And, Section C considers principles for effective adaptation and sustainable impacts. (*Id.* at pp. 3-4.)

Water Quality: The IPCC determined that climate change will reduce raw water quality, posing risks to drinking water quality even with conventional treatment, due to increased temperature, increased sediments, nutrient and pollutant loadings due to heavy rainfall, reduced dilution of pollutants during droughts, and disruption of treatment facilities during floods. (IPCC 2014, Fifth Assessment Report, Ch. 3, p. 3.) The report notes that these changes are known because of isolated studies in rivers and lakes of high-income countries. (*Id.* at p. 7.) However, the report acknowledges that "[p]rojections under climate-change scenarios are difficult, both to perform and interpret, because they require not only integration of the climate models with those used to analyze the transportation and transformation of pollutants in water, soil, and air, but also the establishment of a proper baseline." (*Id.* at p. 16.)

Water Supply: The IPCC determined that climate change will result in less water availability, increased drought conditions, and increased pollution. (IPCC 2014, Fifth Assessment Report, Ch. 26, p. 15.) Reliability of water supply is expected to suffer from increased variability in surface water availability and increased groundwater abstractions. (*Id.* at p. 4.)

Flooding: The IPCC determined that projected increases in flooding may affect areas of urban and water infrastructure. (IPCC 2014, Fifth Assessment Report, Ch. 26, p. 15.)

(b) U.S. Army Corps of Engineers (Corps)

Climate Change and Water Resources Management: A Federal Prospective
(Corps 2009)

The purpose of this inter-agency report, which was jointly issued by the Corps, U.S. Geological Survey, Bureau of Reclamation and National Oceanic and Atmospheric Administration (NOAA), is to explore strategies to improve water management by tracking, anticipating, and responding to climate change. (Corps 2009, p. ES 1.) The report concludes that an array of reasonable approaches exist to study hydrologic conditions and the impact of climate change; currently, no one modeling approach prevails. (*Id.* at Ch. 3, p. 21.) But, current planning approaches, based on the models, have assumed that past climate conditions will be similar to those in the recent past, "an assumption that may be suspect given that climate is changing." (*Id.* at Ch. 4, p. 27.) Specifically, "probability estimates using these approaches could give misleading results that do not consider the full range of uncertainty." (*Ibid.*) Currently, there remain "significant gaps in knowledge, monitoring, and practice that limit incorporation of climate change considerations into water resources planning and management. . . . Sound water management is built on sound, accurate, timely, and long-term hydrological and meteorological monitoring networks that are consistent and that can be used readily to assess and provide decisionmaking tools needed to quantify uncertainty, forecast change, and create the multiphase, multilevel climate scenarios that will provide reasonable and relevant management." (*Id.* at Ch. 6, p. 37.)

Addressing Climate Change in Long-Term Water Resources Planning and Management: User Needs for Improving Tools and Information
(Corps 2011)

This report, jointly issued by the Corps and U.S. Bureau of Reclamation, describes and identifies the information and tools most relevant to water management programs. (Corps 2011, p. viii.) In particular, this report is a policy document, developed to guide decision makers as to the steps necessary to determine climate change impacts on water resources.

The Corps outlines the following steps it plans to use in the future to study climate change impacts on water: (i) summarize relevant literature related to climate change and water resources; (ii) obtain climate change projections; (iii) assess natural system responses to climate change, including watershed hydrology, water quality, and sea level rise; (iv) assess socioeconomic and institutional responses; (v) evaluate infrastructure; (vi) assess and characterize uncertainties; and (vii) distill the information for decision makers. (Corps 2011, pp. x-xi.) Of relevance, appendix A of the report summarizes a scoping workshop from the Climate Change and Water Working Group, a group of federal agencies and research entities, and found several recurrent themes:

- The working group agencies are taking a proactive approach to addressing climate change within the context of western water management.
- Water management agencies have a need to identify the most appropriate role of climate change information in its longer-term planning processes, operations studies, and dam safety decisions.
- There are climate services within the federal government that may be looked upon for information and guidance on climate date usage.
- Water operations managers need improved weather and climate forecast on time scales varying from days to decades.
- Climate change information is necessary for future planning and implications related to supply, demands, and constraints on water.

(Corps 2011, pp. 122-124.)

(c) The Federal Emergency Management Agency (FEMA)

Climate Change Adaptation Policy Statement
(FEMA 2013)

The purpose of FEMA's policy statement is to establish and integrate climate change adaptation planning and actions into FEMA programs and operations. To that end, the policy statement identifies seven actions FEMA intends to initiate to integrate adaptation into its programs and operations. In particular, FEMA intends to:

- Enhance climate research, monitoring, and adaptation capabilities by continuing to establish partnerships with other agencies and organizations that possess climate science and climate change adaptation expertise.

- Study the impacts of climate change on the National Flood Insurance Program (NFIP) and incorporate climate change considerations in NFIP reform effort.
- Evaluate how climate change considerations can be incorporated into grant investment strategies with specific focus on infrastructure and evaluation methodologies or tools such as benefit/cost analysis.
- Understand how climate change will impact local communities and engage them in addressing those impacts.
- Promote building standards and practices, both within FEMA programs and in general, that consider the future impacts of climate change.
- Partner with the climate science community to evaluate the potential impact climate change may have on existing risk data and the corresponding implications for Threat Hazard Identification Risk Assessment development and operational planning.
- Pursue a flexible, scalable, well equipped, and well trained workforce that is educated about the potential impacts of climate change.

(FEMA 2013, pp. 2-3.)

***The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100* (AECOM 2013)**

This study, prepared by AECOM for FEMA, assesses the influence of climate change on the National Flood Insurance Program, and provides "important insight regarding the associated uncertainty inherent in the current state of climate modeling." (AECOM 2013, Foreword.) In particular, the study determined the following:

> Projections of future climatic conditions are *inherently uncertain for two major reasons*. *First*, although great progress has been made in understanding the physics of climate and in the ability to simulate likely changes using powerful numerical models, much research and analysis still remains to be done. *Second*, climate change will depend to some degree upon human choices and actions over the next decades, and these cannot be known with any certainty.

(*Id.* at p. 2-1, italics added.) The study notes that there are two types of uncertainty inherent in addressing climate change: epistemic and aleatory. "Epistemic uncertainty is the uncertainty caused by lack of knowledge; aleatory uncertainty is associated with an inherent randomness of a

natural process." (*Ibid.*) These uncertainties reduce the reliability of the models and projections. (*Id.* at p. 7-3.) In particular, the study indicates that "there is a very great deal of epistemic uncertainty in the currently available climate change forecasts." (*Id.*, at p. 2-2.)

> There are two major levels of uncertainty in the climate data used for the study. First, there are numerous global climate models that have been constructed by independent researchers, and numerous assumptions regarding future greenhouse gas emissions that go into those models. For a given emissions assumption (an emissions scenario) each model yields a different forecast. For a given model, each emissions scenario yields a different forecast. Second, even with a given model and a given emissions scenario, forecasts can still be uncertain, perhaps with defined ranges of variability – for example, that some parameter is expected to lie within a stated range with a defined chance.

(*Ibid.*)

In spite of the uncertainties inherent in climate change data, modeling, and projections, the study includes a summary of its findings, as follows:

- *Riverine Environment*: By 2100, the relative increase in the median estimates of the 1 percent annual chance floodplain (floodplain) depth and area (Special Flood Hazard Area or SFHA) in riverine areas is projected to average about 45 percent across the nation, with very wide regional variability. In populated areas of most interest to the NFIP, approximately 30 percent of these increases in the SFHA and base floodplain depth may be attributed to normal population growth, while the remaining portion represents the influence of climate change. The split is extremely variable from place to place and should not be construed as a definitive value.
- *Coastal Environment*: Assuming a fixed shoreline, the typical increase in coastal SFHA is projected to be about 55 percent by the year 2100, with very wide regional variability. The typical increase may range from less than 50 percent along the Pacific Coast to over 100 percent for portions of the Gulf of Mexico and the Atlantic coasts. Under the receding shoreline assumption, negligible change in coastal SFHA is projected.

(*Id.* at pp. 6-1 to 6-2.)

(d) The U.S. Climate Change Science Program (USCCSP)

The Effects of Climate Change on Agriculture, Land, Resources, Water Resources, and Biodiversity in the United States
(USCCSP 2008)

The report provides an assessment of the effects of climate change, among other things, on U.S. water resources. It builds on scientific literature and recent assessments of the historical and potential impacts of climate change. (USCCSP 2008, Abstract.) It identifies changes in resource conditions that are now being observed, and examines whether these changes can be attributed in whole or part to climate change. (*Ibid.*)

Water Quality: According to the report, "[w]ater quality is sensitive to both increased water temperatures and changes in precipitation. However, most water quality changes observed so far across the continental United States are likely attributable to causes other than climate change." (*Id.* at p. 7.) Studies have shown, rather, that water quality indicators are affected by land use, primarily due to pollutant loadings. (*Id.* at pp. 134, 149.)

(e) California Department of Water Resources (DWR)

Climate Change Handbook for Regional Water Planning
(DWR 2011)

This handbook was developed as a partnership between DWR, the U.S. Environmental Protection Agency Region 9, the Corps South Pacific Division, and the Resources Legacy Fund. The handbook reviews modeling efforts for predicting climate change impacts on water quality, water supply, and water demand in Southern California. Specifically, this handbook reviews the general circulation models (GCMs) developed through the IPCC 2011, and the ways in which the model results are being used in California. (DWR 2011, p. 2-4.) Importantly, the handbook notes that:

> [T]here are many sources of uncertainty inherent in projections of future climate variables, and these uncertainties add an additional layer of complexity to planning. There is uncertainty associated with [citation omitted]:
>
> - *The emission scenarios*. The scenarios supported by the IPCC are their best representation of potential futures and encompass "best" and "worst" cases as well as they can estimate them. However, there is significant uncertainty associated with future global GHG emissions.

- *Data limitations.* The historical dataset available for calibrating GCMs is spatially biased towards developed nations. In addition, difficulties associated with monitoring extreme events make model-data comparisons difficult.
- *Scientific understanding*. The models represent current understanding of the Earth's physical response to increased GHG emissions. There are still many open questions regarding how the Earth responds to a warming climate. For example, uncertainties associated with ice flows in Antarctica and Greenland impact GCM results. The relative strength of various global feedback looks is also unclear.

(*Id.* at p. 2-6.) Finally, the handbook performed a literature review, and found that:

- The available climate change information provides very little specific/procedural guidelines for regional water planners.
- There is an information gap on specific strategies for water agencies to adapt to climate change impacts.
- There is limited information on integration of strategies.
- There is a lack of information related to climate change impacts on groundwater and water quality.
- There is little information regarding mitigation to offset impacts associated with specific water resource strategies developed by the agencies.
- There are a limited number of regional water plans that account for climate change.

(*Id.* at pp. A-5 to -6.)

Water Quality: Specific to water quality, the handbook addresses the following "[p]rimary sources of uncertainty to modeling efforts," which include:

- A limited understanding of how the physical system responds to climate and other variables.
- Numerical accuracy uncertainty due to the limitations of the underlying mathematical equations and the assumption that the historical calibration dataset is comprehensive and representative of future projections.
- Unpredictability in hydrology and climate variability.

- Uncertainty in projecting future conditions of pollutant loading, land use, climate variables, and streamflows.

(*Id.* at p. 5-41.)

Water Supply: Specific to water supply, the handbook addresses the following "[u]ncertainties associated with runoff models results," which include:

- A limited understanding of how the physical system responds to climate and other variables.
- Uncertainty associated with limitations on the numerical accuracy of rainfall runoff models.
- Unpredictability in hydrology and climate variability.
- Uncertainty in projecting future conditions of future land use, irrigated land estimates, and climate variables.

(*Id.* at p. 5-29.)

Flood Hazards: The handbook notes the uncertainties inherent in modeling to predict climate change impacts on flooding events, stating:

> The current suits of GCMs are not designed to project future extreme weather . . . [because] extreme precipitation events that cause flooding occur at hourly and daily time steps. In addition, precipitation patterns are strongly influenced by regional and subregional geography, especially in mountainous areas. GCMs are not designed to provide information at these scales or time steps, and downscaling methods may not provide adequate accuracy or precision for making flood planning decisions. Therefore, the tools and strategies described for other planning activities that rely on GCM data are likely not appropriate for incorporating climate change into flood planning decisions.

(*Id.* at p. 5-57.)

California Water Plan 2013 Update
(DWR 2013)

The California Water Plan (CWP) is the State's strategic plan for managing and developing current and future water resources. (DWR 2013, p. 1-5.) The CWP addresses integrated water management, government agency alignment, and strategies to invest in innovation and infrastructure. (*Id.* at p. 1-7.)

First, integrated water management is a strategic approach to planning and implementing water management programs that combines flood management, environmental stewardship, and surface water and groundwater supply actions to provide statewide benefits. (*Id.* at p. 1-8.) Second, government agency alignment seeks to better align local, state and federal agencies to expedite and implement resource management strategies. (*Id.* at p. 1-9.) Third, investment in innovation and infrastructure is addressed to create a more stable, effective funding stream for successful water resource implementation. (*Id.* at p. 1-10.) The CWP provides this thematic framework to achieve its goals for ensuring California's water supplies are adequate, reliable, secure, affordable and sustainable. (*Id.* at p. 8-7.)

Expanding on these three themes, the CWP addresses current and future water resources. According to the CWP, future conditions affecting water quantity, quality, and infrastructure are difficult to address given the uncertainties of future climate change. (*Id.* at p. 2-12.) Water sector vulnerability to climate change arises from changes in hydrology affecting frequency, magnitude, and duration of extreme events (such as flooding and drought). (*Ibid.*) Specifically:

> Reduction in snowpack storage affects water supply reliability, hydropower, and the amount of runoff during extreme precipitation that leads to flooding. Rising sea levels increase susceptibility to coastal flooding. These climate change conditions also affect Delta levee integrity and water quality. Changes in Delta water quality and the need to meet water quality requirements may require changes in upstream water management and resultant changes in local water supply reliability and water quality. Recreation and tourism are also likely to suffer due to lower water levels in waterways and reservoirs and declining snowpack.
>
> Specific consequences of climate change are that higher temperatures will melt the Sierra snowpack earlier and drive the snowline higher, resulting in higher peak flood flows and less snowpack to supply water to California users. Rainfall events may become more frequent and intense, contributing to increased flood risk. Droughts may become more frequent and persistent this century. Accelerating sea level rise will produce higher storm surges during coastal storms. Together, higher winter runoff and sea level rise will increase the probability of levee failures in the Delta. Sea level rise will also place additional constraints on water management and exports from the Delta, especially as a result of increased salinity from tidal exchange in the Delta. By the end of the 21st century, the

> magnitudes of the largest floods may increase from 110 to 150 percent of historical magnitudes.

(*Ibid.*; see also *id.* at p. 3-59.) Given these uncertainties and speculative consequences, the CWP recommends enhancing integrated water management and infrastructure planning. (*Id.* at p. 2-13.)

By setting forth a plan for future planning, the CWP provides step-by-step methods for planning in the face of climate change uncertainties. (*Id*. at Chapters 2, 4 and 8.) In particular, the CWP lists sources of long-term and short-term uncertainty, based on growth scenarios, simulated precipitation, decision-making steps, and reliability thresholds, in order to provide clear direction on resource management strategies. (*Id*. at pp. 5-12 to 5-32.) In the end, the CWP provides certain objectives for future planning, including strengthening integrated regional water management; use and reuse water more efficiently; expand conjunctive management of multiple supplies; protect and restore surface water and groundwater quality; practice environmental stewardship; improve flood management using an integrated water management approach; manage the Delta to achieve the coequal goals for California; prepare prevention, response, and recovery plans; reduce the carbon footprint of water systems and water uses; improve data, analysis, and decision-support tools; invest in water technology and science; strengthen tribal/state relations and natural resources management; ensure equitable distribution of benefits; protect and enhance public access to the State's waterways, lakes and beaches; strengthen alignment of land use planning and integrated water management; strengthen alignment of government processes and tools; and improve integrated water management finance strategy and investments. (*Id.* at p. 8-10.)

The State Water Project Final Delivery Reliability Report 2013
(*DWR SWP 2014*)

The State Water Project Delivery Reliability Report 2013 updates the estimated water delivery capability of the State Water Project (SWP) for current conditions and two decades from now, in an effort to help plan for reliable future water supplies in California. (DWR SWP 2014, Director's Message.) The Report found: (i) the estimated average annual SWP exports decrease 146 thousand acre-feet per year (taf/year) between existing and future conditions scenarios; (ii) under existing conditions, the average annual delivery of Table A water is one (1) percent more than that estimated in 2011; (iii) under future conditions, the average annual delivery of Table A water is one (1) percent less than that estimated in 2011; and (iv) the likelihood of existing and

future condition SWP Article 21 deliveries being greater than 20 taf/year gas decreased relative to the estimates in 2011. (*Id.* at S-2.)

- Water Supply: SWP facilities include 33 storage facilities, 21 reservoirs and lakes, 20 pumping plants, four pumping-generating plants, five hydroelectric power plants, and about 700 miles of canals and pipelines that provide water to portions of California. (*Id.* at p. 5.) Several factors influence supply from these SWP facilities, including availability at the source, water rights, priority, climate change, regulatory restriction, ongoing environmental and policy planning efforts, and Delta levee failure. (*Id.* at pp. 14-15.) Relative to global climate change, the following information is relevant:
    - Water availability at the source: This factor depends on the amount and timing of rain and snow during a given year, the amount and timing of runoff, and the level of use in SWP source areas. (*Id.* at p. 15.) Because the location, amount, and form of precipitation is unpredictable in any given year, uncertainty exists as to SWP water supply. (*Id.*)
    - Climate change: Using historical data and modeling, DWR projects that - by 2050 - the Sierra snowpack will be reduced from its historical average down to 40 percent, due to increased precipitation falling as rain instead of snow. (*Id.* at p. 16.) This precipitation shift causes the snow to melt earlier, adversely affecting water supply availability for SWP pumping in the summer. (*Ibid.*) Additionally, a reduction in the amount of carryover water is expected. (*Id.* at p. 17.)
    - Increased demands: Warmer temperatures increase evapotranspiration rates, requiring larger water amounts for irrigation, urban landscaping, and environmental needs. (*Ibid.*)
    - Sea level rise: Sea level rise could place more pressure on the Delta's fragile levee system, because the Delta is 20 feet below sea level. (*Ibid.*) Sea level rise may also cause salt water to flow further inland, increasing saltwater intrusion into coastal aquifers, making groundwater unsuitable for water supply or irrigation. (*Ibid.*)
- Water Quality: Climate change may affect Delta water quality standards. Sea level rise could affect Delta water quality due to salt water from the Pacific Ocean moving upstream, requiring DWR to release more freshwater from Lake Oroville. (*Id.* at p. 17.)

- Flood Hazards: In the last 5 years, DWR has worked to improve its ability to respond quickly and effectively to simultaneous levee failures on multiple islands in the Delta. (*Id.* at p. 27.) Currently, a Plan is being prepared to describe DWR's policies and actions relating to flood emergency in the Delta. (*Id.*)

The Report ends with a discussion of future SWP delivery estimates. The Report cautions that "[w]hen modeling water supply deliveries 20 years in the future, the unknowns are considerable and many assumptions must be made." (*Id.* at p. 46.)

California Draft Water Plan Update 2013
(DWR Update 2013)

This update provides a "strategic plan" and "roadmap" for legislative action, planning and decision-making to address the challenges facing California's water resources, which include advancing integrated water management, strengthening government agency alignment, and investing in innovation and infrastructure. (DWR 2013, Executive Summary, p. ES-1, -2.) Specifically, this update "characterizes water resource conditions in the [S]tate today, describes the factors that are driving change, recognizes challenges and impediments to effective solutions, and lays out a comprehensive suite of potential future actions intended to move California towards more sustainable management of water resources and more resilient water management systems." (*Ibid.*)

According to the update, answering the challenges to California's water resources problem has no easy solution. While precipitation is California's primary source for water, "[t]he amount and variability of precipitation, as well as temperatures, differ dramatically between California's northern regions and its southeast portions. As such, statewide average information does not truly depict regional conditions and often over-generalizes California's water conditions." (*Id.* at p. 3-3.) Because of the regional and climatic variability, the study notes the "difficulties of reducing flood risk, sustaining ecosystems, and enhancing water supply reliability. This also complicates government policy and regulation significantly by necessitating place-specific information, trade-offs analysis, and decision-making." (*Ibid.*) Additionally, "[s]cientific capability for intraseasonal to interannual climate forecasting (ISI forecasting) remains unreliable." (*Id.* at p. 3-5.) Further complicating matters is the State's ability to plan for land use/development patterns and population growth. (*Id.* at p. 3-7.) To that end, the Legislature has adopted policies and "supports programs to further the integration of land use and water management" and to push for more urban designs that require less water for landscaping,

minimize polluted runoff water, and increase opportunities for local and floodplain management strategies. (*Id.* at pp. 3-7 to -8.)

To address the challenges facing California's water resources, the update provides for certain objectives and goals, based on the following guiding principles:

- Manage California's water resources and management systems with ecosystem health and water supply and quality reliability as equal goals, with full consideration of public trust uses.
- Use a broad, stakeholder based, long-view perspective for water management. Promote multi-objective planning with a regional focus, and coordinate local, regional, interregional, and statewide initiatives.
- Promote sustainable resource management on a watershed basis. Wisely use natural resources to ensure their availability for future generations. Promote activities with the greatest multiple benefits regionally and statewide.
- Increase system flexibility and resiliency. Evaluate and implement strategies that reduce the impacts of droughts and floods in the region.
- Increase regional self-reliance. Implement resource management strategies that reduce dependence on long-term imports of water from other hydrologic regions for meeting additional future water demands and during times of limited supply, such as a drought or interrupted supply after a catastrophic event.
- Determine values for economic, environmental, and social benefits; costs; and tradeoffs so as to base investment decisions on sustainability indicators. Evaluate programs and projects recognizing economic growth, environmental quality, social equity, and sustainability as co-equal objectives.
- Incorporate future variability, uncertainties, and risk in the decision-making process.
- Apply California's water rights laws, including the long-standing constitutional principles of reasonable use and public trust, as the foundation for public policy-making, planning, and management decisions on California water resources.
- Promote environmental justice.
- Use science, best data, and local and traditional ecological knowledge in a transparent and documented process.

(*Id.* at pp. 8-3 to -4.)

The update recognizes that climate change creates "critical challenges" for California water resources management. (*Id.* at p. 3-28.) In particular, climate change has impacted temperature and precipitation, but "[t]o assess hydrologic impacts, it is important to look at the precipitation record in addition to the temperature record." (*Ibid.*) And, even so, "managing to historical trends will no longer work. Peak flows along major California Rivers have shown an increasing trend in the 20th century." (*Id.* at p. 3-29.) Further, even "[p]rojections are not all in agreement." (*Ibid.*)

Because of the "uncertainty in climate change, energy sector, and other drivers of future change[,]" California will need to "develop effective management strategies based on better science and technology." (*Id.* at p. 3-36.) The "key role for science and technology is to expand options for management and use of water resources." (*Ibid.*) To that end, California has instituted various programs and projects to address this issue, including watershed and resource restoration programs, conservation programs, regional planning and management, local planning and management, the delta and suisun marsh planning, the delta stewardship council, the delta risk management strategy, the delta regional ecosystem restoration implementation plan, the suisun marsh plan, the California floodSAFE program, the California statewide groundwater elevation monitoring program, and the strategic growth council. (*Id.* at pp. 3-38 to -48.)

The update acknowledges that climate change has had, and will continue to have, an effect on California's water resources. (*Id.* at pp. 5-1 to -2.) Further, "[t]raditional approaches for predicting the future based solely on projecting past trends will no longer work. Today there is better recognition that strategies for future water management must be dynamic, adaptive, and durable. In addition, the strategies must be comprehensive and integrate physical, biological, and social sciences, as well as consider risk and uncertainty." (*Id.* at p. 5-2.) To that end, this update includes 27 alternative climate scenarios to evaluate future strategies, and pilot studies to test sustainability indicators. (*Id.* at pp. 5-7, -17.) Equally important, the update concludes that California "needs significant improvements in its analytical tools and data to evaluate the costs, benefits, and tradeoffs of alternative water management strategies effectively." (*Id.* at p. 6-13.)

In light of the traditional approaches, the update recognizes that California has adequately met its water demands in the 20th Century, but further observes that population growth and changes in precipitation trends have taxed regional and local supplies. (*Id.* at p. 3-12.)

Water Supply: The update reviews the availability of California's water supply, because significant water supply challenges persist on the local and regional scale. The update notes the

difficulties in assessing water supply since "baseline water use differs regionally across the [S]tate." (*Id.* at p. 3-3.) Generally, winter precipitation and spring snowmelt are captured in surface water reservoirs to provide water supply. (*Id.* at p. 3-13.) Unfortunately, pumping restrictions continue to have a significant impact on water supply. (*Ibid.*) Desalination (although a small contributor currently) is a "potential new source of water supply and has been looked at for short-term supplies during droughts." (*Id.* at p. 3-25.)

Water Quality: The update states that the "protection of water quality . . . has become a paramount concern for all Californians" due to limitations on the water supply. (*Id.* at p. 3-17.) Like water supply, water quality poses regional challenges. "Although water quality issues can essentially be divided into two categories -- point- and non-point-sources -- specific constituents and circumstances vary from region to region which is evidence as described in each regional report." (*Ibid.*)

Flood Protection: The update acknowledges that flood protection management requires not a "single strategy, but instead uses various techniques including traditional or structural flood protection projects, nonstructural measures such as land use practices, and reliance on natural watershed functions to create an integrated flood management system." (*Id.* at p. 3-12.) California's flood protection system is composed of "aging infrastructure with major design and construction deficiencies" and "has been further weakened by lack of maintenance." (*Id.* at p. 3-18.) California has responded to this challenge by embarking on the Central Valley Flood Protection Plan, which includes proposals to increase the use of the floodwater bypasses. (*Id.* at p. 3-27.)

(f) California Natural Resources Agency (CNRA)

2009 California Climate Adaption Strategy
(CNRA 2009)

This study outlines the development of adaptation strategies to combat the impacts of climate change, while taking into account "the long-term, complex, and uncertain nature of climate change." (CNRA 2009, p. 5.) Prior to assessing future climate risks, the study describes the "substantial scientific research . . . establish[ing] that the early signs of climate change are already evident in the [S]tate." (*Id.* at p. 15.) However, the study notes that there remains "considerable uncertainty" regarding future GHG emission levels because of the difficulty in projecting societal choices. (*Id.* at p. 16.) As a result, the study prefers the use of a range of models and simulations that can then be "averaged" to obtain a general trend. (*Ibid.*)

The study reviews the impacts of climate change on several sectors, including water management, water supply and water quality. The study recognizes the challenge California faces as increasing temperatures, extreme events, and precipitation changes threaten California's water resources, but also recognizes the uncertainty in planning for these changes. (*Id.* at p. 82.) Despite the uncertainty, California remains at the forefront of adapting to these challenges. In particular:

> The Department of Water Resources (DWR), in collaboration with the State Water Resources Control Board, other state agencies, and numerous stakeholders, has initiated a number of projects to begin climate change adaptation planning for the water sector. For instance, the recent incorporation of climate change impacts into the California Water Plan Update is an essential step in ensuring that all future decisions regarding water resources management address climate change.

(*Id.* at p. 85.) To that end, statewide adaptation strategies "aim to fundamentally improve water and flood management systems and enhance and sustain ecosystems." (*Id.* at p. 86.) The study provides 10 strategies for addressing the impacts of climate change on water resources:

- Provide sustainable funding for statewide and integrated regional water management.
- Fully develop the potential of integrated regional water management.
- Aggressively increase water use efficiency.
- Practice and promote integrated flood management.
- Enhance and sustain ecosystems.
- Expand water storage and conjunctive management of surface and groundwater resources.
- Fix Delta water supply, quality, and ecosystem conditions.
- Preserve, upgrade and increase monitoring, data analysis and management.
- Plan for and adapt to sea-level rise.
- Identify and fund focused climate change impacts and adaptation research and analysis.

(*Id.* at pp. 86-91.)

Safeguarding California: Reducing Climate Risk – An Update to the 2009 California Climate Adaption Strategy
(CNRA 2014)

This strategic plan is part of California's continuing efforts to reduce impacts and prepare for climate risks. (CNRA, p. 4.) The plan highlights climate risks and discusses current efforts and future strategies to prepare California for climate related impacts. (*Id.* at p. 7.) As the plan notes, California has "made significant investments in responding to climate change. . . . California has also invested significant resources and leveraged the intellectual capital of the [S]tate to maintain a robust research program on the impacts of climate change; technologies to reduce emissions; and approaches to preparing for climate risks." (*Id.* at p. 8.) To further improve upon these investments, the plan advocates that California establish a mandate and guidelines for all state agencies to consider climate risks in their policies, planning efforts, and investments; provide data, tools, and guidance to support efforts to reduce climate risks; and build the capacity to plan for and implement actions to reduce climate risk through collaboration, education, outreach and funding. (*Id.* at p. 10.)

To that end, the plan reviews California's water management efforts, which have significantly improved water use efficiency, flood protection, and water quality data. (*Id.* at p. 230.) The plan notes that the "major impacts of climate change on California's water sector may be changes in the timing, form, and amount of precipitation, changed runoff patterns, increases in the frequency and severity of extreme precipitation events (floods and droughts), and sea level rise." (*Ibid.*) In particular, the following changes are predicted to result from climate change:

- *Water supply*: A reduction in snowpack and changes in river flow impact water supply and water quality.
- *Water and power operations*: Water system operation difficulties will increase because trade-offs will be necessary between urban, agricultural, and environmental water supply. For instance, hydroelectric power generation may be less reliable do to diminishing supply, while increases in air temperatures may cause more electricity demand.
- *Flooding and droughts*: Higher temperatures and changes in precipitation patterns will lead to periods of drought and flooding, which can cause stress on California infrastructure.
- *Coast and Delta*: Increased salinity in the Delta will degrade drinking and agricultural water quality and alter ecosystem conditions. Seal level rise threatens coastal communities and

infrastructure, where the systems were not constructed or designed to withstand higher water levels.

(*Id.* at p. 236.) But, the plan notes several successful initiatives in California's climate change planning and preparedness areas. First, DWR has been conducting research on climate change effects on water supply since 1987. (*Id.* at p. 238.) Second, the final California Action Plan was released in 2014, laying out California's water-related goals for five years. Those goals include increased regional self-reliance and integrated water management, preparations for dry periods, expansion of water storage capacity, improve groundwater management, and increase flood protection. (*Id.* at p. 239.) Third, the enactment of the Water Conservation Act of 2009, which requires a statewide 20 percent reduction in urban per capita water use by 2020. (*Ibid.*) Fourth, management of the Delta, including the preparation of the Water Quality Control Plan, the Delta Plan and the Bay-Delta Conservation Plan. (*Id.* at p. 240.) Finally, the efforts and activities of the Integrated Regional Water Management programs to address climate change mitigation and adaptation. (*Id.* at p. 241.)

California Water Action Plan
(CNRA Action Plan 2014)

The California Water Action Plan was developed to provide more reliable water supplies, the restoration of important species and habitat, and more resilient, sustainably managed water resources system to withstand future pressures. (CNRA Action Plan 2014, p. 3.) The Plan introduces 10 actions that will address the "most pressing water issues that California faces while laying the groundwork for a sustainable and resilient future." (*Id.*at p. 4.) Those 10 actions include:

- Make conservation a California way of life: expand agricultural and urban water conservation and efficiency to exceed Senate Bill X7 7 targets; provide funding for conservation and efficiency; increase water sector energy efficiency and greenhouse gas reduction capacity; promote local urban conservation ordinances and programs (*id.* at p. 5);
- Increase regional self-reliance and integrated water management across all levels of government: support and expand funding for integrated water management planning and projects; update land use planning guidelines; legislation for local and regional self-reliance; provide assistance to disadvantage communities; demonstrate state leadership; encourage state focus on projects with multiple benefits; increase the use of recycled

water; streamline permitting for local water reuse or enhancement projects (*id.* at pp. 6-7);

- Achieve the co-equal goals for the Delta: begin implementation of the Delta Plan; complete comprehensive plans to recover populations of threatened and endangered species in the Delta and improve water supply reliability for users of Delta water; restore Delta aquatic and intertidal habitat; implement near-term Delta improvement projects; maintain important infrastructure; Bay Delta water quality control plan (*id.* at pp. 7-8);
- Protect and restore important ecosystems: restore key Mountain Meadow habitat; manage headwaters for multiple benefits; bring back salmon to the San Joaquin River; protect key habitat of the Salton Sea through local partnership; restore coastal watersheds; continue restoration efforts in the Lake Tahoe basin; continue restoration efforts in the Klamath basin; water for wetlands and waterfowl; eliminate barriers to fish migration; assess fish passage at large dams; enhance water flows in stream systems statewide; achieve ecological goals through integrated regulator and voluntary efforts (*id.* at pp. 9-12) ;
- Manage and prepare for dry periods: revise operations to respond to extreme conditions (*id* at p. 12);
- Expand water storage capacity and improve groundwater management: provide essential date to enable sustainable groundwater management; support funding partnerships for storage projects; update Bulletin 118, California's groundwater plan; improve sustainable groundwater management; support distributed groundwater storage; increase statewide groundwater recharge; accelerate clean-up of contaminated groundwater and prevent future contamination (*id.* at pp. 13-14);
- Provide safe water for all communities: consolidate water quality programs; provide funding assistance for vulnerable communities; manage the supply status of community water systems (*id.* at p. 15);
- Increase flood protection: streamline and consolidate permitting; create a Delta levee assessment district; improve access to emergency funds; better coordinate flood response operations; prioritize funding to reduce flood risk and improve flood response; identify state funding priorities for Delta levees; encourage flood projects that plan for climate change and achieve multiple benefits (*id.* at p. 16);

- Increase operational and regulator efficiency: prepare for 2014 and beyond through better technology and improved procedures; improve and clarify coordination of state Bay Delta actions (*id*. at pp. 17-18); and
- Identify sustainable and integrated financing options: remove barriers to local and regional funding for water projects; develop water financing strategies; analyze user and polluter fees (*id*. at pp. 18-19).

(g) California Environmental Protection Agency (CalEPA)

Indicators of Climate Change in California
(CalEPA 2013)

This report updates a prior report, issued in 2009, both of which track trends in GHG levels that influence climate, changes in the State's climate, and the impacts of climate change on California's environment and people. Specifically, the report compiles indicators that can be used to provide insight on the impacts of climate change in California. (CalEPA 2013, Executive Summary, p. i.) Examples of such indicators include GHG emissions, atmospheric black carbon concentrations, and atmospheric GHG concentrations. According to the report, the result of studying these indicators imparts some understanding on impacts on changes in climate and impacts on California's water supply and water quality. (*Id.*, Introduction.)

Specifically, the report analyzed climate change effects on annual Sierra Nevada snowmelt runoff, snow-water content, glacier change, sea level rise, Lake Tahoe water temperature, Delta water temperature, coastal ocean temperature, and oxygen concentrations in the California current. (*Id.*, Impacts on Physical Systems, p. 70.) The findings demonstrate an average decline since 1990 in snowmelt runoff (*Id.* at pp. 71-72); but a steady average of total snow water content for the same period (*Id.* at pp. 75-78.) Additionally, glacier surface areas have decreased in the range of 22 to 69 percent, but the report indicates that:

> An analysis of climate data and historical records of glacier extent over the past century showed the latter to be affected more by precipitation than by temperature. There has been an increase in the magnitude and frequency of warm, heavy precipitation-bearing storms driven primarily by inter-decadal swings in precipitation linked to Pacific Ocean climate with the Pacific Decadal Oscillation. Such storms result in an increase in rainfall, as opposed to snow, at low elevations, but an increase in snow accumulation at higher elevations [citation omitted]. Despite warmer temperatures during the past few decades, Mount

> Shasta's ice volume has remained relatively stable and its glaciers have continued to advance due to a large increase in winter snow accumulation.

(*Id.* at pp. 82-85.) And, while the glaciers studied have decrease in area, the "magnitude and rate of change are variable, suggesting that factors other than regional climate influenced these changes" including glacier geometry. (*Id.* at p. 86.) In correlation, sea levels have increased between five to nine inches over the past century, associated with rising temperatures. (*Id.* at pp. 88-90.) Finally, the report studied warming trends in lake and ocean temperatures, and determined that data collected indicated an increase in water temperatures resulting in "changes in productivity, species composition and organism abundance, as well as phonological shifts." (*Id.* at pp. 94-114.)

The report concludes by recognizing that challenges exist in "deciphering the influence of climate among other factors both external (such as land use and environmental pollution) and internal (due to inherent, natural variability) to the climate system." (*Id.*, Emerging Climate Change Issues, p. 223.) To that end, California is on the forefront of addressing climate change and creating a comprehensive strategy to respond to the risks climate change poses.

> California's climate programs encompass mitigation of GHG emissions through a comprehensive set of policies and programs; adaptation strategies designed to reduce California's vulnerability to climate impacts and enhance the resiliency of communities, infrastructure, resources and people; research supporting the understanding of climate change and its impacts in the [S]tate; and joint action efforts through regional and international initiatives to expand emission reduction programs and enable effective adaptation [citation omitted].

(*Id.*, Appendix A, p. A-1.)

(h) Relevant Urban Water Management Plan (UWMP)

UWMPs are prepared by California's urban water suppliers to support their long-term resource planning, and ensure adequate supplies are available to meet existing and future water demands. Every urban water supplier that either provides over 3,000 acre-feet of water annually, or serves more than 3,000 urban connections is required to assess the reliability of its water sources over a 20-year planning horizon, and report its progress on 20 percent reduction in per-capita urban water consumption by the year 2020.

The plans must be prepared every 5 years and submitted to DWR, which then reviews the submitted plans to make sure they have completed the requirements identified in the Water Code in sections 10608 through 10656. DWR submits a report to the Legislature summarizing the status of the plans.

For each round of UWMPs, DWR provides guidance for urban water suppliers. This includes preparation of a guidebook, workshops, and program staff to assist in preparing comprehensive and useful water management plans, implementation of water conservation programs, and understanding the legal requirements.

Castaic Lake Water Agency 2010 Urban Water Management Plan (CLWA UWMP 2010)

The Castaic Lake Water Agency's 2010 UWMP is a planning tool that generally guides the actions of Santa Clarita Valley's water suppliers. (CLWA UWMP 2010, p. 1-1.) The UWMP aids the water suppliers in achieving their goal of delivering reliable and high quality water supply to customers within the Santa Clarita Valley. (*Id.* at p. 1-3.) The water suppliers (oftentimes referred to as the "purveyors") for the Santa Clarita Valley include the Castaic Lake Water Agency, Santa Clarita Water Division of the CLWA, Newhall County Water District, Valencia Water Company and Los Angeles County Waterworks District 36. (*Id.* at p. 1-1.) The UWMP recognizes that "[c]limate change is of special concern because of the range of possibilities and their potential impacts on essential operations." (*Id*. at p. 2-25.)

Water Use: Each purveyor provided projected water demands based on development projects that are under evaluation, in the planning process, or the result of its own water planning efforts for its service area. (*Id.* at p. 2-3.) According to the data compiled in the UWMP, between 2010 and 2050, the purveyors project an average annual increase of about 2%. (*Id.* at Table 2-2.) In addition, population growth in the service area is projected to increase at an average annual rate of approximately 1.5% between 2010 and 2050. (*Id.* at p. 2-12.) To meet Senate Bill X7-7 targets, the UWMP considers the increased use of recycled water and conservation methods. (*Id.* at p. 2-21.) Another factor affecting water usage includes weather, that is, hot and dry weather increases water usage. (*Id.* at p. 2-25.)

Water Resources/Supply: Existing water resources include wholesale/imported supplies, local groundwater, recycled water, and water from existing groundwater banking programs. (*Id.* at p. 3-1.) CLWA's imported water supply consists primarily of SWP supplies. (*Id.* at p. 3-3.) An analysis of current and future SWP water supplies indicates that SWP supplies will remain constant until 2050. (*Id.* at p. 3-9, Table 3-2.)

Groundwater supplies are managed under the Groundwater Management Plan, which monitors groundwater levels, quality project and subsidence; and monitors and manages surface water flows and quality. (*Id.* at p. 3-15 to 3-19.) According to the UWMP, groundwater supplies from the Alluvium appear sustainable over the long-term. (*Id.* at pp. 3-20 to 3-29.) The Saugus Formation supplies appear adequate and available in normal years, but additional wells are planned in 2020 to increase capacity. (*Id.* at pp. 3-29 to 3-30.)

Other water resources include water transfers, desalination plants, and recycled water. (*Id.* at pp. 3-30 to 4-19.)

(i) Other Selected Reports and Studies

The Climate Has Changed: Now What? Integrated Regional Water Management and Climate Change Planning, A Coincidental or Inevitable Union?
(Spanos 2012)

This paper reviews the development of integrated regional water management and climate change planning by DWR, in cooperation with the U.S. Environmental Protection Agency, the Resources Legacy Fund, and the Corps. (Spanos, 2012, p. 2.) The paper lauds this cooperative effort, as a departure from traditional methods, to "manage the uncertainty caused by climate change by looking not only at the historical record but also projected changes in precipitation and temperature and to plan in an integrated manner that considers the relationships of projects in regions and watersheds and even outside of the region." (*Ibid.*) This departure is fundamental according to this paper because "due to climate change, it is widely assumed that the hydrology of the past is an even less reliable an indicator of future conditions." (*Id.* at p. 3.)

In particular, the paper notes that, between 2005 and 2008, DWR introduced "for the first time" recommendations for climate change planning that were not based on past hydrologic conditions, and instead began developing alternative flow data and quantifying climate change scenarios to help State and regional planners test potential effects of global climate change on different management strategies. (*Ibid.*) In addition, DWR has responded to the movement to reduce GHG emissions in California by adopting sustainability, environmental stewardship, and sustainability targets. (*Id.* at p. 6.)

2. County Determination

In summary, the above literature indicates that climate change will affect California, leading to more intense and variable weather conditions. In that regard, federal, state, and local agencies all have taken a proactive approach, establishing and maintaining a variety of programs and projects

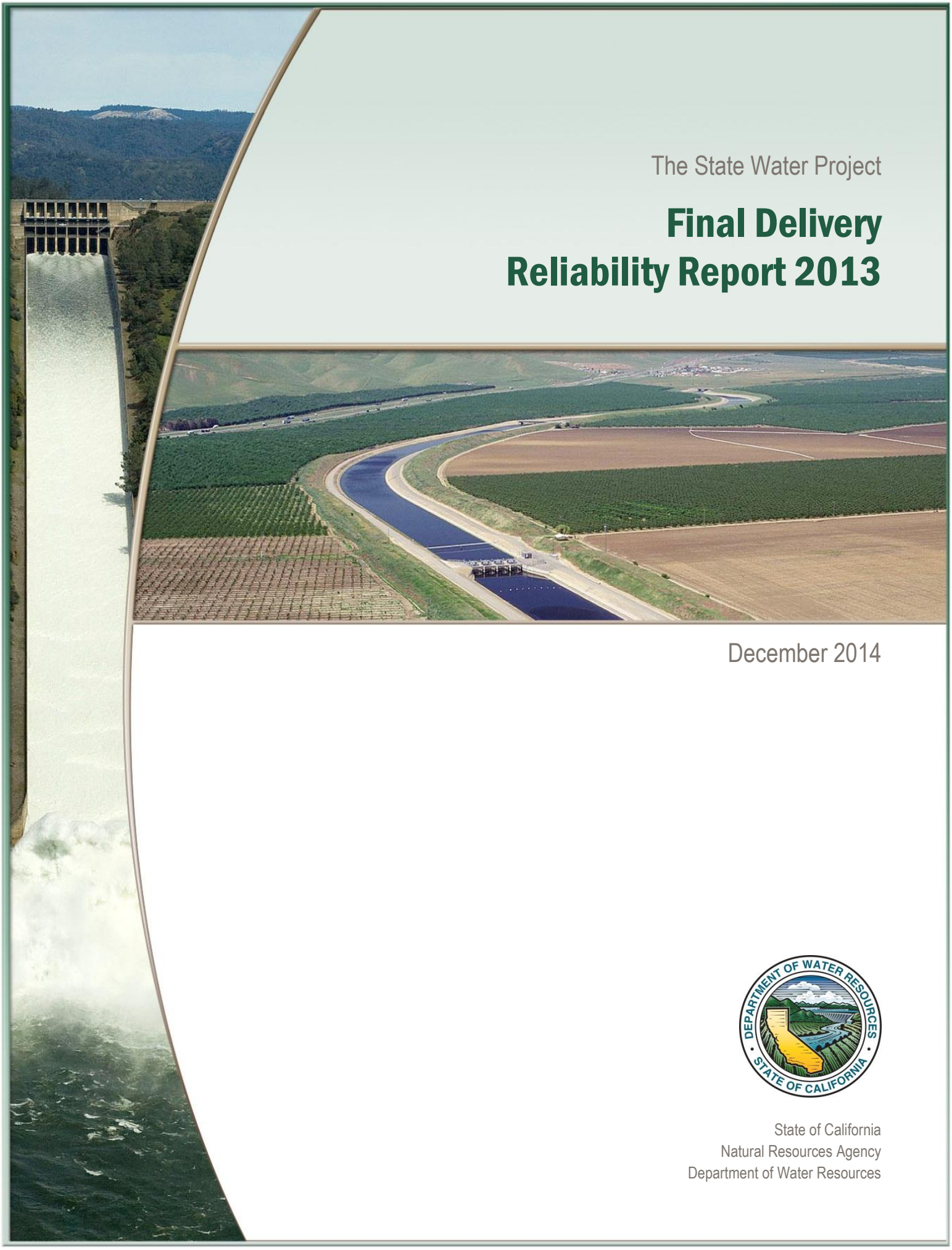
to assess, adapt, and mitigate for climate change impacts. Although the agencies with expertise in the area of water supply, water quality, and flood hazards are looking at how to most effectively plan for the effects of a changing climate and weather patterns that are not consistent with historical "norms," the literature survey above indicates that much scientific work remains to be done. Specifically, predictive models still are not refined enough to provide reliable data on the local scale. Further, the Draft EIR for the proposed Project concludes that an adequate, reliable source of water is available for the project on both short- and long-term bases, and describes various water conservation measures that will be implemented by the project to ensure the efficient use of water.

Based on the information presented herein, as well as the Draft EIR's finding that the proposed Project's GHG emissions would not be significant, the County has made the further factual determination that global climate change and its effect on California's water is too speculative at this time for any further evaluation. Accordingly, the County believes it is appropriate to terminate any further analysis of such effects, consistent with section 15145 of the State CEQA Guidelines.

Appendix 5.21J

The State Water Project Final Delivery Reliability Report 2013

State of California Natural Resources Agency
Department of Water Resources and AECOM
December 2014



The State Water Project

Final Delivery Reliability Report 2013

December 2014

State of California
Natural Resources Agency
Department of Water Resources

State of California
Edmund G. Brown Jr., Governor

California Natural Resources Agency
John Laird, Secretary for Natural Resources

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Director's Message

This *State Water Project Delivery Reliability Report 2013* updates the estimated water delivery capability of the State Water Project (SWP) for current conditions and two decades from now. The estimates include the best-known future effects of climate change and the anticipated changes in Sacramento River basin land uses. Climate change will alter the timing and magnitude of inflows to upstream storage facilities including Shasta, Folsom, and Oroville reservoirs. In addition, rising sea levels will pose operational challenges to maintaining suitable salinity levels in San Francisco Bay and the Sacramento–San Joaquin Delta (Delta).

Other factors in our analysis of SWP reliability have been assumed to not change over time. They are too uncertain to incorporate into the analysis. For example, regulatory restrictions issued by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in their biological opinions are assumed to remain unchanged. The opinions dictate the timing and amounts of the SWP's Delta exports. These restrictions are undergoing further review and analysis under a federal court order. Also, the Delta water quality and flow requirements contained in the State Water Resources Control Board's water quality control plan for the Delta are assumed to remain unchanged. However, the board is revising its water quality control plan. Revisions to the plan and their subsequent inclusion into the California Department of Water Resources' (DWR's) water rights for the SWP could have a significant effect on SWP deliveries.

The estimates in this report can be used by water districts as part of the analyses for their water management plans, which are required by State legislation to be updated in 2015. The report includes estimates for a range of hydrologic conditions that should be considered in water management plans. These estimates do not incorporate the risk of a disruption in SWP deliveries caused by catastrophic failure of Delta levees. Delta levee failure as a result of floods, earthquakes, erosion, or rising sea levels could interrupt water deliveries from the Delta for weeks, months, or even years, depending on the nature and the scope of the failure. Water management plans should describe the response to this potential scenario.

This assessment of current and future SWP reliability is one of several efforts by DWR to help plan for reliable future water supplies in California.

DWR's *California Water Plan 2013* assesses the reliability of management options to reduce the potential for future statewide water shortages. The plan focuses on helping decision makers identify and design strategies that are robust and adaptive over time.

The draft *Bay Delta Conservation Plan* (BDCP), 7 years in the making, is designed to contribute to the recovery of threatened and endangered species in the Delta and to prevent the potential disruption of water deliveries by sending export flows through underground tunnels to the SWP's pumps. The BDCP would not eliminate the need for individual regions in California to become more self-sufficient by investing heavily in water conservation, water-use efficiency, water recycling, and conjunctive use of a region's surface or underground storage.

On a broader scale, to help achieve sustainable management of California's water resources and increase the resiliency of its water management systems, DWR advances the Integrated Water Management

(IWM) approach. IWM is a framework for planning and implementation that melds objectives of improving public safety, fostering environmental stewardship, and supporting economic stability. The framework encourages multi-benefit programs and projects that leverage limited resources and balance needs such as flood risk reduction, ecosystem enhancement, and water supply reliability in an integrated manner across jurisdictional and watershed boundaries.

This *State Water Project Delivery Reliability Report 2013* narrows its focus to the SWP's delivery capability from the Delta, given current Delta regulatory restrictions, expected future climate change, and projected changes in land use in the Sacramento River basin. The results emphasize the ongoing need for local agencies to develop resilient and robust water sources and infrastructure to maximize the efficient use of a variable water supply.

Mark Cowin
Director
California Department of Water Resources
September 2014

Summary

This report is intended to inform the public about key factors important to the operation of the State Water Project (SWP) and the reliability of its water deliveries.

For many SWP water contractors, water provided by the SWP is a major component of the water supplies available to them. SWP contractors include cities, counties, urban water agencies, and agricultural irrigation districts. These local utilities and other public and private entities provide the water that Californians use at home and work every day and that helps to nourish the state's bountiful crops. Thus, the availability of water from the SWP is an important component to the water supply planning of its recipients and ultimately affects the amount of water that local residents and communities can use.

The availability of these water supplies may be highly variable. A wet water year may be followed by a dry or critically dry year. Knowing the probability that they will receive a certain amount of SWP water in a given year—whether it be a wet water year, a critical year, or somewhere in between—gives contractors a better sense of the degree to which they may need to implement increased conservation measures or plan for new facilities.

The Delta is the key to the SWP's ability to deliver water to its agricultural and urban contractors. All but five of the 29 SWP contractors receive water deliveries from the Delta (pumped by either the Harvey O. Banks or Barker Slough pumping plants).

Yet the Delta faces numerous challenges to its long-term sustainability. For example, climate change poses the threat of increased variability in floods and droughts, and sea level rise complicates efforts to manage salinity levels and preserve water quality in the Delta so that the water remains suitable for urban and agricultural uses. Among the other challenges are continued subsidence of Delta islands, many of which are already below sea level, and the related threat of a catastrophic levee failure as water pressure increases on fragile levees.

Protection of endangered and threatened fish species, such as the delta smelt, is also an important factor of concern for the Delta. Ongoing regulatory restrictions, such as those imposed by federal biological opinions on the effects of SWP and Central Valley Project (CVP) operations on these species, also contribute to the challenge of determining the SWP's water delivery reliability.

Two large-scale plans for the Delta that are being developed could affect SWP water delivery reliability: the Delta Plan and the Bay Delta Conservation Plan (BDCP). When complete, the BDCP will provide the basis for issuing endangered species permits to operate the SWP and CVP. The BDCP seeks to improve the health of the ecological system as a whole.

The analyses in this report factor in all of the regulations governing SWP operations in the Delta and upstream, and assumptions about water uses in the upstream watersheds. Analyses were conducted that considered the amounts of water that SWP contractors use and the amounts of water they choose to hold for use in a subsequent year.

Many of the same specific challenges to SWP operations described in the *State Water Project Delivery Reliability Report 2011* (2011 Report) remain in 2013. Most notably, the effects on SWP pumping caused by issuance of the 2008 and 2009 federal biological opinions (BOs), which were reflected in the 2011 Report, continue to affect SWP delivery reliability today. The analyses in this report consider climate change and the effects of sea level rise on water quality, but do not incorporate the probability of catastrophic levee failure. The differences between the 2011 and 2013 Reports can be attributed primarily to updates in the assumptions and inputs to the computer simulation analyses.

As noted in the discussion of SWP exports in Chapter 4 of this report, estimated average annual Delta exports (that is, SWP water of various types pumped by and transferred to contractors from the Banks Pumping Plant) have decreased since 2005, although the bulk of the change occurred by 2009 as the federal BOs went into effect, restricting operations. These effects are also reflected in the SWP delivery estimates provided in Chapters 5 and 6 of this report. Chapters 5 and 6 characterize the SWP's water delivery reliability under existing conditions and future conditions, respectively. The most salient findings in this report are as follows:

- The estimated average annual SWP exports decrease from 2,612 thousand acre-feet (taf)/year to 2,466 taf/year (146 taf/year or about 5.6%) between the existing- and future-conditions scenarios.
- Under existing conditions, the average annual delivery of Table A water estimated for this 2013 Report is 2,553 taf/year, 29 taf (1%) more than the 2,524 taf/year estimated for the 2011 Report.
- Under future conditions, the average annual delivery of Table A water estimated for this 2013 Report is 2,400 taf/year, about 1% less than the 2,465-taf/year estimate for the future-conditions scenario presented in the 2011 Report.
- The likelihood of existing-condition SWP Article 21 deliveries (supplemental deliveries to Table A water) being greater than 20 taf/year has decreased relative to the likelihood presented in the 2011 Report. The same can be said for the estimated likelihood of Article 21 deliveries greater than 20 taf/year under future conditions. Both this report and the 2011 Report show a likelihood ranging between 21% and 26% of Article 21 water deliveries greater than 20 taf/year under both existing and future conditions.

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Chapter 1

Water Delivery Reliability: A Concern for Californians

California's water supplies are crucial to maintaining a high quality of life for the state's residents. The State Water Project (SWP), operated by the California Department of Water Resources (DWR), is an integral part of the effort to ensure that business and industry, urban and suburban residents, and farmers throughout much of California have sufficient water at all times.

Local water agencies in the southern Central Valley's farming areas and in Southern California's urban-industrial regions have undertaken major efforts to increase their self-sufficiency and reduce their reliance on imported sources of water supply. Implementing measures to conserve and recycle water, increase water-use efficiency, and improve the use of groundwater basins has helped local water districts to manage better in dry years, when only limited water supplies are available to import into their service areas.

Despite these efforts, water deliveries by the SWP continue to play an indispensable role in supplying water to meet major portions of the demands in the SWP service areas in the southern San Francisco Bay area, Kern County, the Tulare Lake basin, and Southern California. Thus, the reliability of SWP water deliveries is a vital component of California's economic growth and quality of life.

This *State Water Project Delivery Reliability Report 2013* (2013 Report) describes the expected existing and future SWP water deliveries to its service areas. The term "water delivery reliability," as used in this report, is defined as the annual amount of SWP water that can be expected to be delivered with a certain frequency—that is, the likelihood (probability) that a certain amount of water will be delivered by the SWP in a year.

Reasons to Assess SWP Water Delivery Reliability

Two major factors underscore the importance of assessing the SWP's water delivery reliability: the effects of population growth on California's balance of water supply and demand, and State legislation intended to help maintain a reliable water supply.

Population Growth, Land Use, and Water Supply

California's population has grown rapidly in recent years, with resulting changes in land use. This growth is expected to continue. From 1990 to 2005, California's population increased from about 30 million to about 36.5 million. Based on this trend, California's population has been projected to be more than 47.5 million by 2020. The "current trends" scenario depicted in the *California Water Plan 2013* for year-2050 conditions, based on the California Department of Finance's projections of 2010 U.S. Census data, assumes a population of nearly 51 million—a 75% increase in the 1990 population.

The amount of water available in California—or in different parts of the state—can vary greatly from year to year. Some areas may receive 2 inches of rain a year, while others are deluged with 100 inches or more. As land uses have changed, population centers have emerged in many locations without sufficient local water supplies. Thus, Californians have always been faced with the problem of how best to conserve, control, and move water from areas of abundant water to areas of water need and use.

Population growth and resulting development in California since World War II have been substantial, fueling the need for increased water supply.

Legislation on Ensuring a Reliable Water Supply

The laws described below impose specific requirements on both urban and agricultural water suppliers. These laws increase the importance of SWP water delivery reliability estimates to water suppliers.

California Urban Water Management Planning Act

The California Urban Water Management Planning Act was enacted in 1983. As amended, this law (California Water Code, Sections 10610–10656) requires urban water suppliers to adopt water management plans every 5 years and submit those plans to DWR. DWR is required to review local water management plans and report on the status of these plans. DWR published a guidebook to preparing urban water management plans in March 2011. Guidance documents are available at http://www.water.ca.gov/urbanwatermanagement.

Adoption of the most recent (2010) round of urban water management plans was required by July 1, 2011; the plans were due to DWR by August 1, 2011. The municipalities and water districts that have adopted these plans and submitted them to DWR in 2011, 2012, and 2013 are listed at http://www.water.ca.gov/urbanwatermanagement/2010uwmps/.

Water Conservation Act

The Water Conservation Act of 2009 (Senate Bill X7.7, Steinberg), enacted in November 2009, includes distinct requirements related to both urban and agricultural water use.

This law requires that the State of California reduce urban per capita water use statewide by 10% by the end of 2015 and 20% by the end of 2020. DWR is required to report on progress toward meeting these urban per capita water use goals.

In addition, as part of the Water Conservation Act, agricultural water suppliers with 25,000 acres or more of irrigated land were required to prepare and adopt agricultural water management plans and submit the plans to DWR

by the end of 2012. In November 2012, DWR released a guidebook for developing agricultural water management plans: http://www.water.ca.gov/wateruseefficiency/sb7/docs/AgWaterManagementPlanGuidebook-FINAL.pdf.

Water agencies filing agricultural water management plans as of July 2013 are listed on a Web page maintained by DWR's Water Use and Efficiency Branch: http://www.water.ca.gov/wateruseefficiency/sb7/docs/2012_AWMPs_Received_07-16-2013.pdf.

DWR is reviewing these plans for consistency with Water Conservation Act requirements. The plans must be updated by the end of 2015 and every 5 years thereafter.

Background of This Report

This 2013 Report is the sixth in a series of reports on the SWP's water delivery reliability. DWR is legally required to prepare and distribute this report every 2 years to all SWP contractors (recipients of SWP water), city and county planning departments, and regional and metropolitan planning departments in the SWP's service area. Reports were previously produced for 2002, 2005, 2007, 2009, and 2011.

The requirement for a biennial water delivery reliability report was established in a settlement agreement among the Planning and Conservation League, DWR, SWP contractors, and others that was approved by the 3rd Circuit Court of Appeals in May 2003. The settlement agreement was reached in the aftermath of the "Monterey Amendments" case, which resolved a dispute about the environmental analysis of amendments to the long-term water supply contracts for the SWP that were entered into by DWR and most of the SWP contractors in the 1990s. The terms of the SWP contracts were amended after water shortages during the 1987–1992 drought drastically reduced SWP water deliveries to SWP contractors in the San Joaquin Valley and Southern California.

Attachment B to the settlement agreement specifies that each SWP delivery reliability report must include the following information:

- the overall water delivery capacity of the SWP facilities at the time of the report;
- the allocation of that SWP water to each SWP contractor;
- a discussion of the range of hydrologic conditions, which must include the historic extended dry cycle and long-term average; and
- the total amount of SWP water delivered to all contractors and the amount of SWP water delivered to each contractor during each of the 10 years immediately preceding the report.

DWR's water delivery reliability reports are used by various entities for water planning purposes. The reports must be presented in a format understandable by the public. The information presented in the reports is intended to help local agencies, cities, and counties that use SWP water to develop adequate, affordable water supplies for their communities.

Contents and Use of This Report

The following topics are addressed in this 2013 Report:

- The Summary at the front of this report briefly summarizes the updated findings on water delivery reliability detailed in proceeding chapters.
- Chapter 1, "Water Delivery Reliability: A Concern for Californians," summarizes important issues (including selected State legislation) that underlie the need to assess the SWP's water delivery reliability and provides background on DWR's water delivery reliability reports.
- Chapter 2, "State Water Project and Water Delivery Contracts," describes the SWP's

purpose, background, facilities, and SWP water contracts and contractors.

- Chapter 3, "Factors that Affect Water Delivery Reliability," explains generally how water delivery reliability is calculated. The chapter then describes a variety of factors that make forecasting water delivery reliability inherently challenging, such as:
  - water availability at the source,
  - water rights with priority over the SWP,
  - climate change,
  - regulatory restrictions on SWP Delta exports,
  - ongoing environmental and policy planning efforts, and
  - Delta levee failure.
- Chapter 4, "SWP Delta Exports," discusses how the delivery estimates for the SWP have been reduced as a result of more restrictive operational rules. This chapter also presents the results of DWR's analysis of SWP exports from the Harvey O. Banks Pumping Plant for existing conditions (2013) and future conditions (2033).
- Chapter 5, "Existing SWP Water Delivery Reliability (2013)," estimates the SWP's delivery reliability for existing conditions (2013) and compares these estimates with the existing-condition results presented in the *State Water Project Delivery Reliability Report 2011* (2011 Report).
- Chapter 6, "Future SWP Water Delivery Reliability (2033)," estimates the SWP's delivery reliability for conditions 20 years in the future (2033), reflecting potential hydrologic changes that could result from climate change. This chapter also compares these estimates with the future-condition results presented in the 2011 Report.
- Appendix A, "Historical SWP Delivery Tables for 2003–2012," presents the historical deliveries for SWP contractors over the last 10 years.

In addition, a technical addendum prepared for this report includes more specific details of the technical analyses and results. The technical addendum also describes the computer simulation assumptions and lists the updates to the computer model since the 2011 Report. The technical addendum is available upon request and is posted online, along with this 2013 Report, at http://baydeltaoffice.water.ca.gov.

Urban and agricultural water suppliers can use the information in this report and the technical addendum when they prepare or amend their water management plans. These details will help them decide whether they need new facilities or programs to meet future water demands. Urban water suppliers can also use this information when, as required by the California Environmental Quality Act (CEQA), they analyze whether enough water is available for proposed subdivisions or development projects.

Chapter 2

State Water Project and Water Delivery Contracts

Purpose and Background of the SWP

The SWP is the largest state-built, multipurpose, user-financed water project in the United States. Almost two-thirds of California's residents—25 million people—receive at least part of their water from the SWP. Project water also supplies thousands of industries and irrigates about 750,000 acres of California farmland. Of the SWP's contracted water supply, 70% goes to urban users and 30% goes to agricultural users.

The primary purpose of the SWP is to provide a water supply—that is, to divert and store water during wet periods in Northern and Central California and distribute it to areas of need in Northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and Southern California. Other SWP purposes include flood control, power generation, recreation, fish and wildlife enhancement, and water quality improvement in the Delta.

In 1959, the Legislature passed the California Water Resources Development Bond Act. This law, also known as the Burns-Porter Act, authorized $1.75 billion in bonds to build the SWP's initial facilities, contingent on voter approval. After California voters approved the Burns-Porter Act in November 1960, construction of the SWP by DWR began. The first water deliveries were made to the Alameda County Flood Control and Water Conservation District (Zone 7) and Santa Clara Valley Water District in 1967.

SWP Facilities

Today, the SWP includes 33 storage facilities, 21 reservoirs and lakes, 20 pumping plants, four pumping-generating plants, five hydroelectric power plants, and about 700 miles of canals and pipelines. Figure 2-1 shows the primary SWP facilities.

Facilities North of the Delta

The SWP's watershed encompasses the mountains and waterways around the Feather River in Plumas County. Rain and melting snow run off mountainsides and

Source: Data provided by DWR in 2011

Figure 2-1. Primary State Water Project Facilities

into waterways that flow into Lake Oroville, where the SWP officially begins.

With a capacity of about 3.5 million acre-feet, Lake Oroville is the SWP's largest storage facility. When water is needed, Oroville Dam releases water into the Feather River, which converges with the Sacramento River north of the city of Sacramento. Releases from Shasta and Folsom Reservoirs, facilities of the federal CVP, also flow into the Sacramento River. The Sacramento River flows into the tidally influenced Delta, where inflows from the Sacramento and San Joaquin Rivers are mixed with water from San Francisco Bay. Some of this water is pumped by the Barker Slough Pumping Plant into the North Bay Aqueduct for municipal use by Napa and Solano Counties.

Oroville Dam.

Facilities in the Delta and Central California

The SWP's primary pumping plant, the Harvey O. Banks Pumping Plant, is located in the south Delta in Alameda County. The pumps at the Banks Pumping Plant lift Delta water stored in the Clifton Court Forebay into the California Aqueduct, which at 444 miles long is the longest water conveyance system in California. At Bethany Reservoir, some SWP water is diverted from the California Aqueduct into the South Bay Aqueduct, which serves urban and agricultural uses in Alameda and Santa Clara Counties.

Harvey O. Banks Pumping Plant.

A portion of the water that flows down the California Aqueduct is diverted into the San Luis Joint-Use Complex located in Merced County, which is jointly owned by the SWP and the CVP. Generally, water is pumped from the California Aqueduct into the 2-million-acre-foot San Luis Reservoir from late fall through early spring and is stored temporarily before being released back to the California Aqueduct to meet the higher summertime water demands of SWP (and CVP) contractors.

Facilities in the San Joaquin Valley and Southern California

After leaving the San Luis Joint-Use Complex, water travels through the central San Joaquin Valley via a jointly owned federal/State portion of the California Aqueduct. Along the way, deliveries are made to San Joaquin Valley contractors of both the SWP and the CVP. Near Kettleman City in Kings County, the SWP's Coastal Branch Aqueduct branches off to serve SWP contractors in San Luis Obispo and Santa Barbara Counties. The California Aqueduct continues southeast until, at the base of the Tehachapi Mountains in Kern County, it reaches the A. D. Edmonston Pumping Plant. This pumping station lifts water from the California

Aqueduct 1,926 feet to enter 10 miles of tunnels and siphons that cross the Tehachapi Mountains. After crossing the mountains, the water splits into two branches, the West Branch and East Branch, and is delivered to SWP contractors in Southern California.

A. D. Edmonston Pumping Plant.

SWP Contractors and Water Delivery Contracts

During the 1960s, as the SWP was created, long-term contracts were signed by DWR and 29 urban and agricultural water suppliers in various locations within California. The contracts are essentially uniform and most will expire in 2035. These urban and agricultural water suppliers are referred to in this report as the "SWP contractors" or "contractors." This section introduces the SWP contractors, briefly explains the basics of SWP water contracts and the various types of project water.

For a more comprehensive discussion of the various types of water deliveries, refer to the 2011 Report, available at http://baydeltaoffice.water.ca.gov/swpreliability/FINAL_2011_DRR.pdf.

About the SWP Contractors

The SWP contractors are located along the Feather River north of the Delta, in the north and south San Francisco Bay Area, along the Central Coast, in the San Joaquin Valley, and in Southern California. They include cities, counties, urban water agencies, and agricultural irrigation districts. Most contractors use the project water they receive for municipal purposes; several use the water for agriculture. The SWP contractors mostly use project water to supplement local supplies, including groundwater, or other imported water. The 29 SWP contractors and their service area boundaries and locations are shown in Figure 2-2.

How Water Contracts Work

Under the terms of their long-term water supply contracts with DWR, the 29 SWP contractors receive specified amounts of water from the SWP each year, called "annual allocations."

The SWP's long-term water supply contracts define the terms and conditions governing water delivery and repayment of project costs. In return for the allocated water, the SWP contractors repay principal and interest on both the bonds that initially funded construction of the SWP and the bonds that paid for additional facilities.

The contractors also pay all costs, including labor and power, to maintain and operate project facilities. In addition, they pay transportation charges based on the distance between the Delta and each contractor's water delivery point. Further, the contractors contribute mitigation costs for any environmental impacts of SWP operations on fish and wildlife.

Source: Data provided by DWR in 2011

Figure 2-2. State Water Project Contractors

"Table A" Water

Table A is an exhibit to the SWP's water supply contracts. The current combined maximum Table A amount is 4,172 thousand acre-feet per year (taf/year). Of this amount, 4,133 taf/year is the maximum Table A water available for delivery from the Delta. It is recognized that deliveries will be less than the established maximum Table A amount in some years and more than this amount in other years.

The maximum Table A amount is the basis for apportioning water supply and costs to the SWP contractors. Once the total amount of water to be delivered is determined for the year, all available water is allocated in proportion to each contractor's annual maximum SWP Table A amount. The established maximum Table A amounts for the 29 SWP contractors vary widely; those amounts are listed in Table 2-1.

The deliveries of Table A water to each of the SWP contractors in the last 10 years are shown in Appendix A.

Other Types of SWP Water

Regardless of water year type, Table A water is given first priority for delivery over other types of SWP water. Contractors have several options for what to do with the water that is allocated to them: use it, store it for later use, or transfer it to another contractor.

Each long-term water contract describes several types of SWP water that are available to SWP contractors to supplement Table A water: "Article 21" water, carryover water, and turnback pool water. These other types of project water are briefly discussed below. Deliveries of these project water types over the last 10 years are listed in Appendix A.

Article 21 Water

Article 21 water (so named because it is described in Article 21 of the water contracts) is water that SWP contractors may receive on a short-term basis in addition to their Table A water, if they request it. Article 21 water is used by many SWP contractors to help meet demands when allocations are less than 100%. The availability and delivery of Article 21 water cannot interfere with normal SWP operations.

Carryover Water

"Carryover water" is SWP water that is allocated to an SWP contractor and approved for delivery to that contractor in a given year, but not used by the end of the year. This water is exported from the Delta by the Banks Pumping Plant, but instead of being delivered to the contractor, it is stored in the SWP's share of San Luis Reservoir, when space is available, for the contractor to use in the following year.

Turnback Pool Water

SWP contractors may offer a portion of their Table A water that has been allocated in the current year and exceeds their needs to a "turnback pool," where another contractor may purchase it. Contractors that sell their extra Table A water in a turnback pool receive payments from contractors that buy this water through the turnback pool.

Historical SWP Deliveries (2003–2012)

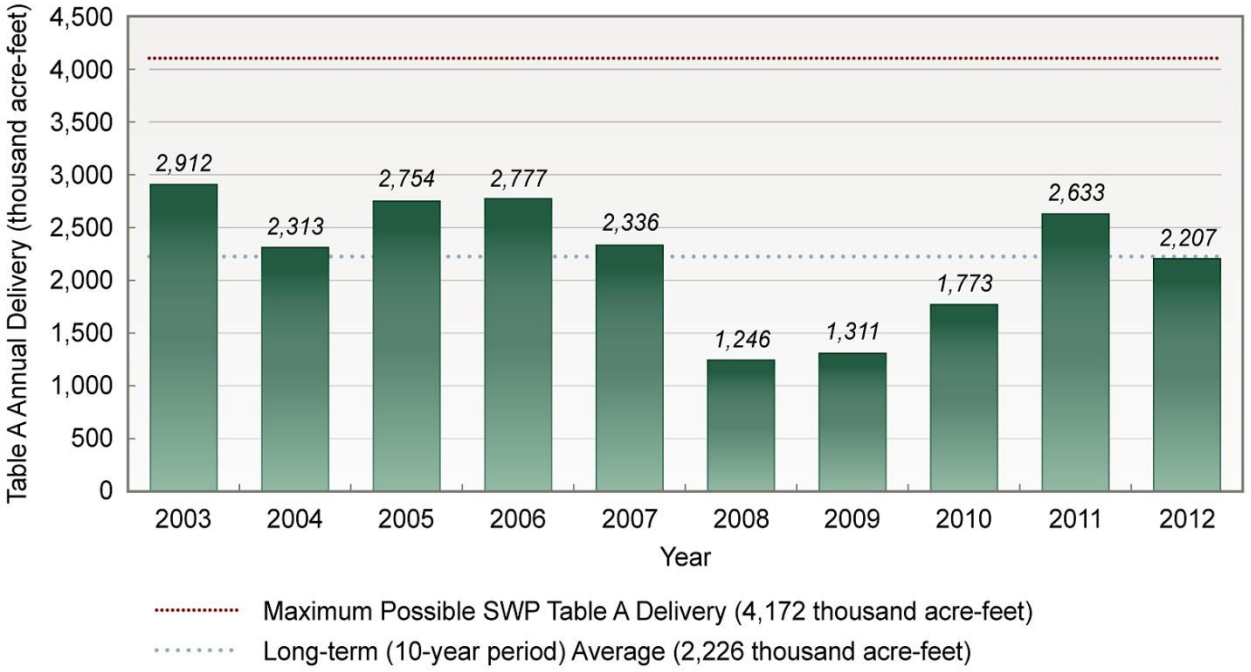
Please see Appendix A for tables listing annual historical deliveries by various water classifications for each SWP contractor for 2003–2012.

Figure 2-3 shows that deliveries of SWP Table A water for 2003–2012 range from an annual minimum of 1,246 taf to a maximum of 2,912 taf, with an average of 2,226 taf. Historical deliveries of SWP Table A water over this 10-year period are less than the maximum of 4,172 taf/year.

Total historical SWP deliveries, including Table A, Article 21, turnback pool, and carryover water, range from 1,362 to 3,730 taf/ year, with an average of 2,719 taf/year for the period of 2003–2012 (Figure 2-4).

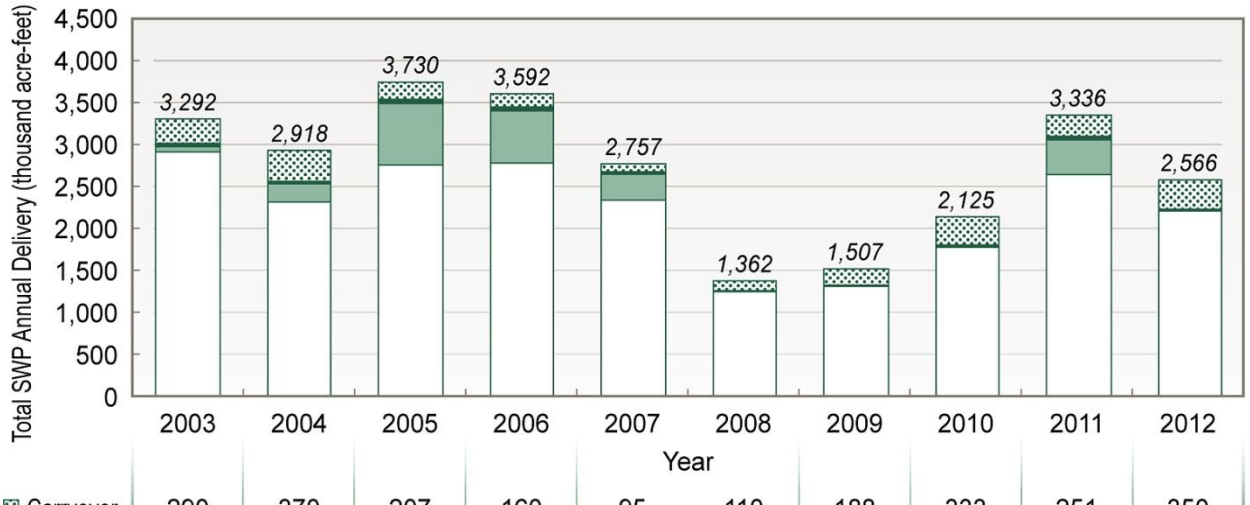
Table 2-1. Maximum Annual SWP Table A Water Delivery Amounts for SWP Contractors

Contractor	Maximum Table A Delivery Amounts (acre-feet)
Feather River Area Contractors	
Butte County	27,500
Yuba City	9,600
Plumas County Flood Control and Water Conservation District	2,700
Subtotal	**39,800**
North Bay Area Contractors	
Napa County Flood Control and Water Conservation District	29,025
Solano County Water Agency	47,506
Subtotal	**76,531**
South Bay Area Contractors	
Alameda County Flood Control and Water Conservation District, Zone 7	80,619
Alameda County Water District	42,000
Santa Clara Valley Water District	100,000
Subtotal	**222,619**
San Joaquin Valley Area Contractors	
Dudley Ridge Water District	50,343
Empire West Side Irrigation District	2,000
Kern County Water Agency	982,730
Kings County	9,305
Oak Flat Water District	5,700
Tulare Lake Basin Water Storage District	88,922
Subtotal	**1,139,000**
Central Coastal Area Contractors	
San Luis Obispo County Flood Control and Water Conservation District	25,000
Santa Barbara County Flood Control and Water Conservation District	45,486
Subtotal	**70,486**
Southern California Area Contractors	
Antelope Valley–East Kern Water Agency	141,400
Castaic Lake Water Agency	95,200
Coachella Valley Water District	138,350
Crestline–Lake Arrowhead Water Agency	5,800
Desert Water Agency	55,750
Littlerock Creek Irrigation District	2,300
Metropolitan Water District of Southern California	1,911,500
Mojave Water Agency	82,800
Palmdale Water District	21,300
San Bernardino Valley Municipal Water District	102,600
San Gabriel Valley Municipal Water District	28,800
San Gorgonio Pass Water Agency	17,300
Ventura County Watershed Protection District	20,000
Subtotal	**2,623,100**
TOTAL TABLE A AMOUNTS	**4,171,536**



Note: The differences in historical deliveries from the State Water Project Delivery Reliability Report 2011 are due to reclassification of the various components of water delivered to SWP contractors.

Figure 2-3. Historical Deliveries of SWP Table A Water, 2003–2012



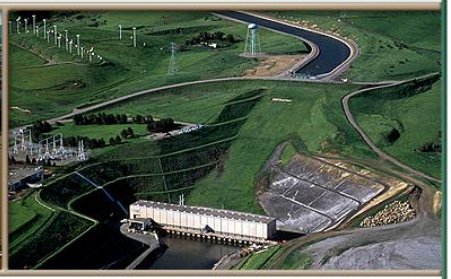
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Carryover	290	370	207	160	95	110	188	333	251	350
Turnback	30	17	38	34	16	3	2	11	31	8
Article 21	60	218	731	621	310	3	6	8	421	1
Table A	2,912	2,313	2,754	2,777	2,336	1,246	1,311	1,773	2,633	2,207

Note: The differences in historical deliveries from the State Water Project Delivery Reliability Report 2011 are due to reclassification of the various components of water delivered to SWP contractors.

Figure 2-4. Total Historical SWP Deliveries, 2003–2012 (by Delivery Type)

Chapter 3

Factors that Affect Water Delivery Reliability



This chapter explains the concept of SWP water delivery reliability and how it is calculated by DWR, and describes the most important factors that combine to affect SWP water delivery reliability. Among these natural and human-created factors are the availability of source water, regulatory restrictions on SWP operations, and the effects of climate change.

Uncertainty also exists because of the potential for an emergency such as an earthquake striking in or near the Delta, which, if substantial enough, could interrupt SWP exports from the Delta. This chapter also describes various statewide efforts by DWR and other agencies to reduce risks to the Delta and enhance emergency response capabilities.

What Water Delivery Reliability Means to SWP Contractors

Water delivery reliability is the annual amount of SWP water that can be expected to be delivered to SWP contractors with a certain frequency. But what does that actually mean in practice?

In essence, it is a matter of probability—specifically, the likelihood that a contractor will receive a certain amount of water from the SWP in a particular year. From the contractor's perspective, water delivery reliability indicates an acceptable or desirable level of dependability of water deliveries to the people receiving the water. This information is vitally important to SWP contractors for their long-term water planning and operations. Will farmers have the amount of water they will need to plant permanent crops? Will urban and suburban water districts have sufficient water to serve planned development, or will they need to call for greater conservation measures by residents and businesses? These are examples of critical questions to which SWP contractors must have answers to serve their customers.

Calculating SWP Water Delivery Reliability

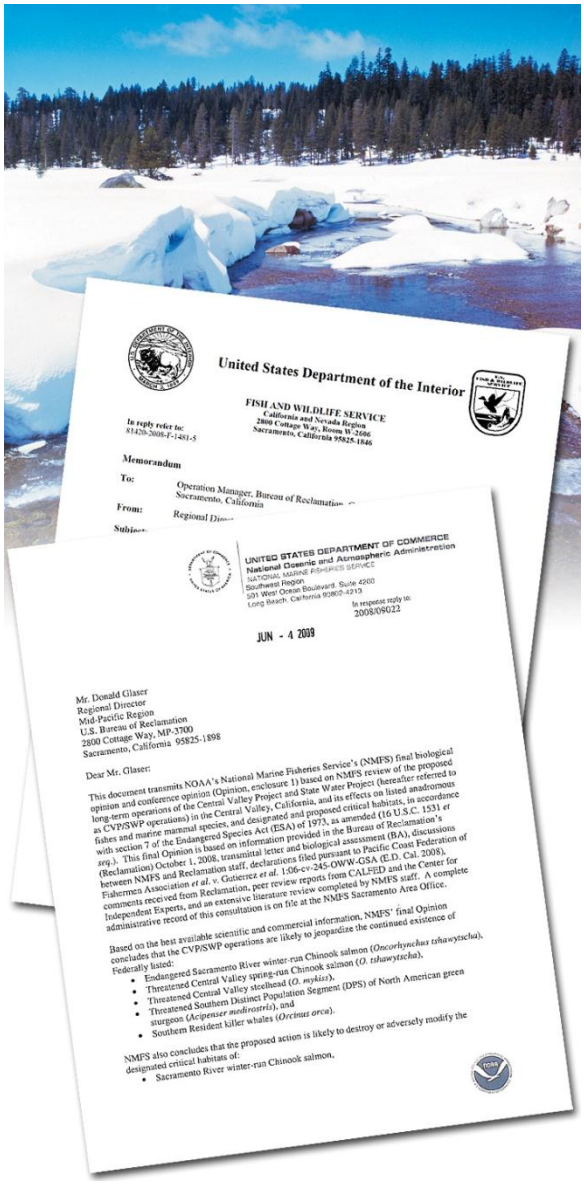
DWR calculates the water delivery reliability of the SWP using the CalSim-II computer model, which simulates existing and future operations of the SWP. No model or tool can predict what actual, natural water supplies will be for any year or years, but a system of probability can be used to calculate water delivery reliability.

The analyses of SWP delivery reliability contained in Chapters 4, 5, and 6 of this report are based on modeling conducted using 82 years of historical data (water years 1922–2003) for rainfall and runoff. Those data have been adjusted to reflect current and future levels of development in the source areas. The resulting data have been used to forecast the amount of water available to the SWP under current and future conditions (with the effects of climate change factored into the modeling for future conditions).

The annual amounts of estimated SWP water deliveries are ranked from smallest to largest; the probability that various quantities of SWP water will be delivered to each SWP contractor is estimated and listed by water type.

Factors that Can Influence the SWP's Water Delivery Reliability

Forecasting water delivery reliability is a difficult task because California is such a large state with numerous microclimates. In a typical year, some areas receive as little as 2 inches of rain, while others receive more than 100 inches. In addition, the determinants of water delivery for a specific water supply system continually change over time and can be difficult to determine and/or model. For example, water use in Sacramento River watersheds has increased over time. The historical data upon which a water supply forecast is based must be adjusted to reflect the current and, if necessary, future use in these watersheds.



Natural factors such as snowmelt and human influences such as federal biological opinions can both influence the SWP's water delivery reliability.

The following factors affect the ability to estimate existing and especially future water delivery reliability:

- water availability at the source,
- water rights with priority over the SWP,
- climate change,
- regulatory restrictions on SWP Delta exports (imposed by federal biological opinions [BOs] and State water quality plans),

- ongoing environmental and policy planning efforts, and
- Delta levee failure.

Water Availability at the Source

This factor affects the SWP's water delivery reliability because it is inherently variable. Availability of water at the source depends on the amount and timing of rain and snow that fall in any given year, the amount and timing of runoff, and the level of development (that is, the use of water) in the SWP's source areas. The location, amount, and form of precipitation in California in any given year cannot be accurately predicted, introducing the greatest uncertainty to the availability of future SWP source water and hence future SWP deliveries.

Generally, during a single dry year or two, surface water and groundwater storage can supply most water deliveries, but dry years can result in critically low water reserves.

DWR measures the water content of snowpack in the northern Sierra Nevada to forecast snowmelt runoff.

Greater reliance on groundwater during dry years results in high costs for many users and increases groundwater overdraft. Further, the ability of some contractors to use local groundwater may be limited; some groundwater basins may be contaminated by toxins such as methyl tertiary butyl ether (commonly known as MBTE), an ingredient in gasoline, and other aquifers may be too deep to reach economically. This makes the availability of the SWP's surface water to contractors especially important.

DWR manually measures snowpack in the northern Sierra Nevada monthly between early January and early May to forecast snowmelt runoff. These surveys and real-time electronic measurements taken throughout the winter measure the snowpack's water content. The size of the snowpack in the Feather River watershed on April 1—when snowpack water content normally is at its peak before the spring runoff—and the storage in Lake Oroville are key components of the SWP's delivery capabilities from April through September.

However, in some years, even measurements taken in the northern Sierra Nevada earlier in the year can demonstrate an apparent trend in water delivery reliability for the rest of the year (assuming that the weather follows typical patterns in spring). For example, manual readings conducted by DWR on December 28, 2009, off U.S. Highway 50 near Echo Summit showed snow-water equivalents in the northern mountains at 77% of normal for the date and 26% of the normal value for April 1. By contrast, the readings taken on the same date in 2010 showed snow-water equivalents in the state's northern mountains at 169% of normal for that date and 57% of the normal value for April 1. These findings indicated the potential for SWP deliveries in 2011 to increase relative to deliveries that occurred in 2010, a below-normal water year.

Water Rights with Priority Over the SWP

California's water rights system affects the SWP indirectly. There are two types of legally protected rights to surface water in California:

- *Appropriative* water rights allow the user to divert surface water for beneficial use. The user must first have obtained a permit from the State Water Resources Control Board (State Water Board), unless the appropriative water right predates 1914. Appropriative water rights may be lost if the water has gone unused for 5 years. The SWP diverts water from the Delta under appropriative water rights.
- *Riparian* water rights apply to lands traversed by or bordering on a natural watercourse. No permit is required to use this water, which must be used on riparian (adjacent) land and cannot be stored for later use.

Generally, the priority of an appropriative water right in California is "first in time, first in right"; therefore, an appropriative water right is subordinate to all prior water rights, whether appropriative or riparian. This means that if another entity with a prior water right increases its use of one of the SWP's sources of water supply—the Delta, the upstream Sacramento or San Joaquin River, or a tributary to either river—the overall amount of water available to the SWP will decrease. Thus, water users with prior water rights are assigned top priority for water in DWR's modeling of the SWP's water delivery reliability, even ahead of SWP Table A water deliveries.

Climate Change

The *California Water Plan Update 2009* identified climate change as a key consideration in planning for the State's water management. California's reservoirs and water delivery systems were developed based on historical hydrology; future weather patterns have long been assumed to be similar to those in the past. However, as climate change continues to affect California, past hydrology is no longer a reliable guide to future conditions. This section discusses effects on the SWP that could result from specific aspects of climate change.

Decreased Water Availability with Reduced Snowpack

As the effects of climate change continue, mean temperatures are predicted to increase, both globally and regionally. Climate projections used to assess the reliability of California's future water supply forecast average air temperature increases for California of about 1.8 to 5.4 degrees by the middle of the 21st century and 3.6 to 9 degrees by the end of the century (Cayan et al. 2009:Figure 3; DWR 2013:Figure 5-5). Climate change is anticipated to bring warmer storms that result in less snowfall at lower elevations, reducing total snowpack. Loss of snowpack is projected to be greater in the northern Sierra Nevada—and thus closer to the Feather River watershed, the origin of SWP water—than in the southern Sierra Nevada because of the relative proportions of land at low and middle elevations.

Snowmelt provides an average of 15 million acre-feet of water for California per year, slowly released from about April to July each year (DWR 2006:2-22; DWR 2013:3-29). Much of the state's water infrastructure, including the SWP, was designed to capture slow spring runoff and deliver it during the drier summer and fall months. However, during the 20th century, the average early-spring snowpack in the Sierra Nevada decreased by about 10%, resulting in the loss of 1.5 million acre-feet of snowpack storage (DWR 2008:3). Using historical data and modeling, DWR projects that by 2050 the Sierra snowpack will be reduced from its historical average by 25% to 40% (DWR 2008:4). Increased precipitation falling as rain instead of snow during winter could result in a larger number of "rain-on-snow" events. This would cause the snow to melt earlier in the year and over fewer days than historically, thus adversely affecting

availability of water for pumping by the SWP during summer.

Such reductions in snowpack could have dire consequences. Under climate change and in some years, water levels in Lake Oroville, the SWP's main supply reservoir, could fall below the lowest release outlets, making the system vulnerable to operational interruption. DWR expects that a water shortage worse than the one during the 1977 drought could occur in 1 out of every 6–8 years by the middle of the 21st century and in 1 out of every 3–4 years at the end of the century (California Climate Change Center 2009a:46). In those years, it is estimated that an additional 575,000–850,000 acre-feet per year of water would be needed to meet current regulatory requirements and to maintain minimum system operations (California Climate Change Center 2009a:Table 1). This could preclude the SWP from pumping as much water as it would otherwise.

Climate change is also expected to reduce the SWP's median reservoir carryover storage. Carryover water is like a water savings account for water managers to use during shortage periods. Thus, a climate change–generated reduction in the amount of carryover water available to SWP contractors would reduce the system's flexibility during dry and critical water years.

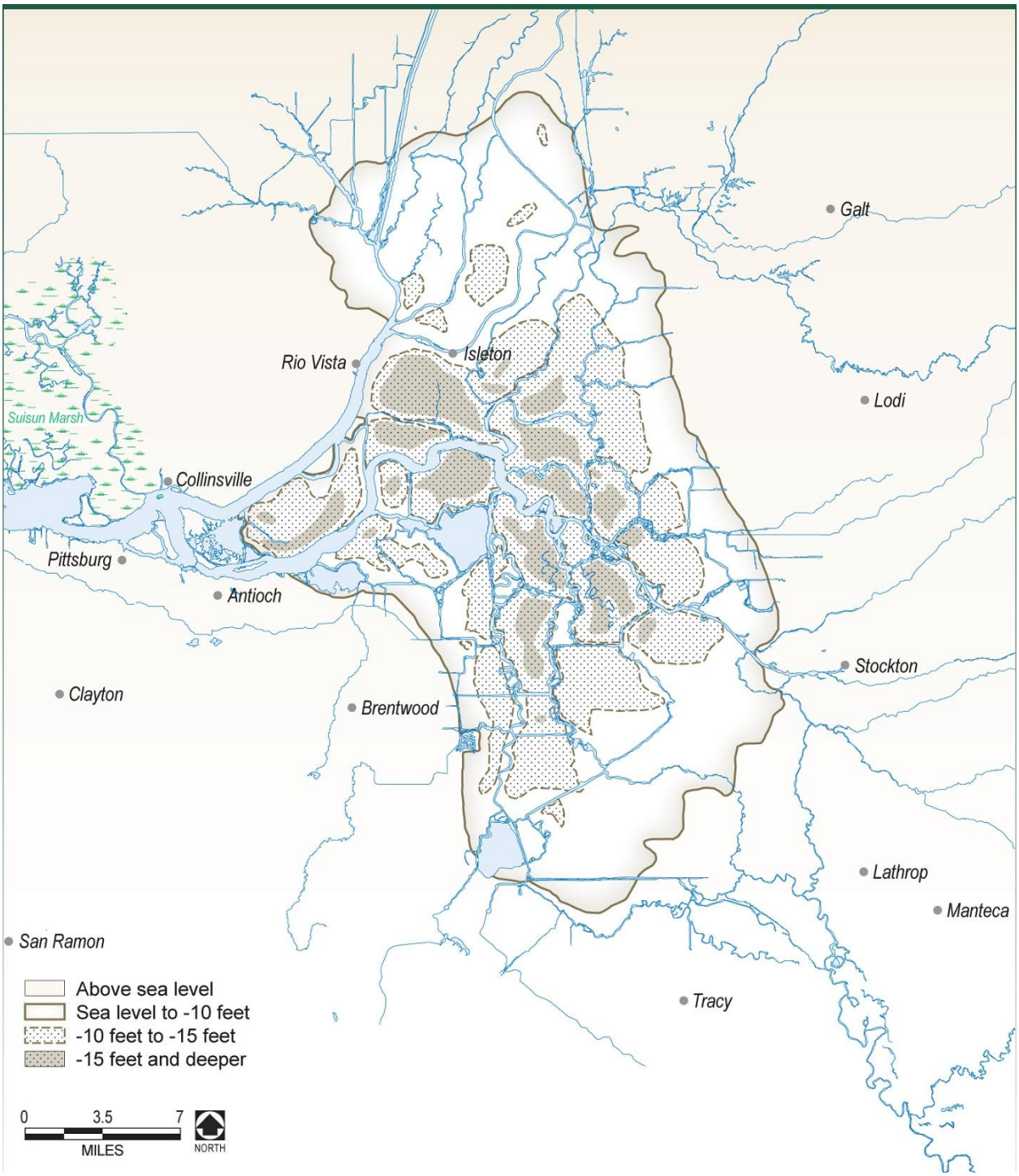
Increased SWP Water Demands

Even as water shortages may result from reduced snowpack, climate change may also cause water demand by SWP contractors to increase. Warmer temperatures may increase evapotranspiration rates (loss of water from soil by evaporation and plant transpiration) and may extend growing seasons. A larger amount of water may be needed for irrigation of certain crops, urban landscaping, and environmental needs. Warmer temperatures will also increase evaporation from surface reservoirs. Reduced soil moisture and surface flow will disproportionately affect the environment and other water users that rely heavily on annual rainfall such as rain-fed agriculture, livestock grazing on non-irrigated rangeland, and recreation.

Sea Level Rise

During the last century, sea level rose 7 inches along California's coast. Continued increases in sea levels could affect SWP water delivery reliability in several ways (Cayan et al. 2009:Figure 17):

- Most of the land in the Delta is below sea level—by as much as 20 feet—as a consequence of ongoing subsidence (Figure 3-1). Increases in sea level could place more pressure on the Delta's already fragile levee system and, as a consequence, cause levee breaches that could threaten SWP Delta exports.
- As salty water from the Pacific Ocean moves farther upstream into the Delta, DWR could be required to increase the amounts of freshwater releases from Lake Oroville to maintain compliance with Delta water quality standards.
- Sea level rise is expected to cause salt water to flow farther inland. The resulting increase in saltwater intrusion into coastal aquifers would make increasing amounts of groundwater unsuitable for water supply or irrigation (California Climate Change Center 2009b:80–81). The reduced availability of groundwater would likely contribute to further increases in demands for surface water from the SWP, especially by the coastal SWP contractors.



Source: DWR 1995:28

Figure 3-1. Areas of the Delta that Have Subsided to Below Sea Level

Regulatory Restrictions on SWP Delta Exports

Multiple needs converge in the Delta: to protect a fragile ecosystem, to support Delta recreation and farming, and to provide water for agricultural and urban needs throughout much of California. Various regulatory requirements are placed on the SWP's Delta operations to protect special-status species such as delta smelt and spring- and winter-run Chinook salmon. As a result, as described below, restrictions on SWP operations imposed by State and federal agencies contribute substantially to the challenge of accurately determining the SWP's water delivery reliability in any given year.

Biological Opinions on Effects of Coordinated SWP and CVP Operations

Several fish species listed under the federal Endangered Species Act (ESA) as endangered or threatened are found in the Delta. The continued viability of populations of these species in the Delta depends in part on Delta flow levels. For this reason, the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) have issued several BOs since the 1990s on the effects of coordinated SWP/CVP operations on several species. These BOs include terms that affect the SWP's water delivery reliability primarily by restricting SWP pumping levels under certain conditions in the Delta.

The first BOs on the effects of SWP (and CVP) operations were issued in February 1993 (NMFS BO for winter-run Chinook salmon) and March 1995 (USFWS BO for delta smelt and splittail). Among other things, the BOs contained requirements for Delta inflow, Delta outflow, and reduced export pumping to meet specified incidental take limits. (See the definition of "incidental take permit" in the Glossary of this report.) These fish protection requirements imposed substantial constraints on Delta water supply operations. Many BO terms were incorporated into the *1995 Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta* (1995 WQCP), as described in the "Water Quality Objectives" section later in this chapter.

The terms of the USFWS and NMFS BOs have become increasingly restrictive in recent years. In December 2008, USFWS issued a new BO covering effects of the SWP and CVP on delta smelt, and in June 2009, NMFS issued a BO covering effects on winter-run and spring-run Chinook salmon, steelhead, green sturgeon, and killer whales. These BOs replaced BOs issued earlier by the federal agencies.

The USFWS BO includes additional requirements in all but 2 months of the year. The BO calls for "adaptively managed" (adjusted as necessary based on the results of monitoring) flow restrictions in the Delta intended to protect delta smelt at various life stages. USFWS determines the required target flow, with the reductions accomplished primarily by reducing SWP and CVP exports. Because this flow restriction is determined based on fish location and decisions by USFWS staff, predicting the flow restrictions and corresponding effects on export pumping with any great certainty poses a challenge. The USFWS BO also includes an additional salinity requirement in the Delta for September and October in wet and above-normal water years, calling for increased releases from SWP and CVP reservoirs to reduce salinity. Among other provisions included in the NMFS BO, limits on total Delta exports have been established for the months of April and May. These limits are mandated for all but extremely wet years.

The 2008 and 2009 BOs were issued shortly before and shortly after the Governor proclaimed a statewide water shortage state of emergency in February 2009, amid the threat of a third consecutive dry year. NMFS calculated that implementing its BO would reduce SWP and CVP Delta exports by a combined 5% to 7%, but DWR's initial estimates showed an impact on exports closer to 10% in average years, combined with the effects of pumping restrictions imposed

by BOs to protect delta smelt and other species. Both the 2008 USFWS and 2009 NMFS BOs were challenged in federal court on various grounds, including the failure by USFWS and NMFS to use the best available science in the development of the BOs. U.S. District Judge Oliver Wanger found that both BOs were not legally sufficient and remanded them to the agencies for further review and analysis. However, the operational rules specified in the 2008 and 2009 BOs continue to be legally required and are the rules used in the analyses presented in Chapters 4, 5, and 6 of this report.

The California Department of Fish and Game, now called the California Department of Fish and Wildlife, issued consistency determinations for both BOs under Section 2080.1 of the California Fish and Game Code. The consistency determinations stated that the USFWS BO and the NMFS BO would be consistent with the California Endangered Species Act (CESA). The consistency determination allowed incidental take of species listed under both the federal ESA and CESA to occur during SWP and CVP operations without requiring DWR or the U.S. Bureau of Reclamation to obtain a separate State-issued permit.

Specific restrictions on Delta exports associated with the USFWS and NMFS BOs and their effects on SWP pumping levels are described further in Chapter 4, "SWP Delta Exports," of this report.

Delta Inflows

Delta inflow varies considerably from season to season, and from year to year. For example, in an above-normal year, nearly 85% of the total Delta inflow comes from the Sacramento River, more than 10% comes from the San Joaquin River, and the rest comes from three eastside streams (the Mokelumne, Cosumnes, and Calaveras Rivers) (Figure 3-2).

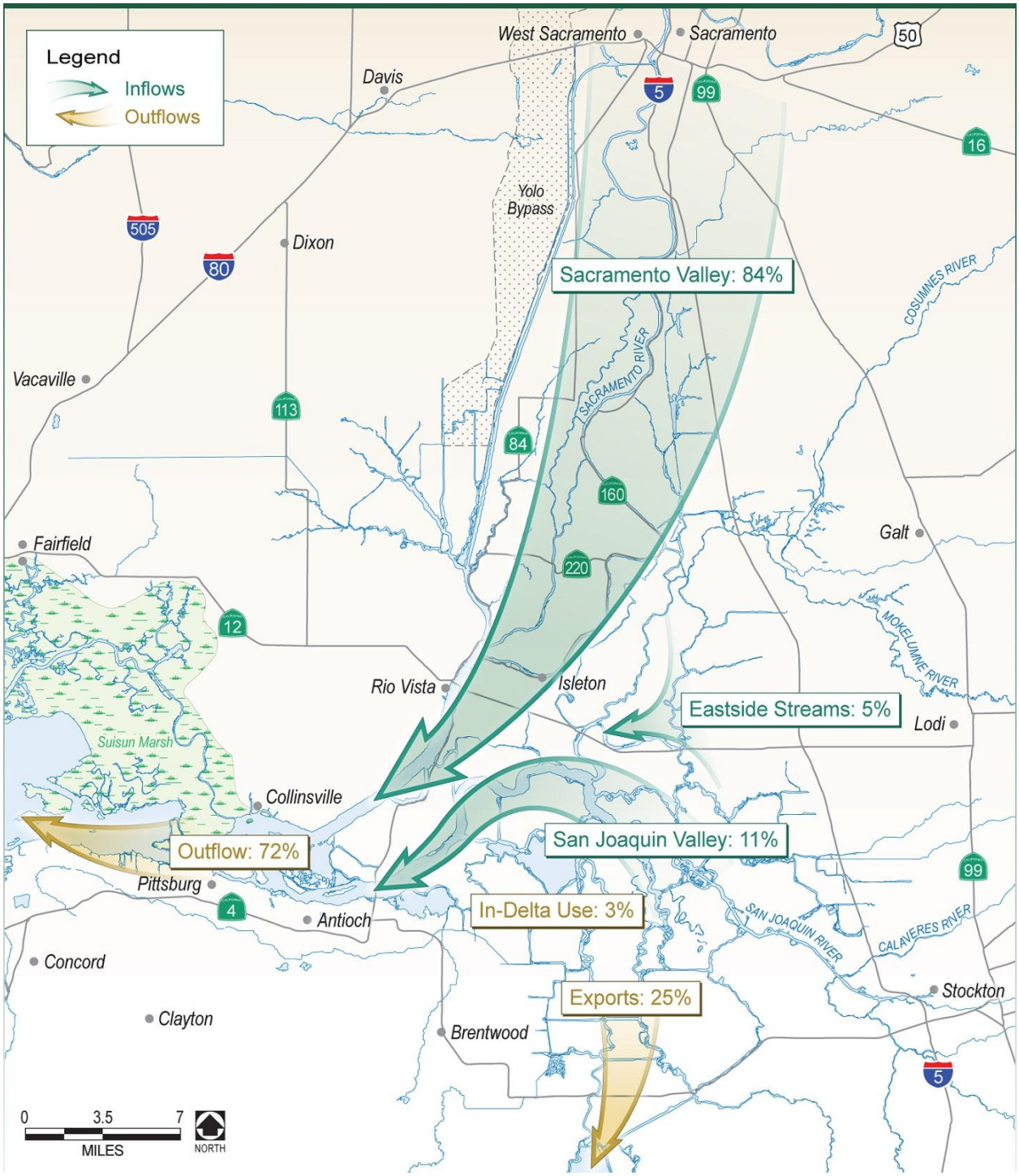
The type of water year is also an important factor affecting the volume of Delta inflows. When hydrology is analyzed, water years are designated by DWR as "wet," "above normal," "below normal," "dry," or "critical." All other factors (such as upstream level of development) being equal, much less water will flow into the Delta during a dry or critical water year (that is, during a drought) than during a wet or above-normal water year. Fluctuations in inflows are a substantial overall concern for the Delta, and a specific concern for the SWP; such fluctuations affect Delta water quality and fish habitat, which in turn trigger regulatory requirements that constrain SWP Delta pumping.

Delta inflows will also vary by time of year because the amount of precipitation varies by season. About 80% of annual precipitation occurs between November and March, and very little rain typically falls from June through September. Upstream reservoirs dampen this variability by reducing flood flows during the rainy season, and storing water to be released later in the year to meet water demands and flow and water quality requirements.

Water Quality Objectives

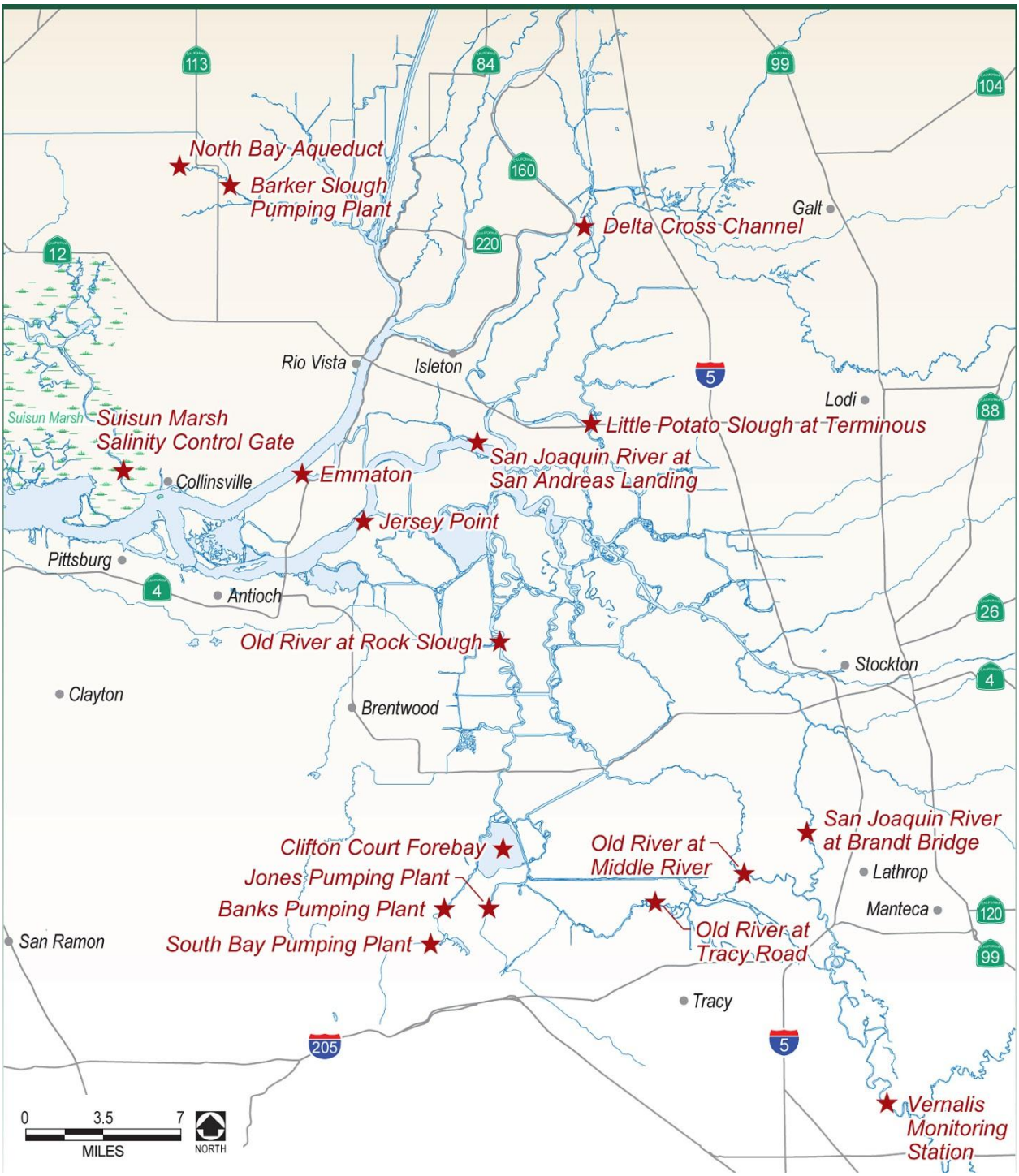
Because the Delta is an estuary, salinity is a particular concern. In the 1995 WQCP, the State Water Board set water quality objectives to protect beneficial uses of water in the Delta and Suisun Bay. The objectives must be met by the SWP (and federal CVP), as specified in the water right permits issued to DWR (and the U.S. Bureau of Reclamation). Those objectives—minimum Delta outflows, limits on SWP and CVP Delta exports, and maximum allowable salinity levels—are enforced through the provisions of the State Water Board's Water Right Decision 1641 (D-1641), issued in December 1999 and updated in March 2000.

DWR and Reclamation must monitor the effects of diversions and SWP and CVP operations to ensure compliance with existing water quality standards. Monitoring stations are shown in Figure 3-3.



Source: DWR 2011a

Figure 3-2. Water Year 2000 (Above-Normal) Delta Water Balance (Percent of Total)



Source: Data provided by DWR in 2011 and 2013

Figure 3-3. Delta Salinity Monitoring Locations of Importance to the SWP

Among the objectives established in the 1995 WQCP and D-1641 are the "X2" objectives. D-1641 mandates the X2 objectives so that the State Water Board can regulate the location of the Delta estuary's salinity gradient during the months of February–June. X2 is the position in the Delta where the electrical conductivity (EC) level, or salinity, of Delta water is 2 parts per thousand. The location of X2 is used as a surrogate measure of Delta ecosystem health.

For the X2 objective to be achieved, the X2 position must remain downstream of Collinsville in the Delta (shown in Figure 3-3) for the entire 5-month period, and downstream of other specific locations in the Delta on a certain number of days each month from February through June. This means that Delta outflow must be at certain specified levels at certain times, which can limit the amount of water the SWP may pump at those times at its Harvey O. Banks Pumping Plant in the Delta.

Because of the relationship between seawater intrusion and interior Delta water quality, meeting the X2 objective also improves water quality at Delta drinking water intakes; however, meeting the X2 objectives can require a relatively large volume of water for outflow during dry months that follow months with large storms.

The 1995 WQCP and D-1641 also established an export/inflow (E/I) ratio. The E/I ratio, presented in Table 3 of the 1995 WQCP (SWRCB 1995:18-22), is designed to provide protection for the fish and wildlife beneficial uses in the Bay Delta estuary (SWRCB 1995:15). The E/I ratio limits the fraction of Delta inflows that are exported. When other restrictions are not controlling, Delta exports are limited to 35% of total Delta inflow from February through June and 65% of inflow from July through January.

Ongoing Environmental and Policy Planning Efforts

As discussed earlier, the Delta is an essential part of the conveyance system for the SWP. SWP pumping at the Banks Pumping Plant is regulated to protect the many uses of the Delta. However, today's uses in the Delta are not sustainable over the long term under current management practices and regulatory requirements. As discussed below, two large-scale plans for the Delta that are currently being developed could affect SWP water delivery reliability: the Delta Plan and the Bay Delta Conservation Plan (BDCP).

Delta Plan

After years of concern about the Delta amid rising water demand and habitat degradation, the Delta Stewardship Council was created in legislation to achieve State-mandated coequal goals for the Delta. As specified in Section 85054 of the California Water Code:

> "Coequal goals" means the two goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.

The final Delta Plan was adopted by the Delta Stewardship Council on May 16, 2013. The Delta Plan contains a set of 14 regulatory policies that will be enforced by the council through its appellate authority and oversight. The Delta Plan also contains 73 recommendations, which are non-regulatory but call out actions essential to achieving the coequal goals.

The State Office of Administrative Law subsequently approved the 14 regulations to implement the Delta Plan, effective September 1, 2013. Among these are policies that:

- require those who use water from the Delta to certify in their water management plans that they are implementing all feasible efforts to use water efficiently and are developing additional local and regional water supplies;
- reserve six high-priority areas for habitat restoration;
- protect agricultural land by requiring developers to locate new residential, commercial, or industrial development in areas planned for urban use;
- require State and local agencies to locate, when feasible, their water management facilities, ecosystem projects, and flood management infrastructure in ways that would reduce or avoid conflicts with agriculture and other existing planned uses;
- further require those agencies to consider locating their facilities on public land before using private land;
- prohibit encroachment on floodways and floodplains;
- require developers of new residential subdivisions to include a level of flood protection that anticipates sea level rise caused by climate change; and
- set priorities for State investment in Delta flood levees.

The Delta Plan includes recommendations to:

- update statewide water-use efficiency goals and groundwater management plans for areas using Delta water, streamline water transfer procedures, and develop a statewide system for reporting how much water is used;
- have the State Water Board update water quality objectives for the Sacramento and San Joaquin Rivers; control or reduce other Delta stressors such as contaminants and invasive species, expand floodplains and riparian habitats, and locate habitat restoration to accommodate sea level rise;
- encourage agritourism, wildlife-friendly farming practices, and recreational opportunities in the Delta; and
- create a Delta flood risk management district to provide adequate funding for flood control and emergency preparedness.

Bay Delta Conservation Plan

The BDCP is a comprehensive plan being developed by a group of water agencies, environmental and conservation organizations, State and federal agencies, and other interest groups. The plan seeks to address a wide array of challenges in the Delta that California's water community has faced for decades.

The BDCP is being developed in compliance with the federal ESA and the California Natural Communities Conservation Planning Act. When complete, the BDCP will provide the basis for issuing endangered species permits to operate the SWP and CVP. Through the BDCP, project proponents agree to implement a suite of habitat restoration measures, other stressor-reduction activities, and water operations criteria in return for the approval by regulatory agencies of the long-term permits required for projects and water operations ("covered activities") to proceed. The heart of the BDCP is a long-term conservation strategy that sets forth actions needed for a healthy Delta.

The BDCP's approach to addressing Delta challenges departs substantially from previous efforts to manage Delta-specific species and habitats, which used a species-by-species approach. In contrast, the BDCP seeks to improve the health of the ecological system as a whole. Each conservation measure plays a part in an interconnected web of conservation activities designed to improve the health of natural communities and, in so doing, to improve the overall health of the Delta ecosystem. A key component of the BDCP is a new dual conveyance system to create options that would move water through the Delta's interior or around the Delta

through an isolated conveyance facility. The BDCP participants are evaluating how these water "operations" could be guided by new rules designed to be helpful for fish, but also to ensure sufficient water flows through the Delta to protect water quality and other habitat. Dual conveyance has the potential for providing the most options to meet the BDCP's planning goals, and also for addressing the threat of levee failure posed by earthquakes and the effects of climate change. These new rules are detailed requirements designed to provide improved habitat conditions for fish, but also help meet other objectives such as reducing fish "entrainment" and minimizing further restrictions at the existing SWP and CVP pumping facilities.

The BDCP will be implemented over a 50-year time frame by several agencies and organizations with specific, prescribed roles and responsibilities. A major part of plan implementation will be monitoring conservation measures to evaluate their effectiveness, and revising actions through the adaptive management decision-making process.

The BDCP has been in development since 2006. A State environmental impact report (EIR) and federal environmental impact statement (EIS) is being prepared to evaluate the BDCP's impacts on the environment, including the human environment, and to identify alternatives and potential mitigation actions. (For more information about the EIR/EIS process, see http://baydeltaconservationplan.com/PlanningProcess/EnvironmentalReview/TheProcess.aspx

The draft EIR/EIS is planned to be released for public review in late 2013. The report is targeted to be final in mid-2014, after which a decision to proceed with the program would be made.

Delta Levee Failure

The fragile Delta faces a multitude of risks that could affect millions of Californians. Foremost among those risks, as they could affect the SWP's water delivery reliability, are the potential for levee failure and the ensuing flooding and water quality issues.

The Delta is protected by levees built about 150 years ago. The levees are vulnerable to failure because most original levees were simply built with soils dredged from nearby channels, and were never engineered. Most islands in the Delta have flooded at least once over the past 100 years. For example, on June 3, 2004, a huge dry-weather levee failure occurred without warning on Upper Jones Tract in the south Delta, inundating 12,000 acres of farmland with about 160,000 acre-feet of water. Because many Delta islands are below sea level, deep and prolonged flooding could occur during a levee failure event, which could disrupt the quality and use of Delta water.

Many vulnerable Delta levees require installation of rock revetments, riprap, or other engineered structures along eroding banks to reduce erosion and protect levee foundations.

Levee failure can result from the combination of high river inflows, high tide, and high winds; however, levees can also fail in fair weather—even in the absence of a flood or seismic event—in a so-called "sunny day event." Damage caused by rodents, piping (in which a pipe-like opening develops below the base of the levee), or foundation movement could cause sunny-day levee breaches.

A breach of one or more levees and island flooding may affect Delta water quality and SWP operations. Depending on the hydrology and the size and locations of the breaches and flooded islands, a large amount of salt water may be

pulled into the interior Delta from Suisun and San Pablo Bays. When islands are flooded, DWR may need to drastically decrease or even cease SWP Delta exports to evaluate the distribution of salinity in the Delta and avoid drawing saltier water toward the pumps.

An earthquake could also put Delta levees, and thus SWP water supplies, at risk. The 2007 Working Group on California Earthquake Probabilities estimated a probability of 63% that a magnitude 6.7 or greater earthquake would strike the San Francisco Bay Area in the next 30 years (WGCEP 2008:6). An earthquake could severely damage Delta levees, causing islands to flood with salty water. The locations most likely to be affected by an earthquake are the west and southwest portions of the Delta because these areas are closer to potential earthquake sources. Flooding of the west and southwest Delta is also more likely to interfere with conveyance of freshwater to export pumps (DWR 2007:17).

Delta levees are prone to failure, increasing risks to State water supplies.

Effects of Emergencies on Water Supplies:

The Delta Risk Management Strategy (DRMS) was initiated in response to Assembly Bill 1200 (2005), which directed DWR to evaluate the potential effects on Delta water supplies associated with continued land subsidence, earthquakes, floods, and climate change. Using information developed by DRMS, the *California Water Plan Update 2009* reported a 40% probability that a major earthquake occurring between 2030 and 2050 would cause 27 or more islands to flood at the same time. If 20 islands were flooded as a result of a major earthquake, the export of freshwater from the Delta could be interrupted by about a year and a half (DWR 2009:5-15). Water supply losses of up to 8 million acre-feet would be incurred by SWP (and CVP) contractors and local water districts.

The Phase 2 report for the DRMS evaluated alternatives to reduce the risk to the Delta and the state from adverse consequences of levee failure (DWR 2011b). Three main categories of "building blocks" were used to formulate alternatives:

- conveyance improvements/flood risk reduction and life safety,
- infrastructure risk reduction, and
- environmental risk mitigation.

The first category is most relevant to the SWP in terms of reducing the risk of disruption of SWP Delta exports, but the environmental risk mitigation category includes reducing water exports from the Delta.

Four risk reduction strategies evaluated by DRMS were as follows:

- *Improved Levees:* Improve the reliability of Delta levees against flood-induced failures by providing up to 100-year flood protection. This strategy would not reduce the risk of potential water export interruptions or change the seismic risk of most levees.

- *Armored Pathway (Through-Delta Conveyance):* Improve the reliability of water conveyance by creating a route through the Delta that has high reliability and the ability to minimize saltwater intrusion into the south Delta. This strategy would reduce the likelihood of levee failures from flood events and earthquakes and would significantly reduce the likelihood of export disruptions.
- *Isolated Conveyance Facility:* Provide high reliability for conveyance of export water by building an isolated conveyance facility on the east side of the Delta. This strategy would not reduce the seismic risk of levee failure on islands that are not part of the isolated conveyance facility.
- *Dual Conveyance:* Improve reliability and flexibility for conveyance of export water by constructing an isolated conveyance facility and a through-Delta conveyance. This strategy would avoid the vulnerability of water exports associated with Delta levee vulnerability and would offer flexibility in water exports from the Delta and/or the isolated conveyance facility. However, seismic risk would not be reduced on islands not part of the export conveyance system or infrastructure pathway.

A promising strategy for resuming water exports after a levee failure would involve placing structural barriers at selected channel locations in the Delta and completing strategic levee repairs to isolate an emergency freshwater conveyance "pathway" (Moffatt and Nichol 2007, cited in DWR 2011a:5-1).

The DRMS study was the first comprehensive risk-based assessment of Delta levee failure and potential consequences to the State. Since the completion of the DRMS report, several projects funded under the Delta Knowledge Improvement Program have been completed to fill the data gaps identified in DRMS. A goal of the Delta Knowledge Improvement Program is to complete bathymetry surveys of the entire Delta. Approximately 15% of the Delta has been surveyed thus far. Potential future projects include compiling in-Delta wind data, conducting wind wave modeling of the Delta, characterizing the soil chemistry of Delta islands to assess levee failures, and supporting hydrology modeling to determine impacts on the Delta from climate change.

Delta Flood Emergency Preparedness, Response, and Recovery Program and Delta Multi-Hazard Coordination Task Force

In the last 5 years, DWR has worked to improve its ability to respond quickly and effectively to simultaneous levee failures on multiple islands within the Delta. *The Delta Emergency Operations Plan Concept Paper* released in April 2007 (DWR 2007) was the initial product of this effort. To enhance the State's ability to prepare for, respond to, and recover from a catastrophic Delta levee failure, DWR subsequently began development of the Delta Flood Emergency Preparedness, Response, and Recovery Program. The goal is to protect lives, property, and critical infrastructure in the Delta while minimizing impacts on the ecosystem. The primary components of the program are:

- develop DWR's Delta Flood Emergency Management Plan,
- facilitate multi-agency coordination with other Delta flood emergency response agencies, and
- design and implement flood emergency response facilities within the Delta.

The Delta Flood Emergency Management Plan, currently in preparation, will describe DWR's policies and actions relating to flood emergency in the Delta, especially relating to potential or actual failure of Delta levees. The plan will describe DWR's concept of operations for Delta flood emergencies, including the roles and responsibilities of the Division of Flood Management, Division of Operations and

Maintenance, Division of Engineering, and Executive Division.

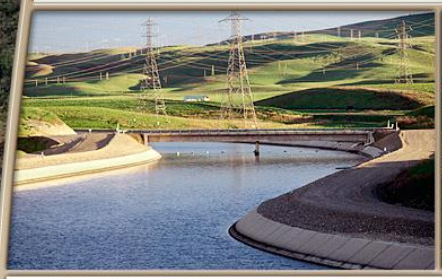
Levee failures and their costly consequences can often be avoided through vigilance, preparedness, and rapid responses to levee emergencies. Local Maintaining Agencies are responsible for maintaining, patrolling, and responding to levee emergencies, but State and federal agencies are often called upon to provide assistance under the State's Standardized Emergency Management System and the federal National Incident Management System, respectively. The intent of the coordination effort is to provide a coordinated and effective multi-agency response during a large-scale Delta flood emergency, with DWR working in concert with other local, State, and federal agencies.

The Delta Flood Emergency Facilities Improvement Project has been proposed to provide DWR with the physical resources to quickly respond to and recover from catastrophic levee failures in the Delta. This would include site acquisition, construction, and material stockpiles. CEQA compliance has been completed and purchase and lease agreements for the proposed facilities at Stockton, Rio Vista, and Brannan Island State Recreation Area are being developed with the property owners, the Central Valley Flood Protection Board, and the California Department of Parks and Recreation, respectively.

The program is also supporting a $5 million Flood Emergency Response Grant Project Solicitation Package to improve local flood emergency response in the Delta region. Under this grant program, DWR will provide financial assistance through a grant agreement with participating agencies to ensure that local agencies have a robust flood emergency plan in place with adequate flood preparedness and response capacity, and will assist counties in the Delta to satisfy a requirement of the Central Valley Flood Protection Act of 2008 by the July 2014 deadline.

Chapter 4

SWP Delta Exports



The purpose of this chapter is to illustrate the effects of factors described in Chapter 3, "Factors that Affect Water Delivery Reliability," on SWP water supplies transferred through the Delta and pumped at the Harvey O. Banks Pumping Plant in the south Delta, i.e., "Delta exports." This chapter also describes how regulatory requirements and climate change have affected or will affect the SWP's Delta water supplies, shows the general pattern of monthly SWP exports from the Delta and focuses on Delta exports associated with the SWP, not on CVP exports through the Banks Pumping Plant via the CVP/SWP joint point of diversion.

The difference between Delta exports and SWP deliveries is explained, and trends in projected average annual exports and SWP Table A water deliveries under various recent existing-conditions scenarios are described. In addition, monthly exports estimated for this 2013 Report are compared with those estimated for the *State Water Project Delivery Reliability Report 2005* (2005 Report) to illustrate the effect of regulatory restrictions.

This chapter also summarizes the primary factors influencing the SWP's Delta export operations and deliveries, presents estimates of exports for the existing-conditions and future-conditions scenarios, and characterizes the likelihood of such exports. Estimated SWP Delta exports by water year type are depicted relative to exports that were estimated for the existing-conditions and future-conditions scenarios in the 2011 Report.

SWP Delta Exports versus SWP Deliveries

SWP Delta exports and SWP deliveries are characterized in separate chapters (this chapter for Delta exports, Chapters 5 and 6 for SWP deliveries) because these two terms are not one and the same.

Water pumped from the Delta is the primary source of SWP supply for 24 of the 29 SWP water contractors listed in Chapter 2, "State Water Project and Water Delivery Contracts." (Occasionally, during very wet periods, flood flows can enter the California Aqueduct and contribute to SWP supply south of the Delta.) As used in

this report, "Delta exports" are the water supplies that are transferred ("exported") directly to SWP contractors or to San Luis Reservoir storage via the Banks Pumping Plant.

SWP Delta exports do not include deliveries of SWP water to the two North Bay Area contractors, which receive SWP water pumped by the Barker Slough Pumping Plant and conveyed by the North Bay Aqueduct. (Water conveyed to the SWP's three Feather River Area contractors is not transferred through the Delta and is not the focus of this chapter or of Chapters 5 and 6.)

By contrast, SWP Table A water deliveries from the Delta include both water pumped by the Banks Pumping Plant and conveyed by the California Aqueduct and water pumped by the Barker Slough Pumping Plant and conveyed by the North Bay Aqueduct. Thus, Table A water deliveries, as described in Chapters 5 and 6, also include deliveries to the two North Bay Area contractors, for a total of 26 SWP contractors.

SWP Delta exports include nearly all types of SWP water, not merely Table A water (see the explanation of SWP water types in Chapter 2). As allowed under the SWP's water supply contracts, the amount pumped from the Delta can be exported in the same year as Table A water, or can be exported as Article 21 water if available. A contractor can opt to have exported Table A water held in San Luis Reservoir as carryover water—that is, as part of the contractor's supply for a subsequent year—or made available to another SWP contractor as turnback pool water. Article 21 water must be delivered immediately to SWP contractors when exported and cannot be stored in SWP facilities.

Recent Trends in SWP Delta Exports and Table A Deliveries

SWP Delta exports and Table A deliveries estimated for this 2013 Report are reduced by the operational restrictions imposed on the SWP by the BOs issued by USFWS in December 2008 and NMFS in June 2009. This same scenario occurred in the 2011 Report. By contrast, the *State Water Project Delivery Reliability Report 2007* (2007 Report) incorporated interim, less restrictive operational rules established by U.S. District Judge Oliver Wanger in December 2007 while the USFWS and NMFS BOs were rewritten. The 2005 Report was based on much less restrictive operational rules contained in the BOs that had been issued in late 2004 and 2005.

Overall trends in both SWP Delta exports and Table A deliveries under existing conditions are summarized below. (For further detail on estimated SWP Table A deliveries for the existing-conditions and future-conditions scenarios, respectively, see Chapters 5 and 6.)

Annual Exports and Table A Deliveries—2005–2013 Scenarios

Figure 4-1 illustrates the effect of the operational restrictions imposed by the USFWS and NMFS BOs on estimated average annual Delta exports and Table A water deliveries. The figure depicts the average values estimated for existing conditions in the 2005, 2007, 2009, 2011, and 2013 Reports.

As shown in Figure 4-1, estimated average annual Delta exports and SWP Table A water deliveries have generally decreased since 2005, when rules affecting SWP pumping operations began to become more restrictive. Under existing conditions, estimated average annual Delta exports have decreased since 2005 from 2,958 taf/year to 2,612 taf/year in 2013, a decrease of 346 taf or 11.7%; average annual Table A deliveries have decreased since 2005 from 2,818 taf/year to 2,553 taf/year in 2013, a decrease of 265 taf or 9.4%. The reasons for these decreases are described under "Primary Factors Affecting SWP Delta Export Operations and Table A Water Deliveries" below.

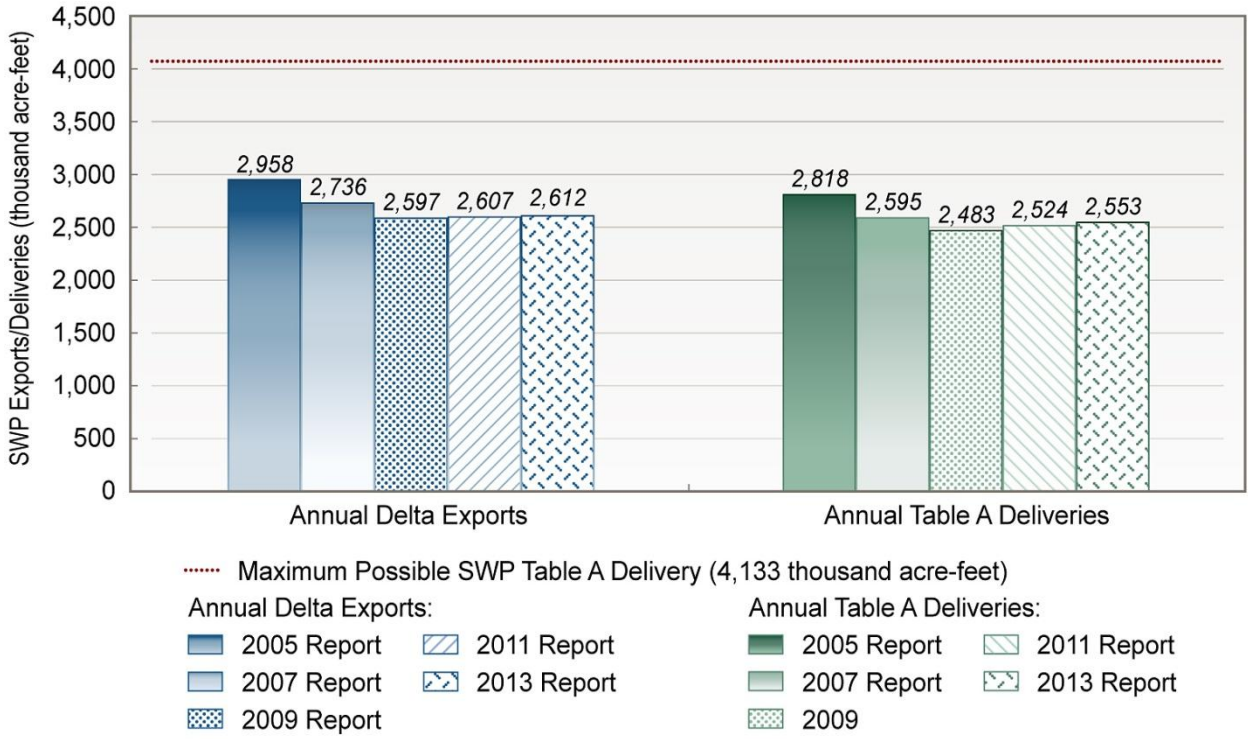


Figure 4-1. Trends in Estimated Average Annual Delta Exports and SWP Table A Water Deliveries (Existing Conditions)

Monthly Delta Exports—2013 Scenario versus 2005 Scenario

Figure 4-2 illustrates the effects of the operational restrictions imposed by the BOs on SWP Delta exports since 2005 by comparing monthly existing-conditions exports estimated for this 2013 Report with those estimated for the 2005 Report. The bar charts show the average exports for each month under each scenario estimated for both reports.

As shown in Figure 4-2, average monthly SWP Delta exports estimated for the 2013 Report are lower than those estimated for the 2005 Report both in the first half of the year and from October through December. The reductions in exports for January through June are substantial, ranging from 21% in June to 55% in April. Exports for July through September as estimated for the 2013 Report exceed those estimated for the 2005 Report, but the increases (45% in July, 18% in August, and 20% in September) are generally smaller than the reductions seen earlier in the year.

Compiling the monthly average values for exports for the entire year under each scenario reveals that, as indicated previously in the description of annual exports, the average annual exports estimated for the 2013 Report are 11.7% less than those estimated for the 2005 Report.

Primary Factors Affecting SWP Delta Export Operations and Table A Water Deliveries

Under current operational constraints on the SWP, maximum exports from the Banks Pumping Plant are generally limited to 6,680 cubic feet per second, except between December 15 and March 15, when exports can be increased by one-third of the San Joaquin River flow at the Vernalis gauge (when the Vernalis flow is greater than 1,000 cubic feet per second). As explained in Chapter 3, regulatory restrictions on the SWP's Delta operations have been among the major factors affecting SWP water delivery reliability. Several of those influence SWP exports from the Banks Pumping Plant and, at times, impose particular

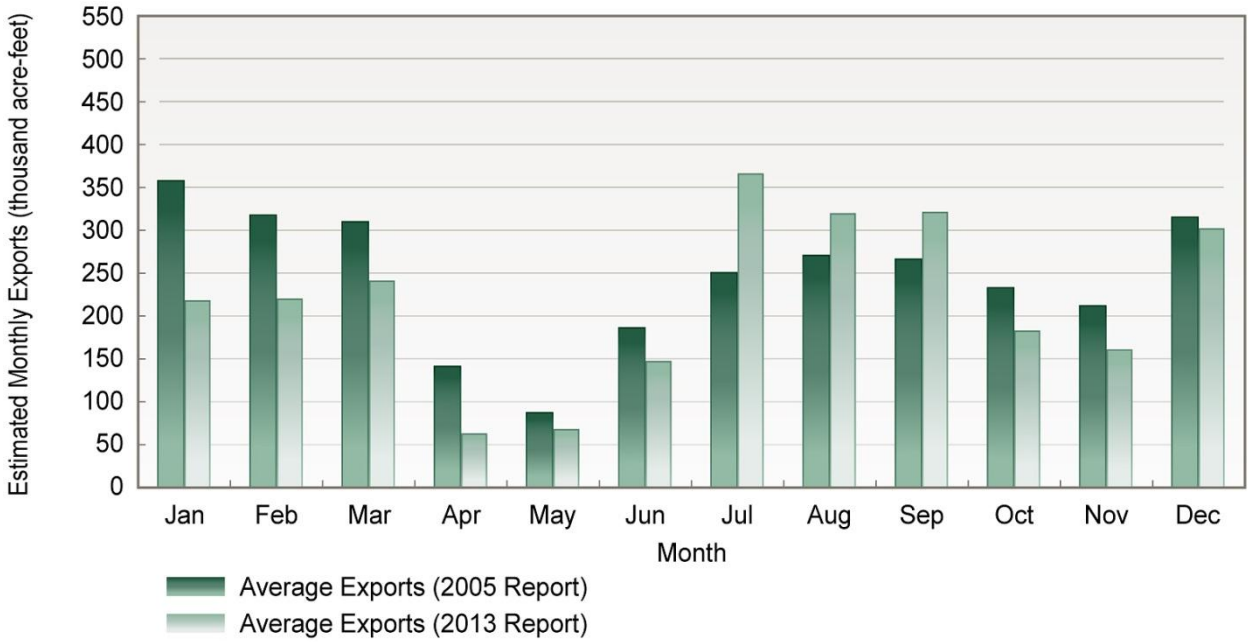


Figure 4-2. Estimated Monthly SWP Delta Exports (Existing Conditions), 2013 Scenario versus 2005 Scenario

limitations on exports. These limits are summarized here to illustrate how they affect the values shown in Figure 4-2:

- *2008 USFWS and 2009 NMFS BOs:* These BOs are much more restrictive than the BOs they replaced. The USFWS BO includes flow restrictions to protect delta smelt, with requirements in all but 2 months of the year. The NMFS BO contains similar limits for January through mid-June, but the greatest restriction imposes limits on total Delta exports in April and May in most years to protect salmon and steelhead.
- *X2:* The "X2" objective mandated by the State Water Board regulates Delta salinity levels in the months of February–June. For the X2 position to be located in the appropriate location to achieve the State Water Board's salinity objective, Delta outflow must be at certain specified levels at certain times between February and June, which can constrain SWP pumping at the Banks Pumping Plant at those times.
- *Fall X2:* USFWS's Reasonable and Prudent Alternative Action 4 sets X2 standards for September through November in wet and above-normal years.
- *Export/Inflow Ratio:* The 1995 WQCP and State Water Board D-1641 limit Delta exports to 35% of total Delta inflow from February through June. Thus, even if substantial runoff occurs during those months (such as during a year with considerable rain-on-snow events, projected to be more likely as the effects of climate change increase), the SWP is limited in its ability to benefit from the availability of that extra water in the Delta by increasing its pumping beyond this limit. Allowable exports increase to 65% of inflow from July through January.
- *Spring Export Limitations:* Spring is an important time in the life cycles of fish protected by the USFWS and NMFS BOs. As a result, requirements for Delta exports exist in several places. D-1641 limits SWP and CVP exports to 100% of the base flow of the San Joaquin River for 31 days during April and May. The NMFS BO limits the combined

exports during all of April and May to a given percentage of the flow: 25% during above-normal and wet years to 100% in critical years. Finally, the previously mentioned flow requirements contained in the USFWS BO to protect delta smelt can also restrict exports during this time.

Figure 4-2 shows reductions in the values estimated for the 2013 Report during January through June and October through December that result from these restrictions. The period of July through September is the time when exports are less restricted. As a result—and to recover some of the water supply lost during the other months—the exports estimated for the 2013 Report for July–September are higher than those estimated for the 2005 Report.

Another factor described in Chapter 3, climate change, is expected to affect the Delta—and SWP exports from the Banks Pumping Plant—under future conditions. The effects of climate change on SWP operations have been factored into DWR's analysis for future conditions.

Estimated SWP Export Amounts—Existing Conditions and Future Conditions

This section provides estimates of average, maximum, and minimum annual Delta exports for both existing (2013) and future (2033) conditions. (The assumptions used to develop both existing and future scenarios for this report are discussed in Chapters 5 and 6, respectively.) This section also summarizes SWP Delta exports by month and by water year type, demonstrating the effects of the USFWS and NMFS BOs and climate change upon SWP Delta exports.

Average, Maximum, and Minimum Annual Delta Exports

Table 4-1 presents the estimated average, maximum, and minimum annual SWP Delta exports (taf/year) for the existing-conditions and future-conditions scenarios, based on the 1922–2003 period of record. The reduction in average exports under future conditions is primarily due to reductions in June through October (Table 4-2). These reductions are caused primarily by climate change conditions. Under climate change, California is expected to see increased precipitation falling as rain instead of snow during the winter, causing the snow to melt earlier in the year and adversely affecting the availability of water for pumping by the SWP during the summer.

Table 4-1. Estimated Average, Maximum, and Minimum Annual SWP Exports

	Existing (2013) (taf/year)	Future (2033) (taf/year)
Average	2,612	2,466
Maximum	4,431	4,119
Minimum	671	760

Table 4-2. Average Estimated SWP Exports by Month (Existing and Future Conditions)

Month	Estimated SWP Exports (taf)		Difference between Future and Existing Conditions	
	Existing	Future	taf	%
January	219	219	0	0
February	220	218	-2	-1
March	241	236	-5	-2
April	63	76	12	18
May	68	71	3	4
June	147	138	-9	-7
July	366	344	-22	-6
August	320	286	-33	-11
September	321	292	-30	-10
October	183	140	-43	-27
November	161	158	-3	-2
December	302	290	-13	-4

Exports by Month

Table 4-2 shows the average estimated SWP exports from the Delta by month under existing and future conditions. As shown, in most months, the average estimated monthly SWP exports for

future conditions are lower than the estimated monthly exports for existing conditions. The most notable exceptions are in April and May. Under both existing and future conditions, the values for those months are essentially the same, reflecting the stricter pumping regulations in place during that time of the year.

Figure 4-3 depicts the annual pattern of the monthly values for existing conditions, as well as the maximum and minimum estimated exports for each month. The pattern and ranges of the monthly values under future conditions are similar to those shown in Figure 4-3.

As shown in Figure 4-3 and Table 4-2, estimated SWP exports are highest on average in July, averaging 366 taf under existing conditions. Exports are consistently lowest in April and May, averaging 63 taf in April and 68 taf in May under existing conditions.

Exports by Water Year Type

Tables 4-3 and 4-4 compare SWP exports by water year type under existing conditions and future conditions, as estimated for the 2011 Report and for this 2013 Report. As shown, the SWP exports estimated for this 2013 Report are similar to the existing SWP exports estimated for the 2011 Report for most water year types. For dry and especially critical water year types, however, there is a decrease under both existing and future conditions. This decrease is caused by refinements to the CalSim code in December 2012 in coordination with the U.S. Bureau of Reclamation. These code updates improved the representation of the sharing of water supplies between the CVP and SWP. (For more details, see the technical addendum to this report, which is available online at http://baydeltaoffice.water.ca.gov/.)

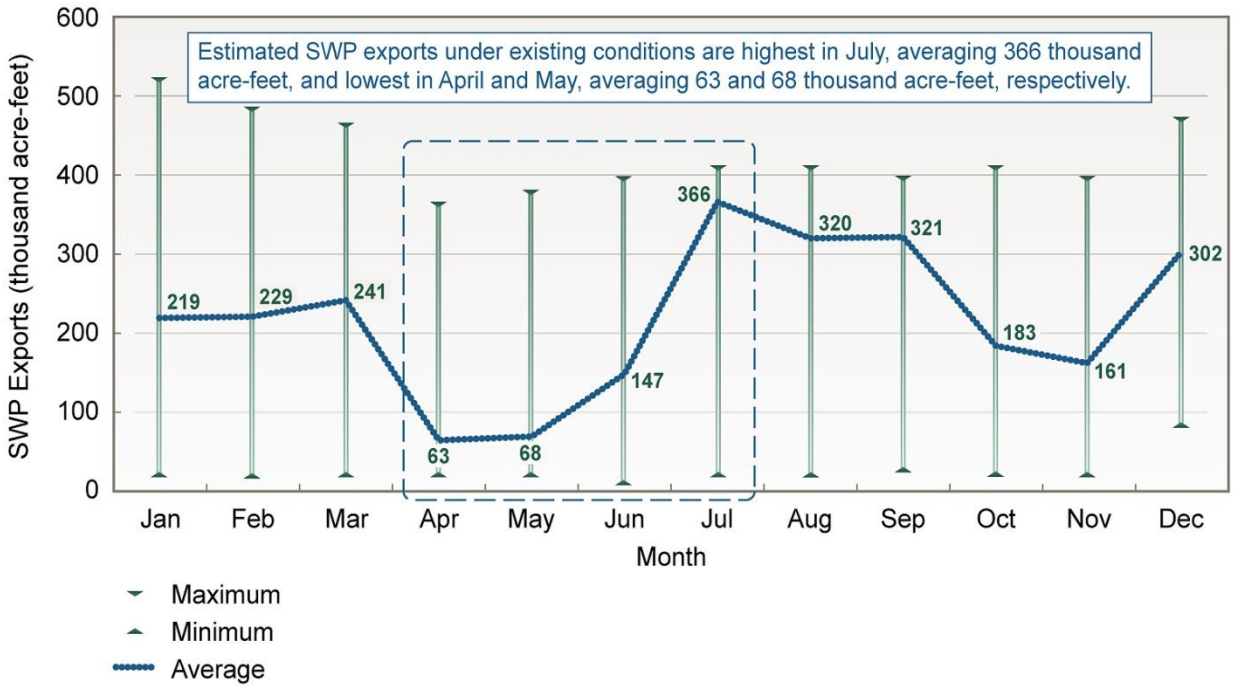


Figure 4-3. Monthly Range of Estimated SWP Exports (Existing Conditions)

Table 4-3. Estimated SWP Exports by Water Year Type (Existing Conditions)

Water Year Type	2011 Report (taf)	2013 Report (taf)
Wet	3,210	3,338
Above Normal	2,783	2,850
Below Normal	2,642	2,736
Dry	2,320	2,218
Critical	1,512	1,248
Average	*2,607*	*2,612*

Table 4-4. Estimated SWP Exports by Water Year Type (Future Conditions)

Water Year Type	2011 Report (taf)	2013 Report (taf)
Wet	3,182	3,224
Above Normal	2,754	2,811
Below Normal	2,556	2,609
Dry	2,120	1,943
Critical	1,414	1,093
Average	*2,521*	*2,466*

Likelihood of SWP Exports—Existing and Future Conditions

The estimated likelihood of a given level of SWP exports under existing conditions and under future conditions is presented in Figure 4-4. A total of 4,431 taf in the existing condition scenario is the largest average yearly export amount that was modeled for the 2013 Report.

As shown in Figure 4-4, approximately 71% of simulated cases for existing conditions have estimated SWP exports between 2,000 and 3,500 taf/year.

Likewise, in about 66% of simulated cases for future conditions, estimated SWP exports are between 2,000 and 3,500 taf/year (Figure 4-4).

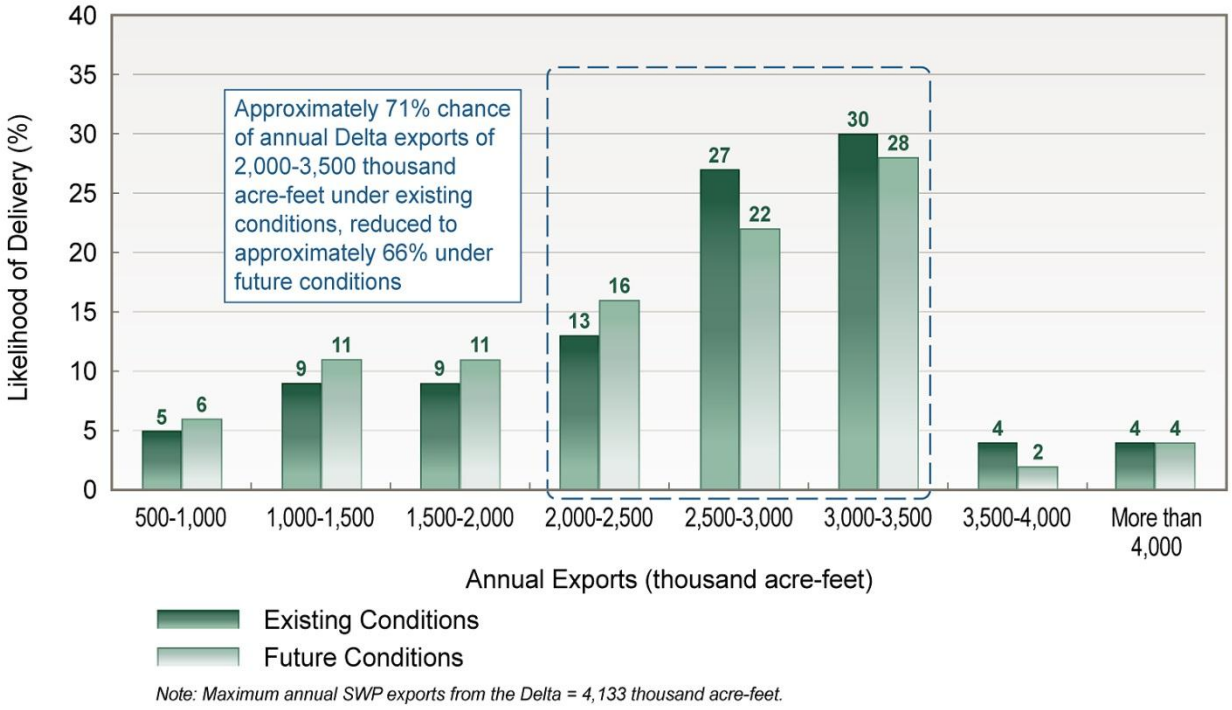


Figure 4-4. Estimated Likelihood of SWP Exports, by Increments of 500 taf (under Existing and Future Conditions)

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Chapter 5

Existing SWP Water Delivery Reliability (2013)

This chapter presents estimates of the SWP's existing (2013) water delivery reliability. The estimates are presented below, alongside the results obtained from the 2011 Report. Like this 2013 Report, the 2011 Report incorporated the requirements of BOs issued by USFWS and NMFS in December 2008 and June 2009, respectively, on the effects of coordinated operations of the SWP and CVP. These BOs are discussed in detail in Chapter 2, "State Water Project and Water Delivery Contracts," and Chapter 3, "Factors that Affect Water Delivery Reliability."

The discussions of SWP water delivery reliability in this chapter and Chapter 6 present the results of DWR's updated modeling of the SWP's water delivery reliability. A tabular summary of the modeling results is presented in the technical addendum to this report, which is available online at http://baydeltaoffice.water.ca.gov/.

The technical addendum also contains annual delivery probability curves (i.e., exceedence plots) to graphically show the estimated percentage of years in which a given annual delivery is equaled or exceeded.

Hydrologic Sequence

SWP delivery amounts are estimated in this 2013 Report for existing conditions using computer modeling that incorporates the historic range of hydrologic conditions (i.e., precipitation and runoff) that occurred from water years 1922 through 2003. The historic hydrologic conditions are adjusted to account for land-use changes (i.e., the current level of development) and upstream flow regulations that characterize 2013. By using this 82-year historical flow record, the delivery estimates modeled for existing conditions reflect a reasonable range of potential hydrologic conditions from wet years to critically dry years.

Existing Demand for Delta Water

Demand levels for the SWP water users in this report are derived from historical data and information from the SWP contractors themselves. The amount of water that SWP contractors request each year (i.e., demand) is related to:

- the magnitude and type of water demands,
- the extent of water conservation measures,
- local weather patterns, and
- water costs.

The existing level of development (i.e., the level of water use in the source areas from which the water supply originates) is based on recent land uses, and is assumed to be representative of existing conditions for the purposes of this 2013 Report.

SWP Table A Water Demands

The current combined maximum Table A amount is 4,172 taf/year. See "'Table A' Water" in Chapter 2, "State Water Project and Water Delivery Contracts," for a full discussion of Table A, which is a table within each water supply contract. Of the combined maximum Table A amount, 4,133 taf/year is the SWP's maximum Table A water available for delivery from the Delta.

The estimated demands by SWP contractors for deliveries of Table A water from the Delta under existing conditions, as determined for the 2013 Report and previously for the 2011 Report, are shown in Table 5-1. The estimated average demand for SWP Table A water is shown, along with maximum and minimum demands. Estimated demands are the result of discussions with staff from DWR's Operations Control Office and the State Water Contractors. The values represent their best estimates of current practices.

Table 5-1. Comparison of Estimated Average, Maximum, and Minimum Demands for SWP Table A Water (Existing Conditions, in taf/year)

	2011 Report	2013 Report
Average	3,722	4,132
Maximum	4,120	4,132
Minimum	3,043	4,132

As estimated for the 2011 Report, demands varied annually depending on local hydrologic patterns and other factors (e.g., demand management and the amount of water storage within the service area). The 2013 Report assumes that the maximum SWP Table A delivery amount is requested (i.e., demanded) each year. The 2011 Report did not assume maximum demand, but because SWP contractors have been requesting the full amount in recent years, the 2013 Report was updated to more accurately reflect the trend in demand. Estimated annual demands for deliveries of SWP Table A water ranged between 3,043 and 4,120 taf/year in the 2011 Report.

SWP Article 21 Water Demands

Under Article 21 of the SWP's long-term water supply contracts, contractors may receive additional water deliveries only under the following specific conditions:

- such deliveries do not interfere with SWP Table A allocations and SWP operations;
- excess water is available in the Delta;
- capacity is not being used for SWP purposes or scheduled SWP deliveries; and
- contractors can use the SWP Article 21 water directly or can store it in their own system (i.e., the water cannot be stored in the SWP system).

The demand for SWP Article 21 water by SWP contractors is assumed to vary depending on the month and weather conditions (i.e., amounts of precipitation and runoff). For the purposes of this discussion of SWP Article 21 water demands, a Kern wet year is defined as a year when the annual Kern River flow is projected to be greater than 1,500 taf. Kern River inflows are important because they are a major component of the local water supply for Kern County Water Agency (KCWA), which is the second largest SWP contractor and possesses significant local groundwater recharge capability. During Kern wet years, KCWA uses more Kern River flows to recharge its groundwater storage and reduce its demand for Article 21 water.

As shown in Figure 5-1, existing demands for SWP Article 21 water estimated for this 2013 Report are assumed to be high during the spring and late fall in non–Kern wet years (214 taf/month) because the contractors cannot rely as heavily on the Kern River flows to recharge their groundwater storage. Demand for Article 21 water is also high during the winter months of December through March in all weather year types (202 taf in Kern wet years and 414 taf in non–Kern wet years). Demands are assumed to be very low (2 taf/month) from April through November of Kern wet years (because high Kern River flows provide groundwater recharge water) and from July through October of Kern dry years.

These demand patterns for SWP Article 21 water are identical to what was presented in the 2011 Report for existing conditions.

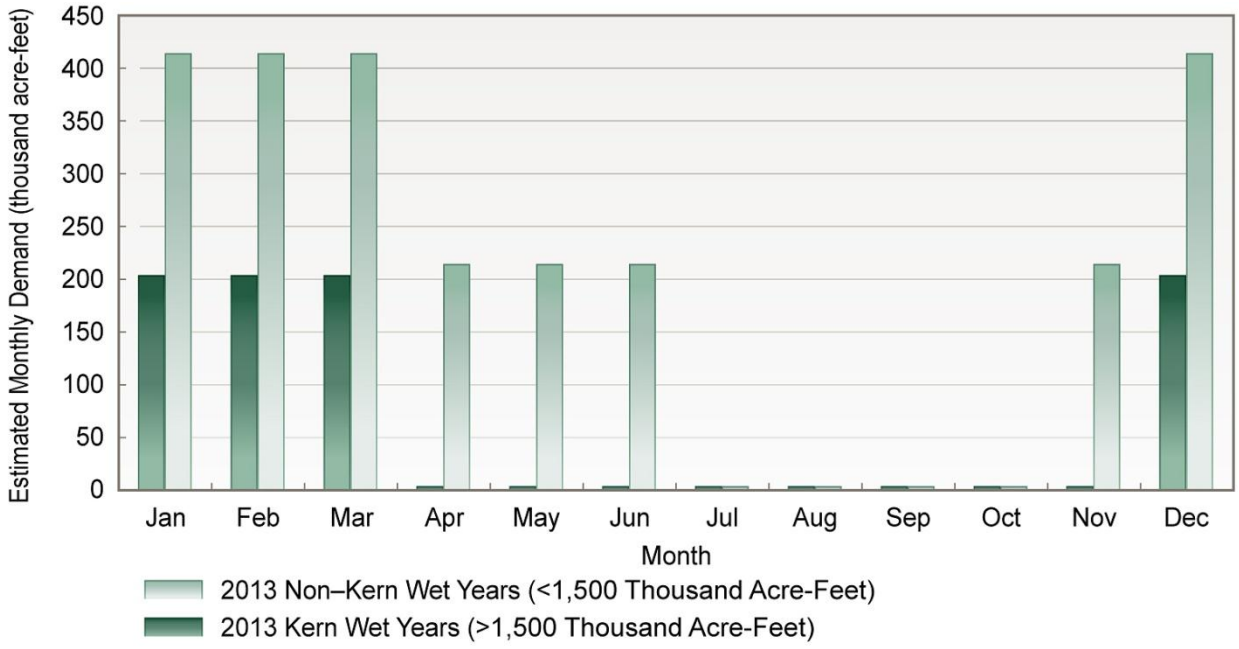
Estimates of SWP Table A Water Deliveries

Table 5-2 presents the annual average, maximum, and minimum estimates of SWP Table A deliveries from the Delta for existing conditions, as calculated for the 2011 and 2013 Reports. The average Table A deliveries are similar between the 2011 and 2013 Reports. The maximum and minimum values are different primarily due to the increased demands assumed in the 2013 Report.

Table 5-2. Comparison of Estimated Average, Maximum, and Minimum Deliveries of SWP Table A Water (Existing Conditions, in taf/year)

	2011 Report	2013 Report
Average	2,524	2,553
Maximum	3,363	3,996
Minimum	377	495

Assumptions about Table A and Article 21 water demands, along with operations for carryover water, have been updated in the model based on discussions with State Water Contractors staff and DWR's Operations and Control Office.



Note: Values shown are the maximum amount that can be delivered monthly. However, the actual capability of SWP water contractors to take this amount of SWP Article 21 water is not the sum of these maximum monthly values.

Figure 5-1. SWP Article 21 Demands during Non–Kern Wet Years and Kern Wet Years (Existing Conditions)

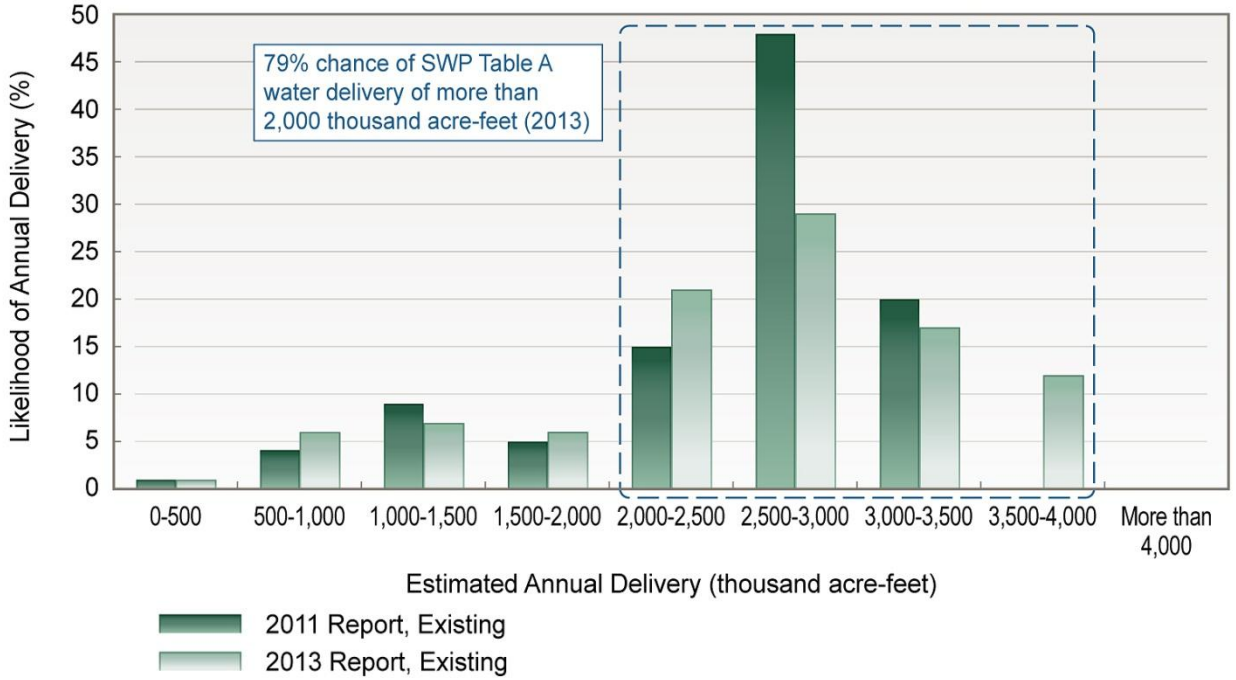


Figure 5-2. Estimated Likelihood of SWP Table A Water Deliveries, by Increments of 500 taf (Existing Conditions)

Figure 5-2 presents the estimated likelihood of delivery of a given amount of SWP Table A water under the existing conditions scenario, as estimated for both the 2011 and 2013 Reports. This figure shows that there is a 79% likelihood (82% with the 2011 Report) that more than 2,000 taf/year of Table A water will be delivered under the current estimates. The distribution of the delivery ranges has also changed since the 2011 Report. For example, Figure 5-2 shows a shift of Table A deliveries from the 2,500–3,000 taf/year range to the 3,500–4,000 taf/year range, because of the increased Table A demand assumed in the 2013 Report (4,133 taf). The 2011 Report assumed variable Table A demands (3,043–4,120 taf) for existing conditions.

Wet-Year Deliveries of SWP Table A Water

Table 5-3 and Figure 5-3 present estimates of SWP Table A water deliveries under existing conditions during possible wet conditions and compares them with corresponding delivery estimates calculated for the 2011 Report. Wet periods for 2013 are analyzed using historical precipitation and runoff patterns from 1922–2003 as a reference, while accounting for existing 2013 conditions (e.g., land use, water infrastructure). For reference, the wettest single year on record was 1983.

The results of modeling existing conditions over historical wet years indicate that SWP Table A water deliveries during wet periods can be estimated to range between yearly averages of 3,086 to 3,996 taf.

Table 5-3 shows that the 2013 deliveries of SWP Table A water increased in wet periods (in comparison to the 2011 Report) because of the assumed higher demand.

Table 5-3. Estimated Average and Wet-Period Deliveries of SWP Table A Water (Existing Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Wet Year (1983)		Wet Periods							
					2 Years (1982–1983)		4 Years (1980–1983)		6 Years (1978–1983)		10 Years (1978–1987)	
2011 Report	2,524	61%	2,884	70%	2,956	72%	2,871	69%	2,872	69%	2,832	69%
2013 Report	2,553	62%	3,996	97%	3,880	94%	3,501	85%	3,361	81%	3,086	75%

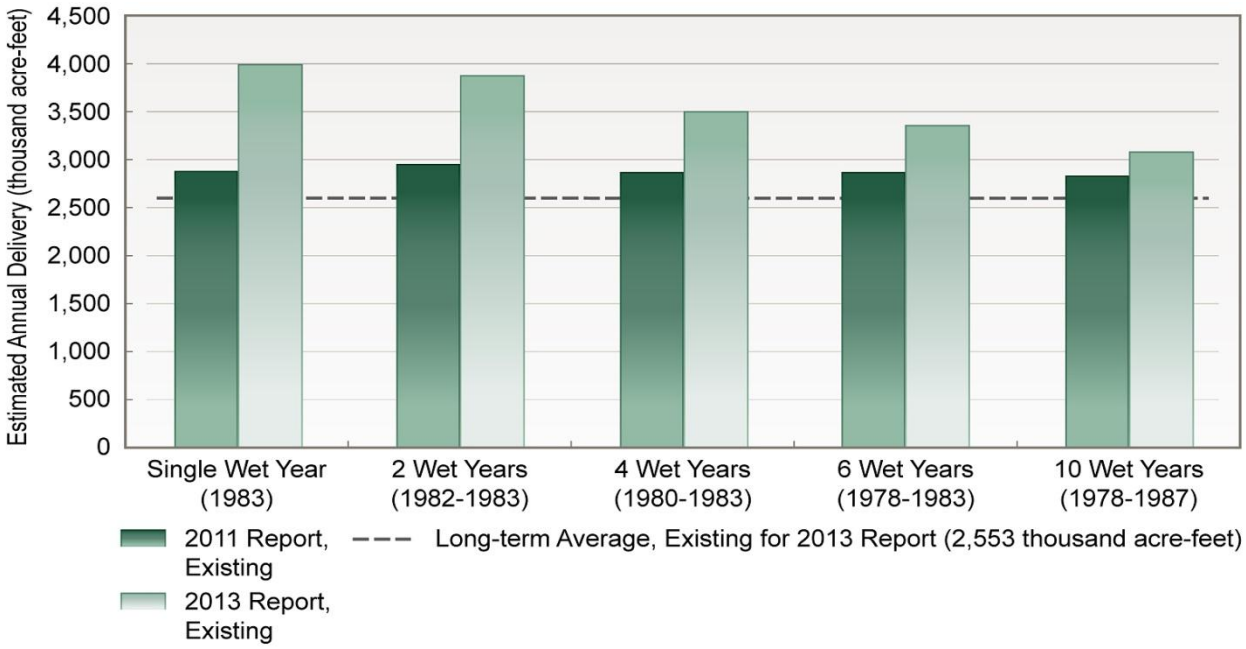


Figure 5-3. Estimated Wet-Period SWP Table A Water Deliveries (Existing Conditions)

Dry-Year Deliveries of SWP Table A Water

Table 5-4 and Figure 5-4 display estimates of existing-conditions deliveries of SWP Table A water during possible drought conditions and compares them with the corresponding delivery estimates calculated for the 2011 Report. Droughts are analyzed using the historical drought-period precipitation and runoff patterns from 1922 through 2003 as a reference, although existing 2013 conditions (e.g., land use, water infrastructure) are also accounted for in the modeling. For reference, the worst multiyear drought on record was the 1929–1934 drought, although the brief drought of 1976–1977 was more intensely dry.

The results of modeling existing conditions under historical drought scenarios indicate that SWP Table A water deliveries during dry years can be estimated to range between yearly averages of 495 and 1,269 taf.

On average, the dry-period deliveries of Table A water are lower in this 2013 Report than in the 2011 Report because of model refinements (discussed in detail in the technical addendum). In the 2011 Report's model, significant CVP north-of-Delta releases were allowed to meet SWP in-basin uses and to support SWP exports. The 2013 Report's model eliminates this artificial support, causing decreases in SWP deliveries during drought periods.

Table 5-4. Estimated Average and Dry-Period Deliveries of SWP Table A Water (Existing Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Dry Year (1977)		Dry Periods							
					2-Year Drought (1976–1977)		4-Year Drought (1931–1934)		6-Year Drought (1987–1992)		6-Year Drought (1929–1934)	
2011 Report	2,524	61%	377	9%	1,571	38%	1,455	35%	1,461	35%	1,433	35%
2013 Report	2,553	62%	495	12%	1,269	31%	1,263	31%	1,176	28%	1,260	30%

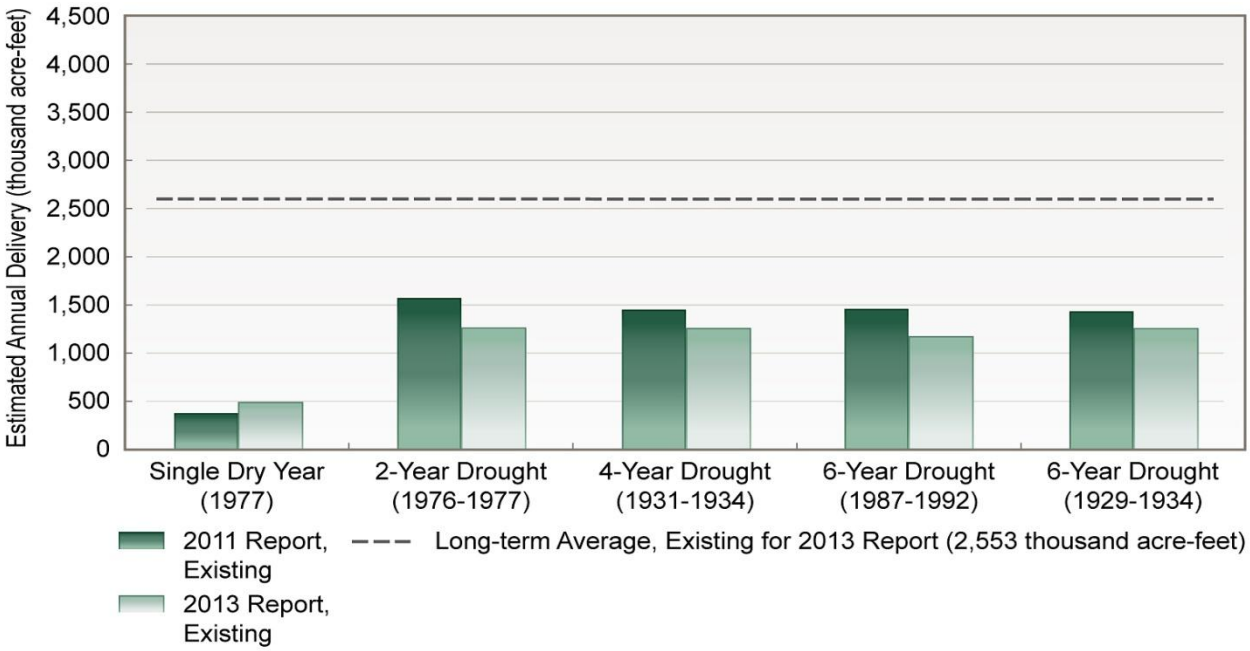


Figure 5-4. Estimated Dry-Period SWP Table A Water Deliveries (Existing Conditions)

Estimates of SWP Article 21 Water Deliveries

SWP water delivery is a combination of deliveries of Table A water and Article 21 water. Some SWP contractors store Article 21 water locally when extra water and capacity are available beyond that needed by normal SWP operations. Deliveries of SWP Article 21 water vary not only by year, but also by month. The estimated range of monthly deliveries of SWP Article 21 water is displayed in Figure 5-5. In May through October, essentially no Article 21 water is estimated to be delivered. In the late fall and winter (November through April), maximum monthly deliveries range from 92 to 245 taf/month.

The estimated likelihood that a given amount of SWP Article 21 water will be delivered is presented in Figure 5-6.

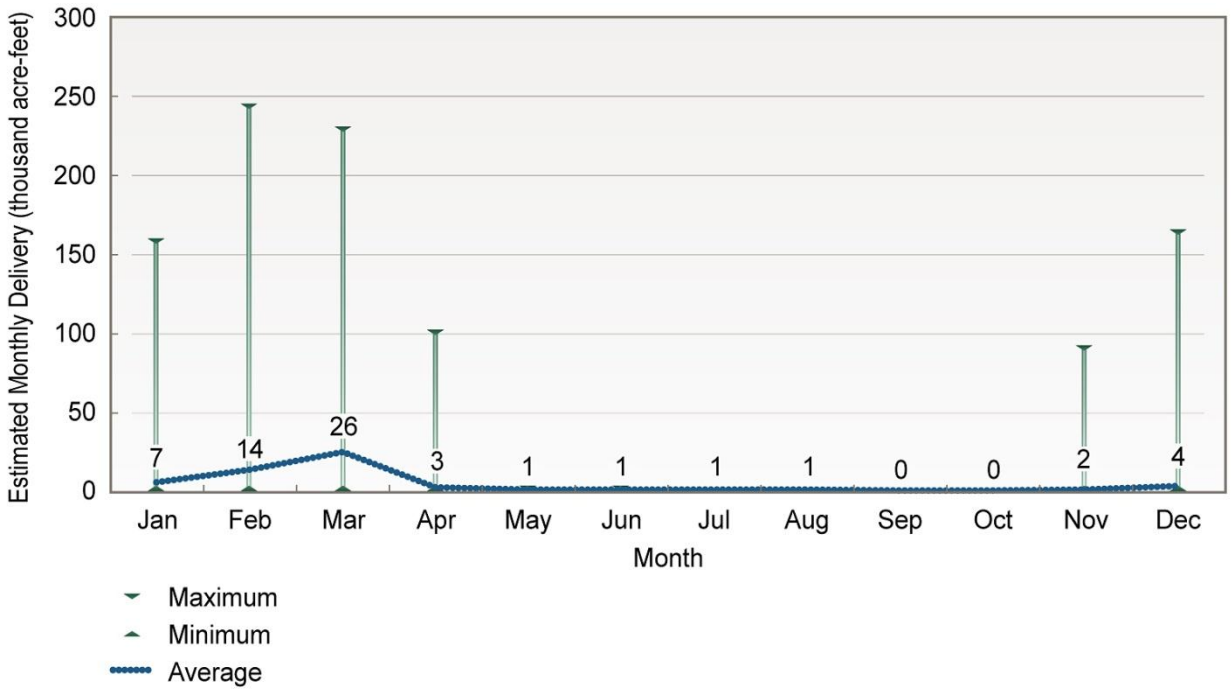


Figure 5-5. Estimated Range of Monthly Deliveries of SWP Article 21 Water (Existing Conditions)

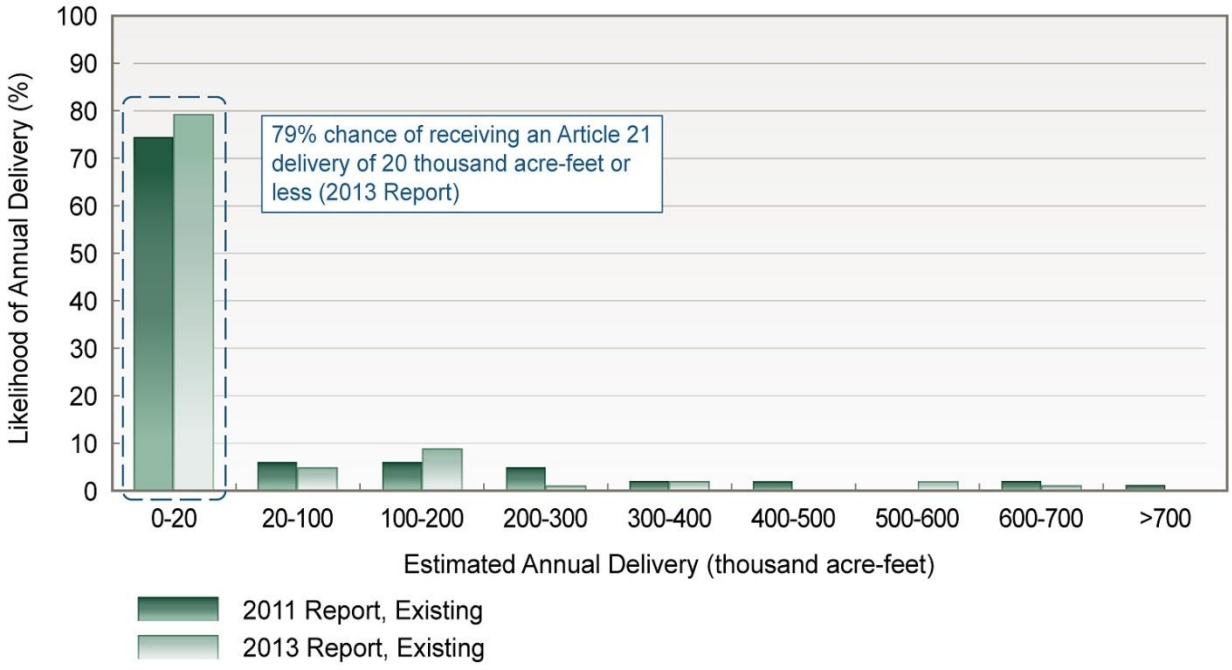


Figure 5-6. Estimated Likelihood of Annual Deliveries of SWP Article 21 Water (Existing Conditions)

Wet-Year Deliveries of SWP Article 21 Water

Table 5-5 shows the estimates of deliveries of SWP Article 21 water during wet periods under existing conditions. Estimated deliveries in wet years are approximately 2.3 to 5.7 times larger than the average existing-conditions delivery of SWP Article 21 water.

In general, the wet-period deliveries in this 2013 Report are lower than in the 2011 Report because of the higher Table A demand assumed in the 2013 Report (the maximum, or 4,133 taf/year). Because Table A demand is higher, the model tries to deliver more water during the year and less is left over to deliver as Article 21 water.

Dry-Year Deliveries of SWP Article 21 Water

Although deliveries of SWP Article 21 water are smaller during dry years than during wet ones, opportunities exist to deliver SWP Article 21 water during multiyear drought periods. As modeled, deliveries in dry years are often small (less than 5 taf); however, longer drought periods can include several years that support Article 21 deliveries. Annual average Article 21 estimates for drought periods of 4 and 6 years vary significantly and can approach the long-term average annual estimate, as shown in Table 5-6.

Table 5-5. Estimated Average and Wet-Period Deliveries of SWP Article 21 Water (Existing Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Wet Year (1983)	Wet Periods			
			2 Years (1982–1983)	4 Years (1980–1983)	6 Years (1978–1983)	10 Years (1978–1987)
2011 Report	76	608	533	306	225	206
2013 Report	58	333	265	196	135	152

Table 5-6. Estimated Average and Dry-Period Deliveries of SWP Article 21 Water (Existing Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Dry Year (1977)	Wet Periods			
			2-Year Drought (1976–1977)	4-Year Drought (1931–1934)	6-Year Drought (1987–1992)	6-Year Drought (1929–1934)
2011 Report	76	3	4	69	9	49
2013 Report	58	10	13	46	11	35

Chapter 6

Future SWP Water Delivery Reliability (2033)

This chapter presents estimates of the SWP's delivery reliability for conditions 20 years in the future (2033). These estimates reflect hydrologic changes that could result from climate change, but they incorporate the same requirements that are assumed under existing conditions, including the USFWS and NMFS BOs.

This chapter also compares these estimates of future conditions with the future-condition results presented in the *State Water Project Delivery Reliability Report 2011* (2011 Report) for the year 2031.

A tabular summary of the modeling results for the future conditions scenario is presented in the technical addendum to this report. The technical addendum also contains annual delivery probability curves (i.e., exceedence plots) to graphically show the estimated percentage of years in which a given annual delivery is equaled or exceeded.

Future Demand for Delta Water

Demand levels for the SWP water users in this report are derived from historical data and information from the SWP contractors themselves. The 2033 level of development (i.e., the level of water use in the source areas from which the water supply originates) is based on the projected assumptions for land use for that year, and is assumed to be representative of future conditions for the purposes of this report.

SWP Table A Water Demands

Future demands for SWP Table A water, as calculated for this 2013 Report, are assumed to be the maximum possible annual amount of 4,133 taf. Therefore, the 2033 future conditions assumptions about SWP Table A water demand are the same as those for the 2013 existing conditions.

The SWP Table A water demands under future conditions as presented in the 2011 Report are also assumed to be the maximum amount of 4,133 taf/year.

SWP Article 21 Water Demands

The assumed future demands for SWP Article 21 water are the same as those assumed for existing conditions (see Chapter 5, "Existing SWP Water Delivery Reliability [2013]").

Estimates of Future SWP Deliveries

When modeling water supply deliveries 20 years in the future, the unknowns are considerable and many assumptions must be made. As was assumed for existing conditions (see Chapter 5), modeling of SWP deliveries for 2033 take into account current Delta water quality regulations and the requirements of the USFWS and NMFS BOs. Climate change as well as changes to water uses in the upstream watersheds (i.e., source watersheds) are also taken into account when modeling water supply deliveries under future conditions. Additional discussion of how the modeling of SWP water delivery reliability is adjusted to account for climate change is provided in Chapter 3, "Factors that Affect Water Delivery Reliability."

One of the most important assumptions when modeling SWP water delivery under future conditions is that the rules and facilities related to Delta conveyance will remain at the status quo. That is, in the future-conditions scenario, no new facilities to convey water through or around the Delta are assumed to be in place because no new programs have been sufficiently developed that can be assumed with certainty.

Future Deliveries of SWP Table A Water

Table 6-1 presents the annual average, maximum, and minimum estimates of SWP Table A water deliveries from the Delta for future conditions, as calculated for the 2011 and 2013 Reports. The SWP Table A water deliveries under future conditions are similar between the 2011 and 2013 Reports. The maximum possible delivery of SWP Table A water, 4,133 taf/year, is not reached under future conditions.

Table 6-1. Comparison of Estimated Average, Maximum, and Minimum Deliveries for SWP Table A Water (Future Conditions, in taf/year)

	2011 Report (Year 2031)	2013 Report (Year 2033)
Average	2,465	2,400
Maximum	4,062	4,068
Minimum	441	453

The estimated likelihood that a given amount of SWP Table A water will be delivered under future conditions is presented in Figure 6-1. Currently, there is a 57% likelihood that 2,000–3,500 taf of SWP Table A water will be delivered under the future-conditions scenario.

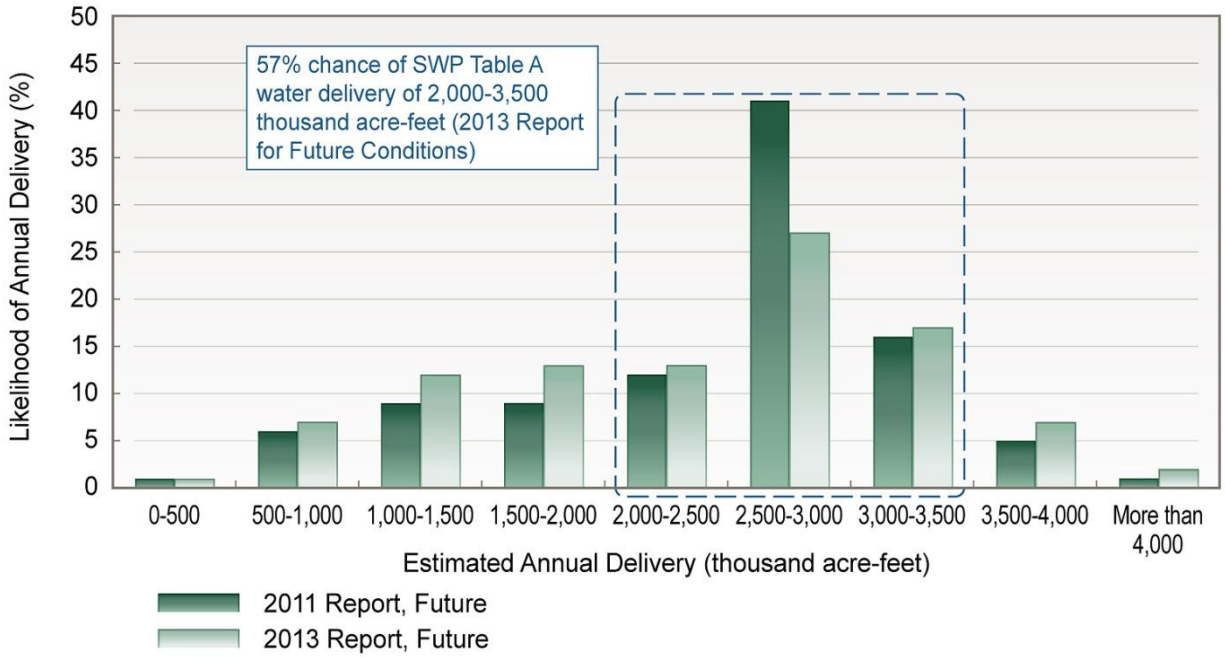


Figure 6-1. Estimated Likelihood of Annual SWP Table A Water Deliveries, by Increments of 500 taf (Future Conditions)

Wet-Year Deliveries of SWP Table A Water under Future Conditions

Table 6-2 and Figure 6-2 present estimates of future SWP Table A water deliveries during a wet period and compare them with the corresponding delivery estimates calculated for the 2011 Report. Wet periods were modeled using historical precipitation and runoff patterns from 1922–2003 as a reference, and accounting for future conditions such as land use and climate change. The results of modeling future conditions over historical wet years indicate that SWP Table A water deliveries during wet periods can be estimated to range between yearly averages of 2,900 to 4,068 taf.

Table 6-2. Estimated Average and Wet-Period Deliveries of SWP Table A Water (Future Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Wet Year (1983)		Wet Periods							
					2 Years (1982–1983)		4 Years (1980–1983)		6 Years (1978–1983)		10 Years (1978–1987)	
2011 Report	2,465	60%	4,062	98%	3,909	95%	3,396	82%	3,248	79%	2,972	72%
2013 Report	2,400	58%	4,068	98%	3,945	95%	3,333	81%	3,191	77%	2,900	70%

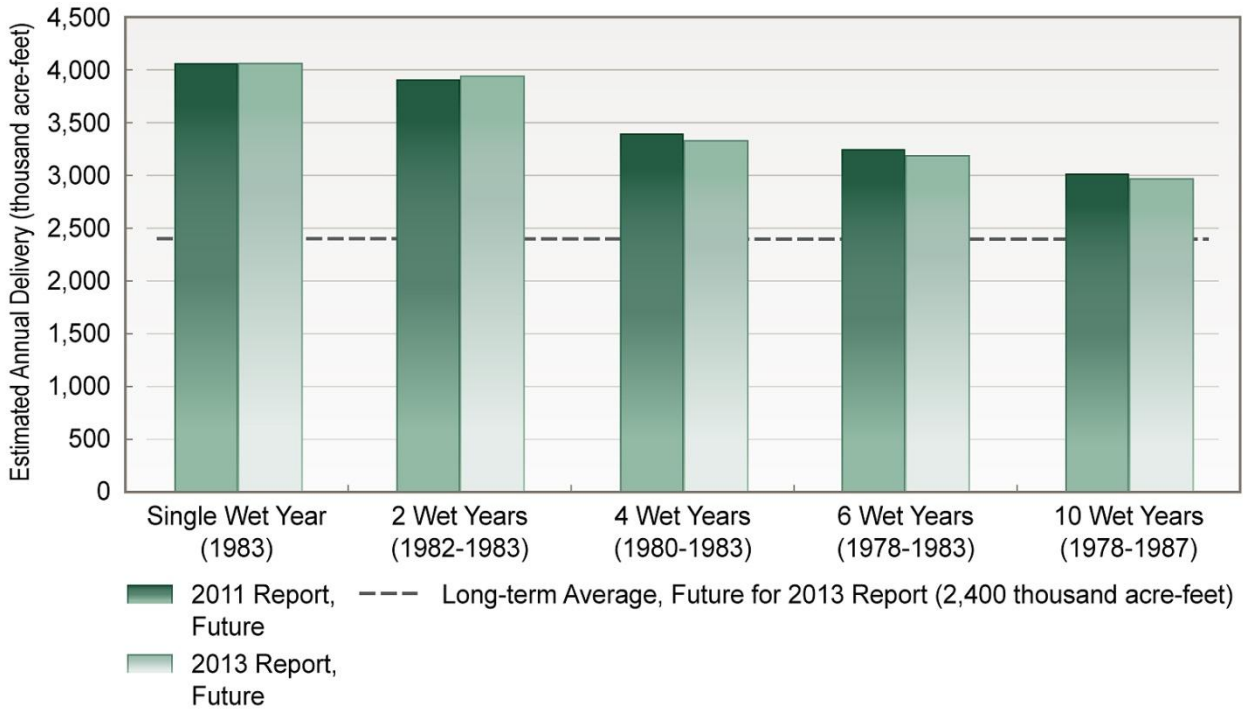


Figure 6-2. Estimated Wet-Period SWP Table A Water Deliveries (Future Conditions)

Dry-Year Deliveries of SWP Table A Water under Future Conditions

Table 6-3 and Figure 6-3 present estimates of future SWP Table A water deliveries during possible drought conditions and compare these estimates with the corresponding delivery estimates calculated for the 2011 Report. Drought scenarios for future conditions are analyzed using the historical drought-period precipitation and runoff patterns from 1922–2003 as a reference, while accounting for future conditions (e.g., land use, climate change).

The results of modeling future conditions under potential drought-year scenarios provide an estimated range of Table A deliveries that can be expected during drought periods.

The 2-year drought period (1976–1977) shows significantly lower Table A deliveries in the 2013 Report than in the 2011 Report (see Figure 6-3), because of modeling refinements (see the technical addendum at http://baydeltaoffice.water.ca.gov/) and reclassification of 1975 into a wet year rather than an above-normal year, as was used in the 2011 Report (due to the change in the assumed climate change model). Because 1975 is now considered a wet year in this 2013 Report's model, there are higher fall X2 requirements to meet and more Delta outflow is required in September. This leads to lower reservoir levels at the start of the new water year and smaller deliveries during the upcoming 2-year dry period.

Table 6-3. Estimated Average and Dry-Period Deliveries of SWP Table A Water (Future Conditions, in taf/year) and Percent of Maximum SWP Table A Amount, 4,133 taf/year

	Long-term Average (1921–2003)		Single Dry Year (1977)		Dry Periods							
					2-Year Drought (1976–1977)		4-Year Drought (1931–1934)		6-Year Drought (1987–1992)		6-Year Drought (1929–1934)	
2011 Report	2,465	60%	441	11%	1,457	35%	1,401	34%	1,226	30%	1,365	33%
2013 Report	2,400	58%	453	11%	978	24%	1,263	31%	1,055	26%	1,251	30%

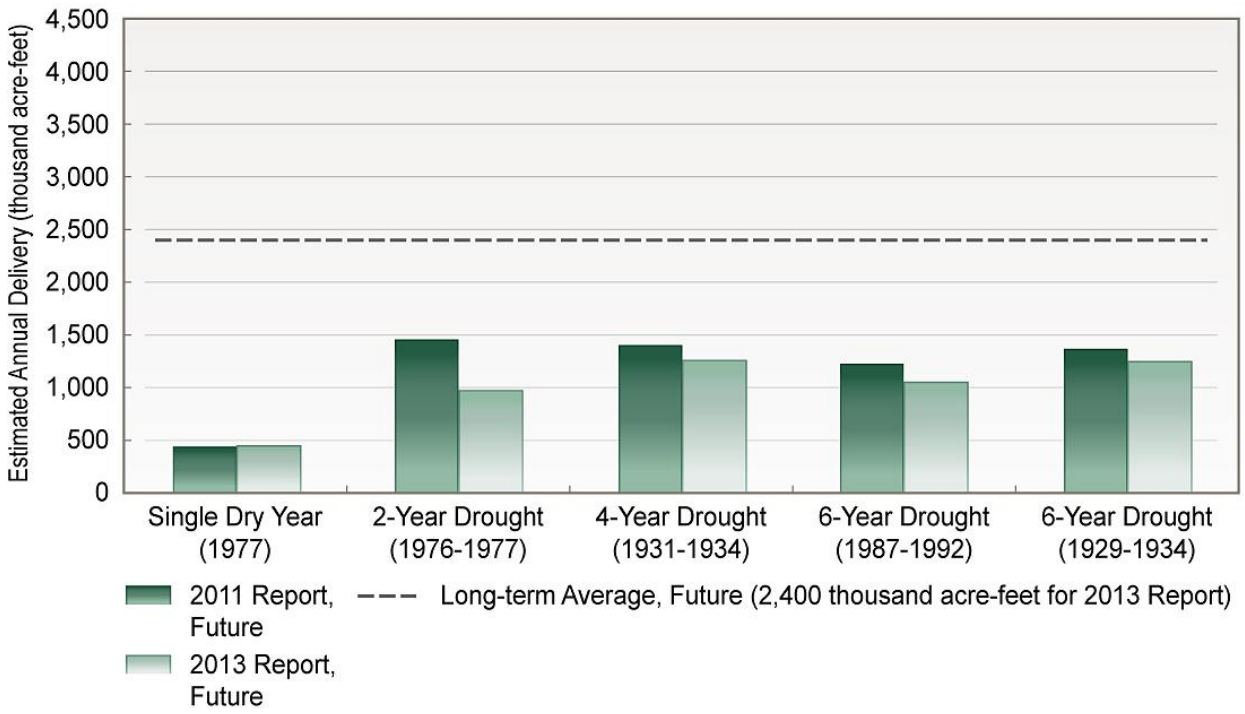


Figure 6-3. Estimated Dry-Period SWP Table A Water Deliveries (Future Conditions)

SWP Article 21 Water Deliveries under Future Conditions

The estimated range of monthly deliveries of SWP Article 21 water is displayed in Figure 6-4. Estimated deliveries of SWP Article 21 water under future conditions vary not only by year, depending on the precipitation and runoff, but also by month. In the spring, summer, and early fall months (May through October), deliveries of SWP Article 21 water under future conditions are estimated to be low, with a maximum of approximately 18 taf/month and a minimum of 0 taf/month. From November through April, maximum estimated future deliveries of SWP Article 21 water can be as high as 256 taf and as low as 41 taf in a given month; however, the average deliveries range between 1 and 25 taf.

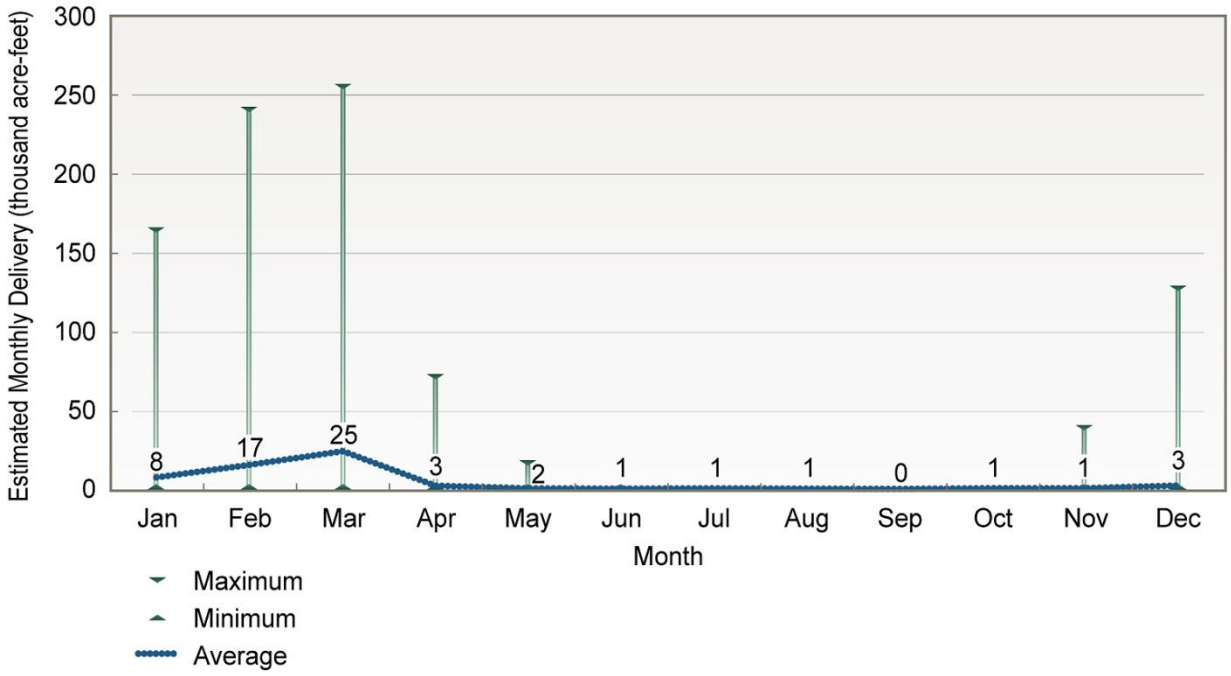


Figure 6-4. Estimated Range of Monthly Deliveries of SWP Article 21 Water (2033 Future Conditions)

The estimated likelihood that a given amount of SWP Article 21 water will be delivered under future conditions is presented in Figure 6-5. There is a 23% likelihood that more than 20 taf/year of SWP Article 21 water will be delivered under future conditions.

In the 2011 Report, there is a 22% likelihood that estimated deliveries of SWP Article 21 water under future conditions are more than 20 taf/year.

Wet-Year Deliveries of SWP Article 21 Water under Future Conditions

Table 6-4 shows the estimates of deliveries of SWP Article 21 water during wet periods under future conditions. The results of modeling future conditions over historical wet years indicate that wet-period deliveries of SWP Article 21 water can be estimated to range between yearly averages of 126–227 taf.

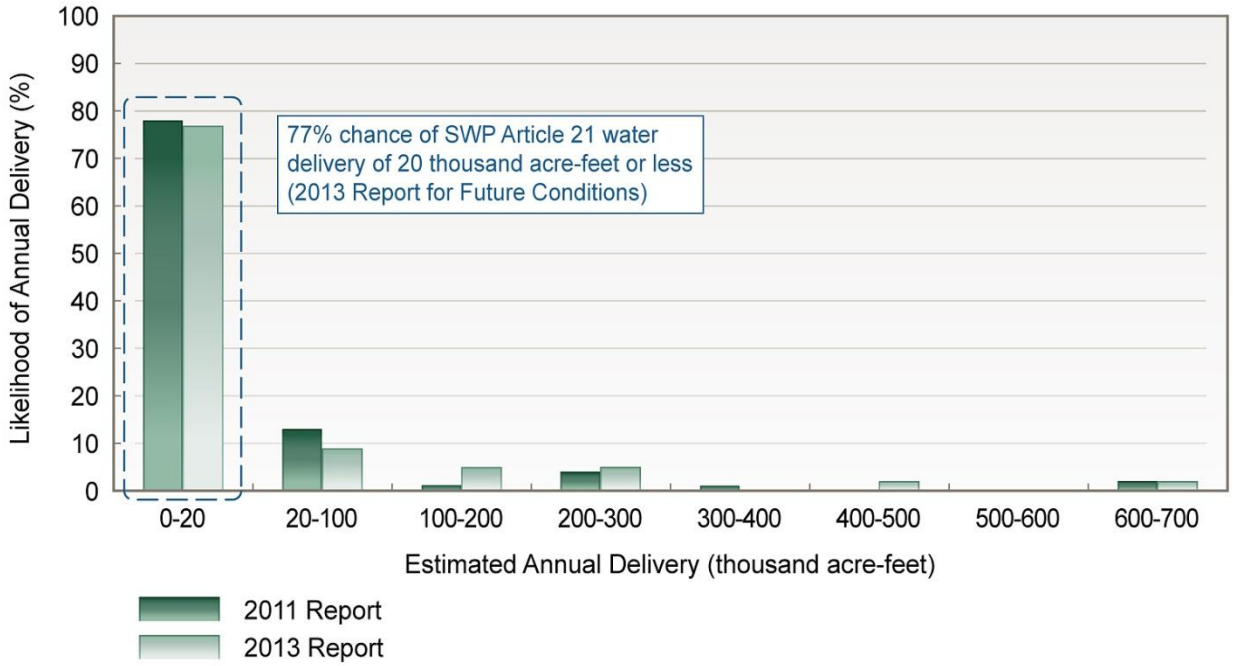


Figure 6-5. Estimated Likelihood of Annual Deliveries of SWP Article 21 Water (Future Conditions)

Table 6-4. Estimated Average and Wet-Period Deliveries of SWP Article 21 Water (Future Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Wet Year (1983)	Wet Periods			
			2 Years (1982–1983)	4 Years (1980–1983)	6 Years (1978–1983)	10 Years (1978–1987)
2011 Report	50	291	190	120	83	121
2013 Report	62	227	211	183	126	146

Dry-Year Deliveries of SWP Article 21 Water under Future Conditions

Table 6-5 shows the estimates of future deliveries of SWP Article 21 water during dry periods. The results of modeling future conditions under historical drought scenarios indicate that deliveries of SWP Article 21 water during dry periods can be estimated to range between yearly averages of 9-41 taf. Although drought-period deliveries are typically less than deliveries in average years, Table 6-4 shows that opportunities to deliver SWP Article 21 water exist during multiyear drought periods.

Table 6-5. Estimated Average and Dry-Period Deliveries of SWP Article 21 Water (Future Conditions, in taf/year)

	Long-term Average (1921–2003)	Single Dry Year (1977)	Dry Periods			
			2-Year Drought (1976–1977)	4-Year Drought (1931–1934)	6-Year Drought (1987–1992)	6-Year Drought (1929–1934)
2011 Report	50	4	7	50	10	37
2013 Report	62	9	13	41	13	32

Alternate Future Scenarios in BDCP

The Bay Delta Conservation Plan describes 3 possible future scenarios which are the Existing Biological Condition (EBC), Existing Conveyance High Outflow (ECHO) and Existing Conveyance Low Outflow (ECLO). The 2013 DRR describes only one future scenario which is similar to BDCP EBC.

The Existing Biological Condition (EBC) is similar in assumptions to the DRR 2013 Future scenario. Each scenario assumes the existing regulatory environment continues into the future. The DRR 2013 Future scenario was modeled with a more recent version of CalSim, which resulted in some minor variations from the results of the BDCP EBC analysis. Because of the different planning horizons (2025 in BDCP and 2033 in the DRR), there were also minor differences in sea level rise estimates and other climate change effects. All other assumptions remain largely the same.

The ECHO and ECLO scenarios are described in *Public Draft BDCP Chapter 9 – Alternatives to Take*. These scenarios assume the South Delta operating restrictions of the BDCP and a range of outflow requirements from high to low. The South Delta operating restrictions of the BDCP include modifications of Old and Middle River (OMR) criteria, modifications of the Head of Old River Barrier operations, and implementation of south Delta temporary agricultural barriers.

Table 6-6. Comparison of Estimated Average Deliveries for SWP Table A Water (Alternate Future Conditions, in taf/year)

	2013 Report (Year 2033)	BDCP EBC (Year 2025)	BDCP ECHO (Year 2025)	BDCP ECLO (Year 2025)
Average	2,400	2,489	1,772	2,078

Table 6-6 compares SWP Table A deliveries of the 2013 DRR Future scenario to the alternate future scenarios in BDCP. The 2013 DRR Future Scenario is most comparable to the BDCP EBC scenario. The 2013 DRR Future scenario estimates 89 taf (3.5%) less average annual delivery than does the BDCP EBC.

Glossary

acre-foot The volume of water (about 325,900 gallons) that would cover an area of 1 acre to a depth of 1 foot. This is enough water to meet the annual needs of one to two households.

agricultural water supplier As defined by the California Water Code, a public or private supplier that provides water to 2,000 or more irrigated acres per year for agricultural purposes or serves 2,000 or more acres of agricultural land. This can be a water district that directly supplies water to farmers or a contractor that sells water to the water district.

annual Delta exports The total amount of water transferred ("exported") to areas south of the Delta through the Harvey O. Banks Pumping Plant (SWP) and the C. W. "Bill" Jones Pumping Plant (CVP) in 1 year.

appropriative water rights Rights allowing a user to divert surface water for beneficial use. The user must first have obtained a permit from the State Water Resources Control Board, unless the appropriative water right predates 1914.

Article 21 water Water that a contractor can receive in addition to its allocated Table A water. This water is only available if several conditions are met: (1) excess water is flowing through the Delta; (2) the contractor can use the surplus water or store it in the contractor's own system; and (3) delivering this water will not interfere with Table A allocations, other SWP deliveries, or SWP operations.

Bay Delta Conservation Plan (BDCP) A plan for the Delta being developed by a group of local water agencies, environmental and conservation organizations, State and federal agencies, and other interest groups. The plan seeks to address challenges in the Delta that California's water community has faced for decades. When complete, the BDCP will provide the basis for issuing endangered species permits to operate the SWP and CVP. The heart of the BDCP is a long-term conservation strategy that sets forth actions needed for a healthy Delta.

biological opinion A determination by the U.S. Fish and Wildlife Service or National Marine Fisheries Service on whether a proposed federal action is likely to jeopardize the continued existence of a threatened or endangered species or result in the destruction or adverse modification of designated "critical habitat." If jeopardy is determined, certain actions are required to be taken to protect the species of concern.

CalSim-II A computer model, jointly developed by DWR and the U.S. Bureau of Reclamation, that simulates existing and future operations of the SWP and CVP. The hydrology used by this model was developed by adjusting the historical flow record (1922–2003) to account for the influence of changes in land uses and regulation of upstream flows.

carryover deliveries See "carryover water."

carryover water A water supply "savings account" for SWP water that is allocated to an SWP contractor in a given year, but not used by the end of the year. Carryover water is stored in the SWP's share of San Luis Reservoir, when space is available, for the contractor to use in the following year.

Central Valley Project (CVP) Operated by the U.S. Bureau of Reclamation, the CVP is a water storage and delivery system consisting of 20 dams and reservoirs (including Shasta, Folsom, and New Melones Reservoirs), 11 power plants, and 500 miles of major canals. CVP facilities reach some 400 miles from Redding to Bakersfield and deliver about 7 million acre-feet of water for agricultural, urban, and wildlife use.

cubic feet per second (cfs) A measure of the rate at which a river of stream is flowing. The flow is 1 cfs if a cubic foot (about 7.48 gallons) of water passes a specific point in 1 second. A flow of 1 cubic foot per second for a day is approximately 2 acre-feet.

Among the SWP's facilities are more than 700 miles of canals that distribute water to urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California.

Delta exports Water transferred ("exported") to areas south of the Delta through the Harvey O. Banks Pumping Plant (SWP) and the C. W. "Bill" Jones Pumping Plant (CVP). The SWP's Delta exports are the primary component of total SWP deliveries.

Delta inflow The combined total of water flowing into the Delta from the Sacramento River, San Joaquin River, and other rivers and waterways.

exceedence plot For the SWP, a curve showing SWP delivery probability (especially for Table A water)—specifically, the likelihood that SWP contractors will receive a certain volume of water under current or future conditions.

existing-conditions scenario For the SWP delivery reliability reports, the results of modeling for SWP Delta exports or deliveries for the year the report was written.

future-conditions scenario For the SWP delivery reliability reports, the results of modeling for SWP Delta exports or SWP deliveries for 20 years into the future.

incidental take permit A permit issued by the U.S. Fish and Wildlife Service or National Marine Fisheries Service, under Section 10 of the federal Endangered Species Act, to private nonfederal entities undertaking otherwise lawful projects that might result in the "take" of an endangered or threatened species. In California, an additional permit is required and take may be authorized under Section 2081 of the California Fish and Game Code through issuance of either an incidental take permit or a consistency determination. The California Department of Fish and Wildlife is authorized to accept a federal biological opinion as the take authorization for a State-listed species when a species is listed under both the federal and California Endangered Species Acts.

riparian water rights Water rights that apply to lands traversed by or bordering on a natural watercourse. No permit is required to use this water, which must be used on riparian (adjacent) land and cannot be stored for later use.

State Water Project (SWP) Operated by DWR, a water storage and delivery system of 33 storage facilities, about 700 miles of open canals and pipelines, four pumping-generating plants, five hydroelectric power plants, and 20 pumping plants that extends for more than 600 miles in California. Its main purpose is to store and distribute water to 29 urban and agricultural water suppliers in Northern California, the San Francisco Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. The SWP provides supplemental water to 25 million Californians (almost two-thirds of California's population) and about 750,000 acres of irrigated farmland. Water deliveries have ranged from 1.4 million acre-feet in a dry year to more than 4.0 million acre-feet in a wet year.

SWP contractors Twenty-nine entities that receive water for agricultural or municipal and industrial uses through the SWP. Each contractor has executed a long-term water supply contract with DWR. Also sometimes referred to as "State Water Contractors."

Table A water (Table A amounts) The maximum amount of SWP water that the State agreed to make available to an SWP contractor for delivery during the year. Table A amounts determine the maximum water a contractor may request each year from DWR. The State and SWP contractors also use Table A amounts to serve as a basis for allocation of some SWP costs among the contractors.

Take Section 9 of the 1973 Endangered Species Act defines this term as follows: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.'

turnback pool water Allocated water that individual SWP contractors may offer early in the year for other SWP contractors to buy later at a set price.

urban water supplier As defined by the California Water Code, a public or private supplier that provides water for municipal use directly or indirectly to more than 3,000 customers or supplies more than 3,000 acre-feet of water in a year. This can be a water district that provides the water to local residents for use at home or work, or a contractor that distributes or sells water to that water district.

Water Rights Decision 1641 (D-1641) A regulatory decision issued by the State Water Resources Control Board in 1999 (updated in 2000) to implement the 1995 *Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta*. D-1641 assigned primary

responsibility for meeting many of the Delta's water quality objectives to the SWP and CVP, thus placing certain limits on SWP and CVP operations.

water year In reports on surface water supply, the period extending from October 1 through September 30 of the following calendar year. The water year refers to the September year. For example, October 1, 2010, through September 30, 2011 is the 2011 water year.

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Appendix A

Historical SWP Delivery Tables for 2003–2012

The State Water Project (SWP) contracts define several types of SWP water available for delivery to contractors under specific circumstances: Table A water, Article 21 water, turnback pool water, and carryover water. (See the glossary for definitions of these terms; Chapter 2 describes each type of SWP water in greater detail.) Many SWP contractors frequently use Article 21, turnback pool, and carryover water to increase or decrease the amount of water available to them under SWP Table A.

The Sacramento River Index, previously referred to as the "4 River Index" or "4 Basin Index," is the sum of the unimpaired runoff of four rivers: the Sacramento River above Bend Bridge near Red Bluff, Feather River inflow to Lake Oroville Reservoir, Yuba River at Smartville, and American River inflow to Folsom Lake. The five water year types used in the Sacramento River Index are as follows:

Sacramento River Index	Water Year Type
1	Wet
2	Above Normal
3	Below Normal
4	Dry
5	Critical

Tables A-1 through A-10 list annual historical deliveries by SWP water type for each contractor for 2003 through 2012. The Sacramento River Index and water year type are presented along with the delivery results for each year. Similar delivery tables are presented for years 2001–2010 in the *State Water Project Delivery Reliability Report 2011*. Any differences in values presented in this 2013 report and those in the 2011 report are due to reclassification of deliveries since the production of the 2011 report.

SWP contractors are listed in Tables A-1 through A-10 by location, as follows:

- *Feather River Area:* Butte County, Plumas County Flood Control and Water Conservation District (FCWCD), and Yuba City
- *North Bay Area:* Napa County FCWCD and Solano County Water Agency (WA)
- *South Bay Area:* Alameda County FCWCD, Zone 7; Alameda County Water District (WD); and Santa Clara Valley WD
- *San Joaquin Valley Area:* Dudley Ridge WD, Empire West Side Irrigation District (ID), Kern County WA, Kings County, Oak Flat WD, and Tulare Lake Basin Water Storage District (WSD)
- *Central Coastal Area:* San Luis Obispo County FCWCD and Santa Barbara County FCWCD
- *Southern California Area:* Antelope Valley–East Kern WA, Castaic Lake WA, Coachella Valley WD, Crestline–Lake Arrowhead WA, Desert WA, Littlerock Creek ID, Metropolitan WD of Southern California, Mojave WA, Palmdale WD, San Bernardino Valley Municipal Water District (MWD), San Gabriel Valley MWD, San Gorgonio Pass WA, and Ventura County Watershed Protection District (WPD)

Table A–1. Historical State Water Project Deliveries, Calendar Year 2003						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	551	–	–	–	551
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	1,324	–	–	–	1,324
	Subtotal	**1,875**	–	–	–	**1,875**
North Bay Area	Napa County FCWCD	6,026	376	1,055	180	7,637
	Solano County WA	25,135	2,280	1,918	–	29,333
	Subtotal	**31,161**	**2,656**	**2,973**	**180**	**36,970**
South Bay Area	Alameda County FCWCD, Zone 7	31,695	–	13,099	656	45,450
	Alameda County WD	31,086	–	5,150	354	36,590
	Santa Clara Valley WD	90,000	936	14,104	841	105,881
	Subtotal	**152,781**	**936**	**32,353**	**1,851**	**187,921**
San Joaquin Valley Area	Dudley Ridge WD	49,425	1,928	1,451	482	53,286
	Empire West Side ID	1,074	175	187	–	1,436
	Kern County WA	860,735	27,891	22,379	8,419	919,424
	Kings County	3,600	58	–	34	3,692
	Oak Flat WD	4,059	19	140	48	4,266
	Tulare Lake Basin WSD	94,376	6,243	4,284	938	105,841
	Subtotal	**1,013,269**	**36,314**	**28,441**	**9,921**	**1,087,945**
Central Coastal Area	San Luis Obispo County FCWCD	4,417	36	–	–	4,453
	Santa Barbara County FCWCD	24,312	339	2,274	43	26,968
	Subtotal	**28,729**	**375**	**2,274**	**43**	**31,421**
Southern California Area	Antelope Valley–East Kern WA	52,730	–	7,049	250	60,029
	Castaic Lake WA	49,895	991	4,760	90	55,736
	Coachella Valley WD	14,045	204	–	194	14,443
	Crestline–Lake Arrowhead WA	1,563	–	–	–	1,563
	Desert WA	23,168	330	–	321	23,819
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,480,252	17,622	204,949	16,920	1,719,743
	Mojave WA	10,907	–	3,528	–	14,435
	Palmdale WD	9,701	–	1,846	–	11,547
	San Bernardino Valley MWD	24,069	200	1,844	–	26,113
	San Gabriel Valley MWD	13,034	200	–	–	13,234
	San Gorgonio Pass WA	116	–	–	–	116
	Ventura County WPD	5,000	–	–	–	5,000
	Subtotal	**1,684,480**	**19,547**	**223,976**	**17,775**	**1,945,778**
TOTAL SWP DELIVERIES		**2,912,295**	**59,828**	**290,017**	**29,770**	**3,291,910**

Table A–2. Historical State Water Project Deliveries, Calendar Year 2004						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	1,440	–	–	–	1,440
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	1,434	–	–	–	1,434
	Subtotal	**2,874**	**–**	**–**	**–**	**2,874**
North Bay Area	Napa County FCWCD	5,030	1,450	1,602	52	8,134
	Solano County WA	17,991	7,787	47	–	25,825
	Subtotal	**23,021**	**9,237**	**1,649**	**52**	**33,959**
South Bay Area	Alameda County FCWCD, Zone 7	40,898	–	11,466	–	52,364
	Alameda County WD	20,956	–	6,714	214	27,884
	Santa Clara Valley WD	52,867	2,983	–	508	56,358
	Subtotal	**114,721**	**2,983**	**18,180**	**722**	**136,606**
San Joaquin Valley Area	Dudley Ridge WD	36,378	7,393	2,184	291	46,246
	Empire West Side ID	1,310	626	1,626	–	3,562
	Kern County WA	640,190	86,513	40,120	5,075	771,898
	Kings County	5,850	3,157	–	46	9,053
	Oak Flat WD	4,324	–	276	29	4,629
	Tulare Lake Basin WSD	58,575	15,299	5,638	489	80,001
	Subtotal	**746,627**	**112,988**	**49,844**	**5,930**	**915,389**
Central Coastal Area	San Luis Obispo County FCWCD	4,096	69	–	–	4,165
	Santa Barbara County FCWCD	29,358	–	208	122	29,688
	Subtotal	**33,454**	**69**	**208**	**122**	**33,853**
Southern California Area	Antelope Valley–East Kern WA	50,532	–	9,199	–	59,731
	Castaic Lake WA	46,358	1,618	35,785	–	83,761
	Coachella Valley WD	8,631	–	6,745	89	15,465
	Crestline–Lake Arrowhead WA	2,006	–	–	–	2,006
	Desert WA	9,966	–	11,122	102	21,190
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,195,807	91,601	215,000	10,223	1,512,631
	Mojave WA	11,176	–	–	–	11,176
	Palmdale WD	10,549	–	1,613	–	12,162
	San Bernardino Valley MWD	35,555	–	20,631	–	56,186
	San Gabriel Valley MWD	15,600	–	–	–	15,600
	San Gorgonio Pass WA	841	–	–	–	841
	Ventura County WPD	5,250	–	–	–	5,250
	Subtotal	**1,392,271**	**93,219**	**300,095**	**10,414**	**1,795,999**
TOTAL SWP DELIVERIES		**2,312,968**	**218,496**	**369,976**	**17,240**	**2,918,680**

Table A–3. Historical State Water Project Deliveries, Calendar Year 2005						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	527	–	–	–	527
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	1,894	–	–	–	1,894
	Subtotal	**2,421**	**–**	**–**	**–**	**2,421**
North Bay Area	Napa County FCWCD	5,322	606	1,741	–	7,669
	Solano County WA	24,515	10,421	83	–	35,019
	Subtotal	**29,837**	**11,027**	**1,824**	**–**	**42,688**
South Bay Area	Alameda County FCWCD, Zone 7	39,388	–	7,849	275	47,512
	Alameda County WD	36,469	846	6,341	943	44,599
	Santa Clara Valley WD	89,476	6,298	12,133	342	108,249
	Subtotal	**165,333**	**7,144**	**26,323**	**1,560**	**200,360**
San Joaquin Valley Area	Dudley Ridge WD	51,609	28,197	821	1,286	81,913
	Empire West Side ID	1,448	1,799	587	–	3,834
	Kern County WA	893,439	453,078	8,985	22,397	1,377,899
	Kings County	8,100	11,504	–	202	19,806
	Oak Flat WD	4,067	–	–	127	4,194
	Tulare Lake Basin WSD	86,604	47,267	3,973	2,158	140,002
	Subtotal	**1,045,267**	**541,845**	**14,366**	**26,170**	**1,627,648**
Central Coastal Area	San Luis Obispo County FCWCD	4,006	245	–	–	4,251
	Santa Barbara County FCWCD	22,981	–	–	155	23,136
	Subtotal	**26,987**	**245**	**–**	**155**	**27,387**
Southern California Area	Antelope Valley–East Kern WA	57,205	–	2,626	–	59,831
	Castaic Lake WA	54,303	2,451	2,702	–	59,456
	Coachella Valley WD	26,984	–	12,819	2,716	42,519
	Crestline–Lake Arrowhead WA	807	–	–	–	807
	Desert WA	33,168	–	14,799	1,122	49,089
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,247,183	168,300	128,140	6,530	1,550,153
	Mojave WA	10,360	–	1,201	–	11,561
	Palmdale WD	10,174	–	1,538	–	11,712
	San Bernardino Valley MWD	31,205	56	282	–	31,543
	San Gabriel Valley MWD	10,500	–	–	–	10,500
	San Gorgonio Pass WA	655	15	–	22	692
	Ventura County WPD	1,665	–	–	–	1,665
	Subtotal	**1,484,209**	**170,822**	**164,107**	**10,390**	**1,829,528**
TOTAL SWP DELIVERIES		**2,754,054**	**731,083**	**206,620**	**38,275**	**3,730,032**

Table A–4. Historical State Water Project Deliveries, Calendar Year 2006						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	468	–	–	–	468
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	4,148	1,194	–	–	5,342
	Subtotal	**4,616**	**1,194**	**–**	**–**	**5,810**
North Bay Area	Napa County FCWCD	7,317	300	172	–	7,789
	Solano County WA	12,070	18,195	390	–	30,655
	Subtotal	**19,387**	**18,495**	**562**	**–**	**38,444**
South Bay Area	Alameda County FCWCD, Zone 7	51,784	–	2,252	491	54,527
	Alameda County WD	39,570	1,922	1,331	256	43,079
	Santa Clara Valley WD	47,344	26,769	524	–	74,637
	Subtotal	**138,698**	**28,691**	**4,107**	**747**	**172,243**
San Joaquin Valley Area	Dudley Ridge WD	55,343	18,429	–	1,068	74,840
	Empire West Side ID	1,500	1,124	658	–	3,282
	Kern County WA	970,689	247,914	5,418	18,610	1,242,631
	Kings County	8,991	366	–	173	9,530
	Oak Flat WD	4,118	–	17	107	4,242
	Tulare Lake Basin WSD	48,361	58,059	–	1,787	108,207
	Subtotal	**1,089,002**	**325,892**	**6,093**	**21,745**	**1,442,732**
Central Coastal Area	San Luis Obispo County FCWCD	3,382	827	–	–	4,209
	Santa Barbara County FCWCD	19,255	4,020	–	–	23,275
	Subtotal	**22,637**	**4,847**	**–**	**–**	**27,484**
Southern California Area	Antelope Valley–East Kern WA	76,623	–	3,761	–	80,384
	Castaic Lake WA	56,758	2,089	3,905	–	62,752
	Coachella Valley WD	121,100	–	–	–	121,100
	Crestline–Lake Arrowhead WA	641	–	–	–	641
	Desert WA	50,000	–	–	–	50,000
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,103,538	238,478	136,424	11,638	1,490,078
	Mojave WA	32,496	–	1,518	–	34,014
	Palmdale WD	10,374	1,653	335	130	12,492
	San Bernardino Valley MWD	31,902	–	3,427	–	35,329
	San Gabriel Valley MWD	13,524	–	–	–	13,524
	San Gorgonio Pass WA	4,278	–	–	–	4,278
	Ventura County WPD	1,850	–	–	–	1,850
	Subtotal	**1,503,084**	**242,220**	**149,370**	**11,768**	**1,906,442**
TOTAL SWP DELIVERIES		**2,777,424**	**621,339**	**160,132**	**34,260**	**3,593,155**

Table A–5. Historical State Water Project Deliveries, Calendar Year 2007						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	956	–	–	–	956
	Plumas County FCWCD	–	–	–	–	–
	Yuba City	2,327	–	–	–	2,327
	Subtotal	**3,283**	**–**	**–**	**–**	**3,283**
North Bay Area	Napa County FCWCD	6,362	3,597	998	–	10,957
	Solano County WA	14,892	8,217	1,822	–	24,931
	Subtotal	**21,254**	**11,814**	**2,820**	**–**	**35,888**
South Bay Area	Alameda County FCWCD, Zone 7	35,972	912	2,895	378	40,157
	Alameda County WD	16,541	550	2,103	197	19,391
	Santa Clara Valley WD	38,812	4,840	8,161	469	52,282
	Subtotal	**91,325**	**6,302**	**13,159**	**1,044**	**111,830**
San Joaquin Valley Area	Dudley Ridge WD	28,457	8,953	2,000	269	39,679
	Empire West Side ID	397	1,172	515	–	2,084
	Kern County WA	592,423	99,861	19,645	4,683	716,612
	Kings County	4,924	474	305	43	5,746
	Oak Flat WD	3,430	41	69	27	3,567
	Tulare Lake Basin WSD	57,272	12,902	16,459	450	87,083
	Subtotal	**686,903**	**123,403**	**38,993**	**5,472**	**854,771**
Central Coastal Area	San Luis Obispo County FCWCD	3,752	24	–	–	3,776
	Santa Barbara County FCWCD	24,760	1,070	1,390	–	27,220
	Subtotal	**28,512**	**1,094**	**1,390**	**–**	**30,996**
Southern California Area	Antelope Valley–East Kern WA	74,459	–	4,364	–	78,823
	Castaic Lake WA	44,974	–	4,216	–	49,190
	Coachella Valley WD	72,660	–	–	568	73,228
	Crestline–Lake Arrowhead WA	1,768	–	–	–	1,768
	Desert WA	30,000	–	–	234	30,234
	Littlerock Creek ID	1,380	–	–	–	1,380
	Metropolitan WD of Southern California	1,146,900	166,517	28,098	8,962	1,350,477
	Mojave WA	45,372	–	737	–	46,109
	Palmdale WD	12,780	843	985	100	14,708
	San Bernardino Valley MWD	57,116	–	–	–	57,116
	San Gabriel Valley MWD	10,000	–	–	–	10,000
	San Gorgonio Pass WA	3,935	–	–	–	3,935
	Ventura County WPD	3,000	–	–	–	3,000
	Subtotal	**1,504,344**	**167,360**	**38,400**	**9,864**	**1,719,968**
TOTAL SWP DELIVERIES		**2,335,621**	**309,973**	**94,762**	**16,380**	**2,756,736**

Table A–6. Historical State Water Project Deliveries, Calendar Year 2008						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	9,436	–	–	–	9,436
	Plumas County FCWCD	243	–	–	–	243
	Yuba City	1,923	–	–	–	1,923
	Subtotal	**11,602**	**–**	**–**	**–**	**11,602**
North Bay Area	Napa County FCWCD	3,636	1,219	7,363	21	12,239
	Solano County WA	10,436	1,510	12,389	–	24,335
	Subtotal	**14,072**	**2,729**	**19,752**	**21**	**36,574**
South Bay Area	Alameda County FCWCD, Zone 7	17,913	–	15,400	–	33,313
	Alameda County WD	4,206	–	8,659	37	12,902
	Santa Clara Valley WD	11,133	–	21,188	88	32,409
	Subtotal	**33,252**	**–**	**45,247**	**125**	**78,624**
San Joaquin Valley Area	Dudley Ridge WD	12,260	–	5,949	51	18,260
	Empire West Side ID	–	–	915	–	915
	Kern County WA	271,636	–	6,815	883	279,334
	Kings County	3,187	–	541	8	3,736
	Oak Flat WD	1,929	–	–	5	1,934
	Tulare Lake Basin WSD	32,302	–	281	85	32,668
	Subtotal	**321,314**	**–**	**14,501**	**1,032**	**336,847**
Central Coastal Area	San Luis Obispo County FCWCD	8,512	–	–	–	8,512
	Santa Barbara County FCWCD	11,311	–	2,532	40	13,883
	Subtotal	**19,823**	**–**	**2,532**	**40**	**22,395**
Southern California Area	Antelope Valley–East Kern WA	31,082	–	10,381	125	41,588
	Castaic Lake WA	18,710	–	12,146	–	30,856
	Coachella Valley WD	42,385	–	–	107	42,492
	Crestline–Lake Arrowhead WA	1,159	–	689	–	1,848
	Desert WA	17,500	–	–	44	17,544
	Littlerock Creek ID	805	–	–	–	805
	Metropolitan WD of Southern California	658,304	–	–	1,689	659,993
	Mojave WA	26,288	–	108	–	26,396
	Palmdale WD	4,226	–	–	19	4,245
	San Bernardino Valley MWD	26,562	–	4,444	–	31,006
	San Gabriel Valley MWD	10,080	–	–	–	10,080
	San Gorgonio Pass WA	5,419	–	300	–	5,719
	Ventura County WPD	3,798	–	–	–	3,798
	Subtotal	**846,318**	**–**	**28,068**	**1,984**	**876,370**
TOTAL SWP DELIVERIES		**1,246,381**	**2,729**	**110,100**	**3,202**	**1,362,412**

Table A–7. Historical State Water Project Deliveries, Calendar Year 2009						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	10,206	–	–	–	10,206
	Plumas County FCWCD	200	–	–	–	200
	Yuba City	2,114	–	–	–	2,114
	Subtotal	**12,520**	**–**	**–**	**–**	**12,520**
North Bay Area	Napa County FCWCD	2,723	1,588	4,475	13	8,799
	Solano County WA	7,118	4,444	3,123	–	14,685
	Subtotal	**9,841**	**6,032**	**7,598**	**13**	**23,484**
South Bay Area	Alameda County FCWCD, Zone 7	16,245	–	14,932	–	31,177
	Alameda County WD	5,911	–	10,883	8	16,802
	Santa Clara Valley WD	9,188	–	29,679	54	38,921
	Subtotal	**31,344**	**–**	**55,494**	**62**	**86,900**
San Joaquin Valley Area	Dudley Ridge WD	13,185	–	7,810	32	21,027
	Empire West Side ID	1,034	–	–	–	1,034
	Kern County WA	323,426	–	56,367	544	380,337
	Kings County	3,153	–	70	5	3,228
	Oak Flat WD	1,825	–	66	3	1,894
	Tulare Lake Basin WSD	35,160	–	1,271	52	36,483
	Subtotal	**377,783**	**–**	**65,584**	**636**	**444,003**
Central Coastal Area	San Luis Obispo County FCWCD	9,723	–	–	–	9,723
	Santa Barbara County FCWCD	4,961	–	6,384	25	11,370
	Subtotal	**14,684**	**–**	**6,384**	**25**	**21,093**
Southern California Area	Antelope Valley–East Kern WA	13,499	–	18,408	77	31,984
	Castaic Lake WA	14,858	–	9,529	52	24,439
	Coachella Valley WD	40,845	–	–	66	40,911
	Crestline–Lake Arrowhead WA	1,000	–	893	–	1,893
	Desert WA	16,865	–	–	27	16,892
	Littlerock Creek ID	920	–	–	–	920
	Metropolitan WD of Southern California	696,817	–	10,721	1,042	708,580
	Mojave WA	30,300	–	242	–	30,542
	Palmdale WD	2,470	–	3,229	–	5,699
	San Bernardino Valley MWD	26,085	–	9,348	–	35,433
	San Gabriel Valley MWD	11,516	–	–	–	11,516
	San Gorgonio Pass WA	5,312	–	480	–	5,792
	Ventura County WPD	3,890	–	–	–	3,890
	Subtotal	**864,377**	**–**	**52,850**	**1,264**	**918,491**
TOTAL SWP DELIVERIES		**1,310,549**	**6,032**	**187,910**	**2,000**	**1,506,491**

Table A–8. Historical State Water Project Deliveries, Calendar Year 2010						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	807	–	–	–	807
	Plumas County FCWCD	243	–	–	–	243
	Yuba City	2,331	–	–	–	2,331
	Subtotal	**3,381**	**–**	**–**	**–**	**3,381**
North Bay Area	Napa County FCWCD	7,275	2,207	3,044	90	12,616
	Solano County WA	13,793	5,298	3,661	–	22,752
	Subtotal	**21,068**	**7,505**	**6,705**	**90**	**35,368**
South Bay Area	Alameda County FCWCD, Zone 7	28,694	–	16,356	249	45,299
	Alameda County WD	11,668	–	14,359	14	26,041
	Santa Clara Valley WD	37,850	–	28,809	34	66,693
	Subtotal	**78,212**	**–**	**59,524**	**297**	**138,033**
San Joaquin Valley Area	Dudley Ridge WD	19,650	–	9,750	156	29,556
	Empire West Side ID	380	–	166	–	546
	Kern County WA	410,856	–	55,419	3,044	469,319
	Kings County	4,094	–	522	29	4,645
	Oak Flat WD	2,412	–	455	18	2,885
	Tulare Lake Basin WSD	39,835	–	3,199	275	43,309
	Subtotal	**477,227**	**–**	**69,511**	**3,522**	**550,260**
Central Coastal Area	San Luis Obispo County FCWCD	3,480	–	277	–	3,757
	Santa Barbara County FCWCD	8,640	–	9,865	140	18,645
	Subtotal	**12,120**	**–**	**10,142**	**140**	**22,402**
Southern California Area	Antelope Valley–East Kern WA	35,312	–	20,813	438	56,563
	Castaic Lake WA	37,054	–	14,501	295	51,850
	Coachella Valley WD	69,175	–	7,595	429	77,199
	Crestline–Lake Arrowhead WA	1,357	–	–	–	1,357
	Desert WA	27,875	–	3,135	173	31,183
	Littlerock Creek ID	1,150	–	–	–	1,150
	Metropolitan WD of Southern California	900,210	–	123,323	5,922	1,029,455
	Mojave WA	41,132	–	20	–	41,152
	Palmdale WD	5,585	–	5,325	59	10,969
	San Bernardino Valley MWD	38,133	–	11,273	–	49,406
	San Gabriel Valley MWD	14,400	–	–	–	14,400
	San Gorgonio Pass WA	5,226	–	1,608	6	6,840
	Ventura County WPD	4,075	–	–	–	4,075
	Subtotal	**1,180,684**	**–**	**187,593**	**7,322**	**1,375,599**
TOTAL SWP DELIVERIES		**1,772,692**	**7,505**	**333,475**	**11,371**	**2,125,043**

Table A–9. Historical State Water Project Deliveries, Calendar Year 2011						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	1,092	–	–	–	1,092
	Plumas County FCWCD	98	–	–	–	98
	Yuba City	2,297	–	–	–	2,297
	Subtotal	**3,487**	**–**	**–**	**–**	**3,487**
North Bay Area	Napa County FCWCD	9,426	–	1,189	–	10,615
	Solano County WA	9,620	15,000	–	–	24,620
	Subtotal	**19,046**	**15,000**	**1,189**	**–**	**35,235**
South Bay Area	Alameda County FCWCD, Zone 7	39,066	–	11,975	1,319	52,360
	Alameda County WD	24,813	1,959	7,840	506	35,118
	Santa Clara Valley WD	64,538	970	19,803	–	85,311
	Subtotal	**128,417**	**2,929**	**39,618**	**1,825**	**172,789**
San Joaquin Valley Area	Dudley Ridge WD	40,141	11,666	5,524	823	58,154
	Empire West Side ID	1,626	138	151	–	1,915
	Kern County WA	753,707	194,119	119,773	16,068	1,083,667
	Kings County	5,294	552	558	152	6,556
	Oak Flat WD	2,644	–	71	–	2,715
	Tulare Lake Basin WSD	39,056	6,909	4,626	1,454	52,045
	Subtotal	**842,468**	**213,384**	**130,703**	**18,497**	**1,205,052**
Central Coastal Area	San Luis Obispo County FCWCD	3,340	–	479	–	3,819
	Santa Barbara County FCWCD	29,132	–	6,587	–	35,719
	Subtotal	**32,472**	**–**	**7,066**	**–**	**39,538**
Southern California Area	Antelope Valley–East Kern WA	77,549	7,629	5,888	–	91,066
	Castaic Lake WA	34,509	400	9,332	–	44,241
	Coachella Valley WD	88,017	–	–	2,262	90,279
	Crestline–Lake Arrowhead WA	423	–	51	–	474
	Desert WA	36,139	–	–	240	36,379
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,286,935	181,610	42,688	8,237	1,519,470
	Mojave WA	4,831	–	268	–	5,099
	Palmdale WD	12,294	–	5,019	–	17,313
	San Bernardino Valley MWD	30,916	–	7,210	–	38,126
	San Gabriel Valley MWD	23,040	–	–	–	23,040
	San Gorgonio Pass WA	8,884	–	1,619	–	10,503
	Ventura County WPD	4,000	–	–	–	4,000
	Subtotal	**1,607,537**	**189,639**	**72,075**	**10,739**	**1,879,990**
TOTAL SWP DELIVERIES		**2,633,427**	**420,952**	**250,651**	**31,061**	**3,336,091**

Table A–10. Historical State Water Project Deliveries, Calendar Year 2012						
Contractor Location	SWP Contractor	SWP Water Type Delivered (acre–feet)				Total SWP Deliveries (acre–feet)
		Table A	Article 21	Carryover	Turnback	
Feather River Area	Butte County	17,875	–	–	–	17,875
	Plumas County FCWCD	79	–	–	–	79
	Yuba City	2,695	–	–	–	2,695
	Subtotal	**20,649**	**–**	**–**	**–**	**20,649**
North Bay Area	Napa County FCWCD	5,062	–	4,278	64	9,404
	Solano County WA	3,428	1,027	22,096	–	26,551
	Subtotal	**8,490**	**1,027**	**26,374**	**64**	**35,955**
South Bay Area	Alameda County FCWCD, Zone 7	32,301	–	18,457	179	50,937
	Alameda County WD	11,951	–	6,420	93	18,464
	Santa Clara Valley WD	34,612	–	14,330	222	49,164
	Subtotal	**78,864**	**–**	**39,207**	**494**	**118,565**
San Joaquin Valley Area	Dudley Ridge WD	17,694	–	–	112	17,806
	Empire West Side ID	1,468	–	774	–	2,242
	Kern County WA	549,932	–	32,477	2,180	584,589
	Kings County	5,337	–	2,001	21	7,359
	Oak Flat WD	2,596	–	612	–	3,208
	Tulare Lake Basin WSD	53,630	–	32,081	197	85,908
	Subtotal	**630,657**	**–**	**67,945**	**2,510**	**701,112**
Central Coastal Area	San Luis Obispo County FCWCD	3,111	–	833	–	3,944
	Santa Barbara County FCWCD	20,874	–	43	–	20,917
	Subtotal	**23,985**	**–**	**876**	**–**	**24,861**
Southern California Area	Antelope Valley–East Kern WA	80,694	–	32,854	–	113,548
	Castaic Lake WA	43,226	–	11,496	–	54,722
	Coachella Valley WD	89,928	–	22,663	307	112,898
	Crestline–Lake Arrowhead WA	483	–	–	–	483
	Desert WA	36,238	–	8,461	124	44,823
	Littlerock Creek ID	–	–	–	–	–
	Metropolitan WD of Southern California	1,084,623	–	75,484	4,241	1,164,348
	Mojave WA	4,672	–	6,572	–	11,244
	Palmdale WD	9,959	–	4,736	–	14,695
	San Bernardino Valley MWD	65,102	–	47,900	–	113,002
	San Gabriel Valley MWD	18,720	–	–	–	18,720
	San Gorgonio Pass WA	5,968	–	4,956	–	10,924
	Ventura County WPD	4,353	–	–	–	4,353
	Subtotal	**1,443,966**	**–**	**215,122**	**4,672**	**1,663,760**
TOTAL SWP DELIVERIES		**2,206,611**	**1,027**	**349,524**	**7,740**	**2,564,902**

Appendix B

Comment Letters on the Draft Report and the Department's Responses

MARK A. PRUNER
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January 17, 2014

Via Email

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SWP Delivery Reliability Report
Attention: Rebecca Daniel
P. O. Box 942836
Sacramento, CA 94236-0001

Re: The State Water Project Delivery Reliability Report 2013 – Draft Public Comments

Dear DWR:

The following comments are made to the draft 2013 State Water Project Delivery Reliability Report ("**DRR**"):

1. The Director's Message, page two, refers to the objective of "improving public safety", but the DRR does not include at any point the public safety component of emergency response (fire suppression, life and safety, transportation routes required to perform such services). The DRR should provide detailed analysis consistent with the Director's Message on this point.

2. The Director's Message, page two, refers to the object of "supporting economic stability", but the DRR does not include at any point analysis of what it would take to support economic stability as a function of the analysis and as a function of the conclusions of the DRR. The DRR should provide detailed analysis consistent with the Director's Message on this point.

3. The DRR, Chapter 1, page 2, left-hand column, text line four, reveals that the data used for population increase ends with the year 2005. The data should be updated to the most current, and certainly through the 2010 census. Because this information is nearly 10 years old, it calls into question the factual and logical underpinnings of the entire DRR.

4. The DRR, Chapter 2, page 5, left-hand column, refers to water quality in the delta as a SWP purpose, but the DRR does not quantatively or otherwise analyze what maintaining water

quality in the Delta is as an impact on delivery and water reliability. This should be added to the DRR.

5. The term "take" is nowhere defined. This term should be spelled out in plain terms in all locations.

6. The DRR, Chapter 3, admits to using water year data only through 2003. This is too old, and makes the entire report inherently unreliable.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

MARK A. PRUNER

MAP:m

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY EDMUND G. BROWN JR., *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

May 20, 2014

Mr. Mark A. Pruner
Post Office Box 3
Clarksburg, California 95612

Dear Mr. Pruner:

This letter is in response to your letter dated January 17, 2014 commenting on the State Water Project Draft Delivery Reliability Report, 2013 (DRR). I very much appreciate your taking time and effort to review this report, and providing us with your comments. Your letter and this response will be included in Appendix B of the final report.

1. Your first and second comments both suggest that this report should have included detailed analysis regarding the objectives of the Integrated Water Management (IWM) approach that Director Cowin mentioned in his message in the foreword to the report. However, the purpose of this report is not to analyze the objectives of the IWM approach to water resources planning discussed in the Director's message, but as mentioned in the last paragraph of this message "*This State Water Project Delivery Reliability Report 2013 narrows its focus to the SWP's delivery capability from the Delta, given current Delta regulatory restrictions, expected future climate change, and projected changes in land use in the Sacramento River basin.*" In fact, the objectives for this report were established in a settlement agreement approved by the 3rd Circuit Court of Appeals in May 2003, commonly known as the Monterey Agreement. Attachment B to the Monterey Agreement specifies that each SWP delivery reliability report must include the following information:

    - the overall water delivery capacity of the SWP facilities at the time of the report;
    - the allocation of that SWP water to each SWP contractor;
    - a discussion of the range of hydrologic conditions, which must include the historic extended dry cycle and long-term average; and
    - the total amount of SWP water delivered to all contractors and the amount of SWP water delivered to each contractor during each of the 10 years immediately preceding the report.

2. Your third comment is about your concern about the effect of what seems to be outdated population data on the validity of the SWP's water delivery capability projections in this report. The paragraph that you refer to is making a general statement about California's population growth rate from 1990 to 2005, and the trend that, if sustained, would result in a population of 47.5 million by 2020. This

is simply to emphasize the fact that population in California would be increasing in the future, and that it could increase statewide demands for M&I water. The analysis used in the simulation runs for this report, however, mainly uses the SWP contract amounts as the basis to estimate M&I demands. In other words, the deliveries made by SWP are limited by the upper bounds of the SWP contract amount, and as such are only minimally affected by changes in population.

3. Your fourth comment deals with the impact of maintaining the water quality standards in the Delta on the SWP delivery capability. While water quality requirements are incorporated into the mathematical model, CalSim, used in estimating the SWP deliveries, the impact of meeting these requirements is not isolated and analyzed in the report. The standards, however, are assured to be satisfied with the use of CalSim. The water quality standards in the Delta are set by the State Water Resources Control Board, SWRCB, through a public process and they do change over time. Analysis of various components of the Delta water quality standards is beyond the scope of this report.

4. Your fifth comment is on the definition of "take". Section 9 of the 1973 Endangered Species Act defines this term as follows: *"to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."* This definition will be added to the glossary of the final version of the report.

5. Your last comment deals with the model simulation period, water year 1922-2003. The use of water years 1922-2003 is to represent the hydrologic variations and trends. In general, the longer the hydrologic period used in an assessment like that in this report, the better becomes the assessment. We continue to add more years to our hydrologic base period as the data become available. We hope to add a few more recent years to the base period in our next update.

Sincerely,

Sina Darabzand, Senior Engineer
Bay-Delta Office

Appendix 5.21K

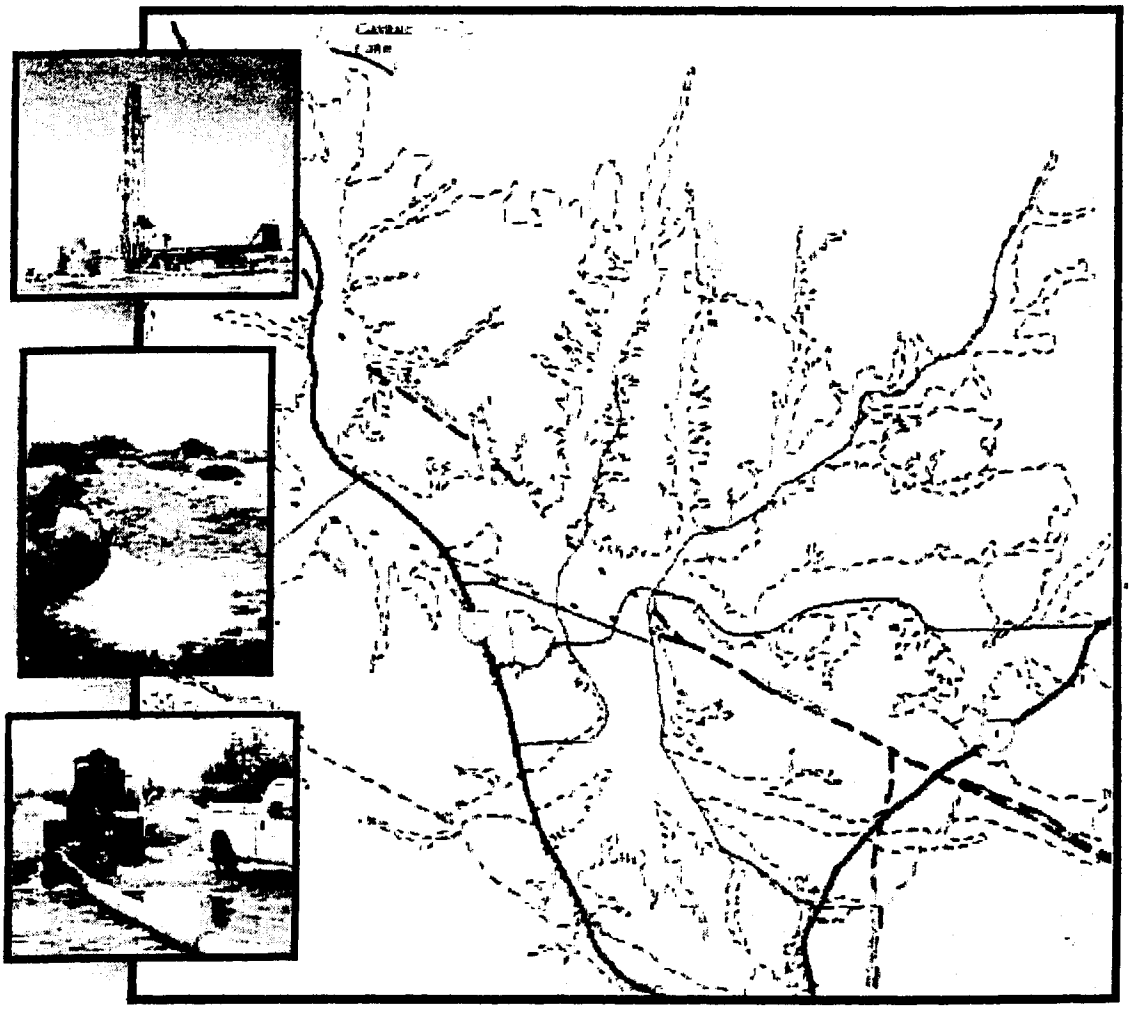
2001 Update Report—Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems

Richard C. Slade & Associates LLC

July 2002

2001 UPDATE REPORT

HYDROGEOLOGIC CONDITIONS IN THE ALLUVIAL AND SAUGUS FORMATION AQUIFER SYSTEMS



VOLUME I - REPORT TEXT

PREPARED FOR
SANTA CLARITA VALLEY WATER PURVEYORS

JULY 2002

JOB NO. S9920

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

July 7, 2002

Mr. Robert J. DiPrimio
c/o Santa Clarita Valley Water Purveyors
Valencia Water Company
24631 Avenue Rockefeller
Valencia, CA 91355

Subject: 2001 Update Report on the Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems

Job No. S9920

Dear Mr. DiPrimio:

We are pleased to present this 2001 Update Report on the Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems in the Santa Clarita Valley area of Los Angeles County, California. This project was undertaken to provide an update of our 1986 report of the alluvial aquifer system and our 1988 report on the Saugus Formation aquifer system.

This 2001 Update Report is provided as a two-volume set as follows:

- ✧ Volume I, which contains the Executive Summary, the report text in chapter format, and the supporting figures and tables.
- ✧ Volume II, which contains the report plates, in large-scale format, to support specific chapters of the report text; there are two sections to Volume II due to the large number of plates.

Volume I and the two sections of Volume II are separately bound.

It has been a pleasure to have worked on this investigation with you and the other Santa Clarita Valley Water Purveyors. This opportunity to have been of service is appreciated.

Very truly yours,
RICHARD C. SLADE & ASSOCIATES, LLC

Richard C. Slade, President

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EXECUTIVE SUMMARY

This report presents our updated findings, conclusions and recommendations regarding the hydrogeologic conditions within the alluvial and Saugus Formation aquifer systems in the Santa Clarita Valley (Valley) of northern Los Angeles County, California. Figure ES-1 – Study Area Map – illustrates the approximate ground surface locations of the alluvial and Saugus Formation aquifer systems which are discussed herein. The report updates and expands upon two separate reports prepared by Richard C. Slade, Consulting Groundwater Geologist, on the alluvial and Saugus Formation aquifers, in 1986 and 1988, respectively. As such, this report supersedes those previous work products and is intended to provide the water purveyors in the Valley with a current assessment of the geologic and hydrogeologic conditions within the local groundwater basin.

The principal findings of this project include:

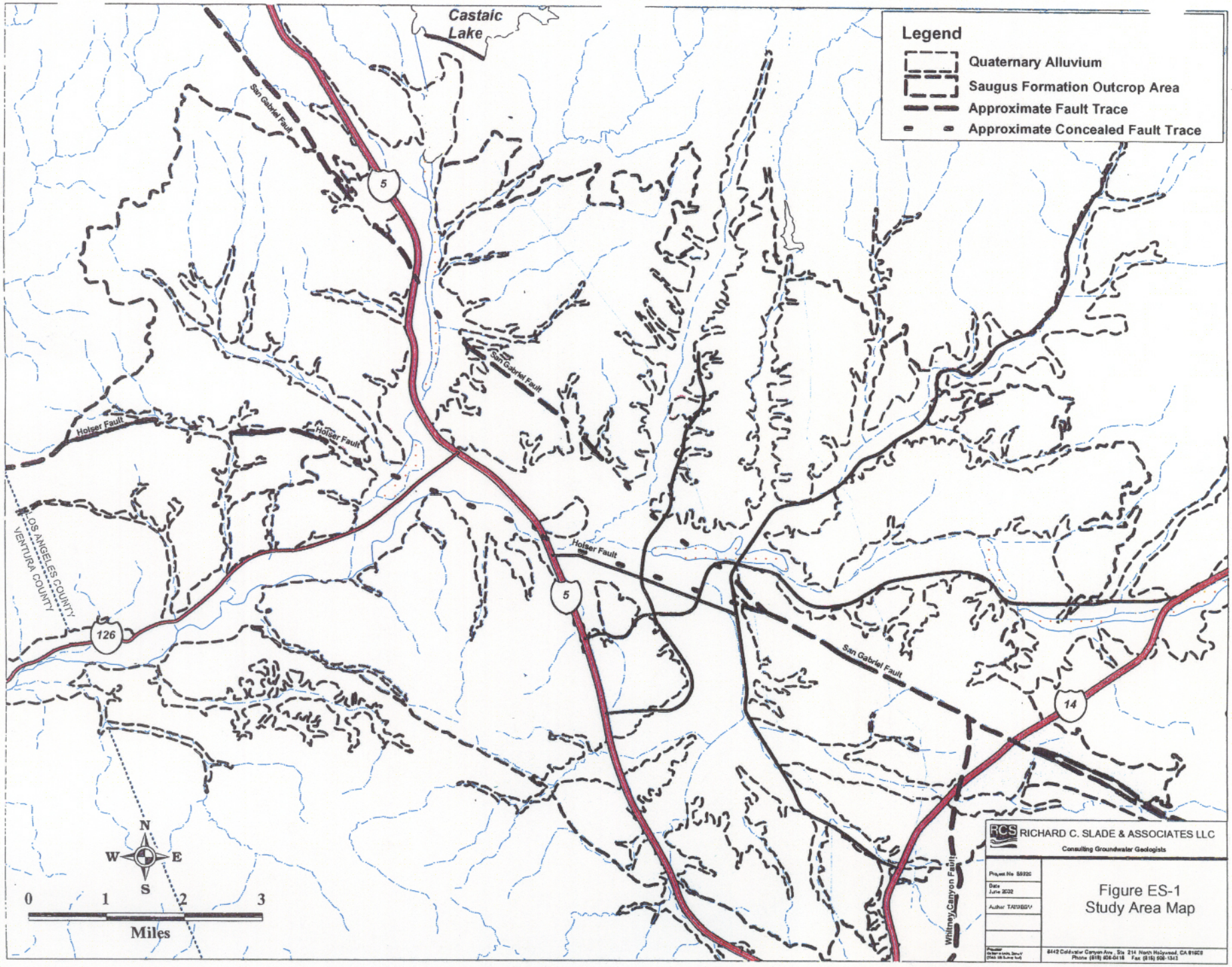
1. Data Compilation and Review

   Significant new data have been acquired that has greatly enhanced our understanding of the local groundwater basin. These new data cover a longer period of time, at a greater level of detail, and with more up-to-date information than previous data, and includes new types of information not previously available. The data are also representative of a broader geographic area of the Valley for both aquifer systems. These new data include information on water levels, water quality, downhole geophysical surveys (electric logs), driller's logs, flow meter surveys (spinner logs), depth specific water sampling, and injection and recovery testing.

   Historic and current data have been incorporated into a Geographic Information System (GIS) database, along with updated base maps and recent aerial photographs of the region.

2. Santa Clara River

   The Santa Clara River drains in a general east to west direction across the Valley. Annual runoff volumes within the river across the Valley have increased over time due to the increased use of imported water from the State Water Project (SWP water), and increased discharges from the two local water reclamation plants.


Castaic Lake
San Gabriel Fault
Holser Fault
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Legend
Quaternary Alluvium
Saugus Formation Outcrop Area
Approximate Fault Trace
Approximate Concealed Fault Trace
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3
Miles
RICHARD C. SLADE & ASSOCIATES LLC
Consulting Groundwater Geologists
Figure ES-1
Study Area Map

Surface water runoff in the Santa Clara River drains into Ventura County at County line at the western end of the study area. This represents the only direct connection of surface water flow to Ventura County from the Santa Clarita Valley. The only direct connection of groundwater flow between the Valley and the downstream groundwater basins of Ventura County occurs at County line and only from subsurface outflow from the alluvium of the Santa Clara River.

3. Geologic Setting

The two principal aquifers in the Valley are (see Figure ES-1):

a) The blanket of unconsolidated alluvium of Quaternary geologic age deposited by the Santa Clara River and its tributaries, which covers the floor of the main river valley to a maximum thickness of approximately 200 ft. The alluvial aquifer consists of complexly interlayered and interfingered beds of gravel, sand, silt, and clay, which, due to their unconsolidated to poorly consolidated nature, and their lack of cementation, tend to have a relatively high permeability and porosity.

b) The considerably thicker, somewhat more consolidated sediments of the geologically older Saugus Formation (Pliocene to Pleistocene geologic age) that underlie the Quaternary Alluvium. The Saugus Formation can be subdivided into two stratigraphic units. The upper portion of the Saugus Formation is up to 5,000 ft thick and contains numerous coarse-grained sand and gravel beds that form the potential aquifer units. The lower portion of the formation, known as the Sunshine Ranch Member, is up to 3,500 ft thick, and does not contain groundwater in sufficient quantity or of adequate quality for municipal-supply purposes because it contains an abundance of fine-grained sediments of low permeability. The Saugus Formation has been deformed by folding and by faulting along the Holser and San Gabriel fault zones.

   A new geologic cross-section through the Saugus Formation has identified and correlated an important stratigraphic zone of coarse-grained sediments encountered in several existing water wells. This correlatable zone (informally termed the Santa Clarita Aquifer Zone), can be identified on electric logs over a wide area of the Valley. The Saugus Formation water wells with the highest pumping rates generally tend to produce groundwater from within and stratigraphically above the Santa Clarita Aquifer Zone.

4. Local Groundwater Sub-basin

In recent years, the California Department of Water Resources (DWR) has begun a process of updating the official names and locations of groundwater basins throughout the State, including the region along the Santa Clara River between the Santa Clarita Valley and the Pacific Ocean. Currently, the alluvial and

Saugus Formation aquifer systems in the study area are considered to lie within the Santa Clara River Valley East Groundwater Subbasin (East Subbasin) of the Santa Clara River Valley Groundwater Basin.

The western boundary of this local East Subbasin is currently taken at County line where it meets the adjoining (downstream) Piru Subbasin of Ventura County. The eastern boundary of the local East Subbasin occurs at a narrows near Lang Station.

5. Alluvial Aquifer System

A. *Groundwater Levels*

Groundwater in the alluvial aquifer occurs under unconfined (water table) conditions. In the western end of the East Subbasin, west of I-5, long-term water levels have remained generally constant over time in large part because of the naturally occurring upward flow of groundwater from the Saugus Formation into the overlying alluvium in this area. This provides a fairly consistent source of recharge that is relatively independent of annual rainfall trends.

In the central portion of the basin, between I-5 and the South Fork of the Santa Clara River, long-term water levels have become increasingly stable and now appear to be relatively insensitive to variations in annual rainfall. This is due in large part to the increased recharge provided to the alluvium from the two local water reclamation plants (WRPs) owned by the Sanitation Districts of Los Angeles County.

In the eastern portion of the alluvial aquifer (east of the South Fork of the Santa Clara River) water levels continue to display a much stronger correlation with annual rainfall totals than wells in the central or western parts of the Valley. Water levels decline temporarily during dry periods, but quickly recover to their pre-drought highs upon a return to wetter or even more normal climatic conditions.

Overall, there is no evidence of a long-term, continuous or permanent decline in water levels in any alluvial aquifer well, and thus no evidence that the alluvial aquifer is being pumped beyond its sustainable capacity (i.e. the aquifer is not in overdraft). While water levels in the alluvial aquifer do fluctuate over time, there is no continued and progressive decline in groundwater levels, leading to a permanent loss of groundwater in storage, which would be indicative of overdraft.

B. *Groundwater in Storage*

The alluvial aquifer contained an estimated 200,000 acre-feet of water in storage at its historical high in 1945, as reported by Slade in the original 1986 report on the alluvial aquifer system (Slade 1986 Report). In the spring of 2000, the total volume of groundwater in storage in the alluvial

aquifer was approximately 161,000 AF. Over time, groundwater levels and associated groundwater storage in the alluvial aquifer have fluctuated, typically in response to wet and dry conditions as they affect water levels and storage in the eastern portion of the alluvial aquifer. However, there has been no long-term, progressive decline in the amount of alluvial groundwater storage that could be considered illustrative of overdraft conditions.

C. *Groundwater Production and Operational Yield*

Since the mid-1940s, annual groundwater production from the alluvium has ranged from a low of approximately 20,000 acre feet per year (AF/yr) in 1983, to a high of at least 44,000 AF/yr in 1955. The historically largest alluvial extractions occurred between 1951 and 1960, and between 1991 and 2000 (both are 10-year periods, during which the average annual pumpage was approximately 37,000 AF/yr and 35,000 AF/yr, respectively.

The annual groundwater production from the alluvial aquifer over the last ten years has averaged approximately 35,000 AF/yr, about 10 percent higher then the "practical or perennial yield" of 31,600 to 32,600 AF/yr calculated in the Slade 1986 Report. However, this increase in average production has occurred without any onset of undesirable conditions such as lowered water levels that might be indicative of overdraft. The primary reason that the alluvial aquifer has been able to supply groundwater in volumes that are well in excess of its previously estimated perennial yield for the past ten years is that imports of SWP water into the Valley have risen from approximately 1,100 AF/yr in 1980 to over 32,000 AF/yr in 2000. Much of this additional water is returned to the alluvial aquifer in the form of discharge from the two WRPs located along the Santa Clara River.

One of the disadvantages of utilizing perennial yield as a basis for managing the pumpage from an aquifer system is that it represents a long-term average value for annual yield. There is a potential for the perennial yield value to be interpreted as a "not-to-exceed" volume, with a related potential for pumpage above the perennial yield value in any given year to be incorrectly interpreted as "overdraft". A recently advanced concept intended to deal with such misinterpretations is that of operational yield. Operational yield can be defined as a fluctuating value of pumpage that may be above or below the perennial (or average) yield in any given year, and that varies as a function of the availability of other water supplies. The basic intent of the operational yield value is that it should not exceed the perennial yield of the groundwater basin over multi-year wet and dry cycles.

The operational yield concept includes flexibility of groundwater use by allowing increased pumping during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is available in

wet/normal rainfall periods. The operational yield protects the aquifer by helping to assure that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. In the Valley, historical groundwater data demonstrate that the alluvium has been, and continues to be developed within its long-term sustainability (i.e. no continuous lowering of water levels, no notable trend toward degradation of groundwater quality, etc.).

It is evident from observation of the response of the alluvial aquifer system to average pumping over the last several decades, and response to pumping in individual years, that pumping from the alluvium can be performed at a higher average pumping rate and over a wide range of yearly pumping rates without inducing undesirable conditions that would be indicative of overdraft, i.e., long-term continuous and progressive decline in water levels and storage. This observation is particularly evident since the initiation of supplemental SWP water deliveries in 1980. As a result, the operational yield of the alluvial aquifer, or the yearly yield for operating purposes, could range from an individual annual pumping volume as low as about 20,000 AF to an individual annual pumping volume as high as about 45,000 AF. The ultimate goals would be to avoid short-term adverse impacts as a result of year-to-year fluctuations in pumping, and to avoid long-term adverse impacts such as continuously lowered water levels and reduced amounts of groundwater in storage.

Recognition of the historical response of the alluvium to the wide range of annual pumping and the higher average rate of pumping in recent years has led to the following two plans regarding operation of this aquifer system: 1) development of an Urban Water Management Plan (UWMP) in 2000 that includes water supply from the alluvial aquifer within both the long-term yearly operational range and the recent (last ten years) average pumping capacity; and 2) commitment via a Memorandum of Understanding (MOU) process between the Santa Clarita Valley Water Purveyors, Castaic Lake Water Agency (CLWA), and the downstream United Water Conservation District to develop a numerical groundwater flow model in order to analyze in greater detail how the alluvium can be operated in the future to optimize its yield without adverse impact to either the aquifer (avoidance of depressed water levels and depleted storage) or the environment associated with this aquifer (avoidance of decreased stream flows, avoidance of depleting riparian vegetation, etc.).

In summary, the combination of historical observations and current planning has led to the present conclusion that the alluvial aquifer system can be operated over a wide range of pumping volumes in any given year. As summarized in the 2000 UWMP, the operation of the alluvial aquifer will typically be in the 30,000 to 40,000 AF/yr range for

most wet and normal rainfall years, with an expected reduction into the range of 30,000 to 35,000 AF/yr in dry years.

Given that the rate of alluvial groundwater extraction over the past ten years has averaged approximately 35,000 AF/yr and no long-term or permanent decline in water levels or groundwater in storage has occurred, the range of pumping proposed for the alluvial aquifer in the most recent UWMP is well within the operational yield of the aquifer.

D. Water Quality

The overall character of groundwater within the alluvial aquifer changes gradually from a calcium bicarbonate to a calcium sulfate character as the groundwater moves from east to west across the Valley. Alluvial groundwater in the tributary canyons in the western part of the area also tends to have a calcium sulfate character.

Concentrations of nitrate and total dissolved solids (TDS) in the groundwater within the alluvial aquifer system show measurable changes as one moves from the eastern to the western end of the Valley. In the eastern and central portions of alluvial aquifer (east of I-5) nitrate levels range from 14 to 27 milligrams per liter (mg/l), while west of I-5 they drop to less than 10 mg/l. TDS concentrations average approximately 550 to 660 mg/l in the eastern and central portions of the alluvial aquifer. TDS concentrations are highest in the alluvial groundwater west of I-5, averaging approximately 1000 mg/l TDS. Neither nitrate nor TDS concentrations exceed their respective State Primary or Secondary Maximum Contaminant Levels (MCLs) in any samples. Groundwater extracted in the area west of I-5 is used solely for agricultural irrigation, and not for municipal-supply purposes.

Between 1985 and 2000, even though some low levels of volatile organic compounds (VOCs) were detected in a few alluvial municipal-supply wells in the Valley, none of these VOCs was encountered at concentrations exceeding its respective MCL. There has been no detection of perchlorate (ClO_4, a component of rocket fuel) in any alluvial, municipal-supply water well in the Valley.

6. Saugus Formation Aquifer System

A. Groundwater Levels

Groundwater in the Saugus Formation occurs under semi-confined to confined conditions in the central part of the Valley, but is likely unconfined near the lateral margins of the Saugus Formation outcrop area. Historic static water levels in the Saugus Formation have typically fluctuated over time: the magnitude of these historic fluctuations varies from well to well, but has generally ranged from a minimum of 50 ft to a maximum of 175 ft; these water level conditions are for wells that

typically range in total depth between 750 to 2000 ft. Long-term water level records show no evidence of a long-term or continuous decline in water levels in any Saugus Formation water well, and like the alluvial aquifer, the Saugus Formation aquifer is not in a condition of overdraft.

B. *Groundwater in Storage*

The amount of groundwater in storage in the Saugus Formation was calculated to be approximately 1.41 million AF, using an upper limit of 500 ft below ground surface (bgs) as part of the calculations, as reported by Slade in the original 1988 Report on the Saugus Formation aquifer system (Slade 1988 Report). More recent information on the thickness of the alluvium and the degree of potential drawdown interference between adjacent Saugus Formation and alluvial water wells has led us to adjust this upper limit from 500 ft bgs to 300 ft bgs. Updated calculations of groundwater in storage reveal a value of approximately 1.65 million AF, an increase of about 18% more than the 1.41 million AF calculated in the original Slade 1988 Report. This increase is due almost entirely to raising the upper limit of our depth zone for calculations from 500 ft to 300 ft bgs.

C. *Groundwater Production and Operational Yield*

Groundwater production from the Saugus Formation has averaged approximately 8,600 AF/yr from 1991 to 2000, with the highest ever historical production of approximately 15,000 AF/yr occurring in 1991, towards the end of a multi-year drought. No long-term continuous or permanent decline in either water levels or the amount of groundwater in storage has occurred under this historical range of pumping. In summary, the combination of historical observations and current planning has led to the present conclusion that the Saugus Formation aquifer system can be operated on a long-term average basis in the range of 7,500 to 15,000 AF/yr. Infrequently, during dry periods of one to three years, pumping extractions from the Saugus Formation can be ramped up from 15,000 to 25,000 AF/yr, and ultimately to 35,000 AF/yr if dry conditions continue. These latter increases would be temporary and would return to or below the historical range of 7,500 to 15,000 AF/yr once rainfall patterns returned to normal.

As summarized in the 2000 UWMP, the operation of the Saugus Formation aquifer system will typically be in the 7,500 to 15,000 AF/yr range for most years of normal or wet conditions, with possible short-term increases in dry periods into the 15,000 to 35,000 AF/yr range. It is recommended that a program of enhanced water level and water quality monitoring accompany this incremental temporary "ramp-up" in groundwater production from the Saugus Formation. However, such a temporary increase in pumping over and above historic levels is unlikely to have an adverse impact on the Saugus Formation aquifer system, and

in particular is unlikely to induce a permanent loss of groundwater from storage or a decline in water quality.

D. Groundwater Quality

Groundwater in the Saugus Formation varies in character from calcium-bicarbonate ($Ca\text{-}HCO_3$) along the South Fork of the Santa Clara River, to calcium-sulfate ($Ca\text{-}SO_4$) in the central part of the Valley, to sodium-bicarbonate ($Na\text{-}HCO_3$) further west within the central fault block. The TDS concentration of Saugus Formation groundwater typically ranges from 500 to 900 mg/l, which is below the maximum State Secondary MCL for TDS of 1000 mg/l. We have performed a recent re-examination of water quality data for possible historical trends in TDS concentrations in the Saugus Formation. This revealed that although there has been a slight increase in TDS concentrations in most Saugus Formation wells in the past 40 years, this increase could not be correlated with increased groundwater production. On the contrary, there is evidence that TDS concentrations have actually decreased during periods of increased Saugus Formation groundwater production.

VOCs generally have not been detected in Saugus Formation groundwater, with the exception of four Saugus Formation water wells in the eastern part of the Valley. In these few wells, certain VOCs (primarily TCE) and the inorganic compound perchlorate have been encountered. None of the four impacted wells has been used for municipal-supply purposes since perchlorate was first detected in each of these wells in 1997. Results of ongoing laboratory testing of the other eight active Saugus Formation municipal-supply wells have all shown non-detection of perchlorate. Steps are currently being taken by the water purveyors to safely restore the capacity of the four impacted wells.

7. Artificial Recharge

Temporary fluctuations in water levels in the alluvial aquifer east of Bouquet Canyon create temporary groundwater storage capacity that could potentially be refilled faster than occurs naturally through a program of artificial recharge via spreading basins adjacent to the Santa Clara River. Excess flood flows in the Santa Clara River that would otherwise flow out of the Valley could be diverted to spreading basins where the water would percolate into and provide additional groundwater recharge to the alluvial aquifer. The purveyors may want to consider a range of recharge programs to augment the management of groundwater in the Valley.

In the Saugus Formation, recent field testing and groundwater modeling has demonstrated that Aquifer Storage and Recovery (ASR) using deep injection wells is feasible and potentially advantageous in terms of overall groundwater management for the local sub-basin. An ASR project of a scope beyond that envisioned for the Newhall Ranch development may provide further benefits to

the Saugus Formation, including increased volume of groundwater in storage, more rapid post-drought recovery of water levels, a possible improvement in the groundwater quality in the Saugus Formation (depending on the source of the injection water), and greater flexibility in the operations and management of the local groundwater sub-basin by the local water purveyors.

8. Groundwater Monitoring

Although a specific basin monitoring program has not been developed as part of this update report, it is expected that the database developed for this report will become the basis for the evolution of historical data collection and recording into a formal program of monitoring, data collection, and database maintenance. These monitoring efforts have actually begun in a cooperative and integrated manner along the entire Santa Clara River as a result of the MOU between the Santa Clarita Valley Water Purveyors and United Water Conservation District.

Data to be collected and interpreted in the MOU process, as part of ongoing groundwater management, should include:

a) Static and pumping water level monitoring in wells in both the alluvial and Saugus Formation aquifers.

b) Water quality data monitoring from wells in both aquifers and for surface water in the Santa Clara River and its major tributaries.

c) Rainfall records.

d) Annual groundwater production volumes by individual wells from all of the major water users, including private and agricultural users.

e) Detailed well construction information for new and existing wells.

f) Records of any well destruction activities, including the dates and methods used.

g) Historic data on aquifer parameters, as well as newer data acquired during well construction and testing.

h) Information on potential groundwater contamination sites obtained from available government and/or private databases and publications.

i) Discharge volume and water quality data for existing and future WRPs.

j) Other relevant data, such as major changes in land use.

9. Conjunctive Use and Management of the Alluvial and Saugus Formation Aquifers

Conjunctive use refers to the coordinated management and operation of multiple water supplies to achieve improved reliability of the water supply. In this aspect, the Santa Clarita Valley is fortunate to have two local aquifers that can be conjunctively used with imported SWP water to provide the Valley with a reliable supply of potable drinking water.

Since beginning to import a supplemental surface water supply in 1980, the Santa Clarita Valley Water Purveyors have been conjunctively utilizing that imported surface water with local groundwater from the alluvial and Saugus Formation aquifer systems. These conjunctive use efforts have allowed increasing water demands to be met while maintaining groundwater production within a range that precludes either aquifer from being in overdraft. A similar, but expanded, conjunctive use program, as described in detail in the 2000 UWMP, is expected to integrate additional supplemental sources of water supply in order to meet further projected increases in water demand while maintaining both aquifer systems within long-term sustainable yield, i.e. no overdraft.

A conjunctive use strategy for the Santa Clarita Valley could include:

a) Utilizing a combination of imported SWP water and groundwater from the alluvial aquifer during periods of average or above average rainfall (normal and wet years).

b) Increased pumping of the Saugus Formation during periods of lower than average rainfall in the valley (dry years), or during periods of decreased SWP water availability.

c) Enhancing the recovery of water levels and storage volume in the Saugus Formation through a program of artificial recharge, via injection, whenever additional water supplies are available.

d) Increasing the available storage capacity of the alluvial aquifer through increased pumping in the area east of Bouquet Canyon. This would serve to enhance both the natural recharge to the aquifer, and the effectiveness of an artificial recharge program using surface spreading basins in the same area.

SECTION 1

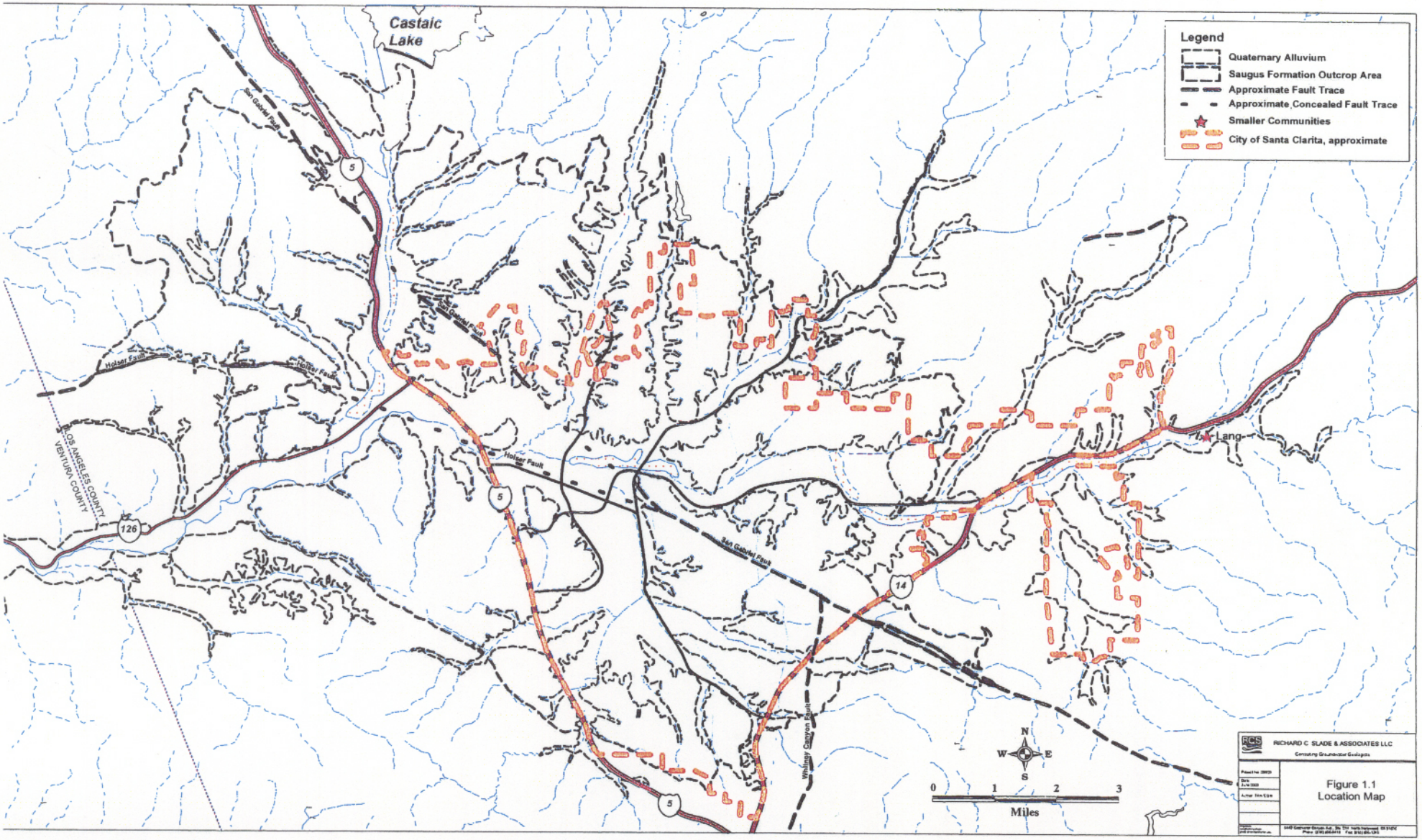
INTRODUCTION

Presented in this 2001 update report are our findings, conclusions and recommendations regarding the hydrogeologic conditions within the alluvial and Saugus Formation aquifer systems in the Santa Clarita River Valley of northern Los Angeles County, California. As shown on Figure 1.1 – Location Map – the area covered by this report is centered near the City of Santa Clarita, and extends roughly 21 miles from the Los Angeles – Ventura County Line on the west, to the town of Lang on the east. In a north-south direction, the study area extends approximately 13 miles from the intersection of Interstate 5 (I-5) and State Highway 14 on the south, to Castaic Dam on the north.

Purpose and Scope of Services

This hydrogeologic study has been undertaken to update and expand upon two previous reports which were originally prepared for the Upper Santa Clara Water Committee (USCWC) by Richard C. Slade, Consulting Groundwater Geologist: the December 1986 report entitled *Hydrogeologic Investigation, Perennial Yield and Artificial Recharge Potential of the Alluvial Sediments in the Santa Clarita River Valley of Los Angeles County, California* [known as the Slade 1986 Report]; and the February 1988 report entitled *Hydrogeologic Assessment of the Saugus Formation in the Santa Clara Valley of Los Angeles County, California* [known as the Slade 1988 Report]. Specifically addressed in this 2001 update report are: updated geology and aquifer parameters; groundwater levels and groundwater quality in both the alluvial and Saugus Formation aquifer systems; an updated calculation of groundwater in storage in both aquifer systems; a discussion of the operational yield of both aquifer systems; and general considerations for conducting ongoing monitoring of both aquifers in the future, including data collection and management.

This project has been conducted for the water purveyors operating in the Santa Clarita Valley. These purveyors include four retail purveyors of domestic water and the Castaic Lake Water Agency (CLWA), which has a contract with the State of California to obtain water from the State Water Project (SWP) and which furnishes SWP water to these four retail purveyors. The four retail purveyors of domestic water are: Los Angeles County Water


Castaic Lake
San Gabriel Fault
Holser Fault
Holser Fault
Holser Fault
San Gabriel Fault
San Gabriel Fault
Whitney Canyon Fault
LOS ANGELES COUNTY
VENTURA COUNTY
Lang
5
5
5
126
14
Legend
Quaternary Alluvium
Saugus Formation Outcrop Area
Approximate Fault Trace
Approximate Concealed Fault Trace
Smaller Communities
City of Santa Clarita, approximate
N
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Miles
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Figure 1.1
Location Map

Works District (LACWWD) No. 36 – Val Verde the Newhall County Water District (NCWD), the Santa Clarita Water Company (SCWC), a Division of CLWA, and the Valencia Water Company (VWC).

A summary of the hydrogeologic work tasks undertaken for this report is as follows:

Task 1 Acquisition of Basic Data

A. Recent geologic and hydrogeologic data and reports.
B. Precipitation data.
C. Water level data for alluvial and Saugus Formation water wells
D. Water quality data for alluvial and Saugus Formation wells.
E. Annual groundwater production data for alluvial and Saugus Formation wells.
F. Well construction and pump installation details for alluvial and Saugus Formation wells.
G. Accurate locations and wellhead elevations for alluvial and Saugus Formation wells.
H. Electric logs for new water wells and for additional wildcat oil wells.

Task 2 Production of Geographic Information System (GIS) Base Map and Digital Database

A. Acquisition of base map components including digital street data, topographic contours, rivers, etc.
B. Digital aerial photographs for land use evaluation.
C. Compile, verify and input data from Task 1 into electronic database and/or GIS format.
D. Import Global Positioning System (GPS) survey results of water well locations for the major purveyors in the Valley into GIS format (GPS survey carried out by others).
E. Update and digitize selected information from maps presented in the Slade 1986 Report and the Slade 1988 Report, and import into the new GIS format.

Task 3 Field Reconnaissance

A. Field reconnaissance of selected alluvial-supply water wells to collect non-pumping water levels.

B. Field reconnaissance of selected Saugus Formation water wells to collect non-pumping water levels.

Task 4 Current Land Use Patterns

Using aerial photography and the GIS system, identify and digitize the general location and extent of various land use types.

Task 5 Hydrogeologic Analysis

A. Identify local groundwater basins.

B. Discuss basic geologic conditions.

C. Review and re-define (as needed) key parameters for the alluvium and/or Saugus Formation, including thickness, extent, and depth to the base of fresh water, based on drilling and electric log data acquired since the mid-1980s.

D. Reinterpret existing and newly acquired electric logs from the Saugus Formation to identify key intraformational stratigraphic marker units.

E. Update existing geologic cross-sections, and construct new cross-sections.

F. Prepare and evaluate updated water level hydrographs (where possible) for selected municipal- and irrigation-supply wells.

G. Prepare and evaluate updated rainfall graphs.

H. Prepare and evaluate updated graphs of specific capacity (where possible) for selected municipal- and agricultural-supply wells.

I. Prepare updated water level elevation contour maps for both the alluvium and the Saugus Formation.

J. Re-assess aquifer transmissivity values for the alluvial and the Saugus Formation aquifer systems.

K. Update calculations of groundwater in storage for the alluvial aquifer and the Saugus Formation.

L. Provide recommendations for areas in the alluvial aquifer where artificial recharge projects might be considered.

M. Re-assess the Slade 1986 Report estimate of the operational yield of the alluvial aquifer.

N. Re-assess the Slade 1988 Report estimate of potential groundwater extractions that might be possible for the Saugus Formation on both short- and long-term periods.

O. Develop a program for groundwater monitoring within the Valley.

Task 6 Report Preparation

Prepare the updated hydrogeologic report, including large-format maps and a digital GIS-compatible database.

Task 7 Meetings

Prepare for and attend meetings with the local water purveyors.

Sources of Data

One of the most ambitious goals of this project has been the research and compilation of a digital dataset that brings together available information pertaining to groundwater in the Valley. Included in this dataset are details of water well construction, annual groundwater extractions, historic groundwater levels and groundwater quality, and both surface and subsurface geology, all in a format compatible with commonly available GIS software.

This unified digital dataset provides a number of significant benefits, in that it:

- Serves as a common, easily accessible source of information and data on groundwater in the Valley.
- Facilitates the cooperative and ongoing management of groundwater resources among the various purveyors.
- Reduces the time required to prepare future annual water reports.
- Facilitates planning and siting of new wells, and the destruction of old ones.
- Simplifies the analysis of wellhead protection/vulnerability studies.
- Greatly simplifies the distribution of data to consultants retained by the member water agencies.
- Facilitates detailed, accurate and rapid analysis of groundwater and geologic data.
- Allows new data to be rapidly incorporated into existing datasets.
- Permits the transfer of data to and from groundwater modeling software.
- Allows groundwater maps be created, updated and printed in hours instead of days or weeks.

Previous Studies

Because the study area overlies several producing and former oil fields, there exist numerous published and unpublished geologic reports and maps dealing with surface and

subsurface geologic conditions in the hills and mountains surrounding the Valley. The earliest works date from the period 1902 to 1924 (importantly, Kew, 1924) and document the initial efforts at naming and mapping the surface exposures of the stratigraphic units and geologic structure in the region.

With the discovery of larger oil fields between the late-1930s and the late-1940s, there was a renewed interest in the geology and the potential for additional petroleum development. Mapping by such workers as Bailey (1954) and Crowell (1954) added considerable detail to the known stratigraphy and to major geologic structures like the San Gabriel fault. Other particularly significant geologic reports include those by Winterer and Durham for the U. S. Geological Survey (1962) and by Oakeshott (1958) for the California Division of Mines and Geology. More recent studies include university theses by Nelligan (1978) and by Stitt (1980).

Considerable information is available to document the history of oil field development in the greater Santa Clarita Valley region. The majority of these reports have been published by the California Division of Oil and Gas. From its Ventura office, the Division of Oil and Gas maintains comprehensive files on the well histories and geophysical electric logs for the large number of existing and former wildcat and producing oil wells in the region.

In contrast to the geology and oil well data, published hydrogeologic and hydrologic information for the region is not nearly as abundant. With the exception of the Slade 1986 Report, the Slade 1988 Report, and the Los Angeles County Flood Control District (LACFCD) annual maps of the region showing water level data for key wells, there have been no previously published studies detailing aquifer characteristics, water well construction and testing, water level elevation fluctuations, or water quality variations in water wells throughout the region.

Previous assessments of the local hydrogeologic conditions are limited to those by: Robson (1972) for the U.S. Geological Survey, which provided the results of an analog computer model of the Saugus-Newhall area; the 1979 State Department of Water Resources (DWR) report, which provided a reconnaissance-level evaluation of the potential for storing excess water from the SWP within the several groundwater basins located along the Santa Clara River in Los Angeles and Ventura counties; the Department of Water Resources (DWR,

1975 and 1980) which identified the boundaries of the various groundwater basins in the region; and numerous maps by the LACFCD which provided water level elevations contour maps for various years.

Many of the references listed above are cited in the Slade 1986 Report and/or the Slade 1988 Saugus Report. Key references specifically cited in this 2001 update report are provided herein in Section 7 – References Reviewed.

Water Wells

Well construction details were obtained from a variety of sources, including the Slade 1986 Report, the Slade 1988 Report, other in-house reports and files for other projects by this investigator subsequent to 1988 for the area, the local major Santa Clarita Valley Water Purveyors, and from State water well completion reports. In some cases, particularly with older or privately-owned wells, information on well construction details was often unavailable.

As of 2001, a total of 30 deep Saugus Formation water wells had been drilled and constructed for municipal-supply and/or irrigation-supply purposes in the Valley. Of these wells, 13 have been abandoned and/or destroyed, whereas the remaining 17 either have remained in operation or are on inactive or standby status. Also as of January 2001, there were 61 currently active alluvial water wells in the Valley; of this number, 37 were used for municipal-supply purposes and 24 were used for irrigation-supply by the Newhall Land & Farming Company (NLF), the largest agricultural user of groundwater in the Valley. The number, usage, viability and location of small, individual, domestic-supply water wells in the alluvial and Saugus Formation aquifer systems in the region are unknown.

Electric logs (e-logs) are available for nearly all of the currently active Saugus Formation water wells, as well as for a number of the currently active municipal-supply alluvial water wells.

An attempt was made to determine the correct and/or complete State Well numbers (SW Nos.) and Los Angeles County Flood Control District numbers (LACFCD Nos.) for wells owned by the major purveyors in the study area. It was hoped this would permit the use of water level records maintained by these agencies together with those maintained by the U.S. Geological Survey (USGS) and LACFCD. Unfortunately, the database of SW Nos.

maintained by the DWR is incomplete and in some cases contradicts other sources of information. The LACFCD records are equally lacking, and although a few SW Nos. and LACFCD Nos. have been updated, there are still numerous wells for which these data remain incomplete. As a result, we are relying in this report solely on the well name or well number designated by its owner for each well discussed in this report.

One major improvement in data collection reflected in this report has been the accurate surveying of the locations of the known Santa Clarita Valley Water Purveyor water wells, as well as a number of other important wells in the area. The surveying program was carried out in December 1999 by Penfield and Smith Engineers & Surveyors, Inc. using a GPS receiver. A total of 99 wells were surveyed.

The GPS receiver used for this study was a Trimble Pathfinder Pro/XRS, and the locations were differentially corrected to a theoretical horizontal accuracy of ±1 meter horizontally and ±2 to 3 meters vertically. Well locations were stored in a Microsoft Access 2000 database in latitude/longitude coordinates, NAD83 datum, and random field checking of these locations by us and others, has revealed them to be accurate for the purposes of this project. However, in reviewing the positional data, errors in the vertical elevation of several wells were discovered because certain wellhead elevations derived from the GPS survey did not agree with the elevation of the ground surface as shown on the USGS 1:24,000 scale topographic contour maps. In these cases, the well elevations were adjusted to match the published USGS digital elevation map.

The positions of historic wells that were destroyed prior to 2000 were digitized from the original Mylar maps that were used in publishing the Slade 1986 Report and the Slade 1988 Report. The locations shown on the current maps for these historic wells are only approximate.

Groundwater Extractions

For the period from 1947 to 1984, groundwater extraction data were available only as a yearly value for each purveyor. Although the database of groundwater production contains some individual well data prior to 1984, those data should not be used to calculate total production figures. The total groundwater production from 1947 to 1966 is a minimum figure,

because the only complete production records for this early period are those from NLF; during that period, NLF–owned water wells extracted the majority of the groundwater production from the local aquifer systems.

From 1984 to the present, groundwater production data are generally available for the individual municipal-supply wells on a yearly basis. The acre-feet per year (AF/yr) values for the NCWD, SCWC and VWC wells are from metered production at each well. For the NLF wells, the reported extractions were estimated from kilowatts of power consumed converted to AF/yr by reference to the results of annual Edison efficiency tests. For the Wayside Honor Rancho (WHR) wells, the actual quantity of water pumped is not known because the individual wells at that facility are not metered. Instead, the annual extractions reported for WHR are based on their estimated water consumption using an estimated number of prisoners and staff using the facilities.

Water Levels

Static water level data supplied by the water purveyors for this project vary considerably in quality and completeness. In some cases, static water levels have been measured on a consistent, once-per-month basis and stored in a regularly updated digital database. In other cases, water level measurements have been taken sporadically or not at all, and data gaps of a few months to several years in duration may exist in the historical records. For this report, available pumping and static water level data for wells in both the alluvial and Saugus Formation aquifer systems have been entered into a Microsoft Access database. In addition, customized queries and reports have been written to provide tables of water level data, and to prepare water level hydrographs for individual wells.

For the alluvial aquifer, the extent of available water level data is as follows:

- A dataset for thirteen of the SCWC wells for the period from 1973 to the present.
- A dataset for eight of the NCWD wells covering the period from the early 1980s to the present.
- A dataset for the fifteen currently active VWC wells, from the early 1990s to present. In addition, some data exist for these same wells from the 1950s to the mid-1980s.
- Finally, for NLF wells, some data exist from the mid-1950s to the early-1980s, little or no data are available for the latter part of the 1980s, and data collected from

Edison Company well efficiency test records (which typically include a static water level data point) were obtained for the period from approximately 1990 to the present.

The alluvial aquifer water level data described above were compiled from our in-house files, purveyor water level records, and available Edison test datasheets. Recorded static water levels in some cases may represent partially recovered, post-pumping water levels, especially for active NCWD wells.

For the Saugus Formation, the extent of available water level data can be summarized as follows:

- A dataset for six of NCWD's Saugus Formation wells from the mid-1980s to the present.
- A dataset for the two SCWC Saugus Formation wells from their construction in the late-1980s to the present.
- A dataset for VWC Well Nos. 157 and 160 from the early-1950s to the present
- Limited available information on water levels for VWC Well No. 159 from 1992 to the present.
- A dataset for VWC Well No. 201 from 1990 to the present.
- For NLF Well No. 156, some data exist from the mid-1950s to the early-1980s, little or no data are available for the latter part of the 1980s, and a few once-per-year Edison test records were obtained for the period from approximately 1990 to the present.

The Saugus Formation water level data described above were compiled from our company files, purveyor water level records, and available Edison test datasheets. Water levels in some cases may represent partially recovered, post-pumping water levels, especially for active NCWD wells.

Water Quality

Water quality data, including general mineral chemistry data on common dissolved cations and anions, as well as inorganics (metals), VOCs, and perchlorate, were obtained primarily from the local water purveyors. Some additional data were derived from our company files, and from the databases maintained by the California Department of Health Services (DHS) and DWR.

Because various agencies, including the DHS, require that drinking water sources such as water wells be tested on a regular basis, water quality data are readily available for the wells used by the various purveyors for municipal-supply purposes in the Valley. Considerably fewer water quality data are available for the NLF wells, because these are used only for agricultural-supply purposes.

Further groundwater quality data are available from a recent re-examination of available TDS data from Saugus Formation water wells in the Valley; this re-examination was carried out as part of a May 2000 presentation by our firm to the California Public Utilities Commission (PUC) on behalf of VWC. The original laboratory data were used to re-calculate TDS concentrations using a more standard, additive method described in a USGS report by Hem (1985). These data were then compared to historic pumping and water level records to look for possible trends in TDS concentrations over time, and to examine if these trends were related to changes in groundwater production.

Surface Geology

The geology of the study area was originally compiled from published sources and presented in the Slade 1986 Report and the Slade 1988 Report for the alluvial aquifer system and the Saugus Formation aquifer system, respectively. For this current update, the original geological units and features shown in those reports were digitized, and in some cases updated using newer published sources (for example, Dibblee, 1996). No major changes have been made to the original geologic maps, although some minor adjustments have been made to the boundaries of the alluvium unit, and to the degree of certainty attached to the mapped location of a portion of the Holser fault across a portion of the Valley.

Subsurface Geology

For the Slade 1988 Report, the subsurface geology of the Saugus Formation was compiled from published reports and from an examination of a few hundred e-logs from oil industry exploration and production wells. The locations of approximately 140 of these oil wells are shown on several maps in that Slade 1988 Report, along with various subsurface geologic contours (depth to the base of fresh water, the thickness of sand units in the Saugus Formation, etc.).

For this 2001 updated report, we have re-examined and re-interpreted the e-logs for each of the 140 oil wells depicted in the Slade 1988 Report (plus approximately 30 additional wells) in order to obtain more detailed subsurface geologic information for the Saugus Formation. The location of each of these wells has been digitized from the original 1988 report map, for use in the GIS system. From each of these approximately 170 e-logs, total sand thicknesses were re-calculated for the depth zone between 300 ft and 2500 ft below ground surface (bgs), or to the base of fresh water, whichever was shallower. Also re-calculated for each of these ±170 wells were the depth to the base of fresh water, the total Saugus Formation thickness, and the depth to the top of a prominent e-log marker bed unit within the Saugus Formation (herein termed the Santa Clarita Aquifer Zone). In addition, a new geologic cross-section Z-Z' (see Plate 3.3 in Section 3 of this report) that parallels the Santa Clara River has been completed across the area from east to west.

GIS Compilation

Data acquired and compiled for this report have been formatted for use with GIS software. This was done to facilitate the updating of maps with newly acquired or corrected data, and to utilize the powerful data manipulation abilities of GIS packages. To accomplish this objective, we first constructed a useable base map of the Valley, combining data from a wide variety of sources as described below.

Topographic contours for the base map were derived from USGS 1:24,000 scale digital elevation models, using TopoDepot, a commercially available software package produced by Sylvan Ascent Inc. of New Mexico. Although they vary slightly in detail from the contours found on printed USGS 1:24,000 topographic quadrangle sheets, the TopoDepot contours are considered to provide sufficiently accurate elevation data for the project area.

Hydrographic features for the base map (streams, reservoirs, etc.), and the Public Lands Survey System (PLSS) features (sections, townships & ranges) were taken from publicly available USGS Digital Line Graph (DLG) files downloaded from the USGS web site. The hydrographic features were digitized by the USGS from 1:100,000 scale topographic maps, and therefore tend to be somewhat generalized in appearance.

The PLSS data are much more accurate, but some caution must be exercised regarding their use with water well and oil well data provided by the State of California. The PLSS sections depicted on the maps supplied with this report include large blank areas where the PLSS system ends at the boundaries of the large historic Spanish land grants. Both the DWR and the Department of Oil and Gas have created artificial section lines that project across these land grant areas in order to assign State Well Numbers to water wells and oil wells. However, these different projections frequently fail to accurately line up with one another, and are therefore not compatible or interchangeable.

The road and freeway network in the Valley was obtained from the Los Angeles County Public Works Department (LACPWD) GIS system. The original data were accurate with respect to location, but contained numerous errors in attribute coding which required our firm to perform extensive editing and correction before use in our base map.

In order to review current land use patterns and distribution, high-resolution seamless color aerial photography covering the entire study area was obtained from Eagle Aerials Ltd. This photography is in digital format with an approximate 1 meter ground resolution, and was flown in June, 2000. Approximate land use polygons were digitized from the aerial photography, although the actual land use categories were not verified by field checking.

SECTION 2

AREA OF INVESTIGATION

Study Area

As shown on Figure 1.1 - Location Map - the roughly rectangular-shaped study area extends from approximately the Los Angeles– Ventura County line on the west, to the community of Lang on the east, and from the southern end of Castaic Lake on the north, to the intersection of the Golden State and Antelope Valley freeways on the south. The study area includes the valley of the Santa Clara River and its major tributary canyons, as well as a large area of rugged hills on the north and south sides of the river.

Elevations along the river valley range approximately from 1800 ft above mean sea level (asl) at Lang at the easterly limit of the region, to 800 ft asl at County line at the western boundary. The overall river gradient across this reach is on the order of 0.009 ft/ft (about 50 feet per mile). Maximum elevations in the hills north of the river are on the order of 2500 to 3000 ft asl, whereas maximum elevations to the south are typically 4000 ft asl in the San Gabriel Mountains and 3000 ft in the Santa Susana Mountains. The highest elevations in the region include Mt. McDill (5180 ft asl) in the headwaters of Mint Canyon north of the Santa Clara River, and Mt. Gleason (6532 ft asl) in the Condor Peak quadrangle south of the Santa Clara River and several miles southeast of the study area.

The largest community in the study area is the City of Santa Clarita, which was formed in 1987 through the amalgamation of the communities of Newhall, Valencia, Saugus, and Canyon Country. Other, smaller, unincorporated communities in the study area include Stevenson Ranch and Val Verde in the west, Castaic in the northwest, and Lang in the east.

The US 2000 Census revealed the population of the City of Santa Clarita to be approximately 151,260; see the approximate City limits on Figure 1.1. The Southern California Association of Governments (SCAG) estimates the population of the surrounding unincorporated Santa Clarita Valley at 48,237 (M. Modugno, City of Santa Clarita Planning Dept., personal communication, 2001); hence, the total current population of the Valley is approximately

200,000. This represents a significant increase over the 1980 Valley population of 79,000 reported in the Slade 1986 Report.

Accompanying this rapid population increase has been a gradual change in valley land use patterns, from largely agricultural use to urban and suburban developments. Nevertheless, a considerable portion of the hills and low mountains bordering the main river valley remain in a natural, undeveloped condition.

Climate

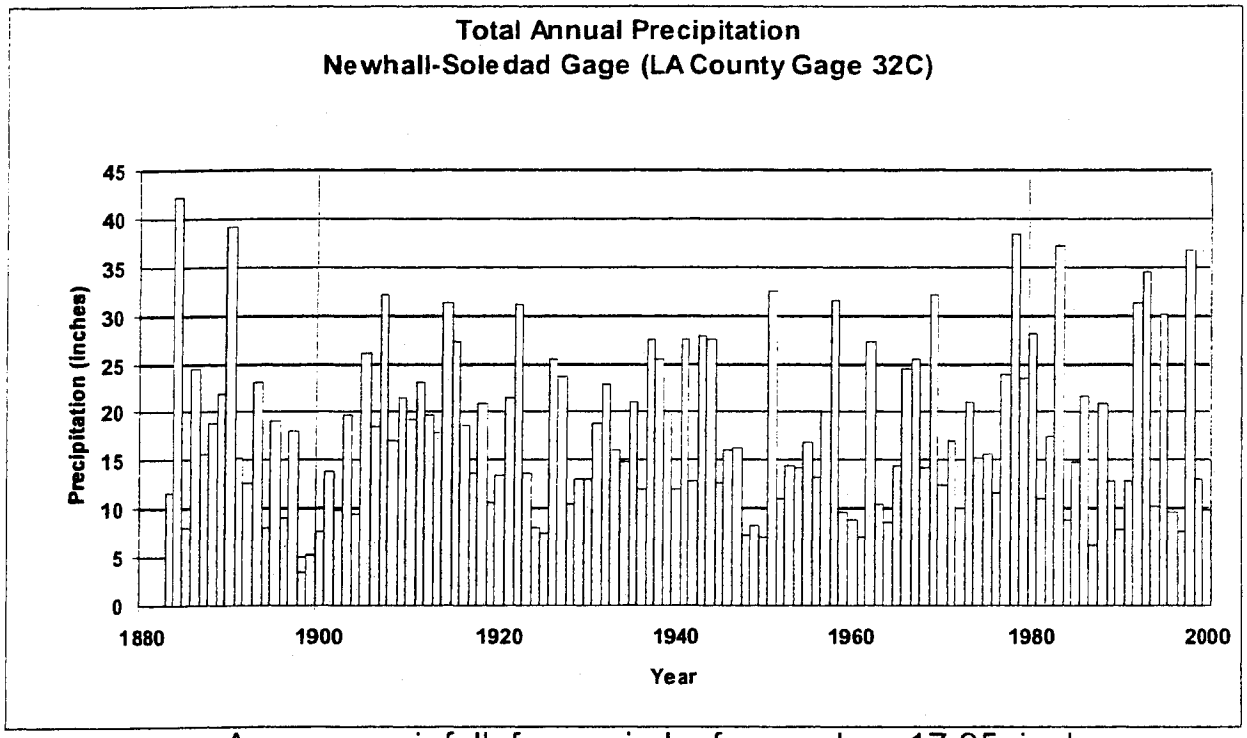
The study area has a semi-arid, Mediterranean-type climate characterized by long, dry summers and relatively short, wet winters. Temperatures in the Valley range from a maximum of approximately 100°F during the summer, to a minimum of 30°F in the winter. Mean monthly temperatures range between approximately 77°F in the summer, to 48°F in the winter.

Rainfall data have been obtained from LACFCD for the Newhall-Soledad gage (Station No. 32C), located near San Fernando Road in the community of Newhall. This gage has a period of record of 1883 to 2000. Unfortunately, the two rainfall gages (Stations Nos. 200 and 1009) discussed in the Slade 1986 Report have been discontinued. Figure 2.1 - Rainfall Totals and Cumulative Departure Curve – presents graphs of both the annual precipitation by water year (October to September), and the cumulative departure from the mean precipitation for the Newhall-Soledad gage.

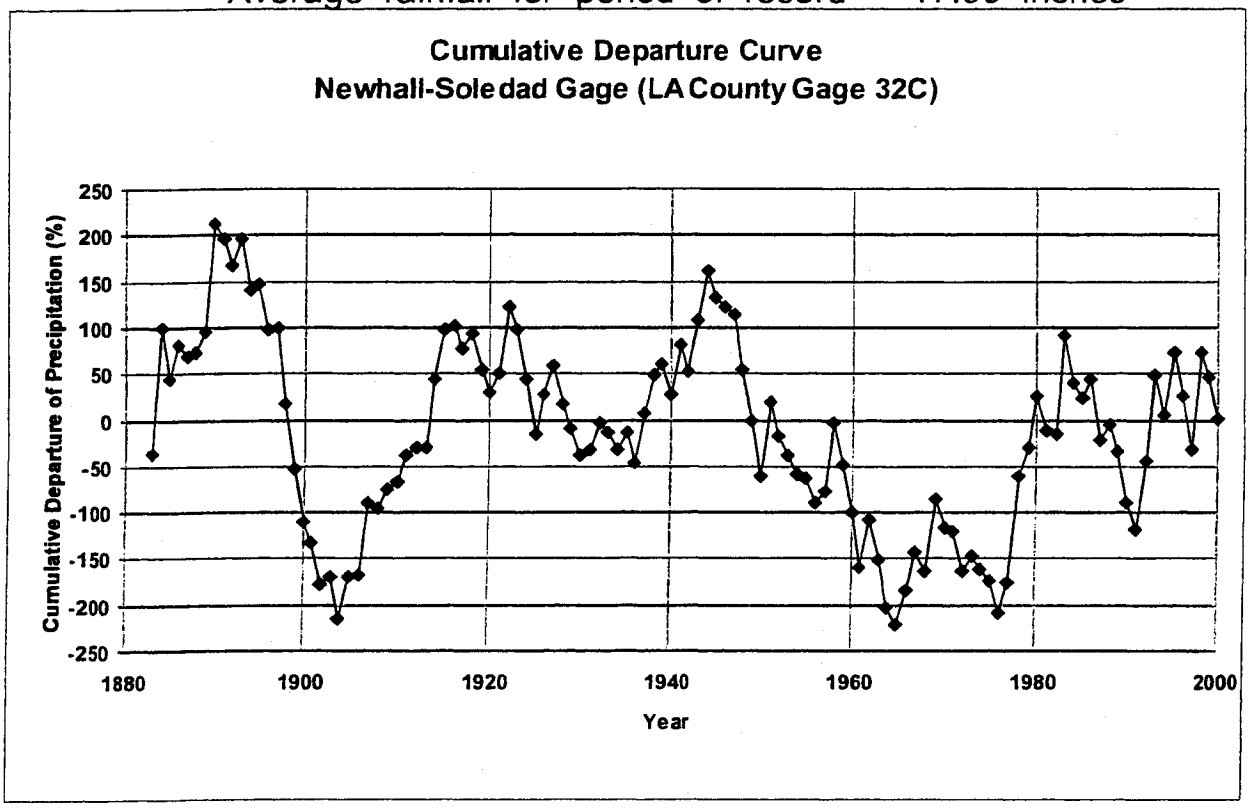
Review of the rainfall data from the Newhall-Soledad gage reveals the following:

- the average rainfall for the 1883 to 2000 period of record (118 years) is 17.95 inches.
- the highest amount of annual rainfall for the period of record is 42.11 inches in 1884, whereas the lowest historic annual total is 3.32 inches in 1898.
- annual rainfall totals show high variability from year to year.

Approximately 80 percent of the annual precipitation in the Valley falls between November and March. Most of these winter storms last only a few days, and are separated by relatively long periods of clear weather.



Average rainfall for period of record = 17.95 inches



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CONSULTING GROUNDWATER GEOLOGISTS

FIGURE 2.1
Rainfall Totals & Cumulative Departure Curve

JOB NO. S9920 June 2002

The cumulative departure curve for rainfall (see Figure 2.1) illustrates trends in the amount of rainfall over time, such that when the curve is descending towards the right (such as from 1890 to 1904, or from 1944 to 1965), an extended period of generally deficient precipitation (drought) has been occurring. In contrast, whenever the curve ascends to the right (such as from 1976 to 1983), an extended period of generally excess or increasing precipitation (wet period) has been occurring. As seen on the cumulative departure curve, the Valley has experienced episodic cycles of dry years followed by periods of wet years. However, these cycles show no discernable periodicity that might be used for predictive purposes.

Drainage

The Santa Clara River provides regional drainage in an east to west direction across this portion of Los Angeles County, and continues westerly across Ventura County to the Pacific Ocean. This river has its headwaters in Soledad Canyon in north-central Los Angeles County and includes a watershed area of several hundred square miles.

Principal tributaries draining the northern side of the study area include, from east to west, Mint Canyon, Bouquet Canyon, San Francisquito Canyon, and Castaic Creek Canyon. Principal tributaries draining the southern side of the Valley include, from east to west, Oak Spring Canyon, Sand Canyon, and Potrero Canyon.

The South Fork of the Santa Clara River, which drains in a northerly direction toward its confluence with the main reach of the Santa Clara River (located just west of Bouquet Junction), has Placerita Creek Canyon, Newhall Creek Canyon, and Pico Canyon as its main tributaries.

Because the headwater areas of these drainages do not extend into high mountainous areas, and because the local climate precludes the buildup of a large snow pack in the watersheds, surface water runnoff in all of the canyons is ephemeral and diminishes rapidly after most rainfall events. Local springs and areas of rising water, together with outflows from the local WRPs, tend to maintain flows even in the summer months within the main reach of the Santa Clara River west of Bouquet Canyon. Following severe storms, river

discharge has been reported to increase from nearly zero flow to as high as thousands of cubic feet per second within a few hours.

The annual volumes of runoff in the river vary directly with annual rainfall, but, in general, are considered to have increased over time due to two man-made activities: the increased importation and use of water in the area from the SWP; and the increased releases, over time, from the two local WRPs. Surface water runoff from the river drains westerly into Ventura County at County line at the western edge of the study area for this project (see Figure 1.1). This represents the only direct connection of surface water flow between the Valley and Ventura County.

Local Water Purveyors

Domestic water purveyors located within the study area include LACWWD No. 36, NCWD, SCWC (a Division of CLWA), and VWC. These four domestic water purveyors and the CLWA make up the management committee for whom this report was prepared. LACWWD No. 36, SCWC and NCWD represent public agencies, whereas VWC is privately owned. Of the four domestic water purveyors, only LACWWD No. 36 has no active wells in either the alluvial or Saugus Formation aquifer systems within the study area.

In addition to the groundwater extractions by the local purveyors, supplemental water is provided to these purveyors for use in the Valley by CLWA via the SWP. SWP water, which is transported from the California Aqueduct, first became available to the Valley area in 1980. CLWA also delivers highly treated recycled water from one of the two WRPs in the Valley, owned by the Sanitation Districts of Los Angeles County, in order to help meet non-potable water demands (golf courses, landscape irrigation, etc.).

Groundwater Basins

The DWR establishes the official names and locations of groundwater basins throughout California (Bulletin 118). At the time of the original Slade 1986 Report and the Slade 1988 Report on the Valley, the alluvial and Saugus Formation aquifer systems were included within an area known as the Eastern Hydrogeologic Subunit of the Santa Clara River Valley Unit. In addition, these two aquifer systems were considered to represent the only two

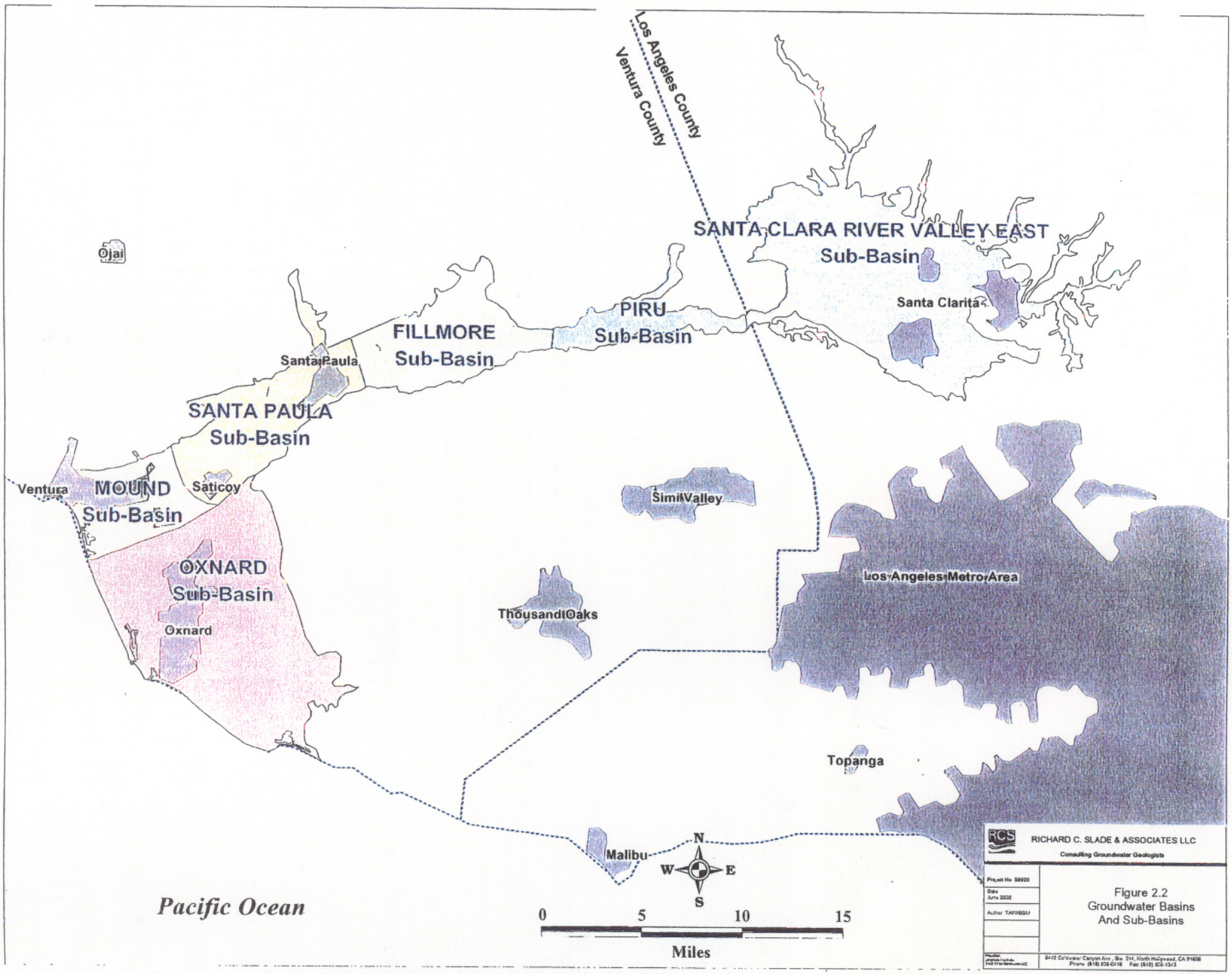
water-bearing formations within the Valley. For the purposes of this report, the water-bearing sediments comprising the alluvial and Saugus Formation aquifer systems are considered to be those earth materials that are capable of providing groundwater in useable quantities and of acceptable quality for beneficial use by the municipal-supply water purveyors. Underlying these water-bearing sediments beneath the Valley and also forming the lateral (surface) margins of the local groundwater reservoir is a very thick accumulation of older sedimentary rocks that are considered to be essentially nonwater-bearing in terms of their general ability to provide groundwater for municipal-supply purposes.

In recent years, DWR has begun a process of updating its Bulletin 118 and has provided new GIS-format maps of its updated basin boundaries and names. Figure 2.2 – Groundwater Basins and Sub-basins – depicts the location and current nomenclature for the official groundwater basins along the Santa Clara River between the City of Santa Clarita on the east and the Pacific Ocean on the west, as adapted from recent DWR work. The alluvial and Saugus Formation aquifer systems are now together considered to lie within the Santa Clara River Valley East Groundwater Sub-basin of the Santa Clara River Valley Groundwater Basin.

DWR basin boundaries were selected on the basis of such features as faults, groundwater divides, exposures of bedrock in the hills, or areas of rising water caused by the presence of bedrock shallowly underlying river alluvium. Where none of these types of conditions exist, arbitrary or even political divides were selected as boundaries between the aforementioned groundwater basins and subbasins.

The western boundary of the Santa Clara River Valley East Groundwater Sub-basin is currently taken at County line where it meets the adjoining (downstream) Piru Sub-basin of Ventura County. The eastern boundary of the local groundwater sub-basin occurs at a narrows along the Santa Clara River near Lang. Upstream (east) of the Santa Clara River Valley East Sub-basin, and separated by a gap of approximately three miles, is the Acton Valley Groundwater Basin.

The only outflow from the Santa Clara River Valley East Groundwater Sub-basin to Ventura County occurs via direct subsurface outflow from the saturated portions of the alluvial aquifer


Los Angeles County
Ventura County
SANTA CLARA RIVER VALLEY EAST
Sub-Basin
Ojai
Santa Clarita
PIRU
Sub-Basin
FILLMORE
Sub-Basin
Santa Paula
SANTA PAULA
Sub-Basin
Ventura
MOUND
Sub-Basin
Saticoy
Simi Valley
OXNARD
Sub-Basin
Oxnard
Thousand Oaks
Los Angeles Metro Area
Topanga
Malibu
Pacific Ocean
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RCS
RICHARD C. SLADE & ASSOCIATES LLC
Consulting Groundwater Geologists
Project No. 58920
Date
June 2002
Author TAN/BGM
Figure 2.2
Groundwater Basins
And Sub-Basins

system of the Santa Clara River at County line; surface water outflow to Ventura County occurs only via direct surface runoff in the Santa Clara River at County line (see Figure 2.2).

SECTION 3

SUMMARY OF GEOLOGIC CONDITIONS

General Statement

Geologic materials illustrated on Plate 3.1 – Geologic Map of the Santa Clarita Valley - have been divided according to their relative water-bearing characteristics, that is, by their relative ability to contain, transmit, and yield groundwater to wells. As such, two divisions are recognized in the Valley: a water-bearing sediment group and a non-water-bearing bedrock group.

The water-bearing sediments consist of a blanket of unconsolidated alluvium of Quaternary geologic age (map symbol, Qal) that covers the floor of the main river valley and its tributary canyons, and the consolidated sediments of the slightly geologically older Saugus Formation (Pliocene to Pleistocene geologic age; map symbol, QTs) which underlie the alluvium. Scattered outcrops of Quaternary-age Terrace deposits (map symbol, Qt) likely have the capacity to contain limited amounts of groundwater on a seasonal basis, but these deposits crop out in only limited areas that are typically situated at elevations above the regional water table.

The alluvium and the Saugus Formation have been penetrated to various depths by numerous water wells and have historically provided all the groundwater extracted in the Valley for municipal-supply purposes. Underlying the water-bearing sediments and exposed on the hillsides beyond the limits of the Saugus Formation exposures are the various older geologic formations that comprise the relatively impermeable, non water-bearing bedrock.

Water-Bearing Sediments

Alluvial Deposits

Sediments shown on Plate 3.1 as Quaternary alluvium range in geologic age from Quaternary to Holocene (Recent), and consist primarily of stream channel and floodplain deposits of the Santa Clara River and its tributaries. Geologic logging performed by RCS geologists during recent water well drilling activities, and an analysis of drillers' logs of older

water wells, reveals that the alluvial sediments are composed of complexly interlayered and interfingered beds of gravel, sand, silt, and clay, with variable amounts of cobbles and boulders. In general, alluvium along the main reach of the Santa Clara River ranges from cobbly- or gravelly-sand in the east, to medium-grained sand in the west. Due to its unconsolidated to poorly consolidated nature and its lack of cementation, the alluvium is considered to have relatively high permeability and porosity.

The maximum thickness of alluvium varies along the Santa Clara River, but generally is considered to be about 200 feet along the main reach of the river. Typically, the alluvium tends to be thickest near the central portion of the main river channel, but then thins or pinches out near the base of the adjoining hills.

Geologic logging of the pilot boreholes for municipal-supply water wells constructed in recent years within the alluvium along the main reach of the Santa Clara River reveals that the alluvium has maximum depths of approximately: 114 ft at SCWC Mitchell Well No. 5B (drilled in 2001); 155 ft in SCWC Lost Canyon Well No. 2A (drilled in 1989); 160 ft in VWC Well W-10 (drilled in 2001); and from 180 ft to 200 ft in VWC Wells S-6, S-7 and S-8 (drilled in 1999 to 2000). Locations of these alluvial wells are shown on Plate 4.1 in Section 4 of this report.

Alluvium in the tributary canyons is generally thinner than that along the main river valley. Larger tributary canyons such as Castaic Creek, San Francisquito Canyon and Bouquet Canyon are typically underlain by more laterally extensive and thicker accumulations of alluvium than which exist within the smaller canyons like Oak Spring or Pico canyons. In these latter canyons, the maximum alluvial thickness occurs near the confluence with the main river valley and is considered to be on the order of 100 feet.

Only two active municipal-supply alluvial wells (VWC W-9 and W-10) have been constructed in recent years in any of the major tributaries of the Santa Clara River. Well W-9 was drilled in 1990 in San Francisquito Canyon, approximately 7000 ft north of its confluence with the main reach of the Santa Clara River (see Plate 4.1). Geologic logging of the pilot hole for this well revealed that the alluvium has a maximum thickness of approximately 140 ft at this location. VWC Well W-10 was drilled in 2001 near the confluence of San Francisquito

Canyon and the Santa Clara River (see Plate 4.1). At this location, the alluvium was geologically logged to a depth of 160 ft.

Another well (now destroyed) was drilled in 1990 along San Francisquito Canyon (VWC No. 202, a Saugus Formation well), approximately 9500 ft north of its confluence with the Santa Clara River (see well location on Plate 5.1 in Section 5 of this report). Geologic logging of the pilot hole for this well revealed the alluvium to be approximately 50 ft thick at this location.

The approximate thickness of alluvium logged in the borehole for a new alluvial groundwater monitoring well in the South Fork area is 190 ft. This monitoring well was constructed in 2000, approximately 40 ft south of VWC 201, as part of the assessment of the feasibility for an aquifer storage and recovery (ASR) program in the Saugus Formation (Slade and Associates LLC, February 2001).

Geologic logging of the pilot boreholes for Saugus Formation water wells drilled since the Slade 1988 Report, and/or correlation of electric logs for existing Saugus Formation wells, reveal the following information on the approximate maximum thickness of the alluvial deposits at these sites (see well locations on Plate 5.1):

a. South Fork area: approximately 80 ft in NCWD-13; 120 ft in NCWD-12; 170 ft in Saugus Well No. 1; and in the range of 150 ft to 180 ft in SCWC Saugus Well No. 2.

b. Main Reach Santa Clara River: less than 50 ft at V-205; 120 ft at V-158; 190 ft at V-157 and V-201; 220 ft at V-203; and approximately 240 ft at V-160.

Terrace Deposits

Terrace deposits are isolated remnants of what was, during the late Pleistocene, a continuous blanket of alluvial material covering the entire floor of the Santa Clara River Valley (Winterer and Durham, 1962). Tectonic uplift of the valley floor led to downcutting and incision of this geologically older alluvial material by the Santa Clara River, leaving the terrace deposits restricted to platforms or benches that are now topographically higher than the Santa Clara River, and hence above the regional water table. Sediments comprising the terrace deposits include crudely stratified, poorly consolidated reddish-brown gravel, sand and silt (Winterer and Durham, 1962). Terrace deposits may be weakly cemented by iron

oxides, clay minerals, or calcium carbonate. Plate 3.1 illustrates the locations of the surface exposures of terrace deposits in the Valley as mapped by others.

Terrace deposits reportedly may be up to 200 ft thick in some areas, but because they are of limited areal extent and because they are generally above the regional water table, they are not considered a viable source for the development of groundwater resources. However, limited zones of perched groundwater may be locally present in portions of these terrace deposits on a seasonal basis. No wells in the Valley have ever been known to extract groundwater from these terrace deposits.

Saugus Formation

The Saugus Formation has traditionally been divided into two stratigraphic units: the lowermost, geologically older Sunshine Ranch Member which is of mixed marine to terrestrial origin; and the remaining, overlying or upper portion of the formation which is entirely terrestrial (non-marine) in origin (Winterer & Durham, 1962); refer to Figure 3.1 – Saugus Formation Stratigraphy – for details of the stratigraphy. The Saugus Formation has been assigned a Pliocene to Pleistocene geologic age based on rare fossil occurrences (Winterer and Durham, 1962).

South of the San Gabriel fault, the gradational contact between the Sunshine Ranch Member and the underlying, geologically older Pico Formation represents a gradual transition from a marine to a continental (terrestrial) environment of deposition throughout the entire study area. Because of its gradational nature, the location of this contact is sometimes difficult to accurately identify, either visually in the field or from e-log correlations.

The Sunshine Ranch Member of the Saugus Formation comprises interfingering shallow marine, brackish-water, and nonmarine deposits of interbedded gray to greenish-gray sandstone and siltstone. Fossils found within the Sunshine Ranch Member indicate an upper Pliocene geologic age for this part of the Saugus Formation. The Sunshine Ranch Member obtains a maximum thickness of approximately 3,500 ft in the central part of the Valley.

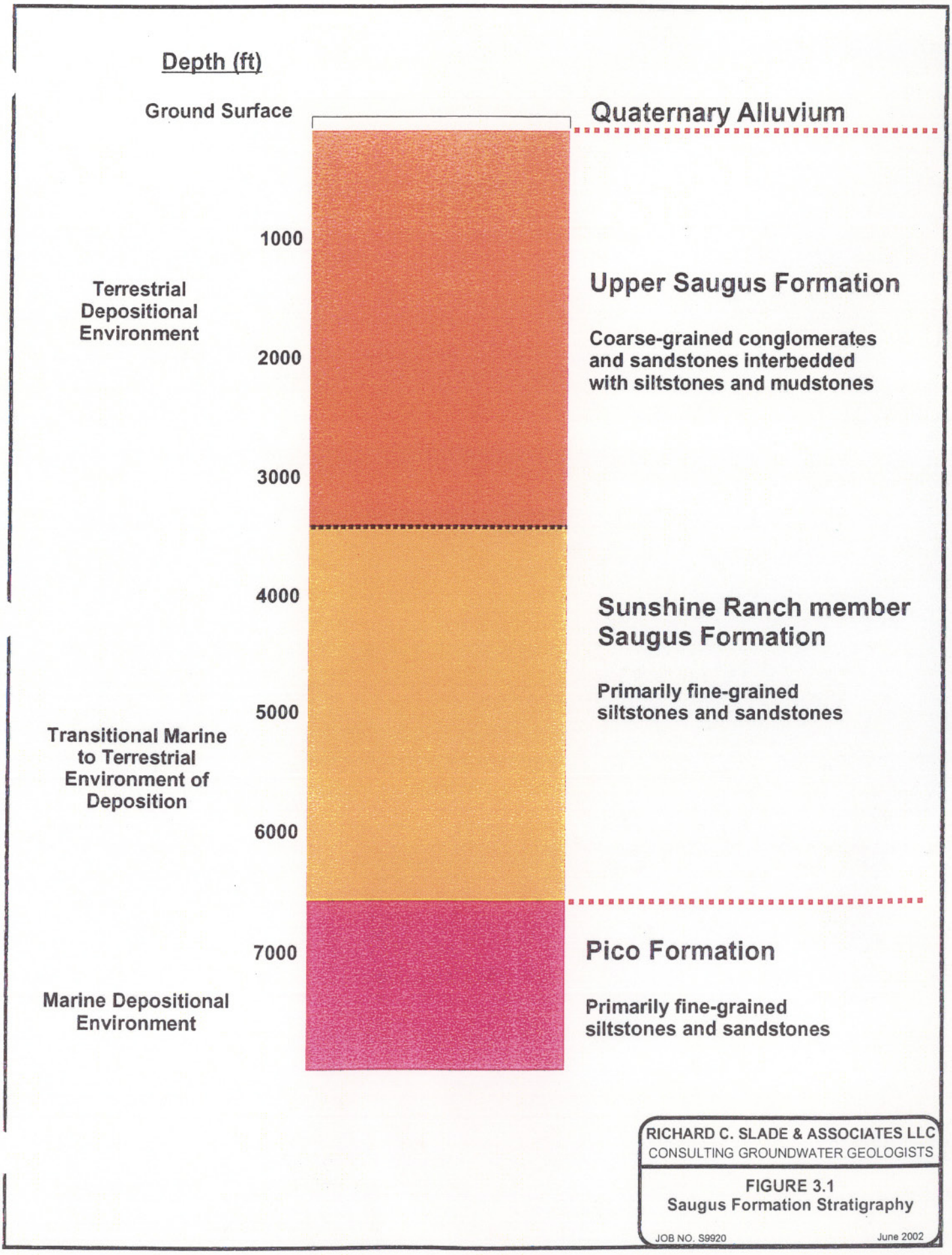

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FIGURE 3.1
Saugus Formation Stratigraphy

JOB NO. S9920 June 2002

Because of the marine origin and the fine-grained nature of the Sunshine Ranch Member, it is not considered to be a viable target for groundwater exploration or production for municipal-supply purposes. Wells drilled near the periphery of the surface exposures of the Saugus Formation, that is, where the Sunshine Ranch Member is at or very close to ground surface, have typically produced groundwater at rates too low for municipal-supply purposes. Evidence from e-logs also suggests that the groundwater in much of the Sunshine Ranch Member may be somewhat brackish in quality and, hence, not useful for municipal-supply purposes.

Stratigraphically above the Sunshine Ranch Member, the Saugus Formation becomes coarser-grained, consisting mainly of lenticular beds of light-gray and brown sandstone and conglomerate that are interbedded with lesser amounts of reddish-brown sandy mudstone. These terrestrial sediments were deposited in stream channels, floodplains and alluvial fans by one or more ancestral drainage systems in the Valley area. The coarser-grained sand and gravel beds of the Saugus Formation were deposited in the main channels of the ancient drainage systems, and these more permeable beds constitute the potential aquifers within the present-day Saugus Formation that will be discussed in this report. As the locations of the ancestral drainage channels changed during the approximately 3 million-year period of deposition of the Saugus strata, the distribution of the coarse-grained channel deposits also changed, both laterally and vertically (in space and time).

The coarse-grained potential sand and gravel aquifers of the Saugus Formation can be distinguished from the finer grained silt and clay layers (i.e., the aquicludes or aquitards) on the basis of their respective electric log signatures. From our analysis of these e-logs, it is evident that the coarse-grained channel deposits (the potential water-bearing strata) are thicker and more numerous in some areas of the Valley than in others. The general distribution of sand and gravel units in the upper portion of the Saugus Formation (between the depths of 300 ft and 2500 ft below ground surface or bgs) can be seen on Plate 3.2 – Thickness of Potential Sand and Gravel Aquifer Units. Details on how that map was constructed are provided in Section 5 of this report.

Although the Saugus Formation displays a considerable amount of lateral variability in lithology and grain size, some thicker stratigraphic packages can be correlated throughout large parts of the local groundwater sub-basin, as can be seen on Plate 3.3 – Geologic Cross-Section Z-Z'. These correlations were produced by identifying distinctive marker horizons during a detailed evaluation of e-logs from approximately 170 oil wells and water wells across the groundwater sub-basin. The locations of this new cross-section that is presented herein and of those presented in the Slade 1988 Report (not reproduced herein), are shown on Plate 5.1 in Section 5 of this report.

One of these key correlated stratigraphic units identified on Plate 3.3 is informally designated herein as the Santa Clarita Aquifer Zone. This unit is not present everywhere in the local groundwater sub-basin, and where it is present, it occurs at different depths below ground surface. Plate 3.4 – Map of Top of Santa Clarita Aquifer Zone – illustrates these variations in the depth to this key stratigraphic unit based on e-log correlations.

It is noteworthy that existing Saugus Formation wells, depending on location, produce groundwater from Saugus Formation strata that lie both above and below the Santa Clarita Aquifer Zone. However, there is a general trend for wells that are screened within or stratigraphically above the Santa Clarita Aquifer Zone to have higher groundwater production rates. Figure 3.2 – Type Electric Log and Santa Clarita Aquifer Zone, VWC 205M – shows a typical e-log (i.e. the "type e-log") for the Saugus Formation from VWC 205M, the 1956-foot deep Saugus Formation groundwater monitoring well that lies approximately 35 ft from VWC 205. Shown on this type e-log is the top of the Santa Clarita Aquifer Zone. Geologically, this Santa Clarita Aquifer Zone lies stratigraphically within the younger (upper) portion of the Saugus Formation in the region.

Non Water-Bearing Bedrock

The Saugus Formation, and in places the overlying Quaternary alluvium, overlie several older, non-water bearing formations in the region. Along the southern and western part of the study area, the Saugus Formation conformably and gradationally overlies the Pico Formation, an older unit of marine origin consisting of gray siltstone and fine-grained sandstone, and light-colored sandstone and conglomerate. The finer-grained portions of the

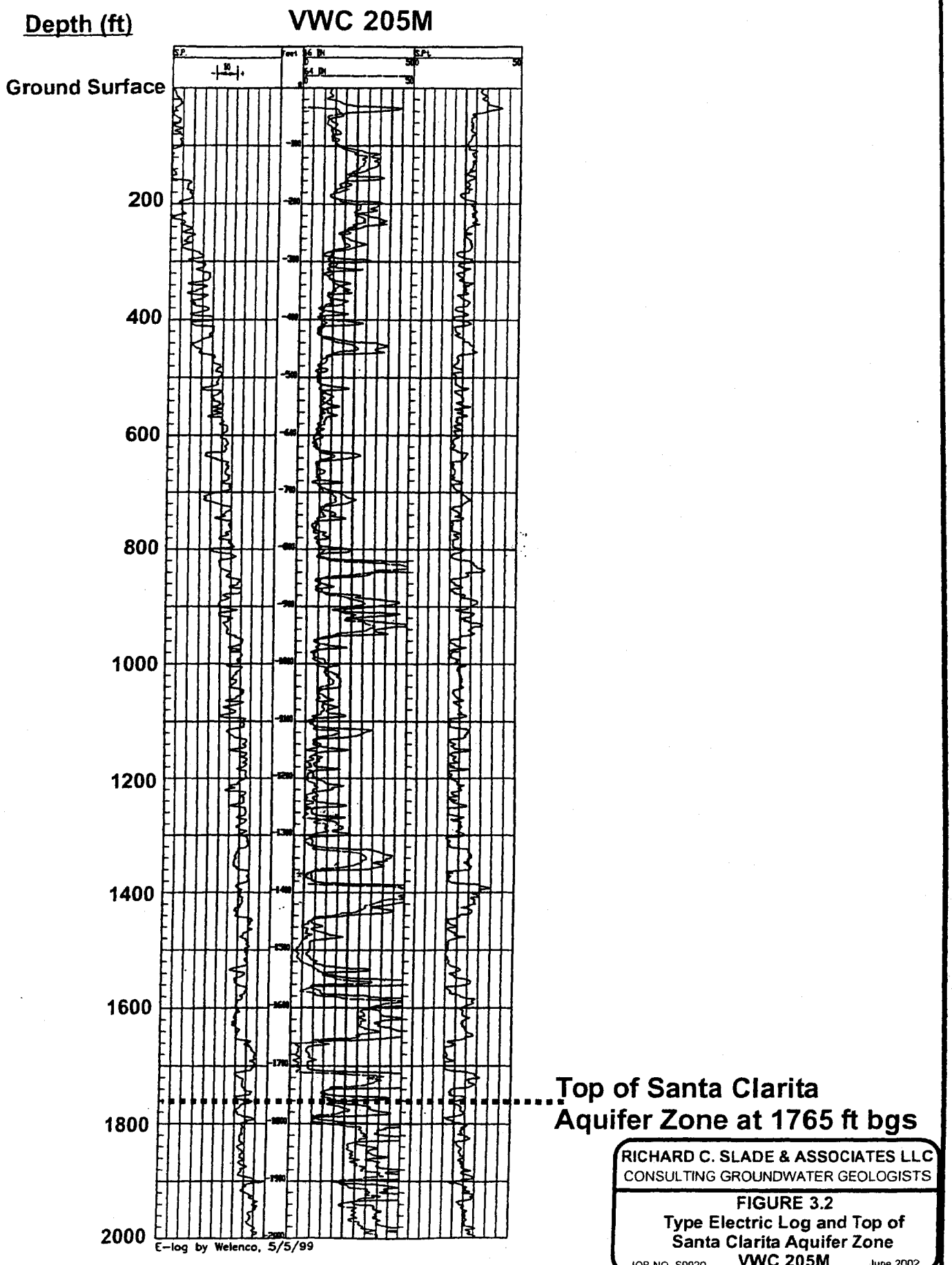

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FIGURE 3.2
Type Electric Log and Top of Santa Clarita Aquifer Zone
JOB NO. S9920 **VWC 205M** June 2002

Pico Formation predominate in the western part of the Valley, whereas in the eastern part, the formation consists mainly of sandstone and conglomerate (Winterer & Durham, 1962). Quaternary alluvium lies directly on Pico Formation rocks in the area west of the Saugus Formation boundary (refer to Plate 3.1).

In the extreme southeastern portion of its outcrop area, the Saugus Formation lies directly and unconformably on much older (pre-Tertiary geologic age) igneous and metamorphic rocks of the San Gabriel Mountains (refer to Plate 3.1). North of the San Gabriel fault, the Saugus Formation unconformably overlies Miocene-age terrestrial sediments of the Tick Canyon and Mint Canyon formations (refer to Plate 3.1). Quaternary alluvium also lies directly on Mint Canyon Formation rocks in the area east of the Saugus Formation boundary.

These older formations that underlie the water-bearing alluvium and Saugus Formation tend to be well-consolidated and cemented, with relatively low porosity and permeability. Wells and test holes drilled in these rocks have typically encountered low groundwater production rates and sometimes groundwater of relatively poor water quality. These older rocks, which essentially form the bedrock to the alluvium and Saugus Formation within the Valley, are not considered water-bearing in terms of their ability to supply groundwater in useable quantities and of acceptable quality for municipal-supply purposes.

Geologic Structure

The Quaternary alluvium is essentially undeformed by recent tectonic activity such as folding or faulting. To some extent, this is also true for the terrace deposits, although they have been tectonically uplifted and in some areas are slightly folded. One such fold has been mapped where the terrace deposits crop out in the hills east of San Fernando Road and the South Fork of the Santa Clara River.

The general structure of the underlying Saugus Formation is one of an isolated "bowl" that has been cut (at least in part) by two major faults and that has also folded along a number of east-west trending folds. The sedimentary layering in the Saugus Formation is inclined (dips) generally toward the center of the "bowl" from all locations along the outer (basal) contact of the Saugus Formation with the underlying formations.

The San Gabriel and Holser faults divide the outcrop area of the Saugus Formation into three structural blocks (refer to Plate 3.1). The San Gabriel fault is primarily a northeast-dipping reverse fault, with a small (less than 500 ft) component of right-lateral, post-Saugus Formation offset (Weber, 1982). The structural block north of the San Gabriel fault has been uplifted relative to the rest of the Valley, and consequently the Saugus Formation in this area is considerably thinner than elsewhere in the Valley. In addition, the Saugus Formation that remains north of the San Gabriel fault consists entirely of the lowermost Sunshine Ranch Member (see Figure 3.1). All overlying, younger and coarser-grained portions of the Saugus Formation have been removed by erosion in this area north of the San Gabriel fault.

The Holser fault is also primarily a reverse fault and the structural block south of this fault has also been uplifted relative to the rest of the Valley; this fault is considered to dip towards the southwest. However, the amount of uplift is considerably less than in the area north of the San Gabriel fault, and a substantial thickness of upper Saugus Formation sediments remains in the southern structural block (south of the Holser fault).

Work by Stitt and Yeats (1983) has cast some doubt on whether a portion of the Holser fault actually extends east of I-5 underneath the blanket of Quaternary alluvium, and whether or not the short fault strand which splays off of the San Gabriel fault in the hills just east of San Fernando Road is part of the Holser fault. Although our in-house e-log correlations do show some apparent offset of strata across the presumed subsurface trace of this fault, the offset could also be explained by dipping beds. In any case, the Holser fault does not appear to have a significant effect on groundwater availability or movement within the Saugus Formation.

The thickest part of the Saugus Formation occurs in the central structural block, bounded by the San Gabriel fault on its north side, and the Holser fault on its south side. This central block has not been uplifted and hence the upper, coarser-grained portions of the Saugus Formation rocks have been largely protected from erosion in this central block area.

SECTION 4

HYDROGEOLOGIC CONDITIONS IN THE ALLUVIAL AQUIFER SYSTEM

Water Wells

Available records reveal that several hundred water wells have been historically drilled in the Valley for domestic, agricultural, industrial, or municipal usage. Nearly all of these wells have been drilled within the areas of alluvial deposits along the Santa Clarita River and its tributaries. Most of these wells are less than 200 ft in depth and likely extract groundwater primarily from the alluvial sediments (Slade 1988 Report).

This section focuses on the relatively high-production municipal- and agricultural- supply alluvial wells in the Valley (refer to Plate 4.1 – Map of Alluvial Well Locations; and Table 4.1 – Construction Data for Existing Alluvial Wells). Municipal-supply wells extracting groundwater from the alluvial sediments in the Valley are owned and operated by: VWC (16 active wells); NCWD (7 active wells); and SCWC (12 active wells). In addition, the Los Angeles County Sheriffs Department has a number of alluvial wells in the Castaic Creek area that supply groundwater to the detention facilities within the WHR complex. However, only three of these wells are reportedly in active use. Further, NLF reportedly has approximately 24 currently active irrigation-supply alluvial wells, most of which are located in the western end of the Valley (west of I-5). Finally, CLWA owns an alluvial well (known as the Park well) near its headquarter facilities and operates it for irrigation-supply purposes (see Plate 4.1); construction data are not available for this well.

New Wells

Between the publication of the Slade 1986 Report and 2000, more recent information reveals that 13 additional municipal- and agricultural-supply alluvial water wells have been constructed in the Valley by the water purveyors and by the WHR (refer to Plate 4.1 for locations). These new wells include: 2 wells constructed for SCWC (Lost Canyon 2A in 1989 and the Mitchell 5B in 2001); 5 wells constructed for VWC in 1990 (W9) and in 1999-2001 (S6, S7, S8, W10); and 6 wells constructed for WHR in the late-1980s (Nos. 1, 2, 3 and 4)

Table 4.1
Construction Data for Existing Alluvial Wells

Agency	Owner Well No	State Well No	Year Drilled	Drilling Method	Status 2001	Aquifer	Elevation (ft asl)	Total Depth (ft)	Perforated intervals (ft bgs)	Perforation Type	Sanitary Seal (ft bgs)	Pump Setting (ft bgs)
Newhall County Water District	Castaic 1	05N/17W-25G06	1966	Unknown	Active	Alluvial	1133	310	110-297	Unknown	20	110
	Castaic 2	05N/17W-25B02	1951	Unknown	Active	Alluvial	1139	120	80-	Unknown	Unknown	100
	Castaic 3	05N/17W-25B04	1961	Unknown	Active	Alluvial	1140	135	55-136	Unknown	Unknown	100
	Castaic 4	05N/17W-25G07	1986	Unknown	Active	Alluvial	1132	203	59.5-	Unknown	50	160
	Pinetree 1	04N/15W-13Q03	1966	Unknown	Active	Alluvial	1604	235	50-210	Unknown	20	160
	Pinetree 2	04N/15W-24E03	1952	Unknown	Inactive	Alluvial	1580	132	50-130	Unknown	8	Unknown
	Pinetree 3	04N/15W-23H01	1969	Unknown	Active	Alluvial	1576	146	50-135	Unknown	50	135
	Pinetree 4	04N/15W-23G01	1975	Unknown	Active	Alluvial	1568	185	110-185	Unknown	50	165
Santa Clarita Water Company	Clark	04N/16W-12N02	1946	Unknown	Active	Alluvial	1264	160	20-120	Knife Cut	Unknown	110
	Guida	04N/15W-06P01	1960	Rotary	Active	Alluvial	1353	116	56-150	factory	Unknown	110
	Honby	04N/15W-18N03	1959	Rotary	Active	Alluvial	1286	226	50-202	factory	30	130
	Lost Canyon 2	04N/15W-23F06	1965	Rotary	Active	Alluvial	1539	310	95-125	factory	30	295
	Lost Canyon 2A	04N/15W-23F07	1989	Rotary	Active	Alluvial	1533	155	95-125	Wire wrap	60	125
	Methodist	04N/16W-14E03	1973	Unknown	Inactive	Alluvial	1180	160	60-160	125 mesh	60	110
	Mitchell 5A	04N/15W-22J01	1976	Rotary	Active	Alluvial	1502	262	76-246	125 mesh	76	162
	N.Oaks Central	04N/15W-21N01	1965	Unknown	Active	Alluvial	1409	244	50-244	Knife Cut	Unknown	140
	N.Oaks East	04N/15W-21N03	1940	Unknown	Active	Alluvial	1407	132	81-150	Knife Cut	Unknown	130
	N.Oaks West	04N/15W-21N02	1940	Unknown	Active	Alluvial	1398	136	80-118	Knife Cut	Unknown	110
	Sand Canyon	04N/15W-23C05	1973	Rotary	Active	Alluvial	1525	127	60-140	factory	60	112
	Sierra	04N/15W-21K01	1973	Rotary	Active	Alluvial	1432	175	60-175	factory	60	128
	Stadium	04N/16W-23F01	1946	Unknown	Active	Alluvial	1207	130	33-130	Knife Cut	Unknown	130
Valencia Water Company	D	04N/17W-12C01S	1950	Unknown	Active	Alluvial	1027	142	60-136	Knife Cut	50	100
	I	04N/16W-17A05S	1945	Unknown	Inactive	Alluvial	1090	172	55-172	Unknown	55	120
	K2	04N/16W-22C01S	1945	Unknown	Active	Alluvial	1128	242	60-220	Knife Cut	50	63
	L2	04N/16W-22C07S	1941	Unknown	Active	Alluvial	1130	182	60-149	Knife Cut	50	120
	N	04N/16W-22D02S	1936	Unknown	Active	Alluvial	1128	247	80-237	Knife Cut	50	140
	N3	04N/16W-22C03S	1941	Unknown	Active	Alluvial	1137	173	60-170	Unknown	50	110
	N4	04N/16W-22C04S	1941	Unknown	Active	Alluvial	1132	186	60-172	Unknown	50	120
	Q2	04N/16W-15R02S	1954	Unknown	Active	Alluvial	1170	170	86-136	Unknown	Unknown	100
	S6	04N/16W-16Q04S	1999	Mud Rotary	Active	Alluvial	1124	220	130-150, 160-195	Louvers	60	
	S7	04N/16W-15N01S	1999	Mud Rotary	Active	Alluvial	1120	210	130-150, 160-190	Louvers	60	
	S8	04N/16W-15P01S	1999	Mud Rotary	Active	Alluvial	1131	220	130-150, 160-195	Louvers	60	
	T2	04N/16W-23A01S	1952	Unknown	Active	Alluvial	1205	150	50-138	Knife Cut	Unknown	100
	T4	04N/16W-23A02S	1953	Unknown	Active	Alluvial	1199	138	60-132	Knife Cut	50	100
	U3	04N/16W-24A06S	1950	Unknown	Active	Alluvial	1260	142	46-140	Unknown	Unknown	100
	U4	04N/16W-24B02S	1944	Unknown	Active	Alluvial	1264	135	60-130	Knife Cut	53	100
	W10	04N/16W-16B01S	1999	Rotary	Inactive	Alluvial	1118	190	120-160	Louvers	99	
	W6	04N/16W-09H02S	1953	Unknown	Active	Alluvial	1155	158	60-129	Knife Cut	50	100
	W9	04N/16W-09Q03S	1990	Rotary	Active	Alluvial	1170	160	70-130	Wire Wrap	42	140
Wayside Honor Ranch	1	05N/17W-36G01	1936	Unknown	Inactive	Alluvial	1126	165	30-116	Knife Cut	Unknown	Unknown
	1A	Unknown	Unknown	Unknown	Abandoned	Alluvial	1101	Unknown	Unknown	Unknown	Unknown	Unknown
	2	05N/17W-36K03	Unknown	Unknown	Inactive	Alluvial	1125	38	Unknown	Unknown	Unknown	Unknown
	3	05N/17W-36H01	1924	Unknown	Inactive	Alluvial	1120	114	40-114	Open Hole	Unknown	Unknown
	4	05N/17W-36H02	1928	Unknown	Inactive	Alluvial	1114	98	Unknown	Unknown	Unknown	Unknown
	5	05N/17W-36H04	1944	Cable Tool	Inactive	Alluvial	1094	110	30-104	Knife Cut	Unknown	Unknown
	8	04N/17W-12B04	1964	Cable Tool	Inactive	Alluvial	1035	151	50-113	Knife Cut	Unknown	Unknown
	10	05N/17W-36J01	1948	Unknown	Active	Alluvial	1092	110	27-39	Knife Cut	Unknown	Unknown
	11	Unknown	1999	Unknown	Inactive	Alluvial	1055	Unknown	Unknown	Unknown	Unknown	Unknown
	15	04N/17W-36H05	1953	Unknown	Active	Alluvial	1040	126	42-124	Knife Cut	Unknown	Unknown
	16	04N/17W-12B02	1954	Unknown	Inactive	Alluvial	1040	144	45-120	Knife Cut	Unknown	Unknown
	17	05N/17W-36H	1955	Cable Tool	Active	Alluvial	1088	110	35-110	Knife Cut	Unknown	Unknown
	18	Unknown	1999	Unknown	Inactive	Alluvial	1068	Unknown	Unknown	Unknown	Unknown	Unknown
Valencia Water Company	Alluvial Monitoring Well	Unknown	2000	Dual-Tube Rotary	Active	Alluvial	1149	190	90-180	Factory PVC	none	N/A

and in 1999 (New No. 11 and New No. 18). Construction data are available for the new SCWC and VWC wells; similar information for the WHR wells was not available for this study.

Destroyed Wells

A number of older municipal- and agricultural-supply alluvial water wells have been destroyed between 1987 and 2000 (refer to Table 4.2 – Destroyed Alluvial Wells). These include NLF Wells E3, E7, Q, R, R2, S, S2, S3, and T. Each of these wells was reportedly destroyed in accordance with the regulations of the Los Angeles County Department of Health Services to minimize the possibility of surface contaminants migrating into the alluvial aquifer via the well bore. Two WHR Wells (Old Nos. 11 and 18) were also destroyed relatively recently, but no details on these well destructions were available for this study.

Private Wells

With a few exceptions, discussion of privately-owned water wells that are used for local domestic supply lies outside the scope of this study; the locations for these wells are not shown on any plates for this report. Although such private wells may be numerous, most of them are considered to be small, low-capacity wells, and the total annual groundwater extraction by these domestic-supply wells is considered to account for only about 1% of the alluvial groundwater production in the Valley.

The Robinson Ranch well is a new privately-owned alluvial-supply well reportedly constructed along the Santa Clara River to provide irrigation water to two new golf course developments in the hillsides south of the general area of NCWD's Pinetree wells in the easternmost part of the alluvium. No details on its construction were available for this study. Plate 4.1 illustrates the approximate location of this well.

Groundwater Occurrence, Recharge and Discharge

Within the saturated zone of the unconsolidated alluvial sediments, groundwater is present in the pore spaces between individual sedimentary grains. These alluvial sediments were deposited primarily by flowing streams and rivers that precluded the formation of areally extensive beds or layers of fine-grained silts and clays. Because of this, groundwater in the

Table 4.2
Destroyed Alluvial Water Wells

Agency	Owner Well No.	Year Destroyed
Wayside Honor Rancho	11-Old	Unknown
	18-Old	Unknown
Valencia Water Company	E3	1997
	E7	1997
	Q	1990-1991
	R	1987-1989
	R2	1991-1992
	S	1999
	S2	2000
	S3	1999
	T	2000

alluvium is considered to occur under unconfined (water table), conditions, although some localized zones of perched water may locally exist in certain tributary canyons or along the main reach of the Santa Clara River.

Recharge

Groundwater in the alluvial aquifer system is recharged from both natural and artificial (man-made) sources. Sources of natural recharge include deep percolation of precipitation that falls directly on the alluvial deposits, subsurface groundwater inflow from upstream areas along the Santa Clara River or its tributaries, upward groundwater flow from certain portions of the Saugus Formation where it is overlain by alluvium, and direct infiltration from surface water runoff along the Santa Clara River and its tributaries.

CH2M Hill recently examined recharge and discharge to the alluvial aquifer system as part of an ASR study (Newhall Ranch ASR Impact Evaluation, 2001). That study found that recharge to and discharge from the alluvium does not occur evenly across the area, but is focused in particular areas. Specifically, their work shows that the largest source of recharge to the alluvium is likely upward flow of groundwater from the underlying Saugus Formation, with this recharge occurring primarily in the downstream portion of the alluvium located generally west of I-5. The CH2M Hill work also indicates that deep percolation of groundwater from the alluvium occurs downward into the Saugus Formation in the upstream portions of the alluvium located in the central and eastern portions of the Valley.

Recharge to the alluvial aquifer system via infiltration of surface water runoff from the Santa Clara River will occur whenever and wherever groundwater levels in the aquifer are below the surface elevation of the river runoff. Using historic data on alluvial water levels, as well as data from several stream flow gages along the Santa Clara River and its tributaries, CH2M Hill determined that the alluvial aquifer system is being recharged from the Santa Clara River in the area upstream from the confluence with the South Fork of the Santa Clara River (CH2M Hill, 2001). In this area, the Santa Clara River is ephemeral, that is, it flows only in the hours or days immediately following significant winter rainfall events. Recharge will occur only while the river is actually flowing, and the amount of recharge will depend

largely on the duration of each surface flow event, and, in some parts of the aquifer, on water levels within the alluvial aquifer.

The amount of recharge obtained by the alluvial aquifer from the direct percolation of precipitation will vary each year depending on such conditions as the amount and timing of rainfall, local soil type, and land use characteristics. Finally, natural recharge by inflow from upstream areas will depend on the cross-sectional area of the saturated alluvium at the upstream end of the study area, on the hydraulic conductivity of the alluvial materials, and on the gradient of the alluvial water table.

Recharge from deep percolation of irrigation water is obtained primarily from urban irrigation (landscape irrigation) in the developed areas of the Valley. Agricultural irrigation was previously more widespread in the Valley, but is now confined mainly to approximately 700 acres of cultivated land in the area west of I-5. Recharge also occurs indirectly as a result of the infiltration of reclaimed water that is actively being released to the Santa Clara River from the two WRPs in the area.

While artificial recharge of the alluvium via spreading basins or other means was discussed in the Slade 1986 Report, there are currently no artificial recharge facilities operating within the study area.

Discharge

Except for groundwater outflow directly from the alluvium down into the underlying Saugus Formation or upward to the Santa Clara River, discharge from the alluvial aquifer system occurs primarily through pumping extraction for municipal-supply use by the water purveyors, and for agricultural-supply use by NLF. Historic annual extractions by these organizations have varied between 20,000 and 43,000 AF/yr during the period for which data are available (1947 to the present).

Evapotranspiration by phreatophyte vegetation is also an important component of the discharge of groundwater from the alluvium. Phreatophytes are plants such as willows and cottonwoods that root directly into the water table in areas of shallow groundwater. CH2M Hill (2001) estimated that as much as 8 to 12% of the total groundwater discharge from the

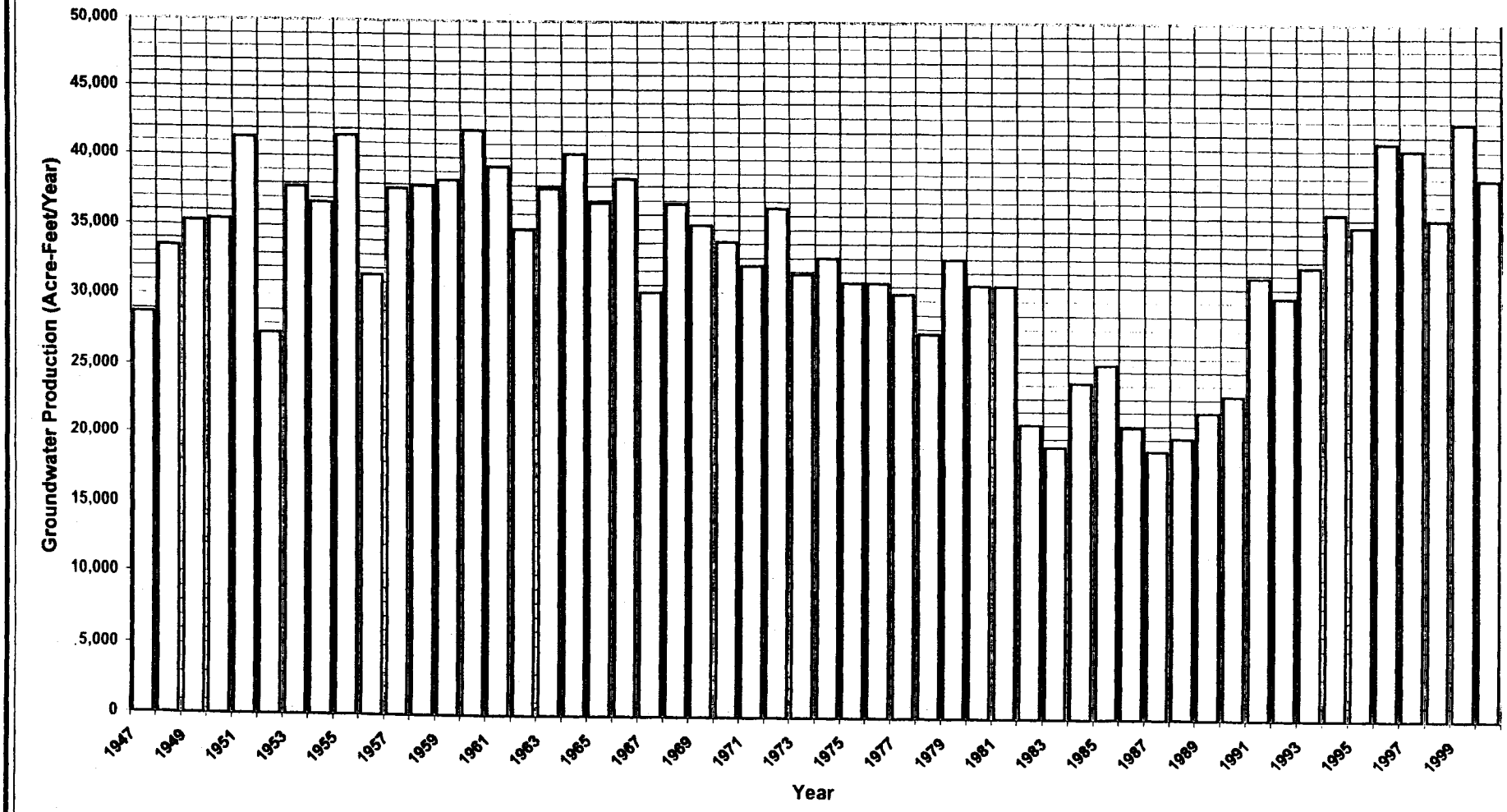
alluvium occurs in this way, primarily in those alluvial areas west of I-5 where depths to groundwater are relatively shallow.

This westernmost part of the local groundwater sub-basin is also an area of groundwater discharge from the alluvium to the Santa Clara River. The amount of upward flow into the river will depend largely on water levels within the alluvium. Groundwater also flows out of the Valley into Ventura County, but this occurs solely as subsurface flow within the alluvium at the downstream end of the study area (the Los Angeles/Ventura County Line). The only other water to flow from the Valley into Ventura County is via direct surface water runoff in the Santa Clara River at County line.

Groundwater Extractions

Groundwater production from the alluvial aquifer system is used primarily for municipal-supply and agricultural-supply purposes. Because of the large number of alluvial wells that have existed since the 1950s, and the difficulty in obtaining groundwater production data for these wells, the groundwater production values discussed in this section can only be viewed as reasonable estimates, particularly for the period prior to 1985.

Figure 4.1 - Historic Alluvial Groundwater Production – illustrates, as a bar chart, the historic trends in alluvial groundwater production since the mid-1940s, the earliest date for which any production records are available. Since that time, total alluvial groundwater production has ranged from a low of approximately 20,000 AF/yr in 1983, to a high of at least 44,000 AF/yr in 1955. For the ten-year period from 1991 to 2000, the average annual alluvial groundwater production by the major producers was approximately 35,000 AF/yr. The historically largest groundwater periods of production from the alluvium occurred between 1951 and 1960, and between 1991 and 2000 (both 10-year periods), during which time the average extractions were approximately 37,000 AF/yr and 35,000 AF/yr respectively. Between those two periods, the region has experienced a dramatic land use change from mainly agricultural to mainly urban and suburban land use. Table 4.3 – Alluvial Groundwater Production 1986 – 2000 – provides a tabulation of groundwater production by each major producer for the period 1986 through 2000.



RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

FIGURE 4.1
Annual Groundwater Production
Alluvial Aquifer

JOB NO. S9920 June 2002

Table 4.3

Alluvial Groundwater Production 1986-2000

Agency	Owner Well No	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Newhall County Water District	Pinetree 1	9	0	3	153	0	47	15	248	154	88	89	89	227	404	245
	Pinetree 2	229	320	356	350	31	0	252	327	218	182	97	0	0	0	0
	Pinetree 3	801	782	768	676	790	723	607	451	608	656	866	812	716	505	494
	Pinetree 4	261	80	5	1	0	0	9	19	231	60	460	510	337	5	355
	Castaic 1	328	465	527	481	437	561	458	459	496	442	534	535	166	427	118
	Castaic 2	423	553	328	682	0	0	0	478	518	419	453	268	257	332	289
	Castaic 3	0	0	328	0	651	531	435	0	0	0	0	0	0	0	0
	Castaic 4	0	0	0	39	0	0	0	0	0	0	0	95	57	6	7
	NCWD Total	*2051*	*2200*	*2315*	*2382*	*1909*	*1862*	*1776*	*1982*	*2225*	*1847*	*2499*	*2309*	*1760*	*1679*	*1508*
Agency	**Owner Well No**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Newhall Land & Farming Company	*NLF Total*	*8071*	*6364*	*5804*	*6490*	*8387*	*8045*	*8939*	*8022*	*10641*	*11182*	*12133*	*12855*	*10272*	*13824*	*11858*
Agency	**Owner Well No**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Santa Clarita Water Company	Clark	205	337	248	301	407	542	662	635	572	662	1027	873	697	878	747
	Guida	217	561	158	530	676	801	978	895	942	744	1252	1479	1274	1556	853
	Honby	190	386	462	216	930	893	731	1393	476	553	352	814	532	1162	815
	Lost Canyon 2	753	910	787	588	601	404	465	692	669	773	678	792	757	946	708
	Lost Canyon 2A	0	0	0	0	293	832	1284	1080	1383	1230	1370	1055	973	890	998
	Methodist	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mitchell	437	573	485	435	264	3	474	663	564	610	598	633	482	913	439
	N.Oaks Central	299	356	153	329	525	704	701	1403	1313	965	851	870	1490	1682	1145
	N.Oaks East	849	959	774	914	454	194	588	1233	1473	1295	900	1033	1407	695	1483
	N.Oaks West	860	459	842	413	275	78	634	866	972	795	663	952	934	1894	1663
	Sand Canyon	507	460	498	1115	458	49	661	918	781	842	1211	1533	1622	1629	1317
	Sierra	842	217	459	730	772	719	1050	1413	1433	1092	1034	597	814	1158	640
	Stadium	164	287	211	214	328	374	60	825	418	656	509	637	444	338	721
	SCWC Total	*5323*	*5505*	*5077*	*5785*	*5983*	*5593*	*8288*	*12016*	*10996*	*10217*	*10445*	*11268*	*11426*	*13741*	*11529*
Agency	**Owner Well No**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Valencia Water Company	D	0	316	606	581	494	661	239	173	491	403	454	1134	1209	921	880
	I	100	0	94	125	71	105	1	0	1	0	0	0	0	0	0
	K2	0	0	0	0	0	953	1134	1708	2078	1154	1305	1076	1489	1420	861
	L2	0	0	0	0	0	814	524	996	1231	818	961	307	187	531	493
	N	1551	1463	1519	1114	768	948	697	66	0	24	263	808	768	1036	935
	N3	0	0	0	0	0	10	999	1536	29	942	1325	1034	1093	1057	778
	N4	0	0	0	0	0	823	248	133	906	1328	1328	1185	772	894	710
	Q2	882	920	528	1404	1355	1732	335	548	1341	1125	1385	1462	1655	1288	1387
	T2	942	941	1039	975	623	643	379		3	280	733	837	941	726	984
	T4	176	0	0	0	0	158	687	3	1	974	1258	804	523	892	625
	U3	1088	657	333	779	1215	1165	369	1	2	764	987	851	560	702	1126
	U4	704	624	718	537	534	567	42	3	2	7	742	789	529	828	1073
	W6	0	150	150	0	0	211	260	204	223	365	615	493	355	416	445
	W9	0	0	0	0	11	876	699	444	504	508	1077	915	627	1111	1176
	S6															515
	S7															111
	S8															79
	W10														0	0
	VWC Total	*5443*	*5071*	*4987*	*5515*	*5071*	*9666*	*6613*	*5815*	*6812*	*8692*	*12433*	*11695*	*10708*	*11822*	*12178*
Agency	**Owner Well No**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Wayside Honor Rancho	1															
	1A															
	2															
	3															
	4															
	5															
	8															
	10	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130
	11															
	11 - Old															
	15	84	84	84	84	84	84	84	84	84	84	84	84	84	84	84
	16															
	17	626	626	626	626	626	626	626	626	626	626	626	626	626	626	626
	18															
	18 - Old															
	WHR Total	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*	*1840*
		1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Annual Total for Major Producers Listed		22,728	20,980	20,023	22,012	23,190	27,006	27,456	29,675	32,514	33,778	39,350	39,967	36,006	42,906	38,913

Note: Production figures from Wayside Honor Ranch are estimates based on total prison estimate populations.
All of the data is supplied by purveyors. Figures do not include domestic or other small-scale extractions.

Groundwater production from the alluvial aquifer system is distributed along the main reach of the Santa Clara River, in the Castaic Creek drainage, and in several of the tributary canyons. Thirteen municipal-supply water wells in the alluvial aquifer system each produced in excess of 1000 AF in 2000 as shown on Table 4.3.

Between 1986 and 2000, NCWD accounted for between 4% and 12% of the total annual alluvial groundwater production; VWC produced between 18% and 31% of the total annual production; SCWC extracted between 26% and 46% of the total annual production; NLF pumped between 25% and 35% of the total annual production; and WHR reportedly accounted for between 8% and 9% of the annual production in this period from the alluvium.

Annual production from the privately-owned, domestic-supply alluvial wells is not known, but is unlikely to have exceeded a total of 100 to 200 AF/yr for all privately-owned, domestic-supply alluvial wells in the region. This represents only about 1% of the average annual groundwater production since 1986 from the alluvium. Beginning in 2000, a new privately-owned golf course irrigation well along the Santa Clara River east of Sand Canyon became active. Although metered pumpage figures are not available for this new well, it is estimated that this well might extract on the order of 350 AF/yr for each of the two onsite 18-hole golf courses that it irrigates.

To illustrate the spatial variability in recent alluvial groundwater extractions within the Valley, we have prepared Plate 4.2 – Map of Alluvial Groundwater Extractions for 2000. Data for Plate 4.2 were derived from the information tabulated for the year 2000 on Table 4.3 for each active municipal-supply well. Annual groundwater extractions for each well on Plate 4.2 are illustrated via a circle centered on the respective well. The larger the diameter of the circle, the greater is the extraction for the particular well in 2000. The map scale used to illustrate the diameter of the circle which represents the year 2000 annual production is: 1 inch equals approximately 667 AF (or, ¾" = 500 AF). It must be noted that the circles (specifically, the diameter of the circles) graphed on Plate 4.2 are drawn to solely represent the relative annual production volume (in AF) for each respective well. The diameter of the circle surrounding each well does not represent and should not be construed or interpreted to signify the area of pumping influence (the extent of the drawdown cone) of the particular well.

For 2000, the largest municipal-supply alluvial extractions occurred along the main reach of the Santa Clara River, by SCWC (in areas east of Bouquet Junction) and by VWC (near and just west of Bouquet Junction); WHR extractions were the largest in Castaic Creek, north of its confluence with the Santa Clara River. There are no municipal-supply wells within the alluvium in the South Fork area of the Santa Clara River or along the main reach of the river valley west of I-5.

Current Groundwater Levels and Flow Directions

Groundwater levels and flow directions within the alluvial aquifer system were determined by creating contour lines of equal groundwater elevation (in ft above sea level, asl) for the available data from wells within the alluvial sediments in the study area. The data used to create these contour lines consisted of measurements, in numerous individual alluvial wells, of the depth to the static (non-pumping) water level. These depths were converted to elevations by subtracting the depth from the reported ground surface elevation at each wellhead. Groundwater flow directions were then determined by recognizing that groundwater flows from high head to low head; hence, the general direction of groundwater flow within the alluvial sediments is interpreted to be perpendicular to the equal elevation contour lines for the date depicted.

Plate 4.3 – Map of Alluvial Groundwater Elevation Contours, Spring 2000 – illustrates the groundwater elevations and interpreted flow directions for the spring (March to May) of 2000, a recent period for which widespread water level data are available. Water level data from approximately 100 different wells throughout the Valley were used to create the elevation contours, with data being obtained from the municipal water purveyors, agricultural well owners, the LACFCD database, and reports on water levels in piezometer wells provided by Seward Engineering Ltd (SE).

As illustrated by the broad arrows on Plate 4.3, groundwater flow directions within the alluvial aquifer system generally mimic surface water flow directions and the land surface gradient, with groundwater moving from east to west along the main reach of the Santa Clara River, and from highland areas towards the main river valley within the alluvium in the tributary canyons along each side of the valley floor. In the main river valley, groundwater elevations

decline from a high of approximately 1700 ft above sea level (asl) in the eastern end of the study area, to a low of about 820 ft near the Los Angeles-Ventura County Line in the west (see Plate 4.3). This equates to a decline of approximately 880 ft over a distance (paralleling the Santa Clara River) of 22 miles, and calculates to an overall down-valley gradient of approximately 40 feet per mile (ft/mi).

The gradient is steeper in the eastern portion of the main Valley east of Bouquet Canyon, where the water level drops 325 ft in 5.6 miles; this represents a gradient of roughly 58 ft/mile. This compares with a gradient of 50 ft/mi for the same area calculated from 1985 water levels (Slade 1986 Report).

In the western part of the alluvium between Bouquet Canyon and the County Line, the groundwater elevation drops 555 ft over 16.3 miles, representing a gradient of roughly 34 ft/mi. This compares with a gradient of 31 ft/mi calculated from 1985 water levels (Slade 1986 Report).

Groundwater gradients are much steeper in the major tributary canyons for which sufficient data exist, with measured spring 2000 gradients of approximately 90 ft/mi in Mint Canyon, 56 ft/mi in Bouquet Canyon, 42 ft/mi in San Francisquito Canyon, and 31 ft/mi along Castaic Creek. The well monitored by LACFCD in the baseball park along Bouquet Canyon appears to be the Park well owned by CLWA; its LACFCD well number is likely 7086B (see Plate 4.2).

An interesting feature on Plate 4.3 is the very low groundwater gradient within the alluvium along the South Fork of the Santa Clara River, a feature that was also seen on previously prepared groundwater elevation maps of the alluvium (Slade 1986 Report). The average gradient along the South Fork for Spring 2000 data is only on the order of 13 ft/mi, although a detailed delineation of gradients in this area is made difficult by the virtual absence of requisite data from alluvial wells in this area. However, it does not appear that any "up-valley" or reversed groundwater flow is occurring southward into this South Fork area.

There is no evidence from the available data that either the San Gabriel or the Holser faults acts as a barrier to groundwater flow within the alluvial deposits of the Santa Clara River or its tributaries.

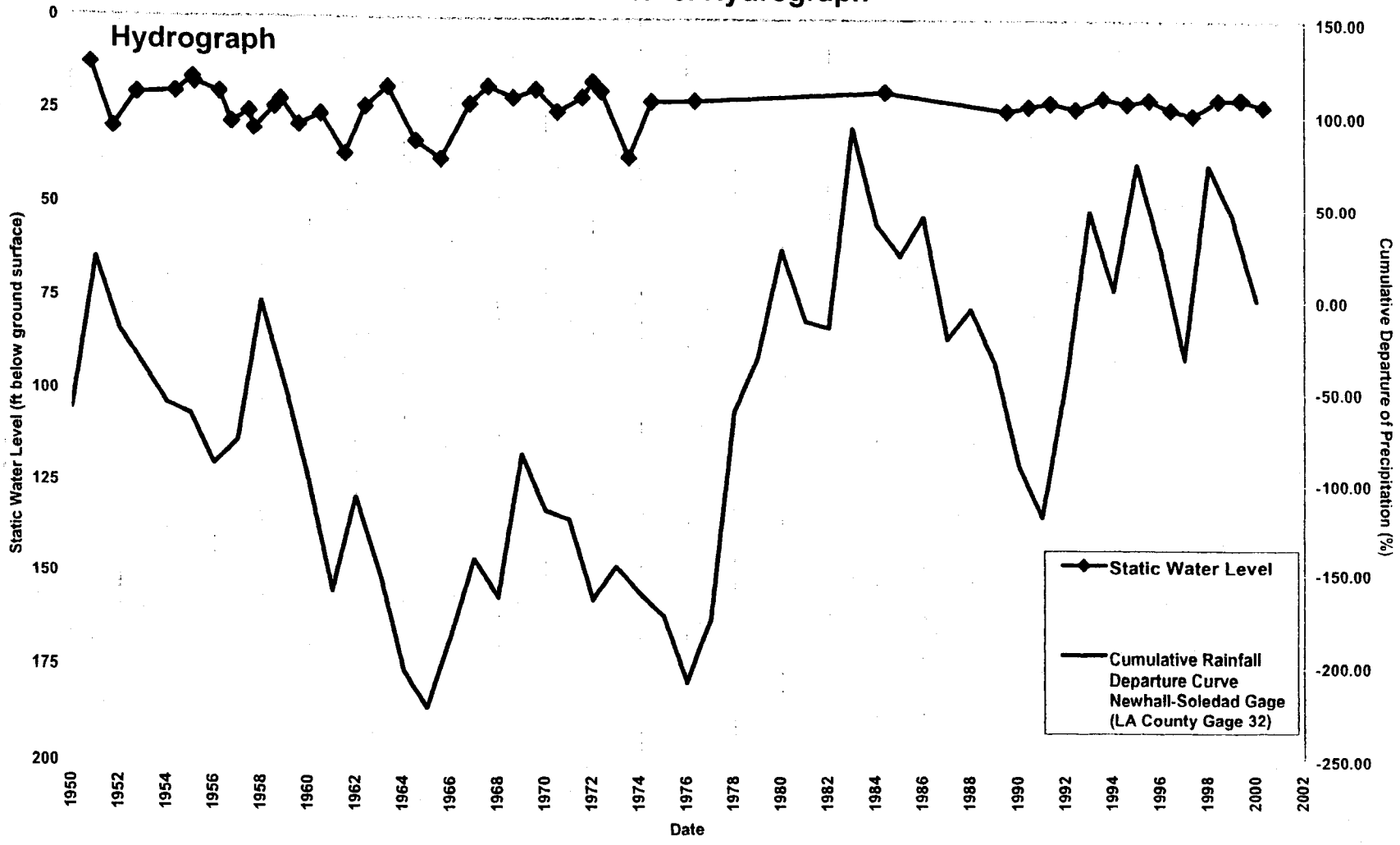
Hydrographs

For the purpose of examining long-term water level trends within the alluvial aquifer, the Valley can be divided up into three areas: the western area, between the Los Angeles/Ventura County line and I-5; the central area, between I-5 and the mouth of Bouquet Canyon; and the eastern area, from Bouquet Canyon east to NCWD Pinetree Well No. 1, which is the easternmost municipal-supply well in the alluvial aquifer system. Long-term water level trends in selected alluvial wells are presented in the form of hydrographs which are graphs of the static water levels (i.e., the non-pumping water levels) in the well versus time; also provided on each hydrograph is a portion of the cumulative departure curve for rainfall (for the period 1950 to 2000) as adapted from Figure 2.1.

The hydrograph for NLF Well C8 (Figure 4.2 – Hydrograph of NLF Well C8: see well location on Plate 4.3 – Map of Alluvial Well Hydrographs) provides a useful, long-term record of water levels in this western part of the alluvial aquifer system (i.e., in the alluvium west of I-5). Water levels in this area have remained remarkably constant over time as evidenced by data for this well, ranging from a high of approximately 13 ft bgs, to a low of 37 ft bgs over a period of data record of approximately 50 years. This lack of marked water level fluctuation in this well is likely due to the well being located in an area where groundwater from the Saugus Formation is considered to be flowing upward into the overlying alluvium, thereby providing a fairly consistent source of recharge that is relatively independent of annual rainfall trends. There has also been somewhat less year-to-year variability in water levels in this well over the past twenty years, when compared to the variability seen in the same record from the 1950s through the 1970s. This may in part be due to the increased additional recharge to the alluvium provided by increasing outflows from the two WRPs located upgradient from this well. Total WRP discharges were approximately 19,000 AF in 2000.

In the central portion of the alluvium, in the area near the confluence of the South Fork with the main reach of the Santa Clara River, the hydrograph for VWC Well Q2 (Figure 4.3 – Hydrograph of VWC Well Q2: see also Plate 4.3 for well location) shows the typical water level response in this area over time. During the 1950s and 1960s, a time of high alluvial

Figure 4.2
NLF Well C8
Water Level Hydrograph



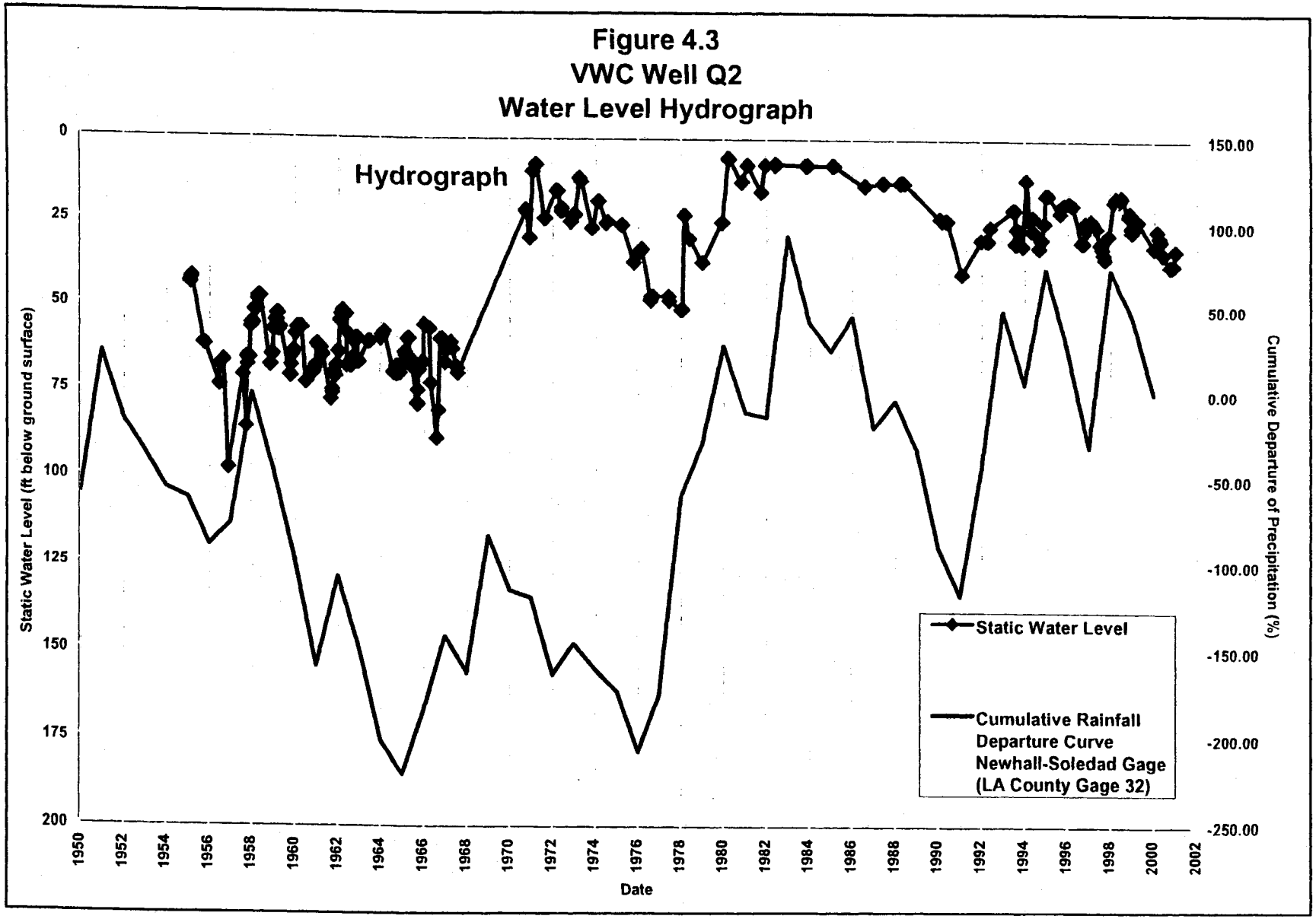


Figure 4.3
VWC Well Q2
Water Level Hydrograph
Hydrograph
Static Water Level (ft below ground surface)
Cumulative Departure of Precipitation (%)
Date
Static Water Level
Cumulative Rainfall Departure Curve Newhall-Soledad Gage (LA County Gage 32)
0
25
50
75
100
125
150
175
200
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
-250.00
1950
1952
1954
1956
1958
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groundwater production and low rainfall, water levels in this well averaged approximately 70 to 75 ft bgs, within an historic range of 42 to 98 ft bgs. Reduced pumping in the alluvium, and a return to more normal rainfall patterns in the 1970s and 1980s, resulted in a rapid recovery of water levels to depths of between 6 and 27 ft bgs; water level declines were to depths as much as 51 ft bgs during the dry years of the mid-1970s. A return to the higher rates of annual alluvial groundwater extractions in the 1990s did not result in a return to the low water levels typical of the 1950s and 1960s. This in part is due to the generally normal rainfall patterns over the last ten years, and the increased recharge provided to the alluvium from the two local WRPs.

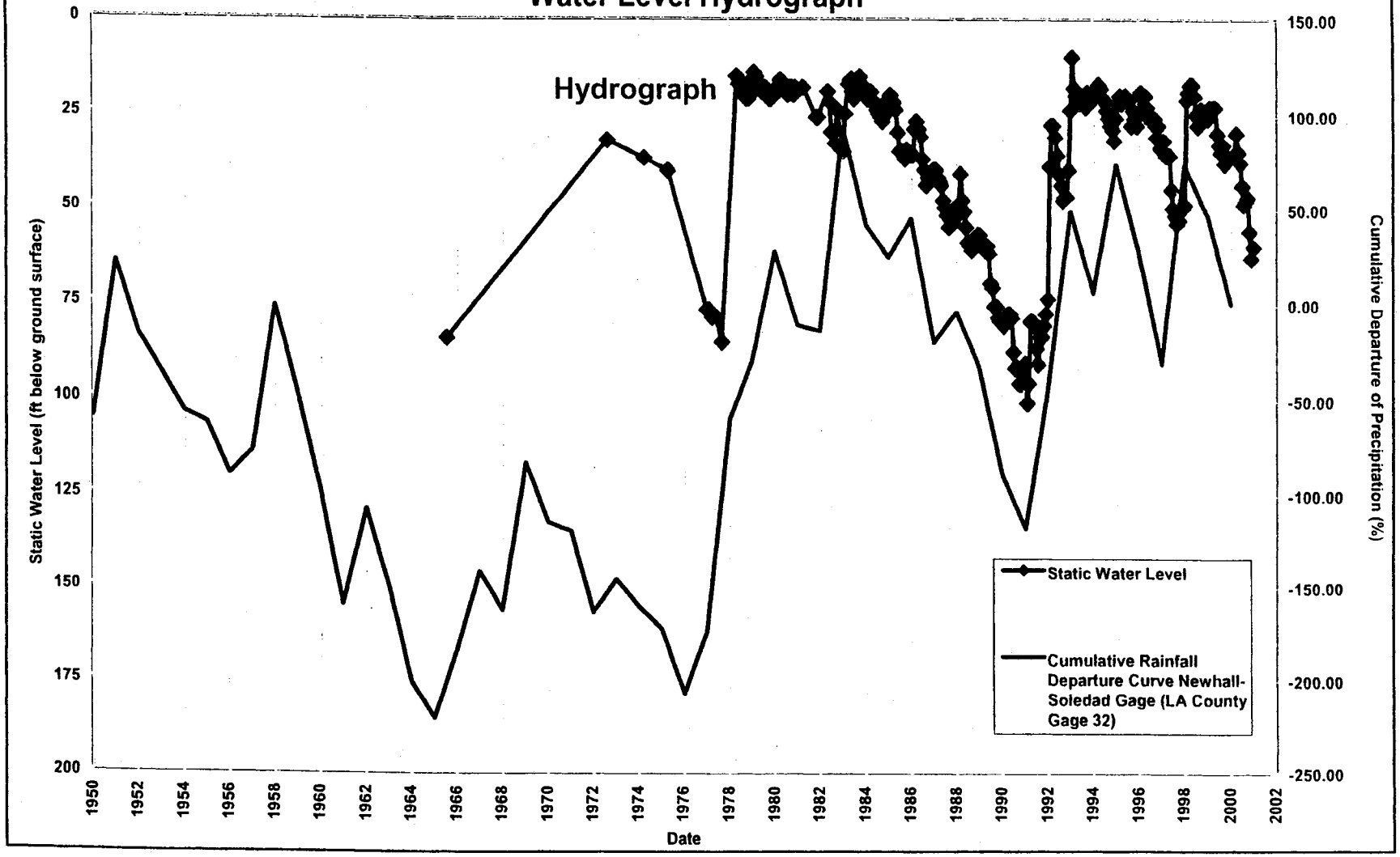
Finally, in the eastern portion of the alluvial aquifer, the representative hydrograph for the SCWC Mitchell Well 5A (Figure 4.4 – Hydrograph of SCWC Mitchell Well 5A and also Plate 4.4) shows a much stronger correlation with annual rainfall totals than is shown by the hydrographs for wells in either the central or western parts of the Valley. Water levels in these easterly-area wells during wet periods such as from 1978 to 1983 tend be in the range of 10 to 20 ft bgs, falling to as low as 101 ft bgs during periods of extended drought such as that from 1984 to 1991. However, by 1993, after a return to wetter climatic conditions, water levels recovered rapidly to their pre-drought range. Water levels also show a declining response during the dry years of 1996 to 1997, and 1999 to 2000. From past trends, it can be seen that these lower water levels are a temporary condition, which then (regardless of the total alluvial production) rapidly return to higher water level conditions as soon as wetter conditions prevail.

Differences in the response of water levels over time in wells located in different parts of the alluvial aquifer system in the Valley are readily seen on Plate 4.4. Hydrographs shown thereon are for various municipal-supply wells, an irrigation-supply well, and for a few LACFCD-monitored wells that are privately-owned (see for example LACFCD Well No. 7132 in the northern portion of Bouquet Canyon).

Aquifer Parameters

The Slade 1986 Report presented a map of estimated aquifer parameters calculated from efficiency tests conducted in a number of alluvial water wells in the Valley by the Edison

Figure 4.4
SCWC Mitchell Well 5A
Water Level Hydrograph



Company. Plate 7 from that report (not presented herein) showed the locations of these wells, annotated with values for transmissivity (T) and hydraulic conductivity (or permeability, herein denoted by symbol P). That report noted that T and P varied considerably over quite short lateral distances within the alluvial aquifer, and suggested that this was because T and P values were calculated from water level drawdowns in the pumping wells rather than from aquifer test data from nearby observation wells. Use of water level drawdown data from pumping wells to calculate T values may provide results that are strongly influenced not only by the properties of the aquifer, but also by the condition of the well casing and gravel pack, particularly with older wells.

Since 1985, a number of new alluvial water wells have been constructed and tested, and generally more accurate T and P values are now available for some of these new wells. In the eastern part of the alluvium, the SCWC Lost Canyon 2A and Mitchell 5B wells were constructed and tested in 1990 and 2001, respectively; these wells had calculated T values ranging from approximately 270,000 to 500,000 gallons per day per foot of aquifer (gpd/ft). This is consistent with the earlier T value of approximately 350,000 gpd/ft calculated for the SCWC Sand Canyon well, (located near Lost Canyon 2A), but is considerably higher than the T values of 96,000 gpd/ft and 81,000 gpd/ft previously calculated for the nearby, older Mitchell 5A and Lost Canyon 2 wells, respectively. This suggests that the higher value (on the order of 350,000 gpd/ft) is more representative of the transmissivity of the alluvial aquifer system in this area.

In the central area of the alluvium, near the Newhall Ranch Road bridge over the Santa Clara River, the Slade 1986 Report indicated NLF Well S2 displayed a T value of 61,200 gpd/ft and a P value of only 380 gallons per day per square foot (gpd/ft^2). More recent testing of VWC Wells S6, S7 and S8, constructed in 1999-2000 in this same central area, revealed T values of between 400,000 and 500,000 gpd/ft and hydraulic conductivities of approximately 3000 gpd/ft^2. Again, these higher values are likely more representative of the alluvial aquifer system in this area.

Finally, two alluvial wells (VWC W-9 and W-10) were constructed in San Francisquito Canyon in 1991 and 1999. Testing revealed T values of 118,000 gpd/ft for W-10 and an

extremely high value of 750,000 gpd/ft for W-9. Whereas the W-9 value may be anomalously high, even the lower T value for VWC W-10 is approximately twice the T values that were previously calculated from Edison efficiency test data for older wells in that area.

Geohydrology

General Statement

Within an aquifer, the amount of groundwater in storage is the total volume of water that exists in underground storage at a particular time, and that could become readily available for extraction by wells. Groundwater within the alluvial aquifer system in the study area occurs under unconfined (water table) conditions, and the amount of groundwater in storage in this aquifer depends on: a) the total volume of the alluvial sediments; b) the specific yield of those sediments, and; c) the proportion of those sediments that is saturated with groundwater.

Because the volume and specific yield of an aquifer do not generally change over time, the amount of groundwater in storage in the alluvial aquifer is directly related to the saturated thickness, which is in turn indicated by measured groundwater levels in water wells within the alluvial sediments. A rising water table increases the thickness of the saturated water-bearing section, and results in an increasing volume of groundwater in storage, whereas the reverse is true for a declining water table.

Because groundwater levels in the alluvial aquifer system are strongly influenced by local rainfall and recharge (a highly variable factor in southern California), the amount of groundwater in storage in the alluvium has varied considerably over the past 50 to 60 years as the local climate has experienced periods of both higher than average rainfall (wet years) and lower than average rainfall (dry years). For example, in November 1965, at the end of a severe 21-year long dry period (see Figure 2.1), groundwater levels in the alluvial aquifer system were at their lowest recorded levels and the amount of groundwater in storage in the alluvium was calculated at 107,000 AF (Slade 1986 Report). Conversely, in April 1945, at the end of a 10- to 11-year period of above average rainfall, groundwater elevations were at

their highest recorded levels and the amount of groundwater in storage was calculated to be approximately 201,000 AF (Slade 1986 Report).

In order to update the Slade 1986 Report, we have re-calculated the amount of groundwater in storage within the alluvial aquifer system based on water level data for the spring of 2000, a recent period for which widespread water level data are available.

Groundwater Storage Capacity

The procedure for re-calculating the amount of groundwater in storage in the alluvial aquifer system is the same as was performed for the Slade 1986 Report, and is summarized as follows:

1. Subdivision of the alluvial aquifer into individual groundwater storage units.
2. Assessment of the total thickness of potentially saturated sediments in each storage unit.
3. Calculation of the thickness of saturated sediments in each storage unit, based on groundwater elevations for the period of interest in other nearby wells (Spring 2000, as seen on Plate 4.2).
4. Grouping of earth materials described on drillers' logs into categories based on grain size, and assignment of specific yield values to each category of earth materials.
5. Computation of groundwater in storage (GW_{st}) using the equation:

   $$GW_{St} = AmS_y$$

   Where A = the surface area of the storage unit, m = the saturated thickness of the aquifer, and S_y = the assigned specific yield.

Storage Units and Saturated Thicknesses

Because the alluvial sediments vary in character, thickness, and hydrogeologic properties, we have again subdivided the alluvium into the same smaller, more manageable groundwater storage units, as was done for the Slade 1986 Report. The boundaries of these units were again taken to coincide with surface or subsurface hydrogeologic boundaries, or topographic features such as canyon "narrows", obvious surface water divides, or similar features. Plate 4.5 – Map of Alluvial Groundwater Storage Units – illustrates the locations of

the groundwater storage units and subunits for the alluvial aquifer system as used herein and as originally delineated in the Slade 1986 Report.

The storage units, and the methods used to determine their volume and saturated thickness are essentially unchanged from those presented in the Slade 1986 Report; a detailed description of these methods can be found in that report. However, the following are the salient points:

1. The water table surface was determined by contouring water level elevations for Spring 2000 and assigning an average water level elevation to each groundwater storage subunit within the alluvial aquifer area. The saturated thickness of each storage subunit was then defined as the distance between the average water table surface in that subunit and the bottom (base) of the alluvium in that subunit.
2. Within storage subunits where no water level elevation data were available for Spring 2000 (also see Plate 4.3), water level elevations for that subunit were estimated using 1985 water level elevations that were adjusted (generally downwards) to match Spring 2000 conditions.
3. The saturated volume of each subunit was calculated by multiplying the surface area of each subunit by the saturated thickness, and then reducing each volume by 25% to account for the fact that the sides and bottom of each alluvial subunit have the form of a generally U-shaped channel rather than a perfect rectangle.

The actual area and volume calculations for each storage subunit (see locations on Plate 4.5) were carried out using in-house GIS software.

Specific Yield Values

The specific yield of an aquifer is that percentage of the total volume of contained groundwater that will drain from the aquifer under the influence of gravity. The remaining portion of the groundwater within the aquifer materials is held in-place during gravity drainage by such actions as molecular forces and capillary attraction.

Specific yield values for the alluvial aquifer materials were determined previously through an assessment of sediment types recorded on approximately 300 drillers' logs for alluvial water wells located throughout the study area (Slade 1986 Report). These same specific yield values, which ranged from 9 to 16 percent, were also used for each of the storage subunits in the updated storage calculations presented in this report.

Estimated Quantity of Groundwater in Storage

The estimated quantity of groundwater in storage within the alluvial aquifer system in the spring of 2000 is calculated by GIS methods to be approximately 161,000 AF (see Table 4.4 – Alluvial Groundwater in Storage Calculations). Because this volume was calculated using a GIS system and digitized versions of the original mylar maps used for the Slade 1986 Report, we have also re-calculated the previous groundwater in storage volumes for 1945, 1965, and 1985 as presented in the Slade 1986 Report. This was done to assess the consistency of the new computer calculations, and to allow comparison between the original calculations of groundwater in storage and the current ones presented at this time. The assessment shows that the variation between the GIS and manual calculations of the original storage volumes (presented in the Slade 1986 Report) is less than 1% in each case. When referring to these historic groundwater in storage volumes, this update report uses the new GIS calculated numbers, which differ only slightly from those presented in the original Slade 1986 Report.

Over time, groundwater levels and associated groundwater in storage in the alluvial aquifer have fluctuated, typically in response to wet and dry conditions as they affect water levels and storage in the eastern portion of the alluvial aquifer. However, there has been no long-term, progressive decline in the amount of groundwater in storage in the alluvium that could be considered indicative of overdraft conditions.

Assessment of Operational Yield

The perennial yield of a groundwater basin was considered in the Slade 1986 Report to be the average annual amount of groundwater that may be extracted over the long-term from the basin by pumping without causing undesirable effects; in essence, it was considered to be a practical rate of annual groundwater withdrawal. The range of undesirable effects can include such things as ground subsidence, a decrease in water quality, or continuous and long-term water level declines in the aquifer. The primary undesirable effect in the alluvial aquifer in the Valley would be a continued and progressive decline in groundwater levels, leading to a permanent loss of groundwater in storage and to excessive pumping lifts. Were this situation to occur, the aquifer would be considered to be in overdraft.

Table 4.4
Alluvial Groundwater in Storage Calculations

Storage Unit	Storage Subunit	Formation	Planimeter Area (acres)	Effective Planimeter Area (75%) (acres)	GIS Area (acres)	Specific Yield (%)	Base of Storage Unit (ft asl)	Saturated Thickness 1945 (ft)	Saturated Thickness 1965 (ft)	Saturated Thickness 1985 (ft)	Saturated Thickness 2000 (ft)	GIS Storage Volume 1945 (AF)	Manual Storage Volume 1945 (AF)	GIS Storage Volume 1965 (AF)	Manual Storage Volume 1965 (AF)	GIS Storage Volume 1985 (AF)	Manual Storage Volume 1985 (AF)	GIS Storage Volume 2000 (AF)	Manual Storage Volume 2000 (AF
A	1a	Undifferentiated Alluvium	477	358	470	19%	1550	95	20	87	82.5	6,363	6,457	1,340	1,359	5,827	5,914	5,525	5,608
A	1b	Undifferentiated Alluvium	301	226	303	17%	1443	111	32	90	74.5	4,288	4,260	1,236	1,228	3,477	3,454	2,878	2,859
A	1c	Undifferentiated Alluvium	792	594	793	15%	1346	118	35	92	84	10,527	10,514	3,122	3,119	8,208	8,197	7,494	7,484
A	1d	Undifferentiated Alluvium	1324	993	1312	14%	1202	128	39	107	105.5	17,633	17,795	5,373	5,422	14,740	14,875	14,534	14,667
A	1e	Undifferentiated Alluvium	559	419	550	16%	1072	128	53	119	115.5	8,448	8,586	3,498	3,555	7,854	7,983	7,623	7,748
A	2	Undifferentiated Alluvium	263	197	264	9%	1505	85	5	55	39	1,515	1,509	89	89	980	976	695	692
A	3a	Undifferentiated Alluvium	325	244	313	9%	1680	50	7	42	50	1,056	1,097	148	154	887	921	1,056	1,097
A	3b	Undifferentiated Alluvium	305	229	291	13%	1525	105	10	50	45	2,979	3,122	284	297	1,419	1,487	1,277	1,338
A	4a	Undifferentiated Alluvium	158	119	153	9%	1570	60	10	55	47.5	620	640	103	107	568	587	491	507
A	4b	Undifferentiated Alluvium	151	113	145	13%	1400	75	10	75	57.5	1,060	1,104	141	147	1,060	1,104	813	847
		Subtotals	**4,655**	**3,492**	**4,594**							**54,489**	**55,084**	**15,334**	**15,477**	**45,020**	**45,498**	**42,386**	**42,8**
		Actual Change from Previous Period:												**-39,155**		**29,686**		**-2,634**	
B	1a	Undifferentiated Alluvium	1515	1136	1472	16%	925	174	112	172	170	30,735	31,633	19,784	20,362	30,382	31,270	30,029	30,906
B	1b	Undifferentiated Alluvium	963	722	958	15%	900	131	100	133	115	14,119	14,192	10,778	10,834	14,334	14,409	12,394	12,459
B	2a	Undifferentiated Alluvium	523	392	526	9%	1412	73	30	58	33	2,592	2,577	1,065	1,059	2,059	2,048	1,172	1,165
B	2b	Undifferentiated Alluvium	352	264	359	11%	1225	90	42	95	85	2,666	2,614	1,244	1,220	2,814	2,759	2,517	2,468
B	2c	Undifferentiated Alluvium	472	354	460	14%	1115	105	22	95	83	5,072	5,204	1,063	1,090	4,589	4,708	4,009	4,113
B	3	Undifferentiated Alluvium	186	140	187	9%	1150	80	35	60	48	1,010	1,004	454	452	757	753	606	603
B	4a	Undifferentiated Alluvium	236	177	229	9%	1245	57	17	55	41	881	908	263	271	850	876	634	653
B	4b	Undifferentiated Alluvium	338	254	331	12%	1140	80	37	78	65	2,383	2,434	1,102	1,126	2,324	2,373	1,936	1,977
B	4c	Undifferentiated Alluvium	365	274	363	14%	1025	130	76	126	105	4,955	4,982	2,897	2,913	4,802	4,829	4,002	4,024
		Subtotals	**4,950**	**3,713**	**4,885**							**64,412**	**65,548**	**38,649**	**39,327**	**62,911**	**64,025**	**57,299**	**58,3**
		Actual Change from Previous Period:												**-25,763**		**24,262**		**-5,612**	
C	1a	Undifferentiated Alluvium	565	424	557	15%	836	144	121	134	124	9,023	9,153	7,582	7,691	8,397	8,517	7,770	7,882
C	1b	Undifferentiated Alluvium	445	334	439	14%	804	123	102	117	116	5,670	5,747	4,702	4,766	5,393	5,467	5,347	5,420
C	1c	Undifferentiated Alluvium	718	539	842	13%	750	115	102	97	110	9,441	8,051	8,374	7,141	7,963	6,790	9,030	7,701
C	2a	Undifferentiated Alluvium	1056	792	987	16%	1035	115	63	75	65	13,621	14,573	7,462	7,983	8,883	9,504	7,699	8,237
C	2b	Undifferentiated Alluvium	1101	826	1107	16%	940	114	82	104	90	15,144	15,062	10,893	10,834	13,815	13,740	11,956	11,891
C	3	Undifferentiated Alluvium	320	240	312	9%	1050	35	15	30	19	737	756	316	324	632	648	400	410
		Subtotals	**4,205**	**3,155**	**4,244**							**53,635**	**53,342**	**39,328**	**38,739**	**45,083**	**44,666**	**42,202**	**41,4**
		Actual Change from Previous Period:												**-14,307**		**5,755**		**-2,881**	
D	1a	Undifferentiated Alluvium	1610	1208	1593	12%	1100	71	38	51	40	10,179	10,288	5,448	5,506	7,312	7,390	5,735	5,796
D	1b	Undifferentiated Alluvium	990	743	975	14%	970	162	77	143	130	16,585	16,840	7,883	8,004	14,640	14,865	13,309	13,514
		Subtotals	**2,600**	**1,951**	**2,568**							**26,764**	**27,128**	**13,331**	**13,510**	**21,951**	**22,255**	**19,044**	**19,3**
		Actual Change from Previous Period:												**-13,433**		**8,621**		**-2,908**	
		Total Groundwater in Storage	**16,410**	**12,311**	**16,291**							**199,301**	**201,102**	**106,642**	**107,053**	**174,966**	**176,444**	**160,930**	**162,0**
		Difference in GIS vs Manual Methods:											**0.9%**		**0.4%**		**0.8%**		**0.**
		Actual Change in Storage from Previous Period:												**-92,658**		**68,324**		**-14,036**	
		Percent Change in Storage from Previous Period:												**53.5%**		**164.1%**		**92.0%**	
		Percentage of All Time Maximum Storage:												**53.5%**		**87.8%**		**80.7%**	

The phrase "continued and progressive decline" is the key to understanding the concept of overdraft. Groundwater levels within the alluvial aquifer system experience temporary fluctuations in response to natural variations in recharge (such as from precipitation or upward flow of groundwater from the Saugus Formation aquifer system), and to changes in groundwater discharge such as pumping extractions. However, these temporary fluctuations in the storage of groundwater in the alluvial aquifer system are not continued or progressive; hence, they are not indicative of overdraft. Examples of this type of temporary fluctuation can be seen in the hydrographs for the SCWC Mitchell Well 5A on Figure 4.4 and SCWC North Oaks East Well on Plate 4.4. During periods of reduced rainfall, as in the periods 1969-1976 and 1983-1991, water levels in these wells declined by 75 ft or more, but these temporarily depressed water levels were clearly seen to recover quickly to their pre-drought levels once rainfall (and recharge) returned to more typical long-term average values. The recent decline in water levels in these wells is in response to the reduced rainfall conditions that began in 1999; the trends in rainfall over time are illustrated by the rainfall accumulated departure curve that is also provided with the hydrograph.

Background

The Slade 1986 Report calculated a "practical or perennial yield" for the alluvial aquifer in the range of 31,600 to 32,600 AF/yr. In deriving this perennial yield value, that study relied on the information available at that time, using the so-called Pumpage and Change-in-Storage method and a base period from 1958 to 1985. That method calculates the changes in storage within an aquifer over a period of time (the base period) that is sufficiently long enough to average out the influence of these temporary water level fluctuations. Groundwater extractions by pumping are then compared to the changes of groundwater in storage. The average annual level of pumping that would maintain the amount of groundwater in storage at a relatively constant figure on a long-term basis (i.e. no overdraft) is considered a reasonable estimate of the perennial yield.

Although that method is used because difficult-to-quantify terms such as recharge and subsurface outflow are not required, the method does have its drawbacks as described in a review of several perennial yield studies of the Yucaipa Valley of southern California (David

Keith Todd Consulting Engineers, 1987). Firstly, because the method works best in aquifers that are fully developed or possibly in overdraft, and where recharge does not play an important role in determining the amount of groundwater in storage, the method may be less reliable in aquifers where these assumptions are not met. As discussed previously, water level hydrographs of alluvial water wells illustrate clearly that: a) the alluvial aquifer is not in overdraft; and b) rainfall recharge will rapidly increase the amount of groundwater in storage, particularly in the alluvium east of the mouth of Bouquet Canyon.

Secondly, because the calculation method relies on average pumping rates and net changes in storage over time, it does not consider cumulative or progressive changes in the hydrology of a basin such as changing land use patterns, or an increase in imported water. The Slade 1986 Report (pg. 87) states specifically that "no recharge of imported water was assumed."

Current Conditions

Current hydrologic conditions in the Valley have in fact changed dramatically over the past twenty years, by such factors as the increased importation of water, the increase in the annual volumes of reclaimed water released to the alluvium, and the rapid conversion of agricultural and ranch lands to urban and suburban uses. In particular, the importation of SWP water has risen from approximately 1,100 AF/yr in 1980 to over 32,000 AF/yr in 2000. Much of this imported water is eventually discharged by the two local WRPs directly into the alluvium of the Santa Clara River. Combined discharges from these two WRPs totaled 19,000 AF in 2000, and this water is directly available for recharging the alluvial aquifer system along the Santa Clara River. Additional recharge comes from the proportion of deep percolation of SWP water that has been used for outdoor irrigation throughout the region.

The effects of this additional available recharge can be seen in the hydrograph for VWC Well Q2 (see Figure 4.3), located downstream of the discharge point for the Saugus WRP. From 1956 to 1970, a period during which groundwater production from the alluvial aquifer system averaged approximately 37,000 AF/yr, water levels in this well were typically at depths of 70 to 75 ft bgs. These water levels recovered rapidly to typical levels of approximately 25 to 30 ft bgs when alluvial groundwater production declined significantly in the early 1970s, eventually reaching an average of just 23,000 AF/yr between 1980 and 1990. However,

when alluvial groundwater production again increased to approximately 35,000 AF/yr (between 1990 and 2000), water levels in Well Q2 (and other nearby wells) did not show a corresponding decline. In fact, water levels in Well Q2 are currently at or near their historic highs in spite of the higher alluvial annual groundwater extractions in the past 10 years.

Because of the progressive changes in the local hydrology over time, and the significance of imported SWP water in recharging the alluvial aquifer, simply re-calculating the perennial yield of the aquifer by updating the prior Pumping and Change-in-Storage calculations would not provide an accurate or useful value.

Operational Yield

One of the disadvantages of utilizing perennial yield as a basis for managing pumpage from an aquifer system is that it represents a long-term average value for annual yield. There is a potential for the perennial yield value to be interpreted as a not-to-exceed volume, with a related potential for pumpage above the perennial yield value in any given year to be interpreted as "overdraft". A recently advanced concept intended to deal with such misinterpretations is that of operational yield. Operational yield can be defined as a fluctuating value of pumpage that may be above or below the perennial yield in any given year, and that varies as a function of the availability of other water supplies. The basic intent of the operational yield value is that it should not exceed the perennial (or average) yield of the groundwater basin over multi-year wet and dry cycles.

The operational yield concept includes flexibility of groundwater use by allowing increased pumping during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is available in wet/normal rainfall periods. The operational yield protects the aquifer by helping to assure that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. In the Valley, historical groundwater data demonstrate that the alluvium has been, and continues to be developed within its long-term sustainability (i.e. no continuous lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data for the Saugus Formation show no lowering of water levels or degradation of water quality where it has been developed at known well locations.

It is evident from observation of alluvial aquifer response to average pumping over the last several decades, and its response to pumping in individual years, that this aquifer system can be operated at a higher average pumping rate over a wide range of yearly pumping rates without inducing undesirable conditions that would be indicative of "overdraft," i.e., long-term continuous and progressive decline in water levels and in groundwater in storage. This observation is particularly evident since the initiation of supplemental SWP water deliveries in 1980. As a result, operational yield of the alluvial aquifer system or the yearly yield for operating purposes, could range from an individual annual pumping volume as low as about 20,000 AF, to an individual annual pumping volume as high as about 45,000 AF. The ultimate goals, of course, would be to avoid both short-term adverse impacts as a result of year-to-year fluctuations in pumping, and to avoid long-term adverse impacts such as continuously lowered water levels and storage in this aquifer system.

Recognition of historical alluvial aquifer response to the wide range of annual pumping and the higher average rate of pumping in recent years has led to the following two plans regarding operation of this aquifer system: 1) development of an UWMP that includes water supply from the alluvium within both the long-term yearly operational range and the recent (last ten years) average pumping capacity; and 2) commitment via an MOU process between the Santa Clarita Valley Water Purveyors and the downstream United Water Conservation District to develop a numerical groundwater flow model in order to analyze in greater detail how this aquifer system can be operated in the future to optimize its yield without adverse impact either to the aquifer (avoidance of depressed water levels and depleted storage) or to the environment associated with the aquifer (avoidance of decreased stream flows, avoidance of depleting riparian vegetation, etc.).

In summary, the combination of historical observations and current planning has led to the current conclusion that the alluvial aquifer system can be operated over a wide range of pumping volumes in any given year, on the order of 20,000 to 45,000 AF, and on a long-term average basis can be operated at an average pumping volume on the order of 10 percent higher than was reported as a "practical or perennial yield" in 1986. As summarized in the UWMP, the operation of the alluvium will typically be in the 30,000 to 40,000 AF per year range for most types of normal or wet years, with an expected reduction into the 30,000 to

35,000 AF per year in dry years.

Water Quality

Groundwater quality is affected by the relative concentrations of dissolved inorganic constituents, organic chemicals, and entrained organisms such as bacteria. This report discusses only the inorganic constituents and organic chemicals in the local groundwater.

The quality of surface water percolating into an aquifer is affected by such factors as the type of earth materials over which the surface water flowed, and the type and location of possible surface contaminants the water might encounter prior to infiltration. After percolation, the water quality is further influenced by such factors as: the lithology and age of the earth materials through which it flows; the rate of groundwater flow; the amounts, rates and locations of recharge; fluctuations in basin-wide water levels; potential contamination due to improperly constructed or destroyed wells; the location and quality of artificially recharged water; and the proximity of irrigated lands or industrial facilities from which degraded water might percolate into the aquifer system.

Groundwater Character

Groundwater character, as illustrated on a Stiff water quality pattern diagram, is defined by the relative proportions of the major dissolved anions and cations within a water sample. In most groundwater, these major ions include the cations calcium, magnesium and sodium, and the anions bicarbonate, sulfate and chloride. As illustrated on Plate 4.6 – Map of Alluvial Wells, *Stiff Pattern Diagrams – the groundwater within the alluvial aquifer system changes in* character as it moves from east to west across the valley floor. In the easternmost part of the Valley, near NCWD's Pinetree wells, the groundwater has a distinctive calcium bicarbonate (Ca-HCO_3) character, with only minor proportions of the other cations and anions. Moving westward down the Valley, the relative proportion of sulfate (SO_4) anions begins to increase such that groundwater in the area between the SCWC Honby and Stadium wells displays both a Ca-$HC0_3$ and a calcium sulfate (Ca-SO_4) character, depending on the particular well. Wells in the central part of the alluvium, between the mouth of Bouquet Canyon and I-5, show a mixed calcium-bicarbonate-sulfate (Ca-$HC0_3$-$S0_4$)

character. West of I-5, the groundwater within the alluvium has a Ca-SO_4 character (see Plate 4.6).

Within the tributary canyons for which requisite water quality data are available, alluvial groundwater within Bouquet Canyon displays a consistent Ca-$HC0_3$ character, whereas in San Francisquito Canyon a Ca-SO_4 water predominates. In Castaic Creek, groundwater appears to change from a Ca-SO_4 character in the upstream reaches near Castaic Dam, to a Ca-$HC0_3$-$S0_4$ character in the middle reaches near the I-5 bridge, and then back to Ca-SO_4 character in the lower reaches of the creek. This sulfate-rich groundwater within the alluvium of Castaic Creek may be one of the main sources for the higher sulfate groundwater conditions known within the alluvium west of I-5.

Inorganic Constituents

Two important inorganic components in groundwater from the alluvial aquifer system include nitrate (as NO_3), which has a State Primary Maximum Contaminant Level (MCL) of 45 milligrams per liter (mg/l) for domestic use, and the TDS concentration; the State Secondary MCL for TDS is expressed as a range with the lower level set at 500 mg/l and the upper level set at 1000 mg/l. No fixed consumer acceptance contaminant level has been established for TDS.

As with water character, the concentrations of nitrate and TDS within the alluvium show measurable changes as one moves from the eastern to the western sides of the Valley. In the eastern portion of the area (near the NCWD Pinetree wells), nitrate concentrations average approximately 14 mg/l, and TDS concentrations average approximately 550 mg/l.

In this easterly area near SCWC's North Oaks wells, average nitrate concentrations are approximately 27 mg/l and TDS is approximately 608 mg/l. Nitrate concentrations in this area are among the highest within any portion of the alluvial aquifer, although still well below the MCL for nitrate as NO_3 of 45 mg/l. Elevated nitrate concentrations in this area may originate from subsurface septic systems located in the unsewered tributary canyons north and south of the main Santa Clara River, or from the former Canyon Park Hog Ranch, located some distance south of the Santa Clara River; water samples from alluvial monitoring wells on the

hog ranch property have reportedly recorded nitrate concentrations as high as 1816 mg/l (Mr. Steve Cole, SCWC, personal communication, 2001). This former hog ranch is reportedly being remediated under the direction of the Regional Water Quality Control Board – Los Angeles Region.

In the area between SCWC's Stadium and Honby wells, just upstream from the mouth of Bouquet Canyon, nitrate concentrations average 22 mg/l and TDS averages 664 mg/l. Just west of Bouquet Canyon, wells in VWC's Pardee wellfield have average nitrate concentrations of 27 mg/l and average TDS values of 706 mg/l. The relatively elevated nitrate concentrations in these wells (although still well below its MCL of 45 mg/l) may be influenced a number of possible factors, including former agricultural activities in this area that used nitrate-bearing fertilizers, or by the lack of deep cement sanitary seals in these former agricultural production wells.

Groundwater from five NLF agricultural-supply wells in the area west of I-5 has an average nitrate concentration of just 6.6 mg/l, despite the ongoing agricultural operations in this part of the Valley. These low nitrate values are likely due to dilution of the higher nitrate concentrations found in upstream groundwater by relatively low nitrate water from three possible sources. The first possible source is water from the Saugus and Valencia WRPs, where nitrate concentrations in the discharge water average approximately 5 and 23 mg/l, respectively. These two plants discharged a total of approximately 19,000 AF of water in 2000. The second possible source of low nitrate water is underflow of groundwater from Castaic Creek Canyon, where groundwater has average nitrate concentrations of approximately 6 mg/l. Finally, the third possible source of low nitrate water is the area west of I-5 where groundwater from the Saugus Formation is considered to be discharging into the alluvium. Saugus Formation groundwater has nitrate values that are typically lower than those in the alluvial groundwater.

TDS concentrations, on the other hand, are highest in the alluvial groundwater west of I-5, averaging approximately 1000 mg/l in the five NLF agricultural-supply wells mentioned above. The Slade 1986 Report discusses some possible sources of the high TDS values in this area, including irrigation return, WRP effluent, oilfield activities, and runoff from surface

drainages where sedimentary rocks are cemented with gypsum or anhydrite ($CaSO_4$ minerals). Another possible cause of the high TDS values in this portion of the alluvium may be groundwater movement from the Saugus Formation into the alluvium.

Other Constituents

A search of the California Department of Health Services (DHS) water quality database reveals that between 1985 and 2000, no VOCs were detected in alluvial municipal-supply wells in the Valley at concentrations exceeding their respective MCLs. Some VOCs were detected in lower concentrations sufficient to require reporting to DHS, but many of these were disinfection byproducts such as chloroform, that result from chlorination of water at the wellhead for disinfection purposes prior to delivering the water into the distribution system.

Perchlorate (ClO_4), a component of rocket fuel, and related chemicals, have been detected in groundwater monitoring wells and in one now-abandoned industrial water well on the north side of a former industrial facility located in the hills southeast of Bouquet Junction. The current DHS advisory action level for perchlorate is 4 micrograms per liter (µg/l). No perchlorate has ever been detected in any of the municipal-supply water wells located in the alluvial aquifer system along the Santa Clara River in this region (see Plate 4.1 for locations of these alluvial-supply water wells).

SECTION 5

HYDROGEOLOGIC CONDITIONS IN THE SAUGUS FORMATION AQUIFER SYSTEM

Water Wells

According to available historic records, the first known water well specifically constructed to extract water from the Saugus Formation aquifer appears to have been NCWD Well No. 1, drilled in 1954 (Slade 1988 Report). At the time of that Slade 1988 Report, 22 Saugus Formation water wells were known to have been drilled in the region. As of 1988, 11 of the known Saugus Formation water wells were considered to be on active or inactive status, whereas the other 11 had been either abandoned or destroyed. NLF Well 155, which was listed as destroyed in the Slade 1988 Report, is now known to have only been abandoned (i.e., the pump has been removed from the well). The current condition of this well is not known. Plate 5.1 – Map of Saugus Formation Well Locations – illustrates the locations of known historically-drilled Saugus Formation wells in the Valley.

Between 1988 and 2001, eight additional Saugus Formation water wells were drilled and constructed in the Valley (refer to Plate 5.1). Of this group of 30 historically known water wells in the Saugus Formation, 17 either are in active operation, or are on some type of inactive or standby status. Table 5.1 – Construction Details for Existing Saugus Formation Wells – summarizes the relevant construction details for each of the existing wells, along with the operational status of each of those wells as of 2001. Also listed on Table 5.1 are the construction details for a groundwater monitoring well drilled in 1999 adjacent to new VWC 205; this groundwater monitoring well (205M) is used solely to monitor water levels and/or water quality in the Saugus Formation.

The remaining 13 wells of the 30 known historically-drilled wells in the Saugus Formation have been destroyed (data for the privately-owned Smiser well are unclear whether it is abandoned or destroyed at this time). Table 5.2 – Destroyed Saugus Formation Water Wells – summarizes the known construction details for those wells which have been reported to be destroyed as of 2001.

Table 5.1

Construction Data for Existing Saugus Formation Wells

Agency	Owner Well No	State Well No	Year Drilled	Drilling Method	Status 2001	Surface Elevation (ft asl)	Total Depth (ft)	Perforated Intervals (ft bgs)	Perforation Type	Sanitary Seal (ft bgs)	Pump Setting (ft bgs)
Newhall County Water District											
	7	04N/16W-35L01	1954	Cable Tool	Inactive	1253	994	520-528 622-664 720-726 874-974	Knife Cut		306
	9	03N/16W-02R02	1958	Rotary	Inactive	1349	675	311-674	Louvers	75	230
	10	04N/16W-34A03	1961	Rotary	Inactive	1207	1555	780-1544	Louvers	114	335
	11	04N/16W-27J03	1973	Reverse Rotary	Active	1185	1136	200-1075	Louvers	150	340
	12	04N/16W-35A01	1985	Reverse Rotary	Active	1209	1340	485-1280	Louvers	420	400
	13	04N/16W-01	1990		Active	1195	1300	420-630 660-750 780-830 870-1280	Unknown	50	445
Private	Lennar (D. Poe)	04N/17W-24(?)	1990	Rotary	Active	1240	2040	No Data	Louvers	500	Unknown
	Lombardi (Anden)	04N/17W-04?	1990	Reverse Rotary	Inactive	1280	1986	No Data	Louvers	450	None
Santa Clarita Water Company											
	Saugus 1	04N/16W-22K06	1988	Reverse	Inactive	1162	1640	490-520 570-630 710-810 890-1000 1020-1080 1130-1190 1290-1330 1400-1620	Wire wrap screen	450	500
	Saugus 2	04N/16W-22K10	1988	Reverse	Inactive	1168	1612	490-495 515-555 585-725 824-883 923-983 1043-1103 1212-1251 1310-1591	Wire wrap screen	460	500
Valencia Water Company	157	04N/16W-22M01	1962	Rotary	Active	1150	2008	586-2008	Vertical Slots	15	340
	159 (irrigation)	04N/16W-33L01	1962	Rotary	Active	1297	1950	662-1900	Louvers	No Data	460
	160	04N/16W-21D01	1964	Rotary	Active	1102	2000	950-2000	Louvers	65	260
	201	04N/16W-21J01	1989	Mud Rotary	Active	1149	1690	540-570 612-690 720-750 780-840 960-1000 1060-1160 1220-1300 1350-1380 1420-1490 1540-1670	Louvers	460	360
	205	04N/16W-21L01	1999	Mud Rotary	Active	1153	1950	820-1930	Louvers	680	None
	205M	Monitoring Well Near VWC-205	1999	Mud Rotary	Active	1152	1956	820-1504 1524-1685 1705-1936	Vertical Slots	100	None
Newhall Land & Farming Company (Private; Irrigation only)	155	04N/16W-27R2	1960	Mud Rotary	Abandoned	1190	1515	108-1468 interspersed	louvers	No Data	None
	156	04N/17W-13J1	1961	Mud Rotary	Active	1053	1805	320-1800 interspersed	louvers	15	210 (?)

Table 5.2
Destroyed Saugus Formation Water Wells

Owner	Owner Well No.	Year Destroyed
Newhall County Water District	1	pre- 1988
	2	pre- 1988
	3	pre- 1988
	4	pre- 1988
	5	pre- 1988
	6	pre- 1988
	8	1987
Santa Clarita Water Company	Lombardi	1982
Valencia Water Company	202	1991
	203 (pilot hole only)	1993
Smiser (Private)	--	Abandoned or destroyed post 1988
Newhall Land and Farming Company	P2	1967
(Private; Irrigation only)	154	1982
	155	Abandoned 1978
	158	1985

Note: NCWD - 9 to be destroyed in 2001

All but one of the existing Saugus Formation water wells are located in the southern structural block, that is, south of the Holser and San Gabriel faults (refer to Plates 3.1 and 5.1). Only the privately-owned Lombardi-Anden well is located within the central structural block (between the two faults), and there are no known existing Saugus Formation wells north of the San Gabriel fault. Historically, only one known attempt has been made to drill and construct a Saugus Formation water well in the area north of the San Gabriel fault where the lower and geologically older portion of the Saugus Formation (i.e., Sunshine Ranch member) is known to exist. That well (VWC 202) did not produce a sufficient quantity of groundwater of acceptable quality for municipal-supply purposes and was subsequently destroyed.

Maximum casing depths for existing Saugus Formation wells range from 675 ft for NCWD Well No. 9, to 2040 ft for the privately-owned Lombardi-Anden well. The depths to the top of the uppermost perforations in existing wells range between 200 and 950 ft bgs, whereas the depths to the base of the perforations range between 674 and 2000 ft bgs.

Pumping capacities in Saugus Formation wells for which data exist, have ranged from approximately 100 gallons per minute (gpm) in wells completed in the lowermost Sunshine Ranch Member near the outer margin of the formation, to rates in excess of 3000 gpm in wells located near the center of the Saugus Formation along the floor of the Valley.

New Wells

Between 1988 and May 2001, eight new Saugus Formation water wells were drilled and constructed in the Valley. The currently inactive SCWC Saugus No. 1 and No. 2 wells, and the currently active NCWD Well No. 13, were drilled and constructed along the South Fork of the Santa Clara River. New Saugus Formation wells along Valencia Blvd include the currently active VWC Well 201, and VWC Well 205. This latter water-supply well also has a 6-inch diameter monitoring well (VWC 205M) which is located approximately 30 ft from the main well, and which was completed with an almost identical perforated interval and casing depth. In the hills in the southwest part of the Saugus Formation outcrop area is the currently active, privately-owned Stevenson well (formerly known as the Poe well). The currently inactive Lennar-Anden well is located in Hasley Canyon. Finally VWC 202 was

drilled and constructed in San Francisquito Canyon, but was subsequently destroyed for the reasons stated above; refer to Plate 5.1 for locations of these wells.

One additional attempt to drill and construct a new Saugus Formation water well in 1993 (VWC 203, located south of Magic Mountain Parkway) had to be terminated and the pilot borehole was destroyed after the contractor encountered technical problems during the drilling phase of the project. However, a detailed geologic log of the drill cuttings from the pilot hole and an electric log of the borehole were completed prior to permanent destruction of the borehole.

Destroyed Wells

As mentioned above, VWC Well No. 202, located in San Francisquito Canyon, was destroyed shortly after its construction in 1990.

In addition, recent discussions with the Ranch Manager at the Smiser Farm located near the I-5 Freeway and Lyons Avenue (personal communication, November 2000) suggest that the Saugus Formation water well on that property was abandoned and covered over sometime after 1988. RCS geologists were unable to locate this well during a brief visit to the property in the fall of 2000, and the date and method for destruction of this well are not known.

Finally, NCWD Well 8 is reported to have been destroyed in 1987, and NCWD Well 9 was reportedly slated for destruction in 2001.

Privately-Owned Domestic Wells

An unknown number of privately-owned, domestic-supply water wells within the Saugus Formation likely exist in some tributary canyons to the Santa Clara River (such as in the upper portion of Hasley Canyon). These wells are thought to provide water primarily for domestic-supply purposes to single-family dwellings and/or ranches that lie outside of the service areas of the local water purveyors. Because the Saugus Formation crops out at or very near ground surface in these areas, the wells are probably relatively shallow, on the order of 100 ft to perhaps 300 or 400 ft in total depth. Maximum pumping rates in such wells would typically be in the range of a few tens of gpm.

Groundwater Occurrence, Recharge and Discharge

Depending on location, groundwater within the Saugus Formation may exist under confined, semi-confined or even unconfined (water table) conditions. In the center of the Valley (refer to Plate 3.1 and to Plate 5.1), the sedimentary layering of the formation is nearly horizontal, and confining layers of low permeability (fine-grained silts and clays) limit groundwater movement in an upward or downward direction. As a result, groundwater in these areas occurs under pressure within the intervening sand and gravel units, and water levels in Saugus Formation water wells are above the top of the perforated casing intervals that intersect coarse-grained aquifer units, indicating confined or semi-confined conditions.

In contrast, near the lateral margins of the Saugus Formation, the sedimentary layering is tilted downward toward the center of the "bowl," and the permeable sand and gravel beds of the formation are either exposed directly at ground surface, or they are in direct contact with overlying, highly permeable alluvial sediments or terrace deposits. In these areas, the Saugus Formation aquifer may be under unconfined, water table conditions.

Recharge

Direct natural recharge to the Saugus Formation occurs via deep percolation of rainfall in the outer portions of the outcrop area where the permeable sand and gravel beds are either exposed at ground surface or lie directly beneath the relatively thin, permeable terrace deposits. Natural recharge to the Saugus Formation also takes place in the eastern end of the outcrop area due to leakage from overlying portions of the saturated alluvium, as originally discussed in the Slade 1988 Report and as corroborated by recent work by CH2M Hill (Newhall Ranch ASR Impact Evaluation, 2001).

Man-made sources of recharge to the Saugus Formation include deep percolation of agricultural and landscape irrigation water in areas where this formation is exposed at ground surface. Urban developments (residential, office, and recreational lands) occupy approximately 9600 acres (17%) of the Saugus Formation outcrop area, and are likely to provide significant amounts of irrigation recharge. On the other hand, direct recharge from infiltration of excess agricultural irrigation is likely to be a fairly minor source of recharge to

the Saugus Formation because most agricultural land in the Valley is situated atop Quaternary alluvium.

To date, deliberate artificial recharge of the Saugus Formation via injection wells or highland spreading basins has never been undertaken in the region. Importantly, however, an injection and recovery study carried out in 2000 in the vicinity of VWC Well No. 205 has demonstrated the feasibility of operating at least a limited ASR program in the Saugus Formation within the Valley (Slade & Associates, LLC, February 2001; and Newhall Ranch ASR Impact Evaluation, 2001).

Discharge

Discharge from the Saugus Formation has historically occurred primarily via groundwater extractions for municipal- and agricultural-supply purposes, but also via natural discharge to the overlying Quaternary alluvium in the western portion of the Saugus Formation (CH2M Hill, 2001).

Depth to Base of Fresh Water

The maximum depth to which fresh groundwater occurs within the Saugus Formation (the base of fresh water) can be determined with some accuracy by examining oil well e-logs, and this has been done for approximately 250 e-logs of oil wells and water wells located throughout the Valley. On some e-logs, the vertical transition from the overlying fresh water to the underlying brackish or saline water is very abrupt and unambiguous. On other e-logs, the transition from fresh water to saline water is gradual and may occur over a vertical distance of hundreds of feet. In such cases, and to be conservative, the base of fresh water was selected, insofar as possible, at the top of the zone of transition from fresh water to saline water.

Plate 3.3 – Geologic Cross Section Z-Z' - provides our interpretation of subsurface conditions within the Saugus Formation in a west to east direction along the main reach of the Santa Clara River (see Section 3 of this report); the basis for the subsurface interpretations was the analysis and correlation of e-logs of wildcat oil wells and water wells. Plate 5.1 illustrates the surface location of this new geologic cross section, together with the lines of geologic

sections A-A' through F-F' that were originally prepared for the Slade 1988 Report (those cross sections are not reproduced herein).

The interpretation of the depth below ground surface to the base of fresh water (i.e. the thickness of fresh water-bearing deposits) within the Valley was originally published as Plate 5 in the Slade 1988 Report. The items of principal interest include:

1. Northeast of the San Gabriel fault, the maximum depth to the base of fresh water within the Saugus Formation is approximately 1500 ft. By comparison, the maximum total thickness of the Saugus Formation, based on e-logs, is on the order of 2000 ft in this area.
2. In the wedge-shaped central fault block between the San Gabriel fault and the Holser fault, the maximum depth to the base of fresh water within the Saugus Formation is approximately 5500 ft. In this area, the maximum total thickness of the Saugus Formation is approximately 8500 ft.
3. Southwest of the Holser fault, the maximum depth to the base of fresh water within the Saugus Formation is approximately 5000 ft. The Saugus Formation obtains a maximum total thickness on the order of 7500 ft in this area.

Groundwater Extractions

Groundwater production from the Saugus Formation has been primarily for municipal-supply purposes, particularly in recent years. Only NLF Well No. 156, the Lennar-Poe well, and possibly the Smiser well are currently or were recently used for agricultural and/or industrial purposes.

Figure 5.1 - Historic Saugus Formation Groundwater Production – illustrates, as a bar chart, the historic trends in Saugus Formation groundwater production since the mid-1950s, the earliest date for which production records are available (see also Table 5.3 – Saugus Formation Groundwater Production 1986-2000). Historically, total Saugus Formation groundwater production has ranged from a low of approximately 550 AF/yr in 1954, to a high of approximately 15,000 AF/yr in 1991. For the ten-year period from 1991 to 2000, the average annual Saugus Formation groundwater production was approximately 8600 AF/yr (see Table 5.1). The total combined groundwater production from the Saugus Formation from 1954 through 2000 has been approximately 268,000 AF. These figures do not include annual pumpage by the smaller domestic-supply water wells known to exist at the single-

Figure 5.1
Historic Saugus Formation Groundwater Production

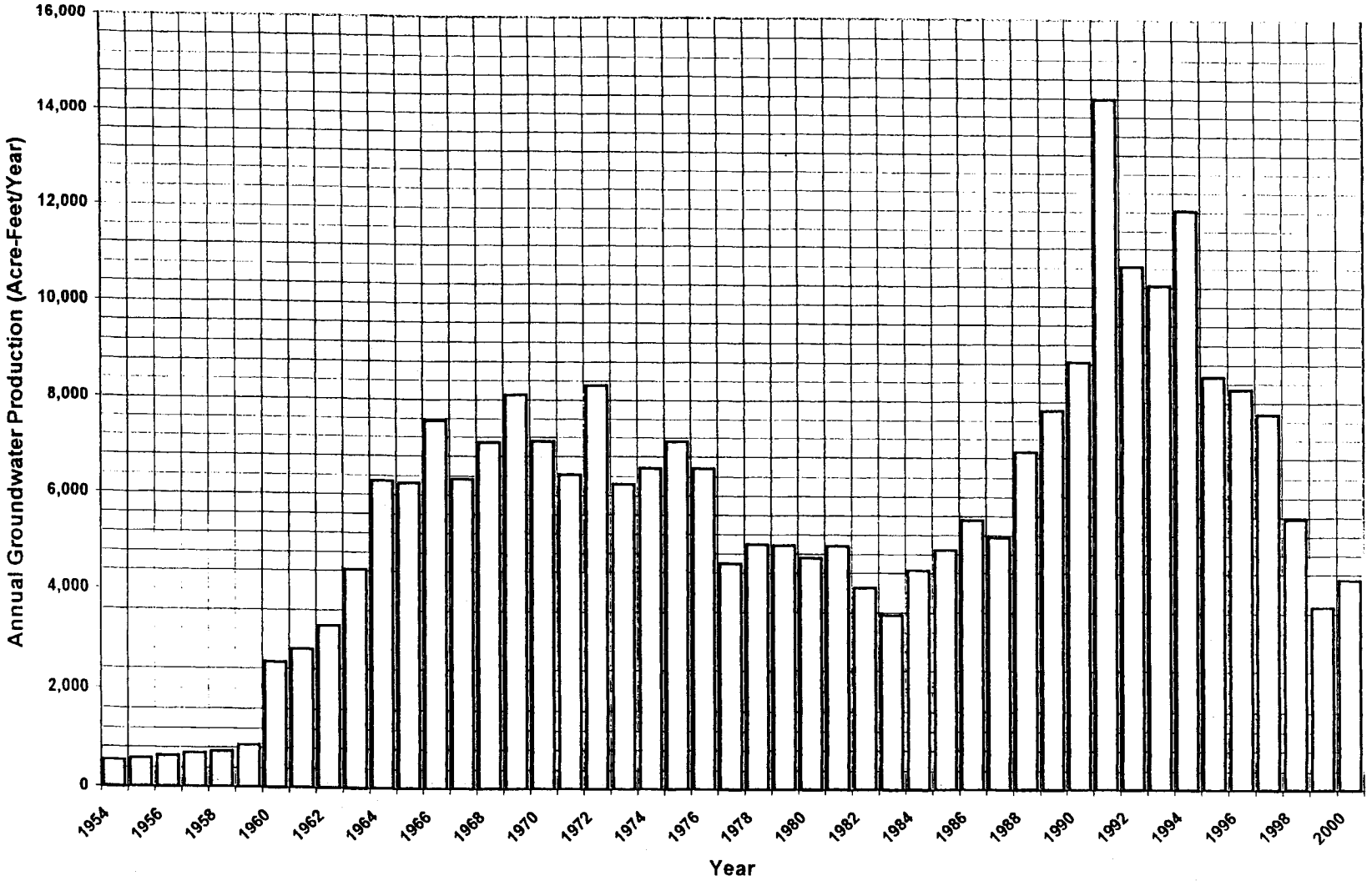


Table 5.3
Saugus Groundwater Production 1986-2000

Agency	Owner Well No	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Newhall County Water District	4	225	0	destroyed	--	--	--	--	--	--	--	--	--	--	--	--
	7	275	230	332	244	241	245	176	259	320	363	337	288	281	172	0
	9	116	123	1	0	5	1	1	0	4	1	1	0	1	0	0
	10	740	789	613	457	642	307	345	59	0	1	0	0	2	0	0
	11	2237	2106	1264	1291	1248	926	420	706	614	520	360	81	14	0	0
	12	0	0	1829	2737	2595	2992	2756	1891	1917	2254	2181	1798	1915	1158	1767
	13	0	0	0	0	0	0	1368	1985	2246	1616	2084	3001	2361	1298	419
	NCWD Total	*3593*	*3248*	*4039*	*4729*	*4731*	*4471*	*5066*	*4900*	*5101*	*4755*	*4963*	*5168*	*4574*	*2628*	*2186*
Newhall Land & Farming Company *(Private; Irrigation only)*	156	20	20	20	20	20	20	20	20	20	20	266	445	426	479	374
	NLF Total	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*266*	*445*	*426*	*479*	*374*
Santa Clarita Water Company	Saugus 1	0	0	31	0	0	1690	437	1226	1333	0	410	451	0	0	0
	Saugus 2	0	0	32	0	40	3091	2476	1675	2530	1726	1766	617	0	0	0
	SCWC Total	*0*	*0*	*63*	*0*	*40*	*4781*	*2913*	*2901*	*3863*	*1726*	*2176*	*1068*	*0*	*0*	*0*
Valencia Water Company	157	780	698	1491	1382	732	1109	677	524	730	518	123	166	0	0	0
	159	0	0	0	0	4	69	77	89	174	88	7	1	0	0	0
	160	1137	1186	1314	1599	968	1462	688	1105	1134	752	551	827	508	553	1332
	201	0	0	0	69	2351	2482	1389	904	1002	680	191	71	63	62	295
	VWC Total	*1917*	*1884*	*2805*	*3050*	*4055*	*5122*	*2831*	*2622*	*3040*	*2038*	*872*	*1065*	*571*	*615*	*1627*
		1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Annual Total for Major Producers Listed		**5,530**	**5,152**	**6,927**	**7,799**	**8,846**	**14,394**	**10,830**	**10,443**	**12,024**	**8,539**	**8,277**	**7,746**	**5,571**	**3,722**	**4,187**

Note: All of the above data is supplied by purveyors. Figures do not include domestic or other small-scale extractions.
VWC 205 became active in 2001
VWC 159 used for irrigation only

family homes and ranches in certain tributary canyons in the Valley that lie outside the service areas of the major water purveyors. Total annual production from all of these privately-owned, domestic-supply wells in the Saugus Formation may be on the order of 100 AF.

Groundwater production from the Saugus Formation is concentrated in the central and southern portions of the Valley where the majority of the currently producing Saugus Formation municipal-supply water wells are concentrated. These existing wells are located within the southern structural block, south of both the Holser and San Gabriel fault zones. The majority of the Saugus Formation groundwater production in 2000 was from two wells, namely, NCWD 12 (1767 AF) and VWC 160 (1332 AF); see Table 5.3 and Figure 5.1.

Between 1986 and 2000, NCWD accounted for between 33% to 82% of the total annual Saugus Formation municipal-supply groundwater production; in this same period, VWC production represented between 10% and 46% of the total annual production; SCWC production has been 0% to 32% of the total annual production in that time period; and NLF accounted for between 0% and 15% of the annual production from the formation. Annual production from such privately-owned, domestic-supply Saugus Formation wells is not known, but is unlikely to have exceeded a total of perhaps 100 AF/yr for all privately-owned wells in the region. This unmetered, privately-owned, domestic-type production represents roughly 1% of the average annual groundwater production from the Saugus Formation since 1986.

Plate 5.2 – Map of Saugus Formation Groundwater Extractions for 2000 – has been prepared to illustrate the spatial variability in recent groundwater extractions from the Saugus Formation. Data for Plate 5.2 were derived from information tabulated on Table 5.3 for the year 2000 for each active well. Annual groundwater extractions for each of the five active Saugus Formation water wells in 2000 are illustrated on Plate 5.2 via a circle centered on the respective well. The larger the diameter of the circle, the greater is the extraction for the particular well in 2000. The map scale used to illustrate the annual production for each well is: 1 inch equals approximately 667 AF or, ¾" = 500 AF. It must be noted that the circles (specifically, the diameter of the circles) graphed on Plate 5.2 are drawn to solely represent

the relative annual production volume (in AF) for each respective well. The diameter of the circle surrounding each well does not represent and should not be construed or interpreted to signify the area of pumping influence (the extent of the drawdown cone) of the particular well.

As seen on Plate 5.2, the greatest producer from the Saugus Formation in 2000 was NCWD-12, located in the South Fork area. The second highest production was from VWC-160 located along the main reach of the Santa Clara River. Privately-owned NLF-156, located near Castaic Junction, produced 374 AF of groundwater in 2000 for irrigation-supply purposes only.

Current Groundwater Levels and Flow Directions

In order to assess groundwater levels and flow directions in the Saugus Formation, we have compiled a database of over 2500 historic and recent Saugus Formation water level measurements from purveyor records, Edison Company well efficiency tests, and RCS data files. In addition, a number of field visits were made in the fall of 2000 to measure water levels in as many Saugus Formation wells as possible (including a few privately-owned wells) within a relatively short time frame. After correcting these fall 2000 water level measurements to mean sea level for each well, maps depicting contours of equal groundwater elevation for these Saugus Formation water wells were prepared. Because the Saugus Formation in those areas where Saugus Formation wells exist is largely confined or semi-confined, these water level elevations are considered to represent the elevation of the piezometric (pressure) surface within the Saugus Formation for that time period.

Plate 5.3 – Map of Saugus Formation Groundwater Elevation Contours, Fall 2000 – illustrates the interpreted groundwater elevation contours for the Saugus Formation for the fall of 2000, a recent period for which requisite data are available. This plate also shows the locations of the Saugus Formation water wells for which water level elevation data were available, and these wells are annotated with the respective well ownership, well number and water level elevation for fall 2000.

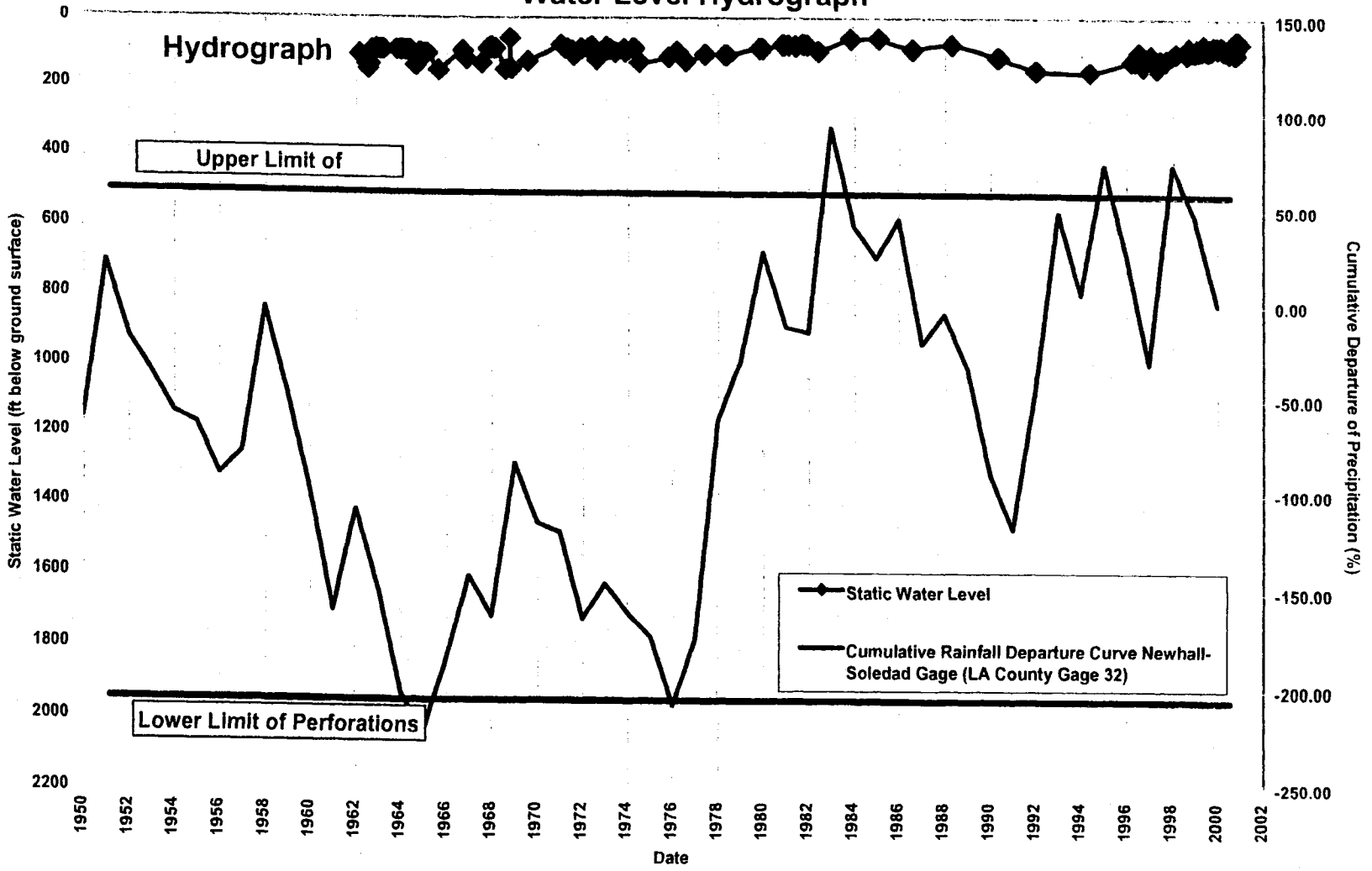
Key points from Plate 5.2 include:

1. Data points (i.e. Saugus Formation water wells) are not evenly or broadly distributed throughout the outcrop area of the Saugus Formation. Wells are generally concentrated along the South Fork of the Santa Clara River and in the community of Valencia, with only a few outlying agricultural or privately-owned wells in other areas. All but one of the known, existing Saugus Formation wells is situated within the southern structural block of the Saugus Formation, south of the Holser fault. No data are available for the region north of the San Gabriel fault because only one Saugus Formation well (now destroyed) has ever been drilled there. As such, the preparation of the Fall 2000 water level elevation contours has been restricted to areas near wells for which current data exist.
2. South of the Holser fault (*i.e.*, the Southern structural block), groundwater elevations range between approximately 1300 ft in NCWD Well No. 9, to approximately 976 ft in NLF Well No. 156. Groundwater in this southern structural block likely flows from the topographic highlands along the edge of the Saugus Formation northward towards the center of the Valley. Upon reaching the center of the Valley, which is delineated by the channel of the Santa Clara River, groundwater generally flows westward and then southwestward before discharging from the Saugus Formation into the alluvium in the area roughly between the I-5 Freeway and the western edge of the formation.
3. In the central structural block (between the Holser and San Gabriel faults), groundwater appears to also flow from the topographic highlands near the edge of the formation towards the Valley floor. In this central structural block, this regional flow appears to be towards the southeast. A confluence between the northerly and westerly flowing groundwater in the southern structural block, and the southeasterly flowing groundwater in the central structural block seems to occur in the vicinity of NLF Well No. 156.
4. Groundwater gradients within the Saugus Formation generally mimic topographic land surface gradients, in that they tend to be steeper in areas of steep topographic relief such as in the highlands south of the Valley, and considerably more gentle (flatter) along the Valley floor. Gradients range from roughly 150 ft/mile (0.028 ft/ft) between NCWD Well Nos. 9 and 7 near the edge of the Saugus Formation, to approximately 25 ft/mile (0.0047 ft/ft) between VWC Well No. 157 and NLF Well No. 156 along the Valley floor.

Hydrographs

Figure 5.2A through 5.2F – Representative Saugus Formation Hydrographs – provides graphs of the available static (non-pumping) water level records versus time for six Saugus Formation wells. Plate 5.4 – Map of Saugus Formation Hydrographs – shows several of these hydrographs on a map of the Saugus Formation. These wells (VWC No. 157 and 160

Figure 5.2A
VWC 157
Water Level Hydrograph



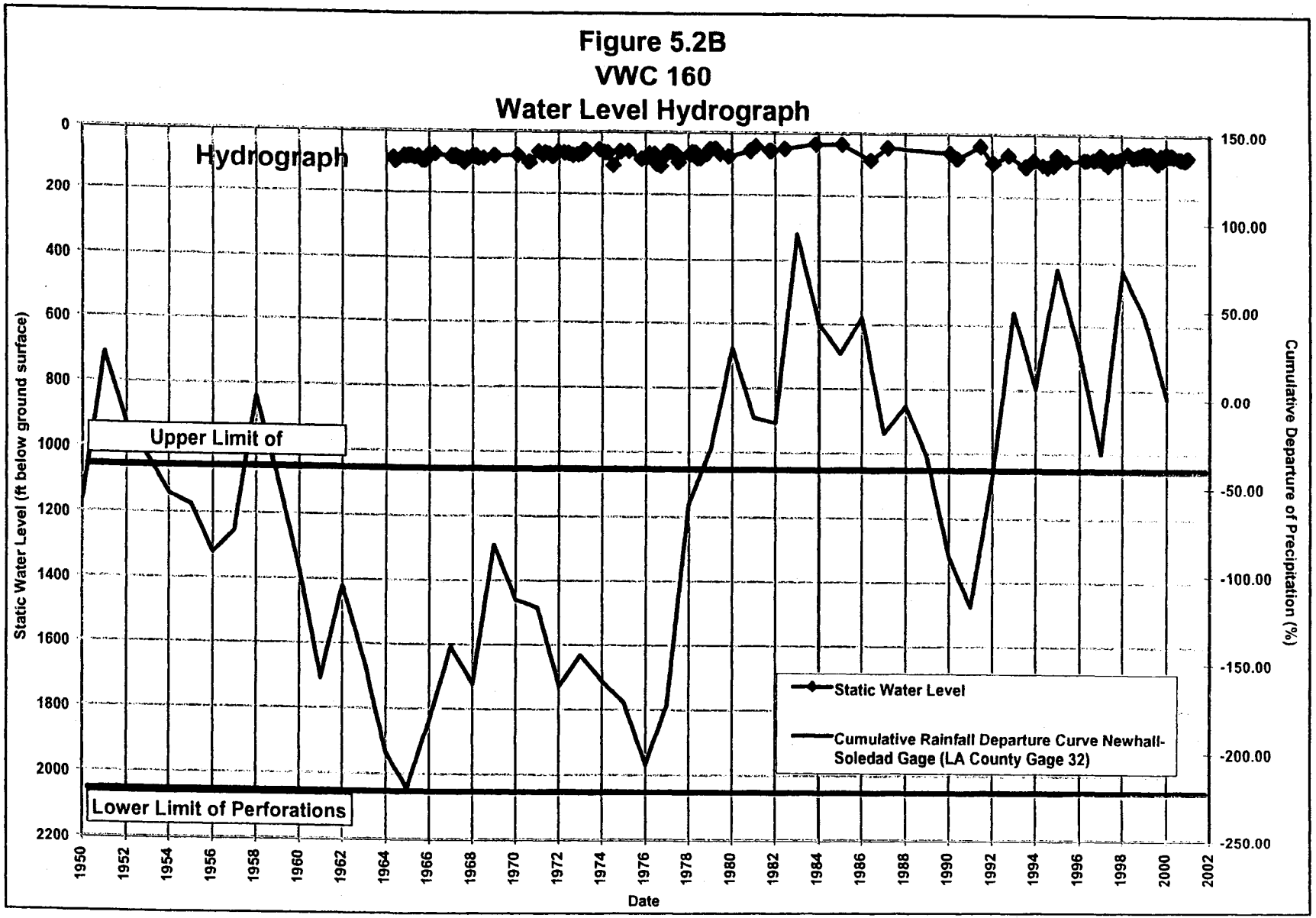


Figure 5.2B
VWC 160
Water Level Hydrograph
Hydrograph
Upper Limit of
Lower Limit of Perforations
Static Water Level
Cumulative Rainfall Departure Curve Newhall-Soledad Gage (LA County Gage 32)
Static Water Level (ft below ground surface)
Cumulative Departure of Precipitation (%)
Date
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
150.00
100.00
50.00
0.00
-50.00
-100.00
-150.00
-200.00
-250.00
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002

Figure 5.2C
NCWD 9
Water Level Hydrograph

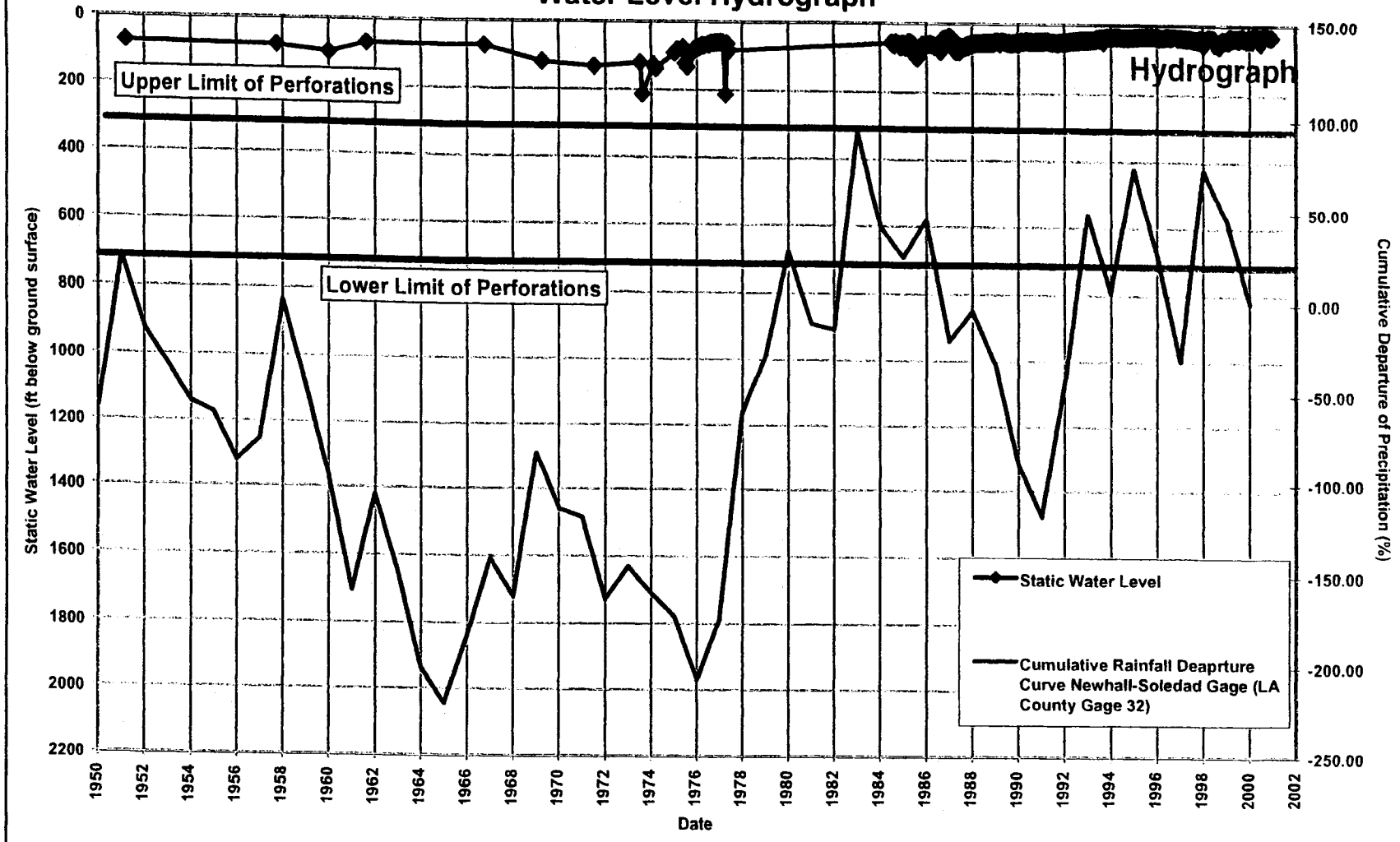


Figure 5.2D
NCWD 10
Water Level Hydrograph

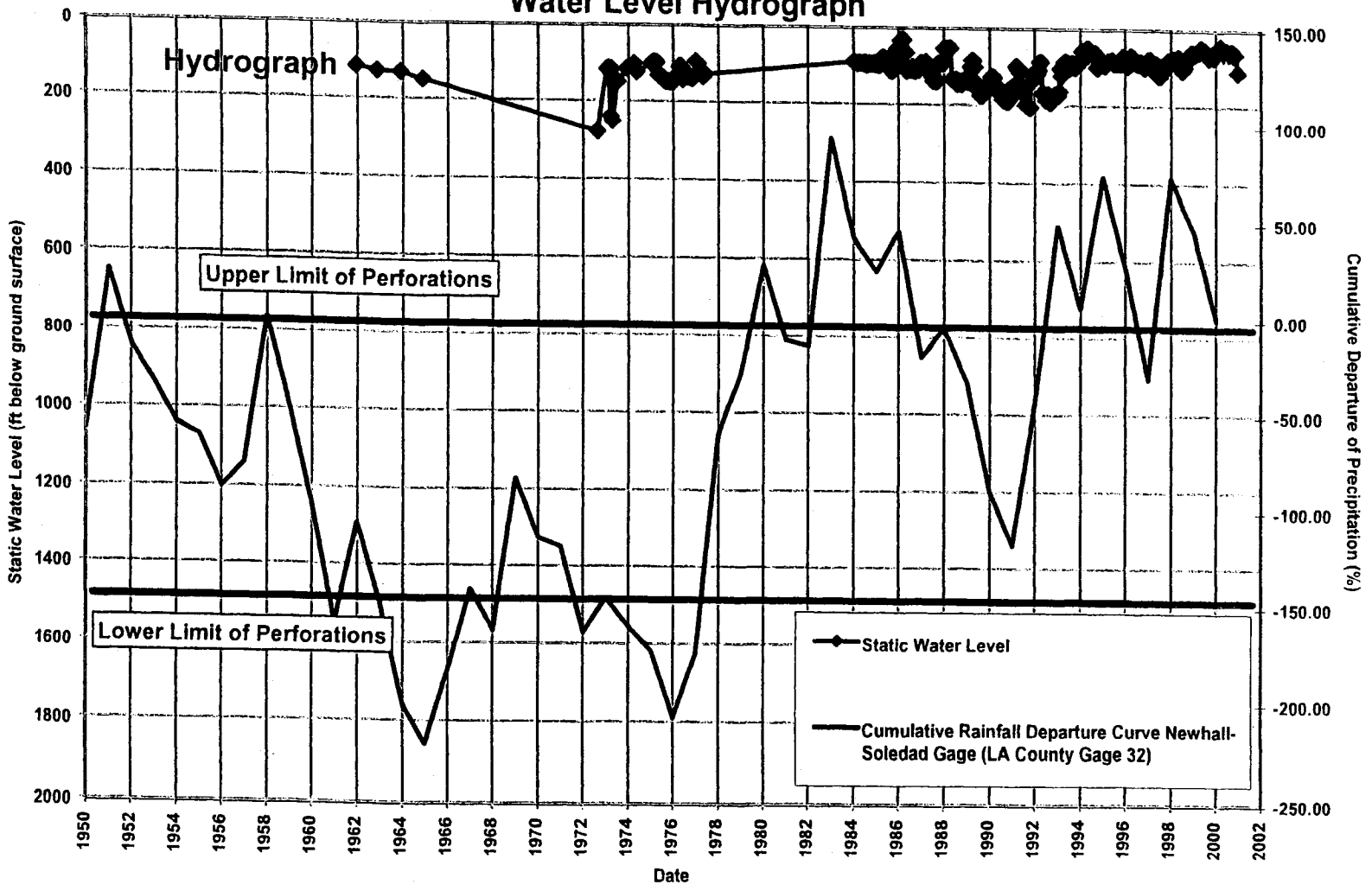


Figure 5.2E
NCWD 11
Water Level Hydrograph

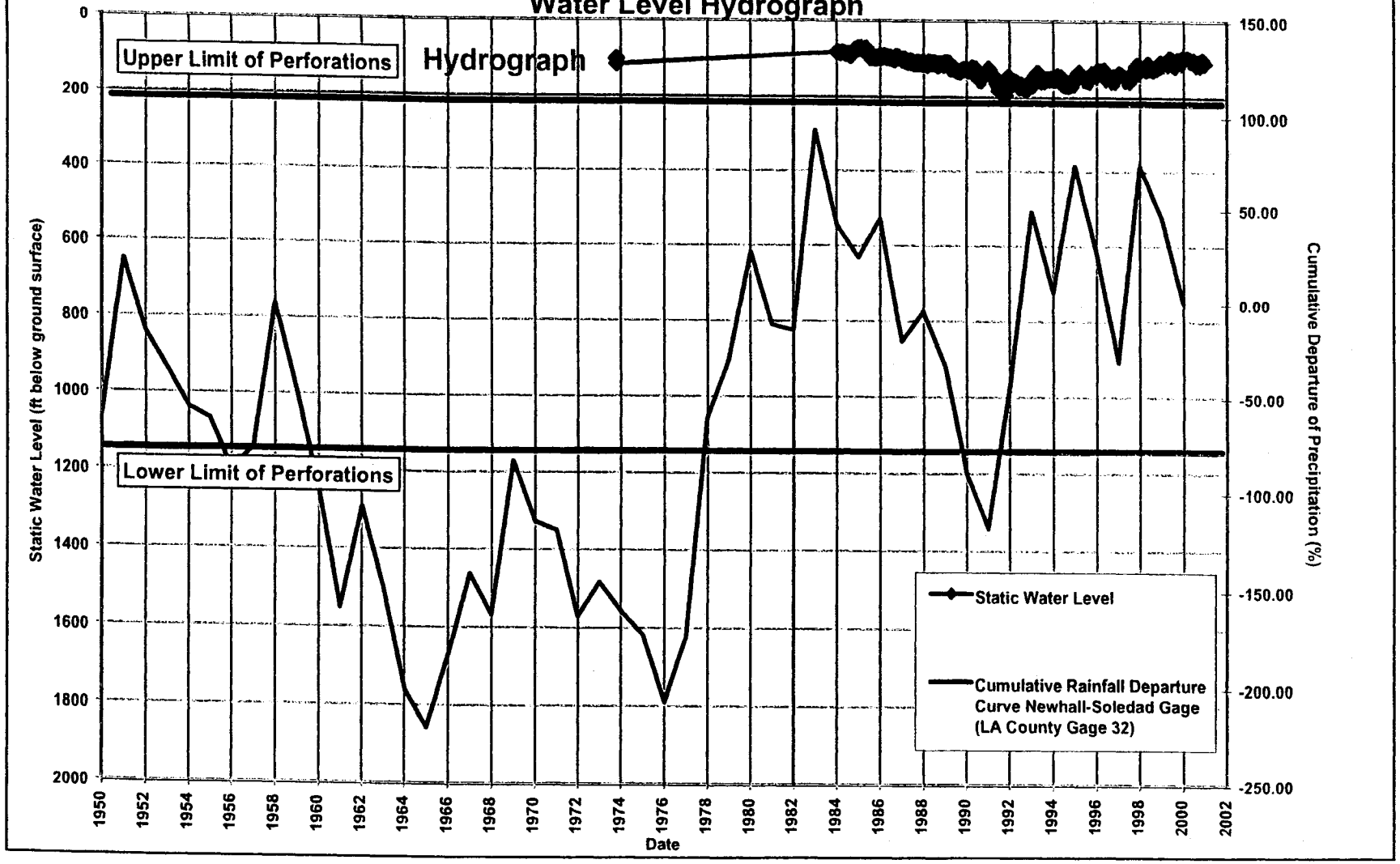
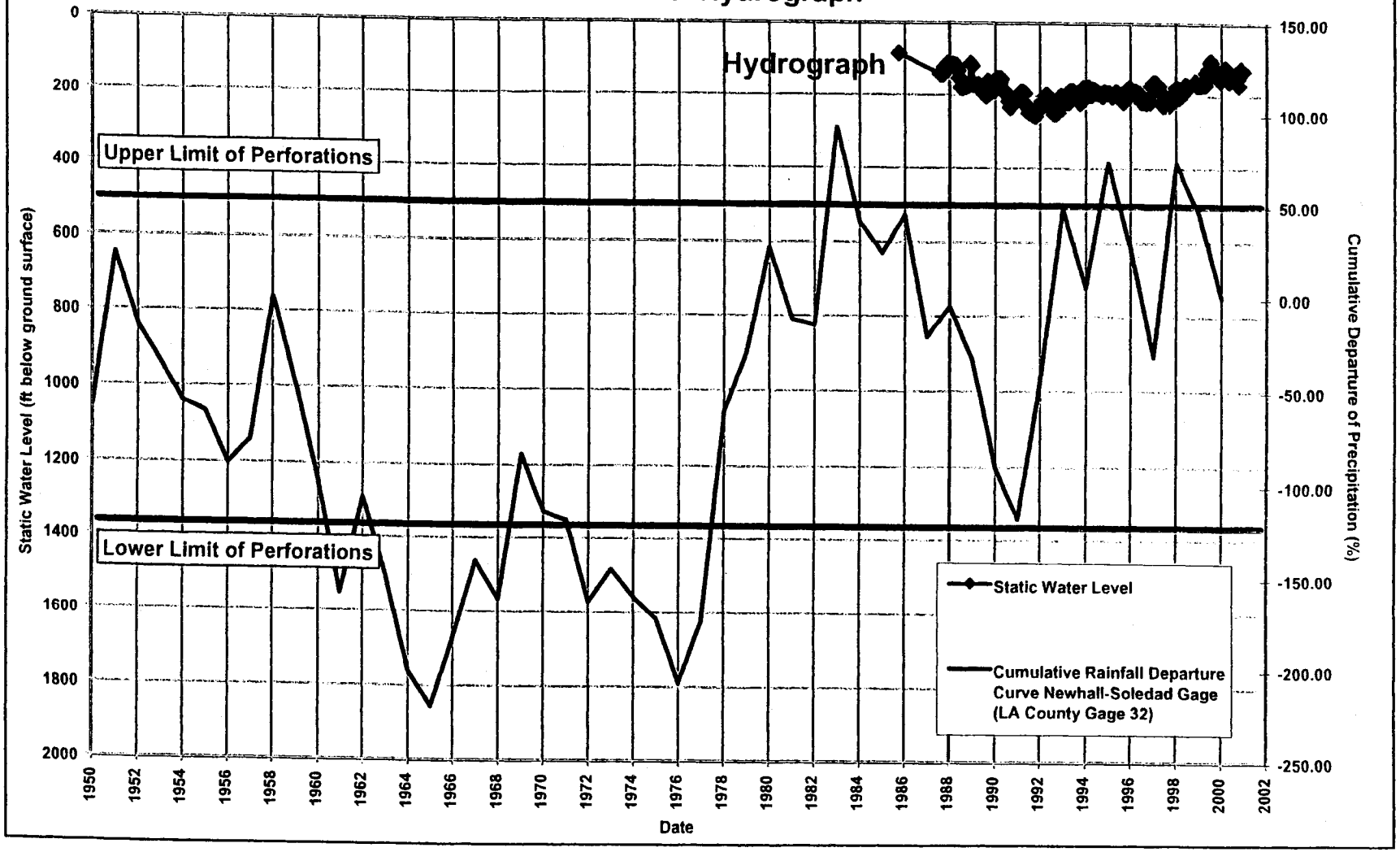


Figure 5.2F
NCWD 12
Water Level Hydrograph



and NCWD Nos. 9, 10, 11 and 12) have been selected for evaluation because of their long, relatively continuous water level monitoring records. Examination of hydrographs for other Saugus Formation wells with shorter water level records (not presented herein) reveals similar patterns of water level fluctuation to those presented herein.

As illustrated on Figures 5.2A through 5.2F and Plate 5.4, historic static water levels (technically, the piezometric surfaces) in these active Saugus Formation water wells have typically fluctuated over time: the magnitude of these historic fluctuations varies with each well, but has generally ranged from a minimum of 50 ft to a maximum of 175 ft of water level change; these water level conditions are for wells that typically range in total casing depth between 750 to 2000 ft. Importantly, it is clearly evident from the hydrographs, that no long-term or continuous decline in water levels has occurred over time in any Saugus Formation water well. For comparison purposes, the depths to the upper limit and lower limit of perforated casing in each well are also shown on the six hydrographs on Plate 5.4.

Also shown on Figures 5.2A through 5.2F and Plate 5.4 are graphs of the cumulative departure from average annual precipitation for the period of 1950 to 2000; the trend of total Saugus Formation groundwater extractions over time are shown for comparative purposes on the figures also. The cumulative departure curve for rainfall illustrates trends in the amount of rainfall over time, such that when the curve is descending towards the right (such as from 1983 to 1991), an extended period of generally deficient precipitation (drought) is considered to have been occurring. In contrast, whenever the curve ascends to the right (such as from 1976 to 1983), an extended period of generally excess or increasing precipitation (wet period) has been occurring.

Water levels in Saugus Formation wells appear to fluctuate in response to patterns of increasing or decreasing rainfall, and to some extent to patterns of increasing or decreasing groundwater extraction from the Saugus Formation. It is somewhat difficult to differentiate the effects of rainfall vs. pumping on historic water levels because total Saugus Formation pumping has historically increased during dry periods, and decreased during wet periods.

Aquifer Parameters

The hydraulic properties (aquifer parameters) of Saugus Formation aquifers are used to help assess well yields, potential water level drawdown interference between pumping wells, and well spacing criteria, but are also useful for developing and calibrating numerical groundwater models. These key aquifer parameters (transmissivity and storativity) and the specific capacities of wells are typically calculated from water level drawdown and recovery data monitored during aquifer (pumping) tests. During the preparation of the original Slade 1988 Report, aquifer tests were performed in 1987 on five selected Saugus Formation water wells in order to provide data for the calculation of the aquifer parameters. Over time, additional aquifer tests have been conducted as part of the construction of each new Saugus Formation well and as part of the Saugus Formation ASR study carried out in 2000. Table 5.4 – Selected Saugus Formation Aquifer Parameters - presents the aquifer parameters calculated from the results of the original 1987 aquifer tests, as well those derived from the more recent tests. Locations of these Saugus Formation wells are shown on Plate 5.1.

Transmissivity and Storativity

Transmissivity, an important aquifer parameter, is a measure of the ability of an aquifer to transmit water to a pumping well, or to accept water from an injection well; it is expressed in units of gallons per day per foot of aquifer width (gpd/ft). Storativity, another important aquifer parameter, is a measure of the volume of water released to a pumping well, or accepted by an injection well, from a given volume of aquifer materials. Storativity is a dimensionless parameter and, thus, has no units. Both transmissivity and storativity values are calculated from water level drawdown and water level recovery data measured in non-pumping wells during an aquifer test.

Transmissivity values presented in the Slade 1988 Report ranged from lows of 3000 to 4000 gpd/ft in NCWD Well No. 9, to highs of 157,000 to 182,000 gpd/ft in VWC Well No. 160. A review of the spatial variability in transmissivity values for wells with such data indicates a general trend from lower transmissivity values near the southeastern edge of the Saugus Formation outcrop area near NCWD 9, to higher transmissivity values near the center of the Valley near VWC 160.

Table 5.4
Selected Saugus Formation Aquifer Parameters

Well No.	Date	Type of Test	Pumping/Injection Rate (gpm)	Length of Test (mins)	Well Monitored	Specific Capacity (gpm/ft ddn)	Transmissivity (gpd/ft)	Storativity	Analytical Method
NCWD 7	Mar-87	Drawdown	341	1440	NCWD 7	3.1	26,400		"Theisfit" Software
NCWD 7	Mar-87	Recovery		1500	NCWD 7		23,300		"Theisfit" Software
NCWD 10	Mar-87	Drawdown	364	1440	NCWD 10	8.3	28,500		"Theisfit" Software
NCWD 10	Mar-87	Drawdown	364	1440	NCWD 12 (160 ft away)		57,700	9.10E-04	"Theisfit" Software
NCWD 10	Mar-87	Recovery		1480	NCWD 10		38,400		"Theisfit" Software
NCWD 10	Mar-87	Recovery		1490	NCWD 12 (160 ft away)		61,500	7.60E-04	"Theisfit" Software
NCWD 9	Mar-87	Drawdown	256	1460	NCWD 9	1.9	3,700		"Theisfit"Software
NCWD 9	Mar-87	Recovery		1500	NCWD 9		3,000		"Theisfit"Software
VWC 160	Mar-87	Drawdown	2562	720	VWC 160	49.8	163,000		"Theisfit"Software
VWC 160	Mar-87	Recovery		850	VWC 160		182,000		"Theisfit"Software
VWC 205	Jul-00	Injection + Recovery	500-800-1100	30,240 / 12,960	205M (40 ft)	12.2	41,370	8.88E-04	"Aqtesolv" Software - Theis Solution
VWC 205	Jul-00	Injection + Recovery	500-800-1100	30,240 / 12,960	201 (2400 ft)		50,450	7.56E-04	"Aqtesolv" Software - Theis Solution
VWC 205	Jul-00	Injection + Recovery	500-800-1100	30,240 / 12,960	157 (4100 ft)		54,880	6.45E-04	"Aqtesolv" Software - Theis Solution
VWC 205	Aug-00	Pumping	2273	12,960 / 14,440	205	18.7			
VWC 205	Aug-00	Pumping + Recovery	2273	12,960 / 14,440	205M (40 ft)	18.7	78,910	9.48E-04	"Aqtesolv" Software -Hantush-Jacob Leaky-Aquitard Solution
VWC 205	Aug-00	Pumping + Recovery	2273	12,960 / 14,440	201 (2400 ft)		76,410	1.37E-03	"Aqtesolv" Software -Hantush-Jacob Leaky-Aquitard Solution
VWC 205	Aug-00	Pumping + Recovery	2273	12,960 / 14,440	157 (4100 ft)		65,880	1.36E-03	"Aqtesolv" Software -Hantush-Jacob Leaky-Aquitard Solution
VWC 201	Oct-00	Pumping	2439	14,440 / 2,880	201	30	65,100	5.75E-04	
VWC 201	Oct-00	Pumping + Recovery	2439	14,440 / 2,880	157 (1900 ft)		44,230	1.17E-03	"Aqtesolv" Software -Hantush-Jacob Leaky-Aquitard Solution
VWC 201	Oct-00	Pumping + Recovery	2439	14,440 / 2,880	205M (2360 ft)		57,210	8.49E-04	"Aqtesolv" Software -Hantush-Jacob Leaky-Aquitard Solution
VWC 201	Oct-00	Pumping + Recovery	2439	14,440 / 2,880	205 (2400 ft)		47,890	6.75E-04	"Aqtesolv" Software -Hantush-Jacob Leaky-Aquitard Solution
SCWC Saugus-1	Jul-88	Pumping	2941	1440	Saugus-1	30.2	69,300		"Theisfit" Software
SCWC Saugus-1	Jul-88	Recovery	2941	480	Saugus-1		59,700		"Theisfit" Software
SCWC Saugus-2	Sep-88	Pumping	2531	2880	Saugus-2	24.1	53,500		Semi-log plot
SCWC Saugus-2	Sep-88	Recovery	2531	1320	Saugus-2		55,700		Semi-log plot
SCWC Saugus-2	Sep-88	Pumping	2531	2880	Saugus-1		71,500	3.60E-04	Semi-log plot
SCWC Saugus-3	Sep-88	Recovery	2531	1320	Saugus-1		60,200		Semi-log plot

Storativity values from the 1987 aquifer tests were calculated from water level drawdown and recovery data measured in NCWD 12 during pumping of nearby NCWD 10. These storativity values were on the order of 10^{-4} (0.0001), with such values being considered typical of confined to semi-confined aquifer conditions.

Additional transmissivity values were derived from more recent aquifer test data obtained during construction and testing of SCWC Saugus Wells 1 and 2 (Slade, 1989 and 1990) and VWC 201 (Slade, 1990). Transmissivity values ranged from 60,200 to 70,300 gpd/ft for the two SCWC Saugus wells, respectively, and from 99,000 to 150,000 gpd/ft for VWC 201. These values are within, and toward the upper end of the previously calculated transmissivity values for the Saugus Formation. Storativity values calculated from these test results were 0.0001 (10^{-4}) for the SCWC Saugus wells, and 0.001 (10^{-3}) for VWC 201.

Transmissivity values were also calculated from the data derived from aquifer tests carried out as part of the 2000 ASR study. Calculated transmissivity data ranged from 66,000 to 76,000 gpd/ft for the pumping test of VWC 205, and from 44,000 to 65,000 gpd/ft for the pumping test of VWC 201 (see well locations on Plate 5.1). These values are in good general agreement with data from prior testing of Saugus Formation water wells (see Table 5.4). Storativity values calculated from these aquifer test data ranged from 10^{-3} to 10^{-4}, which is also in general agreement with previous data.

For the data generated from the ASR study, transmissivity and storativity calculations were carried out using the software program AQTESOLV, using the automatic curve fitting procedure. This permitted the rapid evaluation of several possible numerical solutions for each set of water level drawdown and recovery data. Using this software, it was found that the Hantush-Jacob solution for a leaky confined aquifer provided a good fit for the monitored water level data from VWC 205. This indicates that the individual aquifers within the Saugus Formation at this well site may exhibit some degree of vertical hydraulic connection.

Noteworthy during the pumping tests of the new Saugus Formation wells drilled since 1988 are the pumping rates utilized during the individual step drawdown tests. Step drawdown tests are the initial pumping tests conducted in a new well after its construction and are performed by pumping the well at 3 or 4 increasingly higher pumping rates (or steps), with

each rate (step) lasting approximately three to four hours. After the step drawdown test is performed, a final constant rate discharge test (i.e., the aquifer test) is then conducted in each new well.

The ranges of pumping rates used during the step drawdown tests in each new municipal-supply Saugus Formation water well were as follows:

- NCWD-13 - 1100 gpm to 3350 gpm
- SCWC Saugus -1 - 2014 gpm to 3731 gpm
- SCWC Saugus 2 - 1721 gpm to 3740 gpm
- VWC-201 - 1767 gpm to 3788 gpm
- VWC-205 - 2440 gpm to 4000 gpm
- VWC-202 (now destroyed) - 115 gpm (constant rate only)

These data clearly reveal the relatively high pumping rates that have been achieved during the step drawdown testing of these Saugus Formation water wells. Each subsequent constant rate discharge test in these wells was conducted at rates in the range of 2500 to 3400 gpm, except for that in VWC-202. As noted previously, VWC-202 was destroyed shortly after its construction in 1991 due to its very limited pumping capacity and very low specific capacity; this well was constructed in San Francisquito Canyon within sediments of the Sunshine Ranch Member of the Saugus Formation, north of the San Gabriel fault.

Specific Capacity

Although technically not an aquifer parameter, the specific capacity of a well is commonly used as a measure of the yield of a well. It is calculated by dividing the discharge rate of a well (in gpm) by the total water level drawdown created in that well while pumping at that rate; it is expressed as gallons per minute per foot of water level drawdown (gpm/ft ddn). Specific capacity is not strictly an aquifer property, because it is affected not only by aquifer characteristics but also by the design, construction and condition of the well.

As illustrated in Table 5.4, historically known specific capacity values for Saugus Formation wells are typically on the order of 10 to 70 gpm/ft ddn. Values calculated from the results of

pumping tests during the 2000 ASR study for both VWC 205 (20.4 gpm/ft ddn) and VWC 201 (29.9 gpm/ft ddn) are toward the lower end of the range for Saugus Formation wells in the region.

As a particular well ages, groundwater quality can also impact specific capacity because the casing perforations and the surrounding gravel pack may become clogged with mineral precipitates and/or bacterial growths, leading to an increase in head loss (increase in water level drawdown) for groundwater trying to enter the perforations. This, in turn, leads to a reduction in specific capacity over time and the eventual need for rehabilitation of the well.

Geohydrology

General Statement

The amount of useable groundwater in storage in the Saugus Formation was calculated in the Slade 1988 Report to be approximately 1.41 million AF. In that report, useable groundwater was defined as the groundwater contained only within potential sand and gravel aquifer beds and only between the depths of 500 ft below ground surface (bgs) and the shallower of either: a) a depth of 2500 ft bgs; or b) the base of fresh water within the Saugus Formation; or c) the base of the Saugus Formation. At that time, an upper limit of approximately 500 ft bgs was utilized as the shallowest that a Saugus Formation water well might be perforated while still minimizing potential water level drawdown interference with nearby alluvial water wells. More recent information on the thickness of the alluvium, and the degree of potential drawdown interference between adjacent Saugus Formation and alluvial water wells (based on testing conducted during the ASR project of 2000), has led us to adjust this upper limit from 500 ft bgs to 300 ft bgs for use in the revised calculations of groundwater in storage for this update report.

In order to update the 1988 calculations of groundwater in storage within the Saugus Formation, it was necessary to do the following: identify potential sand and gravel aquifer units from e-logs for a large number of widely distributed oil wells and water wells; calculate the total thickness of these potential aquifer units at each well location; determine the volume of these potential aquifer units both laterally and vertically; and then assign a specific yield

factor to the various areas of the Saugus Formation. The details of these steps are provided below.

Potential Saugus Formation Aquifers

The Saugus Formation is not a single homogeneous aquifer, but rather it consists of numerous potentially water-bearing sand and gravel beds (aquifer units) of varying thickness that are interlayered with finer-grained silt and clay beds. These potential aquifer units were identified by their distinctive signatures on approximately 150 e-logs from oil wells and water wells distributed throughout the Valley. A practical approach to evaluate the feasibility of using a potential aquifer unit to calculate the total potential aquifer unit thickness for any given e-log was utilized in the original Slade 1988 Report. The basic criterion used in that evaluation was whether or not perforated casing would be placed adjacent to a particular sand or gravel unit in a hypothetical water well constructed at that location. Using this criterion, thin sand and gravel units bounded above and below by relatively thick, impermeable silt or clay beds were considered hydrogeologically isolated units and, thus, were not included in the total thickness calculations. To be consistent with that 1988 methodology, this updated report utilizes that same practical approach.

For the Slade 1988 Report, it was assumed that the deeper potential aquifer units at a particular location would actually contribute groundwater to a well constructed at that location. Until recently, there were no data to verify that original assumption. However, two downhole flow meter (spinner) surveys have been conducted in VWC 205, one under pumping conditions and one under non-pumping conditions (see well location on Plate 5.1). These tests revealed that groundwater is produced by this well throughout its entire perforated length (*i.e.*, from 820 to 1930 ft bgs). Specifically, the 1999 spinner survey (performed at a pumping rate of approximately 3400 gpm at the time the well was initially constructed) showed that 2223 gpm, or 65% of the total flow, was from the perforated zone of 820 to 1045 ft bgs. Flow from the remaining perforated zones ranged from: 190 gpm (6% of the total flow) at 1045 to 1270 ft bgs; 401 gpm (12% of the total flow) at 1270 to 1495 ft bgs; 368 gpm (11% of the total flow) at 1495 to 1720 ft bgs; and 218 gpm (6% of the total flow) at 1720 to 1930 ft bgs.

A more recent spinner survey of VWC-205 was conducted for the 2000 ASR project and its results corroborated the initial 1999 testing. The greatest production in VWC 205 was derived from two specific zones: the first zone between 820 to 960 ft brp (34.3% of the total pumping test rate of 2253 gpm), and the second zone between 1570 to 1700 ft brp (22.6% of total flow). The remainder of the groundwater production was distributed fairly evenly over the rest of the perforated intervals in this well. Both of these spinner surveys demonstrate that the aquifer units within the entire perforated thickness of the Saugus Formation at this well (to a depth of at least 1930 ft) are capable of providing groundwater to wells.

In February 2002, NCWD conducted a spinner survey under non-pumping conditions in NCWD No. 10 which is located in the South Fork area (see Plate 5.1). Preliminary results of this spinner survey under non-pumping conditions revealed that groundwater from the deeper perforated sections of the casing was moving upward in the well and outward through the shallower sections of the perforated casing (from Table 5.1, casing perforations are from 780 ft to 1544 ft bgs in NCWD No. 10).

Total Thickness of Potential Aquifers

Plate 3.2 in Section 3 presents a map of contours of equal thickness of potential sand and gravel aquifer units within the Saugus Formation, along with the individual data points (wells) used to create those contours. Potential aquifer units for this update report are now considered to be between the depths of 300 ft bgs and the shallower of either: a) depth of 2500 ft bgs; or b) the base of fresh water within the Saugus Formation; or c) the base of the Saugus Formation.

Key observations from this plate include:

1. The greatest thickness of potential aquifer units within the Saugus Formation occurs within the central structural block, adjacent to the Holser fault zone in the area where the fault alignment crosses the I-5 Freeway. In this area, the total thickness of potential aquifers is in excess of 1500 ft.
2. In the southern structural block, the area of greatest aquifer unit thickness (in excess of 1100 ft) occurs in part beneath the South Fork of the Santa Clara River. This suggests that historical drainage patterns during the original deposition of the Saugus Formation were, in part, similar to those of the present day.

3. North of the San Gabriel fault, the total thickness of potential aquifer units reaches a maximum interpreted thickness of between 500 and 600 ft. A large area north of the San Gabriel fault near the margin of the Saugus Formation outcrop area is interpreted as having no potential aquifer units at all due to the presence of the Sunshine Ranch Member of the formation; this member lies near the base of the formation and is comprised principally by fine-grained strata of relatively low permeability.

Storage Units and Thickness Zones

Because the storage calculations for the Slade 1988 Report relied on hand-drafted maps, the outcrop area of the formation originally had to be divided into smaller, more manageable storage units, before calculating the individual areas using a planimeter. The GIS database and software used in this current report simplified this process, and allowed a slightly different approach to be used.

On the contoured map of potential sand and gravel aquifer units (Plate 3.2), the regions between successive contours were assigned a thickness intermediate between the lower and upper contour values. For example, the region bounded by the 800 ft and 1000 ft contour lines was assigned a thickness of 900 ft. For regions bounded by only a single contour on one side and by one of the fault zones on the other side, a value 100 ft greater than the lower bounding contour was assigned; for example, a region bounded by the 1500 ft contour on one side and the Holser fault on the other would be assigned a thickness value of 1600 ft. The planar surface area, and the total volume of the potential aquifer units for each contour-bounded region, were then calculated using the GIS software.

Specific Yield Values

Specific yield is the volume of water that may drain by gravity from a given volume of aquifer materials, relative to the total volume of aquifer materials; it is typically expressed as a percentage. Specific yield is dependent primarily on the permeability and grain size distribution of the aquifer materials. Because the Saugus Formation aquifer units vary horizontally and vertically in both grain size characteristics and permeability, it was necessary to assign different specific yield factors to different areas of the formation.

The original Slade 1988 Report assigned conservative specific yield values that ranged only between 5 and 8 percent to the Saugus Formation in calculating the approximate volume of groundwater in storage. Because there is no available evidence to suggest that these values should be adjusted, we have retained the conservative 1988 values for specific yield for the updated calculations presented below.

Estimated Quantity of Groundwater in Storage

The estimated volume of groundwater in storage in the Saugus Formation is calculated by multiplying the total volume of potential aquifer units in each contour-bounded region by their assigned specific yield factors, and then summing the results for each region. This is rapidly accomplished using the GIS database.

Table 5.5 - Summary of Groundwater in Storage in the Saugus Formation – summarizes the results of these calculations. As shown, the updated estimate of groundwater in storage is approximately 1.65 million AF, an increase of roughly 18% over the 1.41 million AF calculated in the original Slade 1988 Report. This increase is due almost entirely to raising the upper limit of our depth zone of interest from 500 ft to 300 ft bgs as discussed previously.

The calculated volume of 1.65 million AF is still far less than the approximately 6 million AF estimated by Robson (1972) for the USGS. The difference between the two calculated volumes appears to be due to three main differences in the methods used. The first is that our calculations extend only to a maximum depth of 2500 ft bgs or to the base of fresh water, or to the base of the Saugus Formation (whichever is shallower), whereas Robson's calculations extended to depths as great as 3500 ft bgs. Second, Robson (his Plate 2, 1972) shows considerably thicker aquifer units (up to 2000 ft thick) compared to those determined for this present study, which measured a maximum total aquifer thickness of approximately 1600 ft. Third, the single specific yield value used by Robson (10%) for the entire Saugus Formation is considerably greater than those used in our calculations (5 to 8%).

Operational Yield

As discussed in the preceding Section 4 regarding the alluvial aquifer system, one of the disadvantages of utilizing perennial yield as a basis for managing the pumpage from an

Table 5.5
Summary of Groundwater In Storage in the Saugus Formation

Storage Unit	Lower Thickness Contour (ft)	Upper Thickness Contour (ft)	Average Thickness (ft)	Area (acres)	Sand and Gravel Volume (AF)	Specific Yield (%)	Groundwater in Storage (AF)
Storage Unit 1 - North of San Gabriel Fault							
1A	0	200	100	5,153	515,286	7%	36,070
1B	200	400	300	4,086	1,225,773	7%	85,804
1C	400	Fault	500	1,786	892,930	7%	62,505
1D	400	600	500	149	74,510	7%	5,216
Subtotal							**189,595**
Slade (1988) Subtotal							130,540
Storage Unit 2 - Between San Gabriel and Holser Faults							
2A	400	600	500	122	61,170	7%	4,282
2B	600	800	700	673	470,806	7%	32,956
2C	800	1,000	900	4,506	4,055,265	6%	243,316
2D	1,000	1,000	1,000	563	562,860	6%	33,772
2E	800	1,000	900	181	163,035	6%	9,782
2F	1,200	1,400	1,300	1,203	1,563,575	6%	93,815
2G	1,400	Fault	1,500	689	1,034,085	6%	62,045
2H	600	800	700	89	62,643	7%	4,385
2I	600	400	500	82	41,005	7%	2,870
2J	600	800	700	1,168	817,719	7%	57,240
2K	400	600	500	1,025	512,325	7%	35,863
2L	200	400	300	950	285,096	8%	22,808
2M	0	200	100	1,241	124,085	8%	9,927
2N	1,000	1,200	1,100	1,678	1,846,031	6%	110,762
Subtotal							**723,822**
Slade (1988) Subtotal							641,330
Storage Unit 3 - South of Holser Fault							
3A	1,000	Fault	1,100	3,314	3,645,037	6%	218,702
3B	800	1,000	900	4,214	3,793,032	6%	227,582
3C	1,000	1,000	1,000	174	174,310	6%	10,459
3D	600	800	700	2,355	1,648,164	7%	115,371
3E	400	600	500	2,448	1,223,830	7%	85,668
3F	200	400	300	2,618	785,493	8%	62,839
3G	0	200	100	2,538	253,837	8%	20,307
Subtotal							**740,929**
Slade (1988) Subtotal							641,240
Total Groundwater in Storage							**1,654,346**
Slade (1988) Total							1,413,110

aquifer system is that it represents a long-term average value for yield. There is a potential for the perennial yield value to be interpreted as a not-to-exceed volume, with a related potential for pumpage above the perennial yield value in any given year to be interpreted as "overdraft". A recently advanced concept intended to deal with such potential misinterpretations is that of operational yield. This is defined as a fluctuating value of pumpage that may be above or below the perennial (average) yield in any given year and that varies as a function of the availability of other water supplies. The basic intent of the operational yield value is that it should not exceed the perennial (or average) yield of the groundwater basin over multi-year wet and dry cycles.

The operational yield concept includes flexibility of groundwater use by allowing increased pumping during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is available in wet/normal rainfall periods. The operational yield protects the aquifer by helping to assure that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. In the Valley, historical groundwater data demonstrate that the alluvium has been, and continues to be developed within its long-term sustainability (i.e. no continuous lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data for the Saugus Formation show no lowering of water levels or degradation of water quality where it has been developed at known well locations.

It is evident from observation of the response of water levels in the Saugus Formation to historical pumping that this aquifer system can be operated (pumped) over a range of capacities to at least 15,000 AF/yr per year without causing undesirable conditions that would be indicative of "overdraft," i.e. long-term continuous and progressive decline in water levels and in groundwater in storage. As a result, the operational yield of the Saugus Formation, or its yearly yield for operating purposes, could range up to an individual annual pumping volume on the order of 15,000 AF based on historical pumpage values available at this time. The ultimate goals, of course, would be to avoid both short-term adverse impacts as a result of year-to-year fluctuations in pumping, and to avoid longer-term adverse impacts such as continuously lowered water levels and storage in this aquifer system.

It is also evident from the analysis of aquifer extent, both spatial and vertical, and from the analysis of groundwater in storage, that historical Saugus Formation pumpage has been very small in comparison to aquifer thickness, groundwater in storage, and potential recharge (the latter as reported in the Slade 1988 Report). Recognition of the lack of any adverse impacts associated with historical Saugus Formation pumpage, and the latter observations of aquifer extent, groundwater in storage, and potential recharge has led to the following two plans regarding operation of the Saugus Formation aquifer system: 1) development of an UWMP that includes water supply from the Saugus Formation within the long-term yearly operational range on average (average/normal rainfall years), with short-term increases in single to multiple dry years into the range of 15,000 to 35,000 AF/yr; and 2) commitment via an MOU process between the Santa Clarita Valley Water Purveyors and the downstream United Water Conservation District to develop a numerical groundwater flow model in order to analyze in greater detail how the Saugus Formation aquifer system can be operated in the future to optimize its yield without adverse impact either to the Saugus Formation (avoidance of depressed water levels and depleted storage) or to the overlying alluvial aquifer system (avoidance of decreased flow into the alluvium) and associated environment effects.

In summary, the combination of historical observations and current planning has led to the current conclusion that the Saugus Formation can be operated at this time on a long-term average basis in the range of 7,500 to 15,000 AF/yr. Infrequently, during dry periods of one to three years, pumping operations can be ramped up from 15,000 to 25,000 AF/yr, and ultimately to 35,000 AF/yr if dry conditions continue. These latter increases would be temporary and would then return to or below the historical range of 7,500 to 15,000 AF/yr once rainfall patterns return to normal. As summarized in the UWMP, the operation of the Saugus Formation aquifer system will typically be in the 7,500 to 15,000 AF/yr range for most types of rainfall years, with possible short-term ramped increases in dry periods into the 15,000 to 35,000 AF/yr range. Such temporary and short-term increases above historic pumping volumes are unlikely to have an adverse impact on the Saugus Formation, and in particular, are unlikely to induce a permanent loss of groundwater in storage and/or a permanent decline in water levels. Any short-term water level decline or groundwater storage decline is expected to be restored upon return to the historical operating range on an

average basis.

Water Quality

Groundwater Character

As illustrated on Plate 5.5 – Map of Saugus Formation Wells, Stiff Pattern Diagrams - groundwater in the Saugus Formation varies in character from: calcium-bicarbonate (Ca-HCO_3) in NCWD Well Nos. 7, 8, 10, and 12; to calcium-sulfate (Ca-SO_4) in NLF Well No. 156 and VWC Well Nos. 158 and 160; to sodium-bicarbonate (Na-HCO_3) in the privately-owned Lombardi/Anden well located further west within the central fault block.

Groundwater of Ca-HCO_3 character is generally considered to be representative of oxidizing conditions, indicative of meteoric (rain) water that has percolated and circulated in the aquifer system. The Ca-SO_4 character of groundwater obtained from wells in the central part of the Valley likely reflects a longer residence time of water in the aquifer system allowing the soluble, sulfate-bearing gypsum and/or anhydrite minerals within the Saugus Formation sediments to dissolve into the groundwater. The cause of the Na-HCO_3 character in the Lombardi-Anden well is unclear, but in any case is represented by the results of laboratory testing of only a single sample from this one well.

Aquifer Zone Isolation Testing

Aquifer zone isolation testing (zone testing) has been performed in at least three of the Saugus Formation municipal-supply water wells at the time of their construction. Zone testing is performed in the open borehole (pilot hole) for a new well, after the geologic log and the e-log have been completed, but prior to reaming the borehole and setting the well casing. The basic purpose of the zone testing is to obtain a groundwater sample for subsequent water quality laboratory analysis from the potential aquifer zone being tested.

Specifically, the procedure involves: selecting a potential aquifer zone to test using the geologic log and the e-log; setting an approximately 15- to 30-foot long perforated sampling tool to the desired depth beginning at the deepest aquifer zone to be tested (the tool is lowered into the open borehole at the bottom end of the drill string); placing a bentonite seal

and a gravel pack above and below the perforated tool, and a gravel pack around the tool itself, in order to help isolate the perforated tool in the potential aquifer zone to be sampled; and lowering an air line inside the drill string and using an air compressor to inject high capacity/high pressure air into the air line. This injected air then essentially lifts the fluids from the isolated aquifer zone up within the drill string and to the ground surface. Airlifting continues until the fluids observed at ground surface are relatively clear, and then a water sample is collected for laboratory testing.

Zone tests were performed in SCWC-Saugus 1 at depths of 1510 to 1530 ft bgs and at 490 to 510 ft bgs. The analytical laboratory test results indicated the groundwater was Ca-Na-HCO_3 and Ca-SO_4-HCO_3 in character, with TDS concentrations of 410 mg/l and 530 mg/l, respectively.

Zone testing of VWC-202 (located along San Francisquito Canyon, north of the San Gabriel fault zone) was performed in four separate, 20-foot long zones between the depths of 280 ft and 810 ft bgs. Water quality in these zones ranged from Na-SO_4-HCO_3 to sodium chloride (Na-Cl). Both TDS and TH were relatively low, but iron, manganese and fluoride concentrations were relatively high.

Zone testing was also performed in NCWD-13, located in the South Fork area (see Plate 5.1), at depths of: 1365 to 1385 ft bgs; 970 to 990 ft bgs; 430 to 450 ft bgs; and 320 to 340 ft bgs. Laboratory test data show that the groundwater character was Ca-HCO_3 in the two shallower sampling zones, Ca-Na-HCO_3 in the 970 to 990 ft zone, and Na-Ca-HCO_3 in the deepest zone. TDS in the upper two zones were between 677 and 725 mg/l, whereas in the lower two sampled zones the TDS was 488 to 581 mg/l. Total hardness values showed that groundwater was very hard in the three upper zones (240 to 354 mg/l) but was only moderately hard in the deepest sampling zone (70 mg/l).

Inorganic Constituents

The TDS concentration of Saugus Formation groundwater typically ranges from 500 to 900 mg/l. The State Secondary MCL for TDS is expressed as a range with 500 mg/l set as the

lower level whereas the upper level is set at 1000 mg/l. No fixed consumer acceptance contaminant level has been established for TDS.

Our firm recently re-examined available TDS data from Saugus Formation water wells in the Valley. For that effort, the original laboratory data from each well were used to re-calculate TDS using a more standard, additive method as described in a USGS report by Hem (1985). These data were then compared to historic pumping and water level records to look for possible trends in TDS concentrations over time, and to examine if these trends were related to changes in groundwater production.

The results of that evaluation revealed that although there has been a slight increase in TDS concentrations in most Saugus Formation wells in the past 40 years, this increase could not be correlated with increased groundwater production. Results indicate that TDS concentrations have actually decreased during periods of increased Saugus Formation groundwater production.

Final well blend sample results (where available) for Saugus Formation wells generally show iron and manganese levels below their State Secondary MCLs of 0.3 mg/l and 0.05 mg/l, respectively. The DHS drinking water database lists several analyses for Saugus Formation groundwater with iron levels above 0.3 mg/l and included values up to 1.8 mg/l, but these are likely caused by small amounts of suspended material in the samples, rather than actual dissolved iron.

Well blend samples, and a review of the DHS drinking water quality database, reveals that nitrate (as NO_3) concentrations in Saugus Formation groundwater are also below the Primary MCL of 45 mg/l for this constituent.

Organic Constituents

Organic chemicals generally have not been detected in Saugus Formation groundwater, with the exception of four Saugus Formation water wells in the eastern portion of the Valley. These wells include SCWC Saugus 1 and Saugus 2, NCWD-11 and VWC 157 (see Plate 5.1 for well locations). Trichloroethylene (TCE), an industrial solvent, has been detected at concentrations ranging from 0.5 to 3.8 µg/l in VWC 157 between 1998 and 2001. TCE has

also been detected in concentrations ranging from 0.07 to 3.9 µg/l in SCWC Saugus 1, and from 0.07 to 1.3 µg/l in SCWC Saugus 2, between 1991 and 1997 when the two wells were put on inactive status.

None of the detected TCE concentrations in these wells was above its MCL of 5 µg/l for domestic use, and none of the three affected wells has been used for municipal-supply purposes since 1997.

Perchlorate

Perchlorate (ClO_4), and other related products, have also been detected in the same four wells, listed in the prior paragraph, that are located in the eastern part of the Saugus Formation. The current California DHS advisory action level for perchlorate is 4 µg/l. Testing of NCWD Well No. 11 showed perchlorate concentrations ranging between 9.9 and 23 µg/l between May 1997 and October 2000. This well is currently considered to be on inactive status, although NCWD has voluntarily refrained from using the well since 1998. Testing of VWC Well No. 157 between 1997 and 2000 showed perchlorate concentrations ranging from not detected (ND) to 14 µg/l. This well is also currently considered to be on inactive status, although VWC has voluntarily refrained from using the well since 1997. Finally, testing of SCWC Saugus No. 1 and Saugus No. 2 in 1997 and 1998 revealed perchlorate concentrations ranging from 16 to 42 µg/l in Well No. 1, and from 12 to 47 µg/l in Well No. 2. Neither of these two wells is currently being pumped, and both are on inactive status.

Results of ongoing laboratory testing of the remaining active Saugus Formation municipal-supply wells in the Valley have all shown non-detected concentrations of perchlorate. VWC Well Nos. 201 and 160 were sampled and analyzed for perchlorate in the third quarter of 2000, with the laboratory test data reporting not-detected results for both samples. Existing Saugus Formation water wells owned by NCWD were all tested for perchlorate in October 2000, with all samples returning not-detected results (with the exception of Well No. 11, discussed above).

Depth Discrete Aquifer Sampling

Until recently, little was known about the possible vertical variation in water quality in the Saugus Formation other than the presence of lower quality, higher salinity water in the stratigraphically lowermost portions of the formation (i.e., the Sunshine Ranch Member). However, depth specific water quality samples are now available for VWC Well 205 and NCWD Well 11.

As part of the 2000 ASR testing program, six discrete zones were sampled under pumping conditions within VWC 205, the details of which are summarized in Table 5.6 – Results of Depth-Discrete Sampling of VWC 205. The overall results generally agree with existing water chemistry data for the Saugus Formation. Specifically, the groundwater water has: a Ca-SO_4 to Na-SO_4 character; moderately high TDS (504 to 661 mg/l); low nitrate as NO_3 (4.78 to 8.6 mg/l); and moderately high iron (0.072 to 1.27 mg/l).

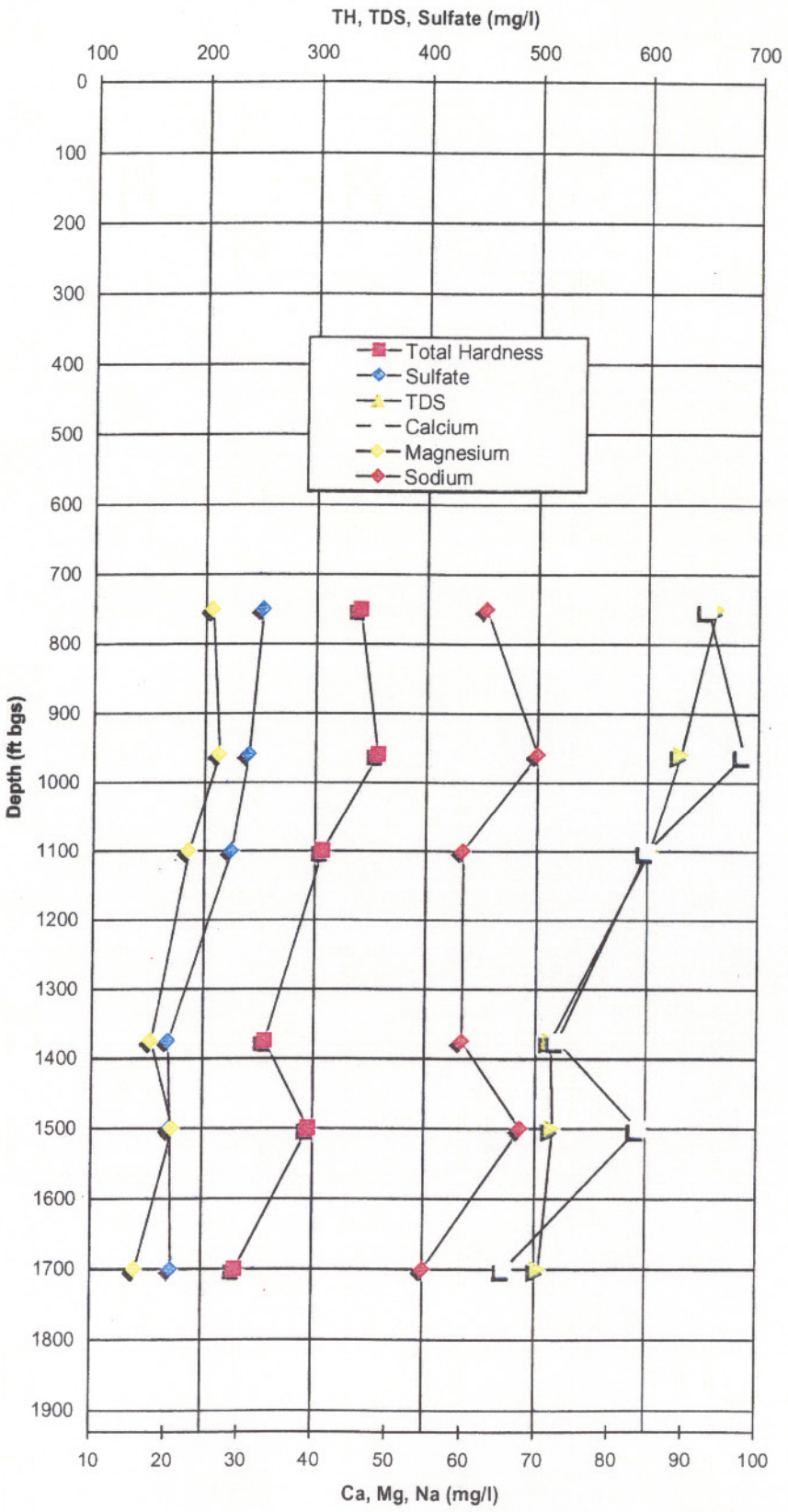
An interesting aspect of these VWC 205 laboratory results is the indication of a vertical chemical gradient within the upper 2000 ft of the Saugus Formation, with the concentration of virtually all dissolved constituents showing a generally consistent decrease with increasing depth of sampling (see Figure 5.3 – Plot of Water Quality vs. Depth, VWC 205). These new data appear to corroborate a similar improvement in water quality with depth that was observed in 1990 in a series of depth-discrete zone samples taken during construction of the Saugus Formation NCWD Well No. 13. It should be noted that VWC 205 penetrates only the upper one-third and geologically younger portion of the total Saugus Formation thickness at that site, and these results provide no information as to water quality in the older underlying beds near the base of the Saugus Formation.

Recent Aquifer Storage and Recovery (ASR) Testing

A preliminary program of aquifer storage (injection) and recovery testing by our firm, combined with groundwater modeling by CH2M Hill, were conducted in 2000-2001 as part of the Environmental Impact Report for the proposed Newhall Ranch development; the program was performed to examine the preliminary hydrogeologic feasibility of conducting an aquifer storage and recovery (ASR) program in the Saugus Formation. Details of the program are

Table 5.6
Results of Depth-Discrete Sampling of VWC 205

	Sampling Depth (ft, bgs)					
Chemical Constituent	**1700**	**1500**	**1375**	**1100**	**960**	**750**
Total Hardness (mg/l)	231	296	256	307	356	339
Ca (mg/l)	66	84	73	85	98	93
Mg (mg/l)	16	21	18	23	27	26
Na (mg/l)	55	68	60	60	70	63
K (mg/l)	2.6	3.4	2.8	2.7	3.1	2.9
Alkalinity (mg/l)	153	161	163	170	170	175
Hydroxide (mg/l)	0	0	0	0	0	0
Carbonate (mg/l)	0	0	0	0	0	0
Bicarbonate (mg/l)	187	196	199	207	207	214
Sulfate (mg/l)	173	171	169	225	240	252
Chloride (mg/l)	25	28	29	30	30	33
Nitrite as NO2 (mg/l)	<1	<1	<1	<1	<1	<1
Nitrate as NO3 (mg/l)	4.9	4.7	5.2	6.4	6.8	8.6
Fluoride (mg/l)	0.18	0.21	0.23	0.27	0.28	0.27
Orthophosphate (mg/l)	<1	<1	<1	<1	<1	<1
Bromide (mg/l)	0.11	0.12	0.12	0.15	0.15	0.15
pH	7.64	7.67	7.62	7.58	7.52	7.52
Specific Conductance (µmhos/cm)	744	784	755	858	908	920
TDS (mg/l)	504	516	514	602	630	661
Color	10	5	5	<5	<5	10
Turbidity (NTU)	9	7	5	4	2	12
Al (µg/l)	9	11	9	11	<5	<5
As (µg/l)	<2	<2	<2	<2	<2	<2
B (µg/l)						
Ba (µg/l)	53	53	49	48	44	43
Be (µg/l)	<1	<1	<1	<1	<1	<1
Cd (µg/l)	2	<1	<1	<1	<1	<1
Co (µg/l)	<1	<1	<1	<1	<1	<1
Cr (µg/l)	2	3	<1	2	1	1
Cu (µg/l)	6	<1	<1	<1	<1	<1
Fe (µg/l)	376	482	125	276	72	1273
La (µg/l)	<1	<1	<1	<1	<1	<1
Mn (µg/l)	5	5	1	3	2	13
Mo (µg/l)	1	0	1	2	1	2
Ni (µg/l)	78	20	13	5	10	6
P (µg/l)	58	40	25	71	40	114
Pb (µg/l)	<20	<20	<20	<20	<20	<20
Sb (µg/l)	<100	<100	<100	<100	<100	<100
Se (µg/l)	<100	<100	<100	<100	<100	<100
Sr (µg/l)	<100	<100	<100	<100	<100	<100
V (µg/l)	15	18	14	10	13	11
Zn (µg/l)	500	495	182	406	33	84



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CONSULTING GROUNDWATER GEOLOGISTS

FIGURE 5.3
Plot of Water Quality vs Depth
VWC 205

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contained in the report entitled Additional Analysis to the Newhall Ranch Specific Plan and Water Reclamation Plant Final Environmental Impact Report (2001), but the key points of that report are as follows:

1. It is hydrogeologically feasible to inject into and recover from the Saugus Formation significant volumes of water. The formation readily accepted water from the injection well, and subsequently yielded a comparable amount of water to the same well during pumping. Local mounding or depression of nearby static water levels (piezometric or pressure levels) due to injection or pumping, respectively, quickly returned to near pre-test levels once injection or pumping ceased.
2. An ASR program operated at annual injection rates of 4500 AF/yr during wet and normal years, and at annual extraction rates of 4100 AF/yr during dry years, was determined to have no significant negative effects on either the Valley, or on downstream users (i.e. Ventura County), as modeled by CH2M Hill (2001). The analysis predicted measurable benefits, including more rapid recovery of Saugus Formation water levels following drought periods.

An ASR project of a scope beyond that envisioned for the Newhall Ranch development may provide further benefits to the Saugus Formation aquifer system, particularly in light of the increased drought-year pumping levels outlined in the UWMP.

SECTION 6

CONCLUSIONS AND RECOMMENDATIONS

General Statement

The Santa Clarita Valley is has two local aquifer systems, the alluvial aquifer and the Saugus Formation aquifer. These important aquifer systems have provided and should be able to continue to provide reliable sources of potable drinking water for the area. Since the publication of the first significant hydrogeologic reports on these aquifer systems in the Slade 1986 Report and the Slade 1988 Report, respectively, significant new hydrogeologic data have been acquired and have greatly enhanced the understanding of the local groundwater sub-basin. Based on recent state-wide updating of groundwater basins in California, DWR currently is defining the local groundwater reservoir in the Valley as the Santa Clara River Valley East Groundwater Sub-basin. The western boundary at this sub-basin is currently taken at County line where it meets the adjoining (downstream) Piru sub-basin of Ventura County. The eastern boundary of the local groundwater sub-basin occurs at a narrows in the alluvium near Lang.

Based on our review of these new hydrogeologic data, we present the following conclusions and recommendations.

Hydrogeologic Conditions in the Alluvial Aquifer System

Extent and Thickness

The alluvial aquifer covers an area of approximately 16,000 acres on the floor of the main Santa Clara River Valley and its major tributary canyons. The aquifer is comprised by unconsolidated sand, gravel, silt and clay, and reaches a maximum thickness of 200 ft in local areas along the main reach of the Santa Clara River. In all canyons that are tributary to the main river, and as the lateral margins of the main river course and of the tributary canyons are reached, the thickness of the alluvium decreases. Groundwater occurs under unconfined (water table) conditions in the alluvial aquifer.

Water Levels

Water levels in the western portion of the alluvium (west of I-5) have historically been quite stable and insensitive to fluctuations in the amount of annual rainfall and surface water recharge. This is likely due, at least in part, to the upward flow of groundwater from the underlying Saugus Formation (particularly west of I-5), which provides a consistent source of recharge that is relatively independent of annual rainfall trends.

In addition, water levels in both the western portion and especially the central portion of the river valley (I-5 to Bouquet Canyon) have shown a progressive reduction in the amount of year-to-year variability, and a decreasing sensitivity to fluctuations in the amount of annual rainfall and recharge over the past ten years. This decreasing amount of annual water level fluctuation is due to the additional recharge provided to the alluvium from the annually increasing outflows (totaling 19,000 AF in 2000) from the two WRPs located between I-5 and Bouquet Canyon along the main river valley. The increase in WRP outflows and subsequent recharge of the alluvial aquifer system is directly related to the ongoing urbanization of the Valley and the concomitant and dramatic increase in the amounts of SWP water imported into the Valley since 1980. Imports of SWP water have risen from approximately 1,100 AF/yr in 1980 to over 32,000 AF/yr in 2000.

Water levels in wells along the main river valley east of Bouquet Canyon continue to display a much greater year-to-year variation, and a stronger correlation with changes in precipitation. In this reach of the river valley, water levels in alluvial wells decline temporarily during dry periods, but quickly recover to pre-drought levels once normal rainfall conditions return. This area is upstream from the two local WRPs, and is not influenced to the same degree by the increases in imported SWP water.

Overall, there is no evidence of a long-term, continuous or permanent decline in water levels in any alluvial aquifer well, and thus there is no evidence that the alluvial aquifer system is being pumped beyond its sustainable capacity. Whereas water levels in the alluvial aquifer do fluctuate over time, there is no continued and progressive decline in groundwater levels, leading to a permanent loss of groundwater in storage, which would be indicative of overdraft. There is clearly no overdraft in the alluvial aquifer system in the Valley.

Groundwater in Storage

As water levels in the alluvial aquifer fluctuate over time, so does the total quantity of groundwater in storage within this aquifer system. The alluvial aquifer contained an estimated 200,000 acre-feet of water in storage at its historical high in 1945. In the spring of 2000, the total volume of groundwater in storage in the alluvial aquifer was approximately 161,000 AF. Over time, groundwater levels and associated groundwater in storage in this aquifer system have fluctuated in response to wet and dry conditions in the Valley; this is particularly evident in the eastern portion of the alluvial aquifer. However, there has been no long-term, progressive decline in the amount of alluvial groundwater storage that could be considered indicative of overdraft conditions.

Groundwater Production and Operational Yield

Annual groundwater production from the alluvial aquifer by the major purveyors over the last ten years has averaged approximately 35,000 AF/yr, about 10 percent above the "practical or perennial yield" of 31,600 to 32,600 AF/yr calculated in the Slade 1986 Report. However, this recent increase in average annual production has occurred without any onset of undesirable conditions such as lowered water levels that might be indicative of excessive extractions or overdraft. The primary reason that the alluvial aquifer system has been able to supply groundwater for the past ten years in annual volumes that are well in excess of its previously estimated perennial yield is the greatly increased amount of water that has been imported into the Valley via the SWP since the early 1980s. Specifically, imports of SWP water into the Valley have risen from approximately 1,100 AF/yr in 1980 to over 32,000 AF/yr in 2000. Much of this additional water is returned to the alluvial aquifer system in the form of discharge from the two WRPs located along the Santa Clara River.

It is evident from observation of alluvial aquifer response to average pumping, and response to pumping in individual years, that the alluvial aquifer can be operated at a higher average pumping rate and over a wide range of yearly pumping rates without inducing undesirable conditions that would be indicative of overdraft, i.e., long-term continuous and progressive decline in water levels and storage. This observation is particularly evident since the initiation of supplemental SWP water deliveries in 1980. The ultimate goals of an increased

operational yield for the alluvium would be to avoid both short-term adverse impacts as a result of year-to-year fluctuations in pumping, and to avoid long-term adverse impacts such as continuously lowered water levels and groundwater in storage in this aquifer system.

In summary, the combination of historical observations and current planning has led to the current conclusion that the alluvial aquifer system can be operated over a wide range of pumping rates, and on a long-term average basis it can be operated at an average pumping rate on the order of 10% higher than was reported as a "practical or perennial yield" in 1986. As summarized in the UWMP, the operational yield of the alluvial aquifer system will typically be in the 30,000 to 40,000 AF/yr range for most average and/or wet years, with expected reduction into the 30,000 to 35,000 AF/yr in dry year periods.

Groundwater Quality

Groundwater pumped by the local water purveyors is routinely sampled and tested by State-certified laboratories. These laboratory data show that the water quality of groundwater pumped from the alluvial aquifer system meets all current Federal and State drinking water standards.

Two important constituents in the groundwater in this aquifer system are nitrate and TDS. Nitrate concentrations in alluvial wells ranged from 14 mg/l in the easternmost alluvial wells, to 27 mg/l in alluvial wells near the confluence between the South Fork and main reach of the Santa Clara River. Nitrate concentrations in the area west of I-5 are quite low, with the concentration in five agricultural-supply wells in this area averaging just 6.6 mg/l. Nitrate concentrations in municipal-supply water wells within the alluvium are below its MCL of 45 mg/l for domestic use.

TDS generally increases from approximately 500 mg/l in the easternmost alluvial wells, to approximately 1000 mg/l in agricultural-supply wells west of I-5. All of the existing municipal-supply alluvial wells are located east of I-5.

VOCs, specifically 1,1,1-TCA and PCE, have occasionally been detected in a few municipal-supply wells in the eastern part of the Valley, but the detected concentrations of these VOCs have been consistently below their respective MCLs. The source(s) of these VOCs is not

known and has not been investigated for this update report. No other alluvial municipal-supply wells have shown repeatable detections of any VOCs. There has also been no detection of perchlorate in any municipal-supply well constructed in the alluvial aquifer system in the Valley.

Groundwater extracted from the alluvial aquifer system by the municipal-supply water purveyors in the Valley has been and continues to be of acceptable quality for beneficial use.

Hydrogeologic Conditions in the Saugus Formation Aquifer System

Extent and Thickness

The Saugus Formation aquifer system is comprised by a deep bowl-shaped group of layered sediments having a surface outcrop area of approximately 55,500 acres. The formation is comprised of semi-consolidated sand, gravel, silt and clay, and reaches a maximum thickness beneath the central part of the Valley of approximately 8,000 ft. However, useable groundwater at this time is considered only to occur in the uppermost 2,500 ft of these sediments. Groundwater occurs under semi-confined to confined conditions within most of the formation; unconfined (water table) conditions may occur within some of the coarser-grained Saugus Formation strata exposed at or near ground surface in the hillsides surrounding the river valley.

The results of recent spinner surveys in selected Saugus Formation wells demonstrate that groundwater is being produced over the entire screened intervals in these tested wells, down to their maximum cased depths of approximately 2000 ft. Pumping tests (both step drawdown tests and constant rate tests) performed in the newer municipal-supply wells in this formation have been conducted at rates in the range of 1720 to 4000 gpm, and 2500 to 4000 gpm, respectively. Such rates document the high pumping rate capacity of this formation south of the San Gabriel fault.

Water Levels

Water levels (piezometric levels) in Saugus Formation water wells have typically fluctuated over time, with the magnitude of these historic fluctuations varying with each well; these annual fluctuations have generally ranged from a minimum of 50 ft to a maximum of 175 ft. It

is important to note that these fluctuations are considered to be small because the Saugus Formation wells in which these fluctuations have occurred range in total cased depth from 750 ft to nearly 2000 ft. Furthermore, the depth to the top of the uppermost perforations in most existing Saugus Formation wells is typically 400 ft or more below ground surface.

Water levels in Saugus Formation wells appear to fluctuate in response to patterns of increasing or decreasing rainfall, and to some extent to patterns of increasing or decreasing groundwater extraction from the Saugus Formation. However, a significant observation from the hydrographs of wells constructed in the Saugus Formation is that no long-term or continuous decline in water levels has occurred in any Saugus Formation water well over time, thereby demonstrating that this aquifer system is not and has not been overdrafted.

Groundwater in Storage

The Slade 1988 Report calculated the volume of groundwater in storage in the Saugus Formation aquifer to be approximately 1.41 million AF. Groundwater in storage at that time was defined as that groundwater contained solely within with potential sand and gravel aquifer beds identified on e-logs, and only between the depths of 500 ft bgs and the shallower of either: a) a depth of 2500 ft bgs; b) the base of fresh water within the Saugus Formation; or c) the base of the Saugus Formation.

For this updated report, the volume of groundwater in storage in the Saugus Formation has been re-calculated using the same criteria used in 1988 except that the uppermost portion of the zone of interest within the formation has been raised from a depth of 500 ft to 300 ft bgs. This change is based on our increased knowledge of the thickness of the alluvial sediments in the Valley and the minimal degree of pumping interaction that was monitored between a pumping Saugus Formation well and a nearby alluvial groundwater monitoring well during the injection test program in 2000.

The current calculated volume of groundwater in storage in the Saugus Formation is approximately 1.65 million AF, or about 18% more than the 1988 calculation value. This increase is entirely due to raising the upper limit of the zone of storage from 500 ft to 300 ft bgs.

The actual volume of groundwater in storage in an aquifer can be less important than the amount of annual recharge to the aquifer for the purposes of determining the amount of water that can be withdrawn by pumping over the long term. However, when the volume in storage is particularly large in comparison to the amount of annual pumping, considerable flexibility is added to the available strategies for aquifer management. For example, the aquifer may be pumped heavily during dry years and then allowed to recover during wet years, either via natural or artificial recharge.

Groundwater Production and Operational Yield

Groundwater production from the Saugus Formation has averaged approximately 8,600 AF/yr from 1991 to 2000, whereas the maximum historical production volume was approximately 15,000 AF occurring in 1991, towards the end of a multi-year drought. No long-term continuous or permanent decline in either water levels or the amount of groundwater in storage has occurred under this historical range of pumping.

The operational yield concept includes flexibility of groundwater use by allowing increased pumping during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is available in wet/normal periods. The operational yield protects the aquifer by helping to assure that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. Limited historical data for the Saugus Formation show that no lowering of water levels or degradation of water quality has occurred in the area.

It is evident from observation of response to historical pumping from the Saugus Formation that this aquifer system can be operated (pumped) over a range of capacities to at least 15,000 AF/yr without causing undesirable conditions that would be indicative of "overdraft," i.e., a long-term continuous and progressive decline in water levels and in groundwater in storage. As a result, the operational yield of the Saugus Formation, or the yearly yield for operating purposes, could range up to an individual annual pumping volume on the order of 15,000 AF based on data available to date. As with the alluvial aquifer system, the ultimate goals of an increased operational yield for the Saugus Formation would be to avoid both short-term adverse impacts as a result of year-to-year fluctuations in pumping, and to avoid long-term adverse impacts such as continuously lowered water levels and storage.

In summary, the combination of historical observations and current planning has led to the current conclusion that the Saugus Formation aquifer system can be operated on a long-term average basis in the range of 7,500 to 15,000 AF/yr. Infrequently, during dry periods of one to three years, pumping operations can be ramped up from 15,000 to 25,000 AF/yr, and ultimately to 35,000 AF/yr if dry conditions continue. These latter increases would be temporary and would return to or below the historical range of 7,500 to 15,000 AF/yr once rainfall patterns returned to normal. As summarized in the UWMP, the operational yield of the Saugus Formation will typically be in the 7,500 to 15,000 AF/yr range for most year types, with possible short-term ramped increases in dry periods into the 15,000 to 35,000 AF/yr range. Such temporary and short-term increases above historic pumping are unlikely to have an adverse impact on the Saugus Formation aquifer system, and, in particular, are unlikely to induce a permanent loss of groundwater in storage. Any short-term water level decline or groundwater in storage decline is expected to be restored upon return to the historical operating range on an average annual basis.

Groundwater Quality

Groundwater pumped from the Saugus Formation aquifer system by the local water purveyors is routinely sampled and tested by State-certified laboratories. These laboratory data show that the water quality of pumped groundwater down to the existing known maximum depth of these wells (2000 ft) meets all current Federal and State drinking water standards. Aquifer zone isolation testing performed in individual aquifer units during the drilling of selected Saugus Formation wells further corroborates that water quality to depths of at least 1530 ft bgs is suitable for municipal-supply purposes.

Groundwater character within the Saugus Formation generally varies from calcium-bicarbonate in the area along the South Fork of the Santa Clara River, to calcium-sulfate towards the deeper central parts of the local groundwater sub-basin.

An important water quality parameter in Saugus Formation groundwater is its TDS concentration. TDS concentrations of Saugus Formation groundwater typically range from 500 to 900 mg/l. The State Secondary MCL for TDS for domestic use is expressed as a

range, with the upper value for TDS being 1000 mg/l. No fixed consumer acceptance level has been established for TDS.

A detailed re-calculation and review of available historic TDS data from Saugus Formation water wells has been performed and revealed that although there has been a slight increase in TDS levels in most Saugus Formation wells in the past 40 years, this increase can not be correlated with increased groundwater production. In fact, there is evidence that TDS concentrations have actually decreased during periods of increased Saugus Formation groundwater production.

Recent depth specific sampling of several Saugus Formation wells under pumping conditions indicates that groundwater quality, as determined by the quantities of certain dissolved inorganic constituents, actually improves slightly with depth in the upper 2,000 ft of the formation.

Perchlorate

Perchlorate (ClO_4), a component of rocket fuel, has been detected at concentrations ranging from approximately 10 to 47 µg/l in four wells (SCWC Saugus Nos. 1 and 2, NCWD-11 and VWC-157) in the eastern part of the outcrop area of the Saugus Formation. The current California DHS advisory action level for perchlorate is 4 µg/l. Each of these four wells was taken out of service following the initial detection of perchlorate in 1997.

Results of ongoing laboratory testing of the remaining active Saugus Formation municipal-supply wells have all shown perchlorate to be not detected. VWC Well Nos. 201 and 160 were sampled and analyzed for perchlorate in the third quarter of 2000, with the laboratory test data showing not-detected results for both samples. The other active Saugus Formation water wells owned by NCWD were all tested for perchlorate in October 2000, with all samples also revealing not-detected results.

Perchlorate in the Saugus Formation groundwater is currently known to affect only the eastern portion of the Saugus Formation aquifer system. The local water purveyors are currently investigating a treatment program using an existing and approved technology to restore the water supply capacity of the four impacted wells, and to assist in remediating and

containing the groundwater contaminated by perchlorate. The California Department of Toxic Substances Control is overseeing the ongoing remediation and cleanup of a suspected source of this (and related) contaminants. All other existing Saugus Formation municipal-supply production wells are unaffected by perchlorate and this aquifer system remains a viable source of groundwater for the Valley.

Future Well Construction

Alluvial Aquifer System

It is considered hydrogeologically feasible to site, drill and construct new municipal-supply water wells within the alluvial aquifer system in the Valley. These new wells, specifically designed and constructed for municipal-supply purposes, should gradually replace those older existing municipal-supply wells that were originally constructed for agricultural-supply purposes. Additional new well construction may also occur as urbanization of the Valley continues and the groundwater currently pumped by existing agricultural-supply wells is designated for municipal-supply purposes.

The site-specific siting and design of new individual alluvial aquifer wells is beyond the scope of this report, but the following points summarize some key siting and design considerations for those new municipal-supply wells:

- New wells should be properly designed, constructed, developed and tested, and then equipped with water level transducers, if appropriate, for ongoing water level monitoring.
- Lateral separation between future and existing municipal-supply wells, and between those wells and existing privately-owned domestic wells, should be carefully selected to minimize the potential for water level drawdown interference.
- New municipal-supply wells should be constructed with relatively deep perforated intervals, and sufficiently deep cement sanitary seals to reduce the potential for inflow of surface water and/or shallow, poor-quality groundwater.
- New wells should be drilled and completed only within the alluvial aquifer to avoid the unplanned cross-flow of water between the alluvial aquifer, and confined portions of the underlying Saugus Formation.
- Proposed well sites should be evaluated for possible sources of past or present groundwater contamination. This will be particularly important as the urbanization of the Valley continues.

- Siting studies for new municipal-supply alluvial wells should include a field reconnaissance and well canvass to determine whether or not there are any nearby wells owned by others that might lie within the cone of water level depression created by future pumping of each newly proposed municipal-supply water well.

Saugus Formation Aquifer System

It is considered to be hydrogeologically feasible to site, drill and construct new municipal supply water wells in the Saugus Formation aquifer system. New Saugus Formation water wells will be needed to provide the increased Saugus Formation groundwater production envisioned by the 2000 UWMP. In anticipation of this new well construction, we have reviewed the construction details and well performance characteristics of existing Saugus Formation water wells in light of recent advances in our understanding of the geology and hydrogeology of the Saugus Formation. This has led to the development of several criteria for identifying areas that are hydrogeologically favorable for the drilling and construction of new Saugus Formation water wells. These criteria include:

1. New wells should be located in areas where the total thickness of potential Saugus Formation sand and gravel units in the depth range of 300 ft to 2500 ft bgs is generally greater than 800 ft (refer to the locations of such areas on Plate 3.2). This criterion will help maximize the total thickness and number of potential coarse-grained aquifer units intersected during drilling of the pilot hole for the new well. Because of the "bowl-shaped" structure of the Saugus Formation in the Valley, areas of thickest potential sand and gravel aquifers are found nearer the center of the basin, especially in areas adjacent to the Holser fault, within the southern and central fault blocks.
2. New wells should be located in areas where the depth to the top of the Santa Clarita Aquifer Zone beneath the potential well site is at least 800 ft below ground surface. This is because the more productive of the existing Saugus Formation water wells tend to intersect the Santa Clarita Aquifer Zone at depths of 1000 ft or more.
3. Extrapolation of the results of recent aquifer testing carried out on VWC Well Nos. 205 and 201 has been used to provide a reasonable approximation of potential drawdown interference between new and nearby existing Saugus Formation municipal-supply water wells. New wells should be located in areas that will provide a minimum separation of 1000 ft from existing Saugus Formation municipal- or agricultural-supply water wells; this is important to help minimize the potential for mutual water level drawdown interference between pumping municipal-supply wells.

4. Siting studies for the new municipal-supply wells in this formation should include a field reconnaissance and well canvass to determine whether or not there are any nearby wells owned by others that might lie within the cone of water level depression created by future pumping of each newly proposed municipal-supply water well.

The depth to the base of fresh water as calculated from e-logs has also been used as a criterion in evaluating these recommended drilling areas. In the recommended areas presented herein, the depth to the base of fresh water was found to be greatly in excess of the anticipated depth range of 1500 to 2000 ft for new Saugus Formation water wells.

At the present time, it is not known if the San Gabriel and/or Holser faults act as barriers to groundwater flow within the Saugus Formation, particularly in the area west of Bouquet Junction. Recent groundwater modeling by CH2M Hill (Newhall Ranch ASR Impact Evaluation, 2001) suggests that the faults do not act as groundwater barriers, but there is currently no way to test this hypothesis due to a complete absence of deep, Saugus Formation water wells north of the faults. The issue is further complicated by the fact that there is not a consensus among geologists as to the position, or even the existence of the Holser fault where it is projected beneath alluvium in the main river valley.

Given the present lack of hydrogeologic information regarding the San Gabriel and Holser faults, we suggest that new Saugus Formation wells avoid being located near mapped traces of the two faults in order to minimize the potential for increased water level drawdown that might occur if the faults were barriers to groundwater flow.

Plate 6.1 – Recommended Areas for New Saugus Formation Water Wells - illustrates a large area in the central portion of the Saugus Formation outcrop area that meets the above hydrogeological and logistical criteria. The favorable areas identified at this time occur within the central and southern fault blocks. Circular buffer zones are shown around existing wells to identify minimum separation zones covered by criteria 3, 4 and 5 above.

The area shown in Plate 6.1 is intended only as a general guide to prospective drilling areas. Each specific future well site should still undergo a detailed evaluation of its unique subsurface geology, geologic structure, site logistics and position relative to existing or planned infrastructure.

When evaluating potential sites for new Saugus Formation water wells, the following site logistics criteria should also be considered:

- Sufficient room to maintain required setbacks from nearby sewers and storm drains.
- Sufficient room for drilling and testing equipment.
- Possible presence of overhead obstructions such as trees or aboveground utilities.
- Availability of water for drilling, from either a nearby hydrant or an existing water well, or from a nearby water transmission line.
- Proximity to nearby residences or other structures for which there could be the potential need for noise abatement procedures and equipment.
- Sufficient room for temporary water storage tanks and an available discharge point for releasing water produced during drilling, development and testing of a new well, to permit conformance with NPDES requirements.

Artificial Recharge

Alluvial Aquifer System

Artificial recharge is the process of augmenting the natural recharge to the aquifer, a process that normally occurs on an ongoing basis via the natural infiltration of precipitation and surface water runoff. Artificial recharge programs utilize a variety of man-made works that are designed to maintain infiltration rates, increase the surface area over which infiltration takes place, and increase the length of time during which infiltration can occur. Regardless of the exact method used, the goals of an artificial recharge program typically include:

- Replenishing or increasing the amount of groundwater in storage in the aquifer.
- Storing water in times of low demand for subsequent use in high demand periods.
- Increasing the infiltration of surface water runoff, particularly during flood flow periods.
- Increasing the flexibility of the operating and management plans of local water purveyors.

Of the numerous methods available for artificial recharge, the most appropriate to the water table conditions in the alluvial aquifer would be a system of surface spreading basins or off-

stream basins, or similar structures. This would involve the construction of basins or impoundments to store water from one or more available sources, and permit the infiltration of the water into the underlying alluvial aquifer.

Plate 6.2 – Potential Areas for Artificial Recharge, Alluvial Aquifer – illustrates the areas within the main river valley upstream (east) of Bouquet Canyon where the Slade 1986 Report suggested artificial recharge could potentially be carried out by means of surface spreading basins. Those areas were chosen for their potentially relatively high rates of vertical infiltration of water through the local soils (generally greater than 6 inches per hour), and the possible absence of low-permeability clay layers in the uppermost 25 ft of alluvial sediments. In addition, local surface water quality constraints and the quality of the local alluvial groundwater at that time were also considered.

Even in areas that may be otherwise suitable for artificial recharge, high (shallow) water levels may limit the amount of available (extra) storage capacity in the aquifer. The limited amount of water level fluctuations seen on hydrographs for wells in the western and central portions of the alluvial aquifer suggests that the aquifer is essentially "full" or nearly "full" in these areas, and thus the aquifer system in those portions of the Valley would tend to have little or no available capacity to receive and store additional water from a nearby artificial recharge program. It is probable that only in those areas along or near the Santa Clara River east of Bouquet Canyon are groundwater levels sufficiently below their likely maximum levels to provide available storage capacity that could be filled by artificial recharge on a regular basis.

Detailed investigations of potential recharge sites have not been performed to date. The Slade 1986 Report discusses the general types of additional work required to evaluate individual sites in greater detail, as well as some potential problems associated with artificial recharge of the alluvium.

Saugus Formation Aquifer System

Because the Saugus Formation is predominantly a semi-confined to confined aquifer with lower permeability and transmissivity than the alluvial aquifer, artificial recharge of the Saugus Formation via spreading basins would not be practical. However, recent field testing

and groundwater modeling have demonstrated that ASR using deep injection wells is both feasible and potentially advantageous for the Saugus Formation.

An ASR project of a scope beyond that envisioned for the Newhall Ranch development may provide further benefits to the Saugus Formation aquifer, including:

- Increased volume of groundwater in storage in the aquifer.
- More rapid post-drought recovery of Saugus Formation water levels.
- Possible improvement in the groundwater quality in the Saugus Formation, depending on the source of the injection water.
- Greater flexibility in the operations and management being performed by the local water purveyors.

Conjunctive Use and Management of the Alluvial and Saugus Formation Aquifers

Conjunctive use refers to the coordinated management and operation of multiple water supplies to achieve improved reliability of the water supply. In this aspect, the Valley is fortunate to have two local aquifers that can be conjunctively used with imported SWP water in order to provide the Valley with a reliable supply of potable drinking water.

Since beginning to import a supplemental surface water supply in 1980, the Santa Clarita Valley Water Purveyors have been conjunctively utilizing that imported surface water with local groundwater from the alluvial and Saugus Formation aquifer systems. It has been conjunctive use that has allowed increasing water demands to be met while maintaining groundwater production within a range that precludes either aquifer system from being in overdraft. A similar, but expanded, conjunctive use program, as described in detail in the recently adopted UWMP, is expected to integrate additional supplemental sources of water supply in order to meet further projected increases in water demand while maintaining both aquifer systems within long-term sustainable yield, i.e. no overdraft.

As projected increases in water demand are experienced in the future, it is anticipated that pumpage from the alluvial and Saugus Formation aquifer systems will remain, on a long-term basis, in the same range as in recent years. Increasing water demands will be met by increased imported supplies, recycled water, demand-side management (conservation), and other sources to be developed.

Future conjunctive use operations are expected to entail some short-term increased pumping from the Saugus Formation during dry periods and reduced SWP water availability. While that pumping could increase into a range of 15,000 to 35,000 AF/yr for one to three consecutive dry years, surface water will be conjunctively used in greater amounts during wet and normal years to allow Saugus Formation pumpage to decrease such that, again on a long-term basis, pumpage is maintained within historic range; overdraft would be avoided. Such future conjunctive use may also include some purposeful injection of water into the Saugus Formation to enhance the recovery of water levels and also to increase the amount of groundwater in storage following periods of higher pumping during dry periods.

A conjunctive use strategy for the Valley could include:

- Utilizing a combination of imported SWP water and increased groundwater pumpage from the alluvial aquifer system during periods of average or above average rainfall (normal and wet years).
- Utilizing increased extraction from the Saugus Formation during periods of lower than average rainfall in the Valley (dry years), or during periods of decreased availability of water from the SWP.
- Enhancing the recovery of water levels and the volume of groundwater in storage in the Saugus Formation through a program of artificial recharge, via injection, whenever additional water supplies are available.
- Increasing the available storage capacity of the alluvial aquifer through increased pumping in the area east of Bouquet Canyon. This would serve to enhance both the natural recharge to the aquifer, and the effectiveness of an artificial recharge program using surface spreading basins in the same area.
- Augmenting the natural recharge to the alluvial aquifer system through the use of spreading basins or similar structures along the river in the area east of Bouquet Canyon.

Groundwater Monitoring

General Statement

During the preparation of this report, a significant effort was made to research, collect, and verify current and historic data on groundwater levels and water quality, on water well locations and construction details, and on aquifer parameters, for both the alluvial and Saugus Formation aquifer systems. A large component of this effort was the construction of a GIS database that not only serves as a repository and analytical tool for historic data, but which should be used as the basis for any future monitoring program. This data collection effort and database creation are now expected to evolve into a formal program of monitoring, data collection, and database maintenance, with standardized procedures for data collection and a central, single repository for the data.

In addition, an effort should be made to fill in existing data gaps by collecting data from existing private wells, agricultural-supply wells, or piezometers (where possible), or, where practical, by drilling and constructing a limited number of new monitoring wells in both aquifer systems in the Valley.

Selection of Monitoring Sites

A specific site for the collection of water quality data is not necessarily a suitable site for the measurement of water level data in an aquifer, and therefore data collection efforts for these two types of data need not be conducted at the same monitoring sites. For example, an active, properly constructed production water well is an excellent location for the collection of water quality samples. However, water levels measured in this same active production well may be strongly affected by incomplete recovery or by pumping water level drawdown in the vicinity of the well, and hence the collected water level data may not be representative of conditions in that portion of the aquifer as a whole. This is particularly true for wells that are not currently equipped with pressure transducers, and that are pumped almost continuously during periods of heavy water demand (e.g. the NCWD Saugus Formation wells). For an existing well to be used in the monitoring program, it will also be necessary to verify that pertinent well construction data exist or can be obtained via a video survey in the well.

Each well selected for water level monitoring should have a permanent reference point marked on the wellhead, and the elevation of each reference point should be accurately determined using either traditional survey methods tied to a benchmark of known elevation, or a survey-grade differential GPS unit. All vertical elevations should be tied to a single, widely used vertical datum.

Alluvial Aquifer System

Given that water levels are used to determine changes in the amount of groundwater in storage, a practical approach to selecting sites for water level monitoring in the alluvial aquifer may be to choose at least one monitoring site in each of the alluvial storage subunits described in Section 4. This would permit a more accurate and reliable determination of the year-to-year variation in groundwater in storage in the alluvium.

It may also be very useful to establish a series of monitoring wells near the downstream end of the alluvial aquifer between Castaic Junction and County Line. This could help to quantify the amount of subsurface outflow within the alluvium, and to assist in groundwater model calibration and groundwater basin management efforts.

Terrace Deposits

Terrace deposits are not considered to be a viable water-bearing aquifer unit because they are generally situated above the regional water table. In addition, surface exposures of these terrace deposits are not considered to be either areally extensive or thick. Hence, establishment of a groundwater monitoring program for these deposits is not recommended.

Saugus Formation Aquifer System

Monitoring of water levels and water quality within the Saugus Formation will likely be restricted to existing and/or newly constructed Saugus Formation water-supply wells for the foreseeable future, given the high cost of constructing deep monitoring wells in this aquifer system. However, a program of regular monitoring of both water levels and (where possible) water quality in existing wells, both active and inactive, would add to the ever-increasing database on the Saugus Formation.

If monitoring wells are to be constructed, careful consideration should be given to areas within the outcrop area of the Saugus Formation where data are lacking, or where the data would be particularly useful for groundwater model calibration purposes. Areas where data are particularly lacking include the area between the Holser and San Gabriel faults, and the area north of the San Gabriel fault. Both the siting and the design of new monitoring wells should be undertaken with these considerations in mind.

Another step that could be taken to enhance the current understanding of Saugus Formation water levels and water quality would be to include several of the existing privately-owned Saugus Formation wells (e.g. the Poe and Anden wells, and NLF-156) in the ongoing monitoring program. These wells are located in key areas in the Saugus Formation where no nearby municipal-supply wells exist.

Network Operation and Monitoring

Data collected should include:

- Static and pumping water levels in both the alluvial and Saugus Formation aquifer systems.
- Water quality data for both aquifers and for the Santa Clara River and its major tributaries.
- Annual groundwater extraction volumes pumped by individual wells from all of the major water users, including private and agricultural users.
- Detailed well construction information for new and existing wells.
- Records of any well destruction activities, including the dates and methods used.
- Historic data on aquifer parameters, as well as newer data acquired during new well construction and testing.
- A well canvass to better define the locations and annual production from privately-owned, domestic-type water wells in both aquifer systems.
- Information on potential groundwater contamination sites obtained from available government and/or private databases and publications.
- Discharge volume and water quality data for existing and future WRPs.
- Rainfall records.
- The amounts, rates, locations, and water quality for any water that is recharged into the two local aquifer systems in the future.

- Other relevant data, such as major changes in land use, and annual variations in the volume of water imported to the Valley.

A series of standardized procedures for collecting, recording, verifying and reporting of the data should be established and implemented on a regular basis. All records collected by the coordinating entity should be stored in a relational database and integrated with a GIS system.

The measurement and recording of water level data should be done, where feasible, via recording pressure transducers, with periodic manual measurements to provide confirmation. This will provide a continuous record that is considerably more useful than infrequent manual measurements for monitoring water level conditions in the Valley. Transducers not only provide a much more complete and accurate water level record, but may also be more cost effective and reliable than a program relying strictly on manual measurements.

SECTION 7

REFERENCES REVIEWED

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Appendix 5.21L

Hydrogeologic Investigation of the Perennial Yield and Artificial Recharge Potential of the Alluvial Sediments in the Santa Clarita River Valley

Richard C. Slade

December 1986

VOLUME I — REPORT TEXT

HYDROGEOLOGIC INVESTIGATION
PERENNIAL YIELD
and
ARTIFICIAL RECHARGE POTENTIAL
of the
ALLUVIAL SEDIMENTS
in the
SANTA CLARITA RIVER VALLEY
of
LOS ANGELES COUNTY, CALIFORNIA

FOR
UPPER SANTA CLARA WATER COMMITTEE
MEMBERS: LOS ANGELES COUNTY WATERWORKS
DISTRICT NO. 36 — VAL VERDE
NEWHALL COUNTY WATER DISTRICT
SANTA CLARITA WATER COMPANY
VALENCIA WATER COMPANY

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Subject: Executive Summary
Hydrogeologic Investigation
Perennial Yield and Artificial
Recharge Potential of the Alluvial
Sediments, Santa Clarita Valley

Dear Mr. Putnam:

I am pleased to present this Volume I report of our hydrogeologic investigation of the alluvial sediments within the Santa Clara River Valley area of Los Angeles County, California. This project was undertaken to evaluate the magnitude of the perennial yield of groundwater that is available to wells from the alluvial sediments and to assess the hydrogeologic feasibility of artificially recharging these sediments.

Work on this project included collecting and reviewing pertinent data from numerous sources, conducting a limited field reconnaissance of the region, providing detailed hydrogeologic analyses of these records, and writing and preparing this report of investigation. Documenting this report are figures and tables, and a list of references reviewed. A separately bound Volume II provides all plates.

Principal conclusions and recommendations include:

1. The study area lies within the Eastern Groundwater Basin of Los Angeles County; alluvium along the stream channels and the Saugus Formation comprise the water-bearing sediments in this basin.

   Because the alluvium is thin (less than 200 feet in maximum thickness) and because it is comprised of coarse-grained, permeable sediments, it is readily subjected to seasonal and long-term climatic (rainfall) changes and water quality impairment. Such climate changes or water quality problems (such as underground leaky tanks) will occur more rapidly and to

a larger degree in the shallow wells of the alluvium compared to wells in the underlying Saugus Formation.

The Saugus Formation ranges in thickness between at least 1500 feet and at least 5000 feet from the northerly to the southerly sides of the San Gabriel fault, respectively. Little is known of the hydrogeology and water-yielding characteristics of the Saugus Formation.

2. Groundwater flows from east to west across the alluvium in the river valley; April 1945 represents the all-time water level high, while November 1965 represents the all-time water level low in much of the alluvium. In general, 1985 water levels are 10 to 30 feet lower than the 1945 levels. Water levels west of Castaic Junction have remained high throughout the period of record.

3. Groundwater in storage in the alluvium has ranged from a high in April 1945 of 201,000 ac-ft, to a low of 107,000 ac-ft in November 1965; at present (Fall 1985) groundwater in storage is approximately 176,400 ac-ft. Because the theoretical maximum storage capacity in the alluvium is 239,900 ac-ft, there is a theoretically available storage capacity of 63,500 ac-ft between the 1985 storage and the theoretically maximum possible storage.

4. Though historic groundwater extraction data are somewhat contradictory, groundwater production for 1985 was: 24,103 ac-ft from the alluvium, using 59 active wells; and 4892 ac-ft from the underlying Saugus Formation, using 8 active wells. The numbers, locations, and annual production from wells actively used by private homeowners, industries and/or commercial establishments are not known; it is probable that total annual production from these sources does not presently exceed a few hundred ac-ft/yr.

5. For our base period of study of 1957-58 through 1984-85, we calculate a practical perennial yield for the alluvium of 31,600 to 32,600 ac-ft per year.

6. Alluvial groundwater quality ranges from a natural calcium-bicarbonate character on the east near Lang to a degraded sodium-sulfate character west of Castaic Junction. Generally, TDS increases in the

downstream direction across the river valley; alluvial groundwater along the river between the South Fork confluence and Castaic Creek also displays high TDS. TDS in the alluvium of Castaic Creek is also high. Causative factors for TDS increases include irrigation returns, rising groundwater, evapotranspiration, and discharges of treated sewage effluent.

7. Surface water quality also becomes more degraded as the westerly end of the study area is approached.

8. It is hydrogeologically feasible to artifically recharge portions of the Santa Clara River Valley via spreading basins. The primary use of spreading basins would be to ensure that the perennial yield of the alluvium is achieved and maintained. Areas considered potentially feasible for such spreading occur along the river east of Bouquet Junction and have been delineated on the basis of high soil percolation rates and lack of clay in the underlying alluvium. In order to optimize the quality of recaptured water, future recovery wells must be placed immediately downgradient from the spreading basins. Further exploration, on a site-specific basis, is essential to accurately define infiltration capacities, basin sizes and designs, availability of property, and the locations and designs of proximally-sited recovery wells.

9. Natural recharge of low-flow surface runoff may be enhanced by cutting holes in the bottoms of existing lined channels, by not lining future channels, and by providing holes in those channels to be lined in the future. Direct injection of water into the alluvium is not considered a viable alternative. A coordinated effort to capture surface runoff for recharge purposes in the major drainages tributary to the Santa Clara River is also not considered feasible.

It has been a pleasure to have worked on this investigation with you and your Committee. This opportunity to have been of service is appreciated.

Very truly yours,

Richard C. Slade

Richard C. Slade
Registered Professional Hydrogeologist

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INTRODUCTION

GENERAL STATEMENT

Presented in this Volume I report are the findings, conclusions and recommendations of our assessment of the hydrogeologic conditions and the potential for artificial recharge within the alluvial, valley-fill deposits along the Santa Clara River in Los Angeles County, California. Particular regard is given in this report to the groundwater storage capacity within the alluvial deposits and to the practical amount of perennial yield that may be extracted on an annual basis by wells within these alluvial sediments.

As depicted on Figure 1 - Location Map - the 275-square mile, rectangular-shaped mapped area includes a main study region that extends 21 miles in an east-west direction between Lang on the east and the Los Angeles-Ventura County line on the west, and 13 miles in a north-south direction between Castaic Dam on the north and the intersection of the Golden State and Antelope Valley Freeways on the south. Situated within this main study area are the communities of Castaic, Canyon Country, Lang, Newhall, Saugus, Valencia, and Val Verde.

This Volume I report has been provided with a list of references which have been specifically reviewed and/or cited during the course of this study. Volume II, separately bound, presents the plates which accompany this report.

PURPOSE AND SCOPE

This hydrogeologic study has been undertaken to evaluate the alluvial aquifer system underlying the Santa Clarita

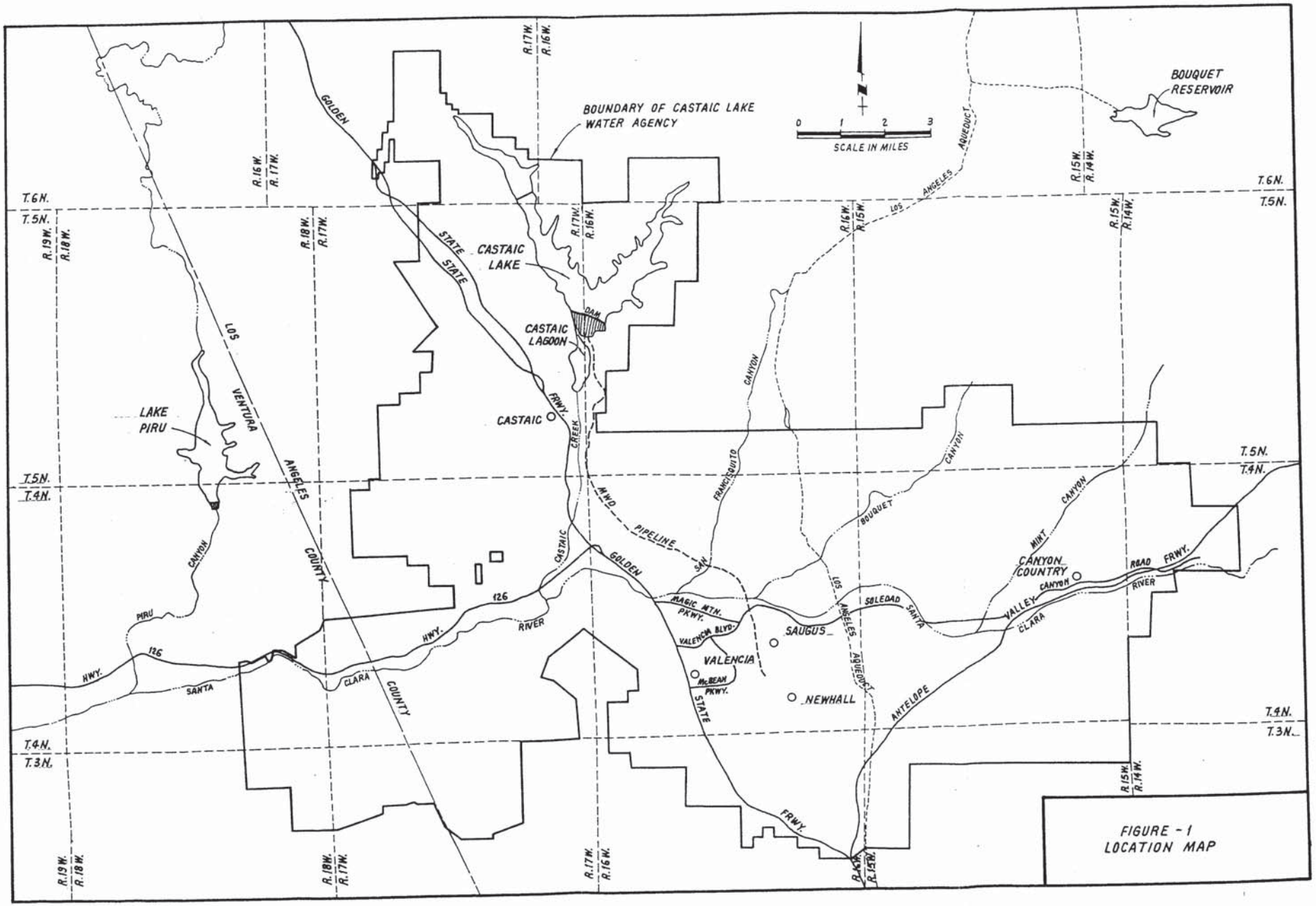


FIGURE - 1
LOCATION MAP

Valley, with particular regard to: assessing local hydrogeologic conditions within these deposits; determining their groundwater storage capacity; identifying their practical perennial yield; and determining their feasibility for being artificially recharged.

An associated purpose of this project has been to update and refine the 1972 U. S. Geological Survey report by Robson which discussed water resources and provided an electric analog computer model of the area. As defined for this report, the surface extent of the alluvial deposits within the Santa Clara River and its major tributaries is presented on each of the major base map plates provided in this text.

This project has been conducted for the Upper Santa Clara Water Committee. This group is composed of the following members: the Castaic Lake Water Agency which has contracts with the State of California to purchase water from the State Water Project in order to wholesale it to the four retail purveyors in the area; and the four retail purveyors of domestic water, these being the Los Angeles County Waterworks District No. 36-Val Verde, the Newhall County Water District, the Santa Clarita Water Company, and the Valencia Water Company. The Newhall Land and Farming Company represents the largest agricultural user of groundwater in the region.

The scope of work for this study was outlined in nine separate tasks in our letter of proposal to Mr. Kenneth R. Putnam, Chairman, Upper Santa Clara Water Committee. This report represents the culmination of work on eight of those nine tasks; work for Task 5, Saugus Formation Data Assessment, has been completed and transmitted to the Committee under separate cover as a letter-report.

A summary of the eight work tasks performed for this investigation is as follows:

Task 1 - Acquisition of Available Basic Data

- obtain and review available geologic reports and maps
- collect subsurface data for water wells and wildcat oil wells
- obtain land use information
- obtain hydrogeologic data for water wells in the region, particularly for each of the five agencies which comprise the Committee
- collect data on the local hydrology and watersheds.

Task 2 - Field Reconnaissance

- conduct field visits to validate specific data
- perform field monitoring of surface flows.

Task 3 - Define Physical Setting of Study Area

- identify drainages and watershed divides
- determine long-term precipitation curves
- assess land use.

Task 4 - Hydrogeologic Conditions

- provide independent assessment of groundwater basins and local geologic conditions
- identify historic and current water levels and flow directions
- identify water quality conditions
- evaluate aquifer and well characteristics
- calculate groundwater in storage
- review soil infiltration data
- assess potential locations for future artificial spreading operations.

Task 5 - Saugus Formation Letter-Report (provided under separate cover)

Task 6 - Hydrologic Conditions

- locate surface water features and identify quality and quality problems
- define a base period of study and identify local forebay (recharge) areas
- calculate change in storage for a specific time period

- assess the "safe yield" of the alluvium; for this report, this has been calculated as the practical perennial yield available from the alluvial aquifer system.

Task 7 - Artificial Recharge Operations

- review soils data and identify clay content
- identify potential sites for future spreading basins and for recapture wells
- assess alternatives for validating site feasibility.

Task 8 - Analyses and Reports

- write and prepare this report
- provide supporting maps, figures and tables to document our findings.

Task 9 - Meetings

- prepare for and attend meetings with the Committee.

Analyses for this project relied solely on available background data and reports. No subsurface exploration or laboratory testing or well testing was conducted for this study. Reports specifically reviewed for this project are shown on the list of References Reviewed.

Field work consisted solely of monitoring surface water flow conditions along the Santa Clara River and its major tributaries. These field visits occurred on March 26, 27, and 28, 1986, and consisted of: estimating runoff in the channels; and measuring the electrical conductivity (units of umhos/cm) and the temperature (^{o}C) of surface flow at 28 sampling sites in the study area. The dates of the field visits had been preceded by recent precipitation in the area.

Throughout the remainder of this report, there will be numerous discussions of water wells in the regions. The four retail purveyors in the area utilize wells to meet all or part of their domestic water requirements. Of these purveyors, the

Los Angeles County Waterworks District No. 36-Val Verde and the Newhall County Water District are public agencies, while the Santa Clarita Water Company and the Valencia Water Company are privately-owned water companies. The main agricultural user of groundwater, the Newhall Land and Farming Company is privately-owned also.

In addition to the wells owned by the above agencies and companies, there are an unknown number of wells used by private homeowners, industries and/or commercial establishments in the area. For the purposes of this report, wells owned by this group of users will be called privately-owned wells.

This report has been written for the Upper Santa Clara Water Committee and with specific application to the hydrogeologic assessment of the alluvial aquifer system within the Santa Clarita Valley. The report has been prepared in accordance with the care and skill generally exercised by reputable professionals, under similar circumstances, in this or similar localities. No other warranty, either expressed or implied, is made as to the professional advice presented herein.

AVAILABILITY OF BASIC DATA

Previous Studies. Because the study area overlies numerous oil fields, there has been a long history of published and unpublished geologic reports and maps dealing with surface and subsurface geologic conditions in the hills and mountains surrounding the Santa Clarita Valley. The earliest works date from the period 1902 to 1924 (importantly, Kew, 1924) and provided the initial efforts at naming and mapping the surface exposures of the stratigraphic units and structure in the region.

With the discovery of larger oil fields between the late-1930's and the late-1940's, there was a renewed interest

in the geology and the potential for additional petroleum development. Mapping by such workers as Bailey (1954) and Crowell (1954) added considerable details to the known stratigraphy and to major structures like the San Gabriel fault. Other particularly significant geologic reports include those by Winterer and Durham for the U. S. Geological Survey (1962) and by Oakeshott (1958) for the California Division of Mines and Geology. Adaptation of the geologic maps provided in these latter reports has permitted the preparation of Plate 4 - Hydrogeologic Map - in this report. Portions of the geologic conditions shown on Plate 4 were modified and updated from work recently available as university theses, including that by Nelligan (1978) and by Stitt (1980).

Considerable information is available to document much of the history of the oil field development in the greater Santa Clarita Valley. The preponderance of these reports have been published by the California Division of Oil and Gas. From its Ventura office, the Division of Oil and Gas maintains comprehensive files on the well histories and geophysical electric logs for the innumerable wildcat and producing oil wells in the region.

In contrast to the geology and oil well data, published hydrogeologic and hydrologic information for the region is not nearly as abundant. With the exception of Los Angeles County Flood Control District (annual maps of the region showing data for key wells), there have been essentially no previously published studies detailing aquifer characteristics, well testing, water level fluctuation or groundwater variations in water wells throughout the region.

The few hydrologic studies of the region that were reviewed for this project included one on sediment yield in the Castaic Canyon watershed (Lustig, 1965, for the USGS), and short letters and memoranda by the Los Angeles County Flood

Control District (1964, 1982a, 1982b). Flood hazard ratings for the Santa Clara River and several of its tributaries were published by the Federal Insurance Administration--National Flood Insurance Program (1980).

Previous assessments of the local hydrogeologic conditions are limited to those by: Robson (1972) for the U.S. Geological Survey, which provides the results of an analog computer model of the Saugus-Newhall area; Tompkins (1979) for the Department of Water Resources, which provided a reconnaissance-level evaluation of the potential for storing excess water from the State Water Project within the several groundwater basins located along the Santa Clara River in Los Angeles and Ventura Counties; the Department of Water Resources (1975 and 1980) which identified the boundaries of the various groundwater basins in the region; and Memoranda by the Los Angeles County Flood Control District (1963, 1969, 1982a) which discussed groundwater in storage and water levels in different years.

Reports by various independent consultants have been prepared for the region, but these tend to be very site specific. Regional groundwater usage, conjunctive use evaluations and discussions of the local integration of the State Water Project within the Santa Clarita Valley have been presented in numerous reports by Bookman-Edmonston Engineering, Inc. (most recently, 1983).

Water Well Logs. The historic collection and filing of basic hydrogeologic data for the study area has been sporadic and random in terms of the date and location of well monitoring. With the exception of a few of the local agencies, there is generally no comprehensive, basin-wide program to provide consistent and periodic monitoring of water levels, quality, specific capacity, and well efficiency on an on-going basis.

Historically, available records reveal that at least 650 water wells have been drilled in the study area for domestic, agricultural, industrial, or municipal usage. As seen on Plate 1 - Basin Boundaries and Well Location Map - virtually all of these wells have been drilled within the areas of the alluvial deposits which underlie the channels of the Santa Clara River and its major tributaries.

Of these approximately 650 wells, review of Plate 1 shows the following approximate breakdown of well locations: 250 wells along the Santa Clara River; 105 wells within the South Fork of the Santa Clara River (including Placerita Canyon); 75 wells within Bouquet Canyon; 60 wells in each of the Castaic Creek and Mint Canyon areas; 45 wells within Sand Canyon; 35 wells in the Hasley and San Martinez drainages on the west side of the study area; 15 wells within San Francisquito Canyon; and 5 wells in the Oak Spring Canyon area. It should be noted that well locations illustrated on Plate 1 are those adopted from maps on file at the Department of Water Resources and the Los Angeles County Flood Control District. In addition to these, there is also an unknown number of monitoring holes and/or test holes not shown on Plate 1, but which were constructed for such projects as exploring tunnel routes and for flood studies along the river.

For only about 40 to 50 percent of these 650 wells on Plate 1 are well logs (drillers' logs) available for analysis of subsurface conditions. Virtually all of the 650 wells are shallow wells (less than 200 to 250 feet in depth) and, thus, are considered to be completed solely in alluvial deposits. For only 14 wells (2% of the total number of wells) are geophysical electric logs available; these wells range in depth to 2000 feet and are considered to be completed solely in the Saugus Formation with only two or three exceptions.

To be noted for the study area is the confusing maze of well numbers and well names. Being in Los Angeles County, each well theoretically would be assigned a well number based on the unique system used by LACFCD. Unfortunately, the number is wholly different from that used by the Department of Water Resources for its well numbering system. In addition, each of the major water purveyors assigns its own well number or well name to individual wells within its distribution system. Moreover, as is the case in the study area, some water companies have changed names or bought wells owned by others, which then results in even more new numbers/names. As a result, there is considerable complexity and confusion in the well naming/numbering system in the area. Wherever possible on Plate 1, we have attempted to use the correct DWR number for the well location depicted.

Water Level and Water Quality Data. Long-term accumulations of water level and water quality data are available for only a very small percentage of wells in the area; the earliest of these dates from the 1950's for water levels and the early 1960's for water quality. Yet, data gaps of from several months to a few years in duration exist for many of these records. Scrutiny of the water level data occasionally reveals measurements which are anomalously low and which are considered not to be directly related to climatological fluctuations. Such anomalies are considered to relate to either monitoring error, the reporting of pumping levels or partial recovery levels instead of true static (non-pumping levels), or the monitoring of a water level in a well affected by mutual drawdown interference from another, nearby well.

For our assessment of water levels, we have plotted hydrographs for several wells and have independently prepared water level contours for Fall 1985 from monitoring data on file with the local purveyors and with the LACFCD.

For our assessment of water quality, we have relied on recent purveyor data, and have prepared trilinear analysis diagrams and Stiff water quality pattern diagrams for wells completed solely in alluvium or solely in the Saugus Formation. Some long-term data were plotted as graphs of total dissolved solids concentration versus time.

Groundwater Extraction Data. Annual groundwater extraction data for the past few years have been collected from each of the four water purveyor members of the Upper Santa Clara Water Committee and from the Newhall Land and Farming Company. Data prior to the early-1980's is not readily available from all members. The recent data appear to represent actually metered gallonage (and hence acre-feet of water produced per year) for Newhall County Water District, Santa Clarita Water Company, and the Valencia Water Company. For the Newhall Land & Farming Company, the reported extractions are based on kilowatts of power consumed. For the L. A. County Waterworks District No. 36 and the Wayside (Pitchess) Honor Rancho, annual extractions per well are based on estimated water consumption for an estimated number of prisoners and employees using the facilities (the actual quantity of water pumped is not known on a well-by-well basis).

For this project, we have separated the annual extractions by agency, by well, and by aquifer being produced for those wells active in 1985. The determination of the ownership, viability and activity of privately-owned wells in the region was not within the scope of work for this project.

Wildcat Oil Well Data. Because of the rarity of local water wells being completed in the Saugus Formation, and to better understand the subsurface relationships within this areally extensive formation, we collected a sizable number of electric logs (approximately 240) from wildcat oil wells in the area. Data on file with the California Division of Oil &

Gas reveal there are considerably more electric log data available for other wells.

Limited review of these data corroborated the suspected relatively great depth of this formation in portions of the study area. Although some effort was expended on preparing contours on the base of the Saugus Formation and on the base of fresh water in the region, much more effort is necessary to complete this work (this work was not included in the scope of work for this study). The reader is referred to the separate letter-report dated July 1, 1986, to the Upper Santa Clara Water Committee for more information on the Saugus Formation (that letter-report represents Task 5 of the original scope of work for this study).

Agencies Contacted. Data repositories and persons contacted during this investigation included the following:

1. Castaic Lake Water Agency: Mr. Robert Sagehorn and Ms. Betty Castleberry. Data collected included numerous unpublished engineering reports for the area and a map of the agency boundaries.

2. Los Angeles County Waterworks Districts-Department of Public Works: Messrs Woodrow Thurlow, Robert Alexander, and Leo Batris. Data collected here included well logs, water quality and groundwater extraction data for wells owned by the Waterworks District and by the Wayside (Pitchess) Honor Rancho.

3. Newhall County Water District: Mr. Jim Jinks. Data provided included well logs, electric logs, historic and current water levels and water quality data, and groundwater extraction data for NCWD wells.

4. The Newhall Land & Farming Company: Messrs. Richard Lypps and Richard Hackney. Data collected included well logs, electric logs, water level and water quality data, and groundwater extraction data for NL&F Co. wells.

5. Santa Clarita Water Company: Messrs. William Manetta and Dennis Rolfe. Well data collected included well

logs, water level and water quality data, well location information, and groundwater extraction data for SCWC wells.

6. Valencia Water Company: Mr. Richard Hackney. Well data collected included well logs and electric logs, historic and current water level and water quality data, well location information, and groundwater extraction data for VWC wells.

7. Los Angeles County Flood Control District: Mr. George Farag and Ms. Lolita Amandy for well logs historically drilled in the area, for historic water level contour maps prepared by LACFCD, and for recently monitored water levels in the area; Mr. Jerry Kwan for surface water quality data; Mr. Donald Carpenter for precipitation data from long-term rainfall stations; and Mr. Donald Keene for flood hazard data for the stream channels.

8. Los Angeles County Engineer--Geology: Mr. Josef Callison for previous reports and for logs of monitored holes installed by LACFCD in the stream channels; and Mr. Brian Scanlon of the Sewer Maintenance Division for maps showing the sewered (and unsewered) regions in the study area.

9. Los Angeles County Department of Health Services, Solid Waste Management Program: Mr. Richard Hanson. Data regarding locations and owners of old landfills in the study area.

10. Metropolitan Water District of Southern California: Mr. David Green for geologic maps, well logs, and water level data for monitoring holes along tunnel routes in the area, and for unpublished reports prepared by others for conditions anticipated along proposed tunnel routes.

11. California Department of Water Resources: Mr. Ed Lowe. Data collected included 1980 land use, soil infiltration data, historic water level and water quality data, well logs and water well location maps.

12. California Division of Oil & Gas: office staff. Data collected included information on wildcat oil wells (electric logs), locations of abandoned and active oil fields, wildcat well location maps, and reports published on the various oil fields in the region.

13. California Regional Water Quality Control Board: Mr. Quang Nguyen for information on waste dischargers in the area; and Ms. Linda Hogg of the Toxic Substances Control Division for the list of Superfund Sites and the list of inactive/abandoned landfills in the Santa Clarita Valley area.

14. California Division of Mines and Geology: office staff. Data collected included published and unpublished geologic reports and maps for the various rock types in the mapped area.

15. U. S. Geological Survey: office staff. Basic data relating to the original USGS analog model study by Robson (1972).

16. U. S. Department of Housing and Urban Development, in Maryland: office staff. Updated maps of 100-year and 500-year flood hazards in the study area.

17. Oregon State University: Dr. Robert Yeats, Professor of Geology. Titles and authors of recent graduate theses relating to the geology and petroleum resources of the greater Santa Clarita Valley area.

AREA OF INVESTIGATION

PROJECT LOCATION AND PHYSICAL FEATURES

As shown on Figure 1 - Location Map - the rectangular-shaped study area encompasses 275 square miles along and adjacent to the Santa Clara River in northwestern Los Angeles County. This study area includes the valley fill deposits within the Santa Clara River and its major tributaries as well as a sizable portion of the hills to the north and south of the river itself. East to west boundaries of the study area are roughly coincident with the community of Lang and the Los Angeles County-Ventura County line, respectively. North and south boundaries coincide approximately with Castaic Dam on

the north, and the intersection of the Golden State and Antelope Valley freeways on the south (i.e., approximately the location of Fremont-San Fernando Pass)..

Geomorphically, the area is comprised by the flat, valley lands of the east-west trending Santa Clara River Valley, and the hills and low-lying mountains which border both sides of the river valley. Elevations along the river valley range approximately from 1800 ft at Lang at the easterly limit of the study area, to 800 ft at County line at the western boundary. The overall river gradient across this reach is on the order of 0.009 ft/ft (about 50 feet per mile). Maximum elevations in the hills north of the river are on the order of 2500 to 3000 ft, while maximum elevations to the south are typically 4000 ft in the San Gabriel Mountains and 3000 ft in the Santa Susana Mountains. The highest elevations in the region include Mt. McDill (5180 ft) in the headwaters of Mint Canyon north of the Santa Clara River, and Mt. Gleason (6532 ft) in the Condor Peak quadrangle south of the Santa Clara River and several miles southeast of the study area.

Principal communities in the study area include: Newhall and Valencia in the south-central part of the area; Val Verde in the west; Castaic in the northwest; Saugus in the central portion; and Canyon Country and Lang in the east.

According to the Los Angeles County-Department of Regional Planning (1983), the Santa Clarita Valley has been undergoing a major change from an agricultural to an urban development environment since the late-1960's. As reported in that General Plan, the 1980 population in the Valley was approximately 79,000; recent revisions suggest populations as high as 213,000 by the year 2000. Nonetheless, a considerable portion of the study area is occupied by hills and low mountains which encompass the main river valley and which still remain in a natural, undeveloped state.

GROUNDWATER BASIN BOUNDARIES

To facilitate analysis of water supply problems, the California Department of Water Resources established names and locations of groundwater basins along the course of the Santa Clara River Valley in both Los Angeles and Ventura Counties (1953, 1975, and 1980). Hydrologic unit boundaries were delineated principally on the basis of topography and watershed divides, and as such, included both alluviated valleys and the adjoining hills and mountains. Each hydrologic unit was further divided, using similar bases, into hydrologic subunits.

As a result of these studies, the principal hydrologic unit in the study area is known as the Santa Clara River Valley Unit. Within the mapped area, it has been subdivided in Los Angeles County into the Eastern Subunit and the Acton Valley Subunit. Originally, the subunit boundary between the Piru Hydrologic Subunit and the Eastern Hydrologic Subunit had been selected approximately 0.7 mile downstream of the gaging station at Blue Cut (located in the Santa Clara River approximately one mile west of County line). Recently, however, DWR (1980) moved the boundary to County line.

For detailed assessments of hydrogeologic conditions, DWR further delineated various groundwater basins within each of the above hydrologic units and subunits. Basin boundaries were selected on the basis of such features as faults, groundwater divides, exposures of bedrock in the hills, or at areas of rising water caused by the presence of bedrock shallowly underlying river alluvium. Where none of these types of conditions exist, arbitrary or even political divides were selected as groundwater basin boundaries.

As revealed on Plate 1 - Basin Boundaries and Well Location Map - the alluvial sediments which comprise the focus

of this entire investigation lie within the Eastern Groundwater Basin of the Santa Clara River Valley Basin of Los Angeles County. This groundwater basin is comprised by the alluvial deposits which lie along the Santa Clara River and its major tributaries.

The western boundary of the basin is currently taken at County line where it meets the adjoining (downstream) Piru Groundwater Basin portion of the Santa Clara River Valley of Ventura County (name recently changed by DWR, 1980, to Ventura Central Groundwater Basin). Prior to this 1980 basin name and boundary change, DWR had selected the western boundary of the Eastern Basin near a narrows in the Santa Clara River, approximately one mile west of County line. The eastern boundary of Eastern Basin occurs at a river narrows near Lang as shown on Plate 1; east of this boundary is the Acton Groundwater Basin.

As defined above, and to be consistent with DWR terminology, the Eastern Groundwater Basin as used for this investigation will be comprised both by the alluvial sediments along the river and its tributaries and the Saugus Formation sediments which are exposed in the adjoining hills and which underlie the alluvium in the river and its tributaries. Further discussion of the water-bearing potential of the Saugus Formation is in the Hydrogeology Section of this report.

CLIMATE

Climatically, the study area exhibits a semi-arid, Mediterranean-type climate that is characterized by long, dry summers and relatively short, wet winters. Typical temperatures in the valley range from maximums of approximately 100°F during the summer to minimums as low as 30°F occasionally in the winters. Mean monthly temperatures range between approximately 77°F in summer to 48°F in the winter.

Rainfall data have been obtained from Los Angeles County Flood Control District for two rainfall gages, one near Castaic Junction (Station No. 200, elevation 1065 ft) and the other near Mint Canyon (Station No. 1009, elevation 1645 ft). These data, which are presented on Figure 2 - Rainfall Data - have been graphed to show the annual precipitation totals for Station No. 200, and the cumulative departure from the mean precipitation for both rainfall stations. The locations of each station are illustrated later in this report on Plate 6.5 - Location Map of Data Graphs.

Review of the rainfall data on Figure 2, and data for Station No. 1009 not presented on that figure, reveals the following:

1. Mint Canyon Gage (upstream area):

   a. The average rainfall over the 1946-47 through 1983-84 period of record is 12.1 inches.

   b. The historic high was 26.52 inches and occurred in 1982-83; 26.30 inches occurred in 1968-69.

   c. The historic low was 4.66 inches and occurred in 1950-51; 4.95 inches occurred in 1960-61.

2. Saugus-Edison Gage (downstream area):

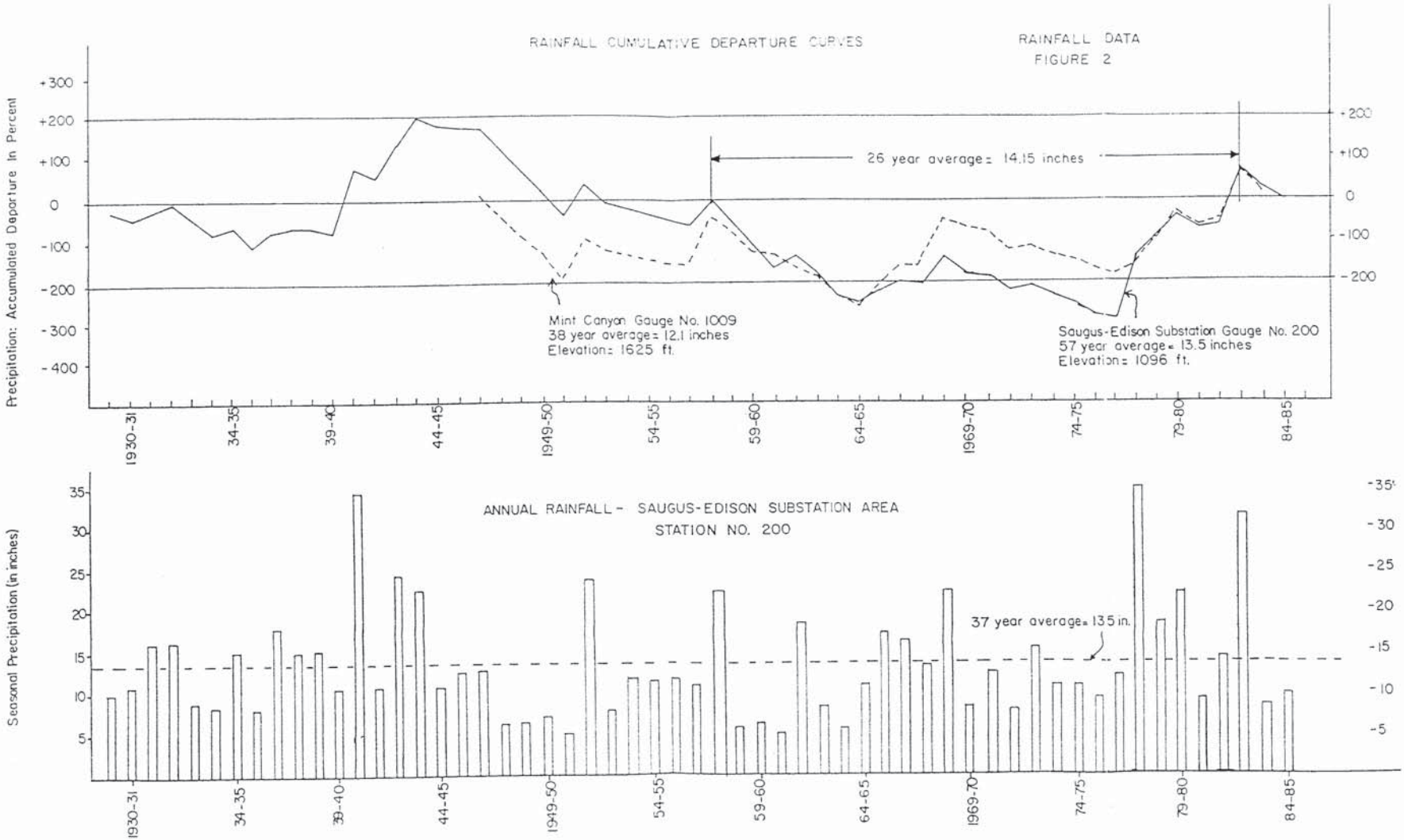
   a. The average rainfall over the 1928-29 through 1984-85 period of record is 13.5 inches.

   b. The historic high was 34.77 inches and occurred in 1977-78; 34.43 inches occurred in 1940-41.

   c. The historic low was 5.09 inches and occurred in 1960-61; 5.25 inches occurred in 1950-51.

Approximately 80 percent of the average annual precipitation in the Valley occurs between November and March. Moreover, the bulk of these winter storms last for one to only a few days; relatively long periods of clear weather typically occur between these storms. Notable on Figure 2 is that the

RAINFALL DATA
FIGURE 2



precipitation fluctuates widely from area to area and from year to year.

As seen on the cumulative departure curves, there have been pronounced periods of dry years followed by periods of wet years. However, no rhythmical or fixed cycle of fluctuations is detectable. For these cumulative departures, a positive slope for each curve indicates above-normal rainfall, while a negative slope indicates below-normal precipitation, regardless of the position of the curve with respect to the ordinate representing the long-term mean (i.e., the zero percent cumulative departure).

For example, the period 1935-36 through 1943-44 on the cumulative departure curve for the Saugus-Edison gage is characterized by positive (upward to the right) slopes; this is indicative of a hydrologically wet period which was characterized by an accumulation of years of average or above average precipitation.

In contrast, the period 1944-45 through 1964-65 on the curves for both rainfall stations displays a protracted, hydrologically dry period that was characterized by an accumulation of generally average or below average rainfall (a negative or downward-sloping curve). Since 1964-65, the curves for both rain gages reveal a generally upward trend up through the present time and, hence, an overall period of excess precipitation.

Noteworthy, also, is that the period 1957-58 through 1984-85 represents a period of balanced rainfall. That is, even though periods of both deficient and excess rainfall have occurred between 1957 and 1985, the net effect is that at the beginning of the period (1957-58) and at the end of the period (1984-85), the cumulative departure from the mean precipitation has been zero.

DRAINAGE

Regional drainage across this portion of Los Angeles County, and continuing westerly across Ventura County to the Pacific Ocean, is provided by the Santa Clara River. This river has its headwaters in Soledad Canyon in north-central Los Angeles County and includes a watershed area of several hundred square miles.

Principal tributaries draining in a southerly direction to their confluence with the Santa Clara River include, from east to west across the study area: Mint Canyon, Bouquet Canyon, San Francisquito Canyon, and Castaic Creek Canyon. Principal tributaries which drain in a northerly direction toward their confluence with the Santa Clara River include, from east to west: Oak Spring Canyon, Sand Canyon, and Potrero Canyon.

The South Fork of the Santa Clara River, which drains in a northerly direction toward its confluence with the main course of the Santa Clara River (just west of Bouquet Junction), has as its main tributaries: Placerita Creek Canyon; Newhall Creek Canyon; and Pico Canyon.

Because the headwater areas of these drainages do not extend into high mountainous areas, and because the local climates preclude the buildup of large snowpacks in the watersheds, flow in all the stream canyons is considered to be ephemeral only and, thus, diminishes rapidly after most rainfall events. Springs, areas of rising water, and even outflows from local wastewater treatment facilities tend to maintain flows even in the summer months in several locations along the Santa Clara River. According to Bookman and Edmonston Engineering, Inc. (1983), the average annual runoff in the Santa Clara River near County line is on the order of 25,000 acre-feet per year, although runoff volumes tend to be

extremely variable from year to year. DWR (1968) reported that runoff in the river has ranged from nearly 550 percent of the mean to less than one percent; following severe storms, river discharge has been reported to increase from nearly zero flow to flow as high as thousands of cubic feet per second within a few hours.

Based on review of the drainage, watershed, and topographic conditions in the study area, the hill and mountain areas surrounding the Santa Clara River have been divided into 13 individual watersheds as listed on Table 1 - Watershed Subdivisions. Delineated on this table are the names and map symbols of the 13 watersheds, the approximate range in elevation within each watershed, and the major local tributaries (subdrainages) within each of the main watersheds. The locations and drainage boundaries for these 13 watersheds are illustrated later in this text on Plate 9 - Map of Watersheds and Drainages.

Further discussion of watershed sizes and of recoverable water from the various watersheds in the mapped area are presented in the Hydrology section of this report. Lines of equal annual precipitation (isohyetal contours) for the watersheds in the mapped area are also shown later in this report on Plate 9.

LAND USE

The cultural environment of the area can be characterized as semi-urban, locally losing its rural atmosphere in recent years as urbanization and industrial development continue. The scenic and recreational values of the region continue to increase, both with usage along the unlined portions of the Santa Clara River with its sandy banks and local riparian habitats, and within the Castaic Lake area at the northern fringe of the region.

Table 1 - WATERSHED SUBDIVISIONS

Watershed Name	Watershed No. on Map	Local Tributaries	Range in Elevation (feet) Maximum	Minimum
Oak Spring	1	Oak Spring	4320	1680
Sand Canyon	2	Bear, Coyote, Iron	4760	1560
Placerita Canyon	3	Los Pinetos, Quigley, Oro Fino	4003	1213
South Fork Santa Clara River	4	Newhall Creek, Whitney, Elsmere, Gavin, Rice, Leaming, Towsley, Wiley, Lyon	3670	1209
Pico Canyon	5	Wickham, Dewitt	3645	1315
Potrero Canyon	6		2375	870
Tick Canyon	7		3045	1670
Mint Canyon	8	Baker, Rush, Rowner, Space Spring	5180	1440
Bouquet Canyon	9	Plum, Dry, Bouquet, Haskell, Pettinger, Coare Gold, Vasquez, Texas, Mystic, Full	4850	1173
San Francisquito Canyon	10	Drinkwater, Baird, Bee, Clearwater, South Portal Cheney, Dowd	4605	1110
Castaic Creek Canyon	11	Castaic Creek, Wayside, Tapia, Charlie, Bitter, Grasshopper, Marple, Palomas, Violin	3544	997
Hasley Canyon	12	Hasley, Sloan, Romero	2494	995
Martinez Chiquito Canyon	13	San Martinez Chiquito	2400	960

To document major land use patterns in the study area, Plate 2 - Land Use Map - has been prepared. As noted thereon, industrial uses occupy the largest surface areas in the region and are dominated by the numerous oil fields in the hills and mountains which adjoin the valley lowlands. The oil resources and their development in the region are well documented in the literature, with the original oil wells dating back to the mid-1870's. Comparing the locations and shapes of the surface projections of the oil fields on Plate 2 to the geologic structure shown later on Plate 4 - Hydrogeology Map - two main conditions are notable: first, the main oil fields all lie athwart or south of the west-northwest-trending San Gabriel fault; and second, the oil fields are generally oriented in a northwest-southeast direction which is consistent with the structural regime of the entire region.

Additional industrial development includes (see Plate 2): gravel borrow pits along the Santa Clara River near Lang; Lockheed Corporation research and test facilities in Rye Canyon just northeast of Castaic Junction (it reportedly was established in the late-1950's); the large Valencia Industrial Park which is undergoing development just east of Castaic Junction; the industrial structures along the South Fork of Santa Clara River (just south of Bouquet Junction), which also include the now-abandoned Thatcher Glass Co. manufacturing facility; the Whittaker-Bermite Co. facility and the automobile raceway about two miles upstream from Bouquet Junction; the Lubrication Company of America property near Lang; and the Space Ordnance Systems and the Micronics International testing facilities in the mountains near the watershed divide between Sand Canyon and Placerita Canyon.

Maps and data on file with the State Toxic Substances Control Division revealed that the following three facilities are possible EPA Superfund sites: Lubrication Company of

America; Space Ordnance Systems; and Thatcher Glass Company (refer to Plate 2).

Old, abandoned and/or currently active landfills, and/or mudsump disposal areas from oilfield drilling operations are also depicted on the land use map. These sites were adapted from maps on file with the Los Angeles County Health Department-Solid Waste Section. Very little information is available for any of these sites to document such items as the types and quantities of fluids which were disposed. Active landfills are known to exist at the Wayside (Pitchess) Honor Rancho (a Class II facility) and in Chiquita Canyon west of Castaic Junction (also Class II).

Agriculture remains the major industry in the region on the basis of the quantity of land utilized. Truck crops, citrus and avocados, and irrigated and non-irrigated grasses and grains are the predominant agricultural land uses. Most of the agricultural lands are owned by the Newhall Land and Farming Company and lie along the major river valleys.

The Magic Mountain Amusement Park in Valencia has drawn several satellite businesses to the area including mobile home parks, motel, restaurants, and service stations. Specialty electronics firms have commenced to enlarge their facilities, and new firms have settled in the area.

The Los Angeles County detention facilities at the Wayside (Pitchess) Honor Rancho occupy approximately 2800 acres of land along the east flanks of Castaic Creek between Charlie Canyon and Castaic Junction. Land usage here, other than the aforementioned landfills, include some irrigated agriculture, a dairy and grazing land, and even brine ponds (see Plate 2).

Other land usage denoted on Plate 2 includes trailer parks, a few of the major oil storage areas, a few areas of stables, and regional areas mapped as "sewered" or

"unsewered." These latter regions have been adapted from maps on file with the Los Angeles County-Sewer Maintenance Division. Though not shown on Plate 2, additional areas of oil storage and of livestock feeding and grazing are known to occur in the region.

Finally, the land use map shows the location of the two major discharges of treated municipal and industrial wastes to the Santa Clara River. These two facilities are the Los Angeles County Sanitation Districts' (LACSD) Plants No. 26 (near Bouquet Junction) and No. 32 (near Valencia). Recent (1986) work by the Los Angeles County Sanitation Districts reportedly indicates that Plant No. 26 discharges approximately 5 to 6 million gallons per day (mgd) of effluent having a total dissolved solids concentration (TDS) of about 600 mg/l, while Plant No. 32 is being expanded to discharge nearly 7.5 mgd of effluent having a TDS of about 650 mg/l (LASCD, 1986).

LOCAL WATER PURVEYORS

The study area lies within lands served by the Castaic Lake Water Agency. Domestic water purveyors located within the Agency boundary include Los Angeles County Waterworks District No. 36, Newhall County Water District, Santa Clarita Water Company, and the Valencia Water Company. Also included in the present study is the Newhall Land and Farming Company which also owns and operates numerous wells in the region to supply water to meet their agricultural demands. The four domestic water purveyors and the Castaic Lake Water Agency make up the management committee to whom this report is addressed. Los Angeles County Waterworks District No. 36 and Newhall County Water District represent public agencies, while the Santa Clarita Water Company and the Valencia Water Company are privately owned.

Information obtained during the course of this investigation indicates that during the past 30 years, the main domestic and agricultural water purveyors in the study area have pumped an average combined total of approximately 31,000 to 32,000 acre-feet of groundwater per year. During the period of record, pumping has ranged from a combined maximum of approximately 41,000 ac-ft in 1960 to a combined minimum of approximately 19,000 ac-ft in 1983.

Table 2 - Summary of Groundwater Production - has been prepared to document the quantity of groundwater produced by each major purveyor and the number of active wells operated by each for the years 1984 and 1985. The total production is further divided on Table 2 to delineate the production of each purveyor from either alluvial aquifers or Saugus Formation aquifers. As noted on Table 2, these purveyors used a total of 67 active wells in 1985, to produce a total of 28,995 ac-ft of groundwater. Of these totals, 59 active wells produced 24,103 ac-ft of groundwater from the alluvium, while the remaining eight active wells produced 4892 ac-ft from the Saugus Formation.

Not included on this table is similar information regarding the activity of and total production from the privately-owned house, industrial and/or commercial wells in the region. It is probable that total annual production from this group of wells does not presently exceed 1000 ac-ft.

To further illustrate the variability of groundwater extractions in the study area, and to better display the locations of these active wells for 1985, we have prepared Plate 3 - Map of Groundwater Extractions for 1985. Each of the 66 active agency wells is shown thereon, together with the respective well owner and well name; the total production in acre-feet for each well, by aquifer system, is denoted, also, using special symbols and circles of specific radii for scale.

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Table 2 - SUMMARY OF GROUNDWATER PRODUCTION[a]

Agency	Total Number of Active Wells 1985	Total Groundwater Production—1985 (ac-ft)	Number of Wells, Per Geology		Breakdown of Total Annual Production (ac-ft)			
			Alluvium	Saugus Fm	1985 Qal	1985 Qts	1984 Qal	1984 Qts
Newhall County Water District	12	5205	7	5	1773	3432	1550[c]	3000[c]
Santa Clarita Water Company	11	6242	11[b]	0	6242[b]	0	6057[b]	0
The Newhall Land and Farming Company	30	9348	29	1	9328	20	11237	20
Valencia Water Company	7	6074	5	2	4634	1440	4975	1474
Wayside Honor Rancho and Scott Well (Dist. No. 36)	6 1	2126[d]	7	0	2126[d]	0	777[d]	0
TOTALS	67	28,995	59	8	24,103	4892	24,596	4494

NOTES: (a) Groundwater production by the four member purveyors and the NL & F Co. Well production for individual homes and for industries and commercial establishments is not known.
(b) Includes production from one well (Lost Canyon Well) having perforations in alluvium and possibly in the Mint Canyon Formation (total production from this well = 692 ac-ft, in 1985).
(c) Estimated from fiscal year data supplied by NCWD.
(d) Actual production not metered, but rather estimated on an annual basis by Los Angeles County.

Pumpage data provided on Table 2 and Plate 3 represent actual metered data, except for that supplied by Los Angeles County and by the Newhall Land and Farming Company. The former agency estimates its annual production for each well on the average number of prisoners and employees at each facility and on the estimated amount of water applied for irrigation. The Newhall Land and Farming Company estimates its production on the basis of electrical power consumption data for each well.

From Table 2 and Plate 3, the following items are evident:

1. Most of the present groundwater production in the study area is from alluvial wells; these wells are typically shallow (less than 200 ft in depth).

2. The major alluvial wells lie along the permeable channel of the Santa Clara River; fewer active wells lie along Castaic Creek, Bouquet Canyon, San Francisquito Canyon, and even Sand Canyon. No agency-owned alluvial wells currently exist in the South Fork area of the Santa Clara River.

3. The largest producer of groundwater in the area is the Newhall Land and Farming Company (9348 ac-ft in 1985); they also operated the largest number of active alluvial wells (29). All of these wells are used for agricultural purposes.

4 The largest individual alluvial well production in 1985 is represented by wells B-5 and B-6 (NL&FCo.) which together produced 1607 ac-ft; wells C, C-5, and C-6 (NL&FCo.) which produced 1272 ac-ft (these wells are all metered jointly); NL&F well E (1945 ac-ft); the Santa Clarita Water Company Sierra well, 1777 ac-ft; and the Valencia Water Company well U3 which produced 1410 ac-ft in 1985.

5. The eight Saugus Formation wells active in 1985 are deep wells (typically greater than 1000 feet in depth), and lie within the Santa Clara River valley just west of Bouquet Junction, or within the Newhall area of the South Fork of the Santa Clara River.

6. The largest Saugus Formation production well in 1985 was NCWD well No. 11 (1783 ac-ft).

7. There are presently no Saugus Formation production wells north of the trace of the San Gabriel fault (refer also to Plate 4 - Hydrogeology Map).

In addition to the groundwater extractions by the local purveyors, supplemental water supplies to the Santa Clarita Valley are provided by the Castaic Lake Water Agency via the State Water Project. This agency has signed contracts with the local retailers in the valley to provide delivery of its entitlement of State project water for urban use. These imported State project waters are transported from the California Aqueduct and first became available to the valley area in 1980. By 1990, the delivery entitlement to the Castaic Lake Water Agency service area of State project water has been estimated to be 39,300 ac-ft (DWR, 1983).

Based on available information, the Agency is providing approximately 12,000 acre-feet per year to three of the four local purveyors: Los Angeles County Waterworks District No. 36, the Santa Clarita Water Company, and the Valencia Water Company. Reportedly, the Newhall County Water District is to begin taking these supplemental State water supplies in late-1986.

GROUNDWATER GEOLOGY

GENERAL STATEMENT

Geologic materials depicted on Plate 4 - Hydrogeology Map - have been divided according to their relative water-bearing characteristics, that is, to their relative ability to contain, transmit, and yield groundwater to wells. As such, two divisions are recognized: a water-bearing sediment group

and a nonwater-bearing rock group. Plate 4 provides the exposures and areal extents of these materials, together with local geologic structure, including bedding attitudes and the alignment of major faults and folds.

Depending on water levels, the water-bearing sediments can become saturated, thereby permitting them to provide water to wells. Thus, they constitute the groundwater reservoir of the study area. In effect, these sediments should be wholly included within the lateral and vertical boundaries of the local Eastern Groundwater Basin along the Santa Clara River Valley of Los Angeles County. As discussed previously, DWR commonly includes only the post-Saugus Formation strata (i.e., alluvium and terrace deposits) within the Eastern Basin, and because this current study is investigating the water resources only of the alluvial deposits along the river valley, we shall follow their definition. It should be noted, however, that the alluvium contact displayed on all of our base maps for this study may differ somewhat from that utilized by DWR for their Eastern Basin definition.

Underlying the water-bearing sediments in the Valley areas, and exposed on all adjoining hill and mountain areas, is the relatively impermeable, nonwater-bearing bedrock.

WATER-BEARING SEDIMENTS

This group comprises two units: undifferentiated alluvial or valley fill deposits which underlie the Santa Clara River and its tributaries; and partially consolidated, older sediments assigned to the Saugus Formation which are exposed in the westerly part of the study area and which also underlie the river and its tributaries in this area. The water-bearing sediments consist of Holocene alluvium (map symbol, Qal), terrace deposits (Qt), and a group of geologically older sediments known as the Saugus Formation (QTs). Geologic contacts

mapped on Plate 4 have been adapted from work by Winterer and Durham (1962), Oakeshott (1958), and Stitt (1980).

The undifferentiated alluvial-type deposits are Pleistocene to Holocene (Recent) in geologic age and, generally, are exposed in the study area as follows: on the valley floor as floodplain deposits and stream channel deposits; as alluvial fans near the mouths of canyon draining the adjoining hills; as elevated terraces along the margins of the basin; and as terraces in the low foothills which adjoin the main river valley. For the most part, these water-bearing strata are geologically younger, more permeable, less consolidated, and less structurally deformed than the nonwater-bearing, underlying bedrock.

The water-bearing sediments, as a group, have been penetrated to various depths by the large number of wells in the basin and historically have provided virtually all the groundwater extracted by these wells. These sediments constitute the groundwater reservoir of Eastern Basin as defined by DWR, and represent the main focus of this study.

Analysis of available drillers' logs clearly reveals that these sediments are composed of extensively interlayered and interfingered mixtures of gravel, sand, silt, and clay, with variable concentrations of cobbles and boulders. In general, alluvium in the main river valley ranges from medium-grained sand on the west to cobbly- or gravelly-sand on the east. Due to its unconsolidated to poorly consolidated condition, and its lack of cementation, Holocene alluvium is subject to rapid erosion.

These alluvial sediments lie within and along the courses of the Santa Clara River and its main tributaries (refer to the alluvium contact on the map base for plates in this report). The maximum thickness of alluvium varies along the Santa Clara River, but generally is considered to be on

the order of 200 feet. Typically, the alluvium tends to be thickest near the central portion of the river, and thins or pinches out as the flanks of the adjoining hills are approached.

Alluvial thicknesses in the tributary canyons are considered to be less than that in the main river valley. In general, larger watershed areas such as Castaic Creek and Bouquet Canyon are underlain by more areally extensive and thicker accumulations of alluvium than smaller canyons like Oak Spring or Pico. In these latter canyons, the maximum alluvial thickness occurs near the confluence with the main river valley and is on the order of only 75 to 125 feet.

Older alluvium of late-Pleistocene age has also been mapped in the area by others to include the exposures of sediments that have been elevated onto mesas and terraces along the main river valley. These terrace deposits (map symbol, Qt, on Plate 4) are considered to be of the same general composition as Holocene alluvium and were formed in much the same manner. Regional uplift and continued downcutting of the creeks and washes has left these terrace deposits elevated with respect to current stream gradients.

In general, the terrace sediments are more deeply weathered and characteristically reddish-brown in color; because of chemical and mechanical breakdown of the minerals within these sediments, there also tends to be light to moderate cementation by clays and/or iron oxides. Because of their topographically elevated position in the study area, these sediments, although potentially water-bearing, are considered to be of very limited use as a water resource; they nearly always lie above the regional water table.

Underlying Holocene alluvium and/or terrace deposits in the westerly two-thirds of the study area is the Saugus Formation (map symbol QTs) of late Pliocene-early Pleistocene

geologic age. As reported by most previous investigators, the Saugus Formation is considered to be primarily of terrestrial (continental) origin, having been deposited as channel and floodplain sediments and as alluvial fan materials by local ancestral rivers and creeks. Because of its primarily continental mode of origin, Saugus strata, with rare exception, tend to lack definitive fossils. Near its base, the Saugus is reported to contain shallow-water marine fossils locally.

Review of historic and recent literature regarding the Saugus Formation does reveal some disagreement among the previous workers regarding the placement of the true base of the formation; i.e., principally in regard to its contact with the underlying Pico Formation. The disagreements result from such factors as the similarity in sediment types and colors and grain sizes in the lower Saugus-upper Pico beds, the lack of good index fossils in sediments near the contact, and the rapid lateral and vertical changes in Saugus sediments which further compounds the problem of correlating individual Saugus strata from well to well using electric log data.

Some previous investigators consider the lower portion of the Saugus to be comprised by interfingering shallow-water marine to brackish water marine deposits. These, in turn, would grade vertically upward to true non-marine (continental) deposits, but would be considered to grade downward geologically (and also in a westerly direction) into the main deep-water marine strata of the Pico Formation. Due to similarities in color and stratigraphy, the lower Saugus contact with either the Sunshine Ranch or Pico Formation is gradational and interfingering at best and, thus, difficult to distinguish, particularly on the basis of electric logs alone.

As seen on Plate 4, the Saugus Formation is exposed principally westerly of the San Gabriel fault, although outcrops of Saugus strata do exist on the easterly side of this

major geologic structure. Although not shown by geologic cross sections for this report, the Saugus Formation is generally considered to attain at least a 5000-foot maximum thickness southerly of this fault; to the north, where subsurface Saugus data are more limited, maximum thicknesses are likely on the order of only 1500 feet.

As noted by Winterer and Durham (1962), and Oakeshott (1958), the Saugus Formation consists of poorly sorted, interbedded layers and lenses of moderately- to well-consolidated sandstone, conglomerate, and siltstone; conglomeratic sandstone, pebbly sandstone, and claystone occur at irregular intervals, also. Colors are variable, ranging from gray to yellowish-gray to brown, or even red-brown or red-green. Based on the distribution, general lithology and petrology of the gravel, cobble or boulder clasts in the Saugus, it is apparent that this formation was derived from erosion of all older sedimentary and igneous rocks in the region; principal source areas were likely the Sierra Pelona and the San Gabriel Mountains. Carbonate cementation is locally well developed, particularly in the conglomeratic beds located in scattered horizons within the formation.

Westerly of the San Gabriel fault, Saugus strata lie with great angular unconformity on the Pico Formation. To the east of the fault, the Saugus beds tend to unconformably overlap and onlap directly onto both the Pico and Castaic Formations.

NONWATER-BEARING ROCKS

Underlying the water-bearing sediments in the study area are a series of consolidated, cemented sedimentary rocks of Tertiary geologic age, and/or an assemblage of crystalline rocks of pre-Tertiary age. For the most part, the sedimentary rocks are exposed along the flanks of the hills and mountains

which border the Santa Clara River Valley, while the geologically older crystalline metamorphic and igneous rocks crop out in the upper watershed areas of the Sierra Pelona and the San Gabriel Mountains. Exposures of these various bedrock units are depicted on Plate 4.

Previous geologic investigators in the region (including Oakeshott, 1958, and Stitt, 1980) have recognized a differing stratigraphy in the region, depending on which side of the San Gabriel fault is being evaluated. Based on the work of these and other investigators, Table 3 - Stratigraphic Summary, Bedrock Formations - has been prepared. The reader is referred to Plate 4 to denote the locations and areal extent of the exposures of these various nonwater-bearing rocks.

Due to their cemented and/or crystalline nature, the above rocks possess only secondary porosity and may contain groundwater only along bedding planes, joints, shears or fractures. As a result, and because of their structural complexity and low permeability, these rocks are not considered capable of yielding water readily to wells. Moreover, they have a very limited storage capacity, and their ability to provide long-term sustained yields to wells is unpredictable. These cemented and/or crystalline rocks are not considered part of the groundwater reservoir in the study area.

GEOLOGIC STRUCTURE

Dominating the geologic structure in the Plate 4 mapped area is the northwesterly-trending San Gabriel fault. This fault, together with the Holser fault to the west, are recognized as controlling the sedimentation and structural orientation of the deposits throughout the region for a long period of geologic time. Even the Saugus Formation is recognized as having been disturbed and offset by the San Gabriel fault.

Table 3 - STRATIGRAPHIC SUMMARY, BEDROCK FORMATIONS

Westerly of San Gabriel Fault			Easterly of San Gabriel Fault		
Geologic Age	Formation and Map Symbol	Description	Geologic Age	Formation and Map Symbol	Description
Upper to Middle Pliocene	Pico Fm (Tp) (including Sunshine Ranch member)	marine, gray siltstone, with brown to gray conglomeratic sandstone	Upper to Middle Pliocene	Pico Fm (Tp)	marine, sandstone and siltstone, gray to brown
Miocene	Towsley Fm (Tt)	marine, greenish brown siltstone and gray sandstone and conglomerate	Miocene	Castaic Fm (Tc) and Violin breccia (Tvb)	marine, brown to gray siltstone and mudstone; red brown angular breccia in sandy matrix
Miocene	Modelo Fm (Tms)	marine, alternating gray-brown sandstone and gray-green siltstone, with conglomerate and mudstone	Miocene	Mint Canyon Fm (Tmc)	non-marine, red-green sandstone and conglomerate, buff siltstone
			Miocene	Tick Canyon Fm (Ttc)	non-marine, reddish sandstone, siltstone and conglomerate
			Oligocene	Vasquez Fm (Tv)	sandstone, multicolored
Pre-Tertiary	Basement Complex (bc)	crystalline granitic and gneissic rocks	Pre-Tertiary	Basement Complex (bc)	Pelona schist, crystalline

NOTES: 1. Table does not include alluvium, terrace deposits or Saugus Formation; these strata are potentially water-bearing and occur on both sides of the San Gabriel fault.
2. Data above adapted from Oakeshott (1958), as modified by Stitt (1980) and Schlaefer (1978).
3. Refer to Hydrogeology Map for outcrop areas.

The San Gabriel fault, as seen on Plate 4, trends northwesterly across the study area, intersecting the Santa Clara River near Bouquet Junction. Work by numerous investigators (such as Crowell, 1954; Oakeshott, 1958; Schlaefer, 1978, Saul and Wootton, 1983, and Ehlig, 1986) reveal that this major structure consists of a series of steeply north-dipping faults with primarily right lateral offset movement; the northerly side of the fault has generally been uplifted relative to the southerly side of the fault. It has been mapped through the region because of such strong topographic expressions as: the fault alignment is noticeable on aerial photographs, it has displaced geologic formations (such as the Saugus Formation), it has offset drainage patterns; and it has induced folding in many rock units. It is also known to have created stratigraphic traps for the accumulation of oil in several oil fields in the area (see also Land Use Map).

Recent work by Ehlig (1986), which included details of geologic logging of exploratory trenches across the fault, has also corroborated the fact that the fault is really a zone of faulting, ranging from a single plane with only little fault gouge, to a zone as much as a half-mile wide containing numerous faults, complex folds and intense shearing and brecciation. This fault is also considered to create at least a partial barrier to groundwater flow in the Santa Clara River Valley as will be discussed later in this text.

Other recent work by Cotton (1986) document that the San Gabriel fault has experienced Holocene (Recent) activity, although the cause of this activity is still being debated in the geologic community. Reportedly, the fault had its origins during the Middle Miocene epoch and, since that time, has induced right lateral offsets in the rocks as great as 40 miles; its overall estimated mapped length is 80 miles.

Several other faults (such as the Holser fault) and folds (such as the Pico anticline) are depicted on Plate 4. For the most part, these structures are not considered to display a significant impact on the hydrogeologic characteristics of the alluvial aquifer system in the study area.

HYDROGEOLOGY

GROUNDWATER OCCURRENCE, RECHARGE & DISCHARGE

Within the saturated zone of the water-bearing alluvial deposits of the Eastern Basin, groundwater occurs in the pore spaces and voids between the individual sedimentary grains. In general, water table conditions appear to prevail throughout the alluvial sediments, although semi-perched conditions may exist locally in portions of the main river valley and its tributary canyons. Due to the mode of deposition of these alluvial sediments, sedimentation of thick, areally extensive clay layers has been precluded; as a result, confined (artesian conditions are not considered to exist in the alluvial wells.

Natural sources of recharge to the groundwater reservoir within the alluvial aquifer system include: deep percolation of direct precipitation; infiltration of stream runoff in the river valley and its tributaries; subsurface inflow, depending on water levels from the adjoining hill and mountain areas; and subsurface inflow from the upstream Acton Basin. The relative magnitude of each of these recharge sources has not been quantified for this investigation, due principally to a lack of requisite data.

Man-made sources of recharge to the alluvial aquifer system include: deep percolation of irrigation returns and of seepage from the unsewered areas in the canyons (see also Land

Use Map); infiltration of surface flow and underflow from Castaic Dam within the Castaic Creek area; infiltration of water released by Los Angeles Department of Water and Power from their reservoir facilities in Dry Canyon and upper Bouquet Canyon; and infiltration of wastewater treatment plant discharges directly to the Santa Clara River from Plant No. 26 near Bouquet Canyon (a discharge in 1985 of about 5 mgd or about 5600 ac-ft/yr) and from Plant No. 32 near Valencia (a discharge of about 4 mgd or 4480 ac-ft/yr).

No artificial recharge operations either by direct surface spreading basins or by shallow well injection, have been historically utilized in the river valleys to make use of excess surface runoff for purposes of augmenting alluvial aquifer water levels. No water from the State Water Project has been used for these purposes either . Moreover, portions of the Santa Clara River east of Bouquet Junction and local portions of a few tributaries have been concrete lined for flood protection; this lining has typically included both the sides and the bottom of the flow channel.

Outflow or discharge from the alluvium occurs principally by water well extractions (total 1985 alluvium production from the four main purveyors and the Newhall Land and Farming Co. and their 59 total active wells was 24,103 ac-ft). Additional, but non-quantified, discharge is known to occur by: subsurface outflow to the downstream Piru Basin to the west; subsurface outflow, depending on water levels, to the underlying permeable portions of the Saugus and older formations; and evapotranspiration in areas of phreatophytes that grow in the few reaches of the main river valley where rising water is known to occur. An additional groundwater production of 1000 ac-ft/yr or less may occur from the wells utilized by individual houses, industries and/or commercial establishments in the area.

WATER LEVELS

To evaluate the status of groundwater levels and flow directions in the study area, the elevation of the water table at numerous points must be obtained. When lines connecting point of equal water table elevation are drawn, the lines represent contours of equal elevation of the water table. To construct water level contour maps requires obtaining non-pumping water depth measurements for a specific time period from wells spaced throughout the study area. These water level depths are then corrected for elevation, plotted on a map, together with the well location and well identification, and then contoured.

Groundwater flows from high head to low head, and hence flow directions are perpendicular to the contour lines themselves. However, it should be noted that because the vast majority of wells in the region contain relatively long lengths of continuously perforated casing, groundwater enters the well bore from all strata encountered by the well. This precludes analysis of water movement in individual aquifers. Also because there is not even distribution of wells throughout the study area, there are numerous data gaps; contour lines must be interpolated in these areas. Lastly, it should be noted that some reported water levels are questionable and likely relate to some form of human error as discussed in the Available Basic Data section of this report.

For this investigation, four time periods were selected to represent groundwater conditions and the direction of groundwater flow: 1945, 1958, 1965, and 1985. April 1945 was selected because it represents that period of time when water levels in the study area were at or near their all-time high. The year 1958 was selected because it is the beginning

of the Base Period selected for use in our hydrologic analyses; water levels at this time were intermediate between all-time highs and all-time lows. The water year 1965 represents the all-time low period for water levels in the project area. From the 1977-78 rainfall season to the 1979-80 period, groundwater levels rose markedly in the alluvium in response to a series of back-to-back unusually wet winters. Subsequent to this period of high rainfall, groundwater levels began to decline, reflecting more usual precipitation patterns. In order to present groundwater level and flow direction information, 1985 was selected to represent present conditions; in addition, these water levels represent the end of the Base Period selected for our hydrologic analyses.

Water level data for these four separate periods were obtained as follows: directly from water level contour maps previously prepared by Los Angeles County Flood Control District for the region for 1945, 1958, and 1965; and from Fall 1985 basic water level readings for wells in the region that were on file at LACFCD. These latter readings were annotated for each respective water well monitored, and then contoured as illustrated on Plate 5 - Contour Map of Groundwater Elevations, Fall 1985. The contour maps prepared for the three earlier time periods by LACFCD are not presented herein.

As described in other sections of this report, the alluvial aquifer system in the study area is divided into numerous subunits, or storage units, the boundaries of which have been selected on the basis of geologic and topographic features. However, in describing groundwater movement, the alluvium is considered a single entity: the Santa Clara River System, upstream from the Los Angeles-Ventura County line to the community of Lang. The basin does include a number of tributary drainage areas; however, their contribution to the

main basin is relatively small. The location and areal extent of the alluvial aquifer system is shown on Plate 5.

In the Spring of 1945, groundwater levels were higher than at any other time for which data are available in the study period which extends from 1945 to 1985. Though not presented in this text, the LACFCD water level contour map for April 1945 has been reviewed and reveals the following:

1. Water level data were available for the Santa Clara River channel between County line on the west and the intersection with Sand Canyon on the east; no data were available for the remainder of the river valley to the east toward Lang.

2. Our estimation of groundwater levels for the entire reach of the Santa Clara River Valley between Lang and County line ranged from an estimated elevation of 1690 ft at Lang (depth of about 45 ft) to a contoured elevation of about 825 ft at County line (depth of less than 10 ft).

3. Groundwater flows westerly along the main river valley across the study area from Lang to County line. Across much of the valley, groundwater levels remained generally high, typically 20 to 25 feet below ground surface as, for example, near Solemint and Bouquet Junction. In general, the groundwater gradient is on the order of 25 to 35 feet per mile.

4. Along the South Fork of the river, between Newhall and Saugus, groundwater flows in generally northerly direction. In this region, groundwater varies in elevation from about 1170 feet at Newhall to 1130 feet in the vicinity of Saugus. Depth to groundwater is somewhat deeper to the south, approximately 50 feet, compared to the northerly portion of the South Fork where it stands at depths of no more than 30 feet below ground surface.

5. Groundwater in Castaic Canyon, a major tributary drainage to the Santa Clara River, flows in a southerly direction and stands at depths of less than 10 feet below ground surface. In the vicinity of Sulfur Springs, for example, depth to groundwater is less than six feet.

6. Water level contours were not available, or only locally available, for many of the remaining watersheds for April 1945. For example, no data exist for Sand Canyon, Placerita Canyon and Mint Canyon, and only meager contour data exist for Bouquet and Dry Canyons. Calculated groundwater gradients for these latter canyons are relatively steep (about 55 ft/mi and 46 ft/mi, respectively).

In November, 1965, groundwater levels in the investigation area varied in elevation from 1635 feet above sea level at the easterly limits of the study area in the Santa Clara River to about 825 feet near the County line. Highest groundwater elevations were exhibited in the upper alluviated portion of Mint Canyon where groundwater reached a maximum elevation of 1950 feet above sea level. Groundwater movement was to the west in the main channel of the Santa Clara River, generally to the south in tributary canyons lying north of the river, and to the north in the southern tributaries .

Depth to water in November 1965 for the river valley east of Bouquet Junction is considered to be moderately deep, with typical water levels being at 100 to 150 feet below ground surface.

In the main river valley between Bouquet Junction and Castaic Junction, water levels were relatively shallow, typically 30 to 40 ft or less below ground surface. Near the confluence of Castaic Creek, water levels in the alluvium of the river were about 20 to 30 ft below ground surface, while in the river valley between this confluence and County line water levels ranged from roughly 10 to 30 ft below ground surface.

In the vicinity of Newhall in the South Fork, Santa Clara River, groundwater flowed northerly toward the main channel of the river along a hydraulic gradient of about 175 feet per mile in November 1965. Between Newhall and Saugus, groundwater gradients flattened substantially and, at a point

near the juncture of Bouquet Canyon, water from the south meets the main river channel and begins flowing to the west. Even with the contribution of flow from Bouquet Canyon and from the Saugus area, the groundwater gradient to the west of the point of intersection was rather flat, about 25 feet per mile. This is due, in part, to the widening of the alluvial basin and the increase in thickness of the alluvium in the main river channel compared to that in the South Fork.

Groundwater contours for 1965 prepared by LACFCD are noted to be likely affected by the San Gabriel fault in the vicinity of Bouquet Junction. At this locale, groundwater contours appear to steepen near the fault. Because only contours are displayed on their map (it is not annotated with data for individual wells) it is not possible to denote the actual amount of water level offset on opposite sides of this fault. This offset may be reflective of a change in aquifer transmissivity values on either side of the fault rather than the fault acting as a barrier to groundwater movement, however.

Noteworthy in an analysis of water level contour data for both the high period of 1945 and the very low period in 1965 is the fact that during the recent wet years commencing in 1977-78 until the end of the unusually wet winter of 1979-80, water levels in the alluvium were noted to fluctuate rapidly and to a large degree in response to wet and dry conditions; this occurred not only in individual areas or individual wells, but in general throughout the entire study area. This condition of rapid response to wet years may not prevail to the same degree in the future, however, because of the rapid decrease in natural recharge areas due to urbanization and the paving of natural infiltration areas, increase in runoff velocity, diversion of surface water to lined channels, and modification of natural catchment areas.

Review of water level contours prepared for this study for Fall 1985 (see Plate 5) reveals the following:

1. Basic water level data were available from approximately 90 wells in the study area; our water level contours were prepared from these data. A special arrow symbol has been used on Plate 5 to illustrate the direction of groundwater flow in the alluvium for the entire study area.

2. The overall hydraulic gradient in the main river valley between Lang and Bouquet Canyon is approximately 50 ft/mi; in this reach, the river valley is typically on the order of 2500 feet in width and comprised by relatively coarse-grained, sandy deposits.

3. The overall hydraulic gradient in the river valley between Bouquet Canyon and County line is approximately 31 ft/mi; in this reach, the river valley varies from 2500 to 5000 feet in width and is generally comprised by sediments which have an overall grain size that is relatively fine compared to that farther east. By application of the Darcy equation (and assuming constant underflow), it appears that the overall thickness of alluvium in the river valley may be greater in the reach between Castaic Junction and County line than in the reach between Lang and Bouquet Junction.

4. Groundwater in the alluvium of the Santa Clara River flows from east to west across the study area between Lang and County line; corresponding water table elevations are 1700 feet and about 820 feet, respectively.

5. Depths to groundwater in the main river valley are typically on the order of 35 to 60 feet in the reach between Lang and Bouquet Junction, and 10 to 25 feet in the reach between Bouquet Junction and County line.

6. Groundwater in the alluvium of the South Fork, Santa Clara River, moves in a general northerly direction toward its confluence with groundwater in the main reach of that river; the hydraulic gradient across the Saugus area is very flat due, at least in part, to a lack of well data. Farther to the south, in the Newhall and Placerita Canyon areas, steeper gradients occur.

7. Contours could be prepared for nearly all of the main tributary canyons in the area. In general, relatively

steep hydraulic gradients occur in these tributaries, with values on the order of 60 ft/mi to 80 ft/mi being most common.

8. A groundwater contour anomaly in the river valley near Bouquet Junction appears to coincide with the surface trace of the San Gabriel fault. Groundwater levels in the alluvium appear to be about 25 to 30 feet higher east of the fault compared to water levels on the west. A relatively steeper hydraulic gradient occurs on the east also, although this may relate to differences in the cross-sectional area of saturated flow in the alluvium within the main river channel itself.

   In the portion of Castaic Creek crossed by the San Gabriel fault, this apparent barrier effect of the fault is not nearly as pronounced. To some degree, this could relate to a lack of well data near the fault trace. A slightly steeper hydraulic gradient does exist north of the fault trace in Castaic Creek compared to that south of the fault.

9. Except for some possible small irregularities in the groundwater contour pattern in the alluvium just west of Saugus, there is no definitive barrier effect created by the Holser fault in the region.

HYDROGRAPHS

Water level fluctuations in nine wells in the study area were obtained from various data repositories and plotted versus time to construct water level hydrographs. These hydrographs reveal the continuous adjustment of groundwater in storage to changes in basin-wide recharge and discharge. The hydrographs, which are present along with graphs of total dissolved solids concentration versus time onto Plates 6.1 to 6.4 - Hydrographs and TDS Graphs - permit the assessment of both long-term and short-term-seasonal changes occurring in the alluvial aquifer system. Of the nine hydrographs, five represent fluctuations of groundwater levels in the alluvium, two represent water level changes in the Saugus Formation, and two hydrographs represent water level fluctuations in wells that

were perforated in both the alluvium and in the Saugus Formation.

Those wells perforated in the alluvium and representing only water level changes in that aquifer, are distributed virtually along the entire length of the Santa Clara River and in the Castaic Creek area. Saugus Formation wells lie within the area bounded by Saugus on the east and Castaic Junction on the west. Combination alluvium-Saugus Formation wells are located between Newhall on the south and Saugus on the north. The locations of wells for which hydrographs have been prepared are indicated on Plate 6.5 - Location Map of Data Graphs. Assessment of the hydrographs is supplemented with the use of precipitation data shown on Figure 2 for rainfall gages located at Saugus-Edison Substation and at Mint Canyon.

Inspection of the water level fluctuations on Plates 6.1 through 6.4 indicates that changes in groundwater in storage in the study area occur both in the short-term (seasonal) and in the long-term (period of several years). Such changes occur rapidly and to a greater degree in the alluvium wells; such fluctuations are significantly attenuated in the Saugus wells and in the combination wells. Regardless of the location of the alluvium well within the main river valley, water level fluctuation in response to infiltration of direct precipitation or runoff is rapid. For example, well 4N/15W-13P1, an alluvium well, located along the Santa Clara River about 1.5 miles downstream of Lang, displays the typical short response time of water levels to recharge/discharge (see Plate 6.1). As a result of the 1962-66 dry period, groundwater levels in the well dropped to an elevation of about 1480 feet above sea level in 1965. By 1968, subsequent to above-average rainfall in 1965-67, groundwater levels in the well rose about 80 feet. In 1978, in response to unusually high rainfall in the amount of almost 35 inches, water levels rose from 1480

feet to 1560 feet, or 80 feet in one season. It is interesting to note that the all-time low water level in 1964-65 was almost repeated by the 1976-77 season.

The hydrograph for alluvial wells 4N/15W-20F1 and -20F2 (Plate 6.1) represents water level changes in two wells located only a few feet apart and constructed in almost an identical manner. Although the record is not continuous, it does extend, as does the previously discussed well hydrograph, from 1956-57 to 1980-81. These two proximal wells are located in the river channel approximately 1.3 miles downstream of Solemint. The all-time low water level in well -20F1 occurred in the 1965-66 season, while its all-time high level occurred in the 1968-69 season. In 1965-66, water levels in well -20F1 stood at an elevation of about 1230 feet above sea level; in the 1968-69 season, the static water level in this well stood at nearly 1340 feet above sea level. A second high water level was attained in the neighboring -20F2 well during the 1977-78 season when static water levels in the well were at about 1320 feet above sea level (see Plate 6.1). As in the case of other alluvium wells, response to rainfall is extremely rapid.

Alluvial well 4N/16W-16Q3 is located approximately 1.5 miles downstream and northwest of Saugus. Its hydrograph (Plate 6.3) is somewhat unusual because of the relative lack of activity prior to the flood of 1969. During the period 1957 to 1968, the static water level of the well fluctuated no more than about 20 feet. However, in response to infiltration of runoff in the river and its tributaries, water levels in the well rose to a high of 1082 feet above sea level in the 1968-69 season. The all-time high water level for the well occurred in the early-1980's, following the heavy rainfalls in 1978 and 1980. From the high water table elevation of 1968-69 until 1979-80, water levels in this well fluctuated less than

20 feet, virtually the same variation in water levels that occurred during the period 1957-69.

Well 5N/17W-36A3 (Wayside Honor Rancho Well No. 14) is located in the floodplain of Castaic Creek just east of Sulphur Springs. As shown on Plate 6.4, the record for this well is one of the longest, extending from 1960 to 1985. Maximum fluctuation of water levels in this alluvial well is about 40 feet throughout its entire record. Water levels in the well rose in response to heavy precipitation and runoff in the 1961-62 season, but declined in the 1968-69 season, a wet year. Later, water levels declined in the 1970-71 season when the area was subjected to 12.45 inches of precipitation, but rose more than 20 feet in the following year when precipitation was only 7.88 inches (see also Figure 2).

The last alluvial well for which a hydrograph has been prepared is well 4N/17W-14Q2(NLF, Well C) which is located in the floodplain of the Santa Clara River about two miles downstream of Castaic Junction (see Plate 6.4). The well is the most westerly of the alluvial wells for which hydrographs have been prepared. Its record clearly reveals a limited amount of "long-term" fluctuations in water levels in this reach of the river alluvium. The maximum water level change in the period of record graphed on Plate 6.4 is only about 21 ft. The lowest water level on record occurred in 1965, concomitant with a general period of decreased precipitation in the region.

The highest water level recorded for NLF Well C occurred in 1977-78 when water levels in the well rose to 941 feet above sea level. It is interesting to note that water levels in this well fluctuated no more than five feet during the period 1967-68 to 1977-78 even after the unusually wet winter of 1977-78 when more than 34 inches of rainfall were recorded. This could be explained, in part, by the well's

location at the westerly limits of the study area and the lag time required for this portion of the basin to refill in response to infiltration of rainfall upstream. Moreover, it is possible that the bulk of sediments in this reach of the river are saturated much of the time and, thus, there is little room for increases in storage; hence, recharge may often be rejected in this reach.

Two wells known to be perforated solely in the Saugus Formation have been selected as representative of water level changes which occur in that formation. These are well Nos. 158 and 160, both of which are owned by Valencia Water Company. Both wells lie approximately two miles northwest and downstream of Saugus and are situated in the Middle Reach of the floodplain of the Santa Clara River. Their hydrographs are illustrated on Plate 6.2.

Well No. 158 is perforated in the zone 740 to 1600 feet below ground surface. Although the well passes through the alluvium, the perforations are considered too far below the alluvium to be impacted by water level changes in this upper aquifer system. Although the well is abandoned now, water level data for No. 158 extend between 1963 and 1980. Review of the hydrograph reveals the following:

1. An all-time low water level elevation of 1002 ft, in 1963-64.

2. An all-time high water level elevation of 1048 ft, in 1979-80.

3. A subdued relationship occurs on this hydrograph between water levels and precipitation; water levels did respond to the high precipitation of 1977-78 and to the low precipitation of 1975-76. The greatest fluctuation in water levels occurred between 1970-71 and 1971-72 when water levels declined about 30 feet. During this period, rainfall was 12.45 and 7.88 inches, respectively. Because of the presumably large quantity of groundwater in storage in the Saugus Formation and the limited number of wells tapping this

aquifer as a source of supply, it is not surprising to find that water level changes are not as pronounced as in the alluvial aquifer system.

Saugus Formation Well No. 160 is perforated in the interval 950 to 2000 feet below ground surface and is probably the deepest well for which any data are available. Most apparent from analysis of its hydrograph (Plate 6.2) is that it does not, in every instance, mirror the water level fluctuations seen in well No. 158. In fact, in several instances its peaks and valleys do not coincide with those of the previously-described well. Until the precipitation which occurred in the 1977-78 season, the low water levels became progressively lower. For the low water seasons of 1964-65, 1969-70, 1973-74, and 1975-76, water level elevations were 1002 feet, 998 feet, 990 feet, and 989 feet, respectively. The greatest water level fluctuation occurred in response to the 34.77 inches of rainfall in the 1977-78 season, when water levels rose 37 feet. The difference in the pattern of water level fluctuations in well Nos. 158 and 160 may be due to either their pumping regimen, the fact that the two wells are perforated in different zones, or a combination of both of the above possibilities. Indeed, other construction details, such as the length of the cement sanitary seal (hence the length of alluvium open to the gravel pack in the well) may also contribute to these water level differences.

Two "combination" wells were selected to represent water level fluctuations that occur in wells which are responsive to both water level changes in the alluvium and in the Saugus Formation (the hydrographs are shown on Plate 6.3). These are well No. 154 (owned by the Newhall Land & Farming Co.) and private well 4N/16W-27J1. As seen on Plate 6.5, these two wells lie along the east side of the South Fork, Santa Clara River, between Saugus and Newhall.

The hydrograph for -27J1 extends from 1955-56 through 1979-80 and demonstrates a direct responsiveness to changes in precipitation. This well reportedly is 380 ft deep, but no perforation interval data are available. It produces from the alluvium and possibly from the Saugus Formation.

The all-time water level low for well -27J1 was 1046 feet above sea level, and it occurred in the 1964-65 season. Water levels responded rapidly to subsequent rainfall occurring in the 1968-69 season, and thereafter remained rather constant until the large rainfall of 1977-78. This latter period reflects the all-time high water level for this well which is 1108 feet above sea level, a 62-foot change from its all-time low. What is most significant about this hydrograph is its lack of decline during the protracted drought period which occurred during the 1969 to 1976-77 period. During this extended period of time, groundwater levels changed no more than 11 feet. This lack of fluctuation may be due, in part, to the fact that much of the groundwater pumped by the well probably came from the Saugus Formation which does not respond as rapidly to changes in rainfall.

Well No. 154 is perforated in the interval 45-1016 feet below ground surface, and thus obviously extracts groundwater from both aquifer systems. The record of water levels for this well extends from 1959-60 to 1977-78, and although relatively short, does include the significant years of 1964-65, 1968-69, and 1977-78 when water levels were either very low or very high. The pattern of the hydrograph for this well is virtually identical with that of the previous well (-27J1). Its lowest water level elevation occurred in the 1964-65 season when the water table stood at an elevation of 1029 feet above sea level, and its recorded high of 1088 feet occurred in response to the heavy rains of the 1977-78 rainfall season (compare Figure 2 with Plate 6.3). As was the case with well

4N/16W-27J1, water levels did not change by more than a few feet throughout the period 1969-70 through 1978-79. It appears that once water levels had risen to a particular elevation they remained at this point regardless of changes in precipitation. This may be due to a large percentage of groundwater extracted that was removed from the Saugus Formation by this well, in spite of the fact that it is perforated in both aquifer systems. On the other hand, the consistently high water levels during this period occur may signify that the alluvium is nearly full and, thus, even with further increased precipitation, further recharge to the alluvium is rejected.

THEORETICAL AQUIFER PARAMETERS

To assess well yields and aquifer parameters, it is necessary to first evaluate the water transmitting, or hydraulic properties of the aquifers. These aquifers represent the water-bearing zones in the groundwater reservoir; that is, those strata comprised of permeable sandy or gravelly materials, or both, which are mixed with lesser concentrations of silt and clay. The arrangement, sorting, shape, and size of the individual grains in the aquifers control the ability of water to move through the strata.

Characterizing the water transmitting properties of the aquifers are the aquifer coefficients of transmissivity (symbol T, in gallons per day per foot of aquifer, gpd/ft), and storativity (S, in cubic feet per square foot per foot, ft^3/ft^3, and thus dimensionless). An additional parameter, permeability (P, in gallons per day per square foot, gpd/ft^2) can be calculated from T values, or is determined by field tests or by soils laboratory testing of aquifer samples.

Transmissivity and permeability will be discussed in this section of the report. Storativity will be discussed in the Geohydrology section.

Typically, T is calculated from aquifer tests conducted in the field on individual pumping wells (based on water level drawdown and recovery measurements versus time). Due to a virtual absence of requisite field data in the basin, such direct calculations of transmissivity were not possible.

Instead, an empirical method of assessing T values was used for this project in order to review the relative ability of the local aquifers in the basin to yield water to wells. This method, which is based on the modified Thiem formula, determines the theoretical value of transmissivity by relating T to the specific capacity of the well.

For the assumed water table conditions in the study area, the empirical relationship is approximately:

Theoretical T = 1750 Q/s, where Q/s is the specific capacity of the well;
Q is the well yield in gpm;
s is the amount of drawdown, in feet, created in the well by that pumping rate;
1750 is an empirical constant.

Actual values of Q and s were obtained from data on drillers' logs or from efficiency tests conducted on local wells by the Edison Company.

Using data from the well logs and Edison tests and the empirical formula above, the theoretical T value for each well was then calculated. Results are illustrated on Plate 7 - Map of Aquifer Characteristics. This plate depicts areas of relatively high theoretical T ($\geq$ 500,000 gpd/ft) and areas of relatively low theoretical T ($\leq$ 12,000 gpd/ft). These values shown represent the overall range of transmissivity of the aquifers penetrated/perforated by the wells to their particular total depths. Because aquifer T values are additive, it

follows that if wells were drilled deeper into the alluvium, then the overall T value would increase at that particular location.

It must be recognized that such calculations of theoretical T relate directly to the age, efficiency, condition, and design of the well and its perforations. This is because the key factor in the calculation is well drawdown (symbol, s). Drawdown, in turn, is a measure of the head loss for water entering the well perforations as a result of pumping. Wells that are old, have inefficient designs, that contain precipitates or incrustation on perforations, or that have limited open areas in their perforated intervals will have larger head losses (drawdown) than wells with the opposite of such conditions.

Review of theoretical T and P values on Plate 7 indicates:

1. The largest T values occur in the central portions of alluvium along the channel of the Santa Clara River. Values as large as 500,000 to 600,000 gpd/ft are locally present.

2. Within the river alluvium itself, theoretical T and P values are generally larger in the reach west of Bouquet Canyon.

3. Conditions other than just mere differences in sedimentation have caused large variations in T values across short lateral distances. In Section 23, T4N, R15W, for example, two wells situated in close proximity to one another exhibit T values of 80,700 gpd/ft and 348,200 gpd/ft. About one mile upstreamm from this locale, T values as low as 3100 gpd/ft have been computed as representative of the alluvium. Santa Clarita Water Company wells No. Oaks-Central, -West, and -East, and Sierra are constructed in alluvium where transmissivity is on the order of 500,000 gpd/ft. Based on these T values, and the known alluvial aquifer thickness, the permeability of the alluvium in this area is as great as 7000 gpd/ft^2. Such theoretical P values are considered remarkably high and must be indicative of very clean, poorly graded

sands or gravels that are rounded and unconsolidated. To account for the large reductions in T and P values between these wells, one must conclude it is caused by differences in the construction or efficiency of the wells themselves.

4. With the possible exception of Castaic Creek, T and P values in the remaining tributary canyons are not nearly as large as those in the Santa Clara River; hence, alluvium in these tributaries is not as granular or as permeable as that in the main river valley. Theoretical T values in Castaic Creek are often in the range of 250,000 to 400,000 gpd/ft. DWR (1964) reported T and P values in Castaic Creek alluvium near the dam of approximately 115,000 gpd/ft and 2400 gpd/ft^2, respectively.

5. Areas of low T and P values exist, however, throughout the study area. Wells in Mint Canyon, for example, exhibit T values of 5000 gpd/ft and P values of 50 gpd/ft^2. Alluvial sediments in this area are thin, and drawdown is impacted by the narrowness of the canyon which causes boundary conditions for water flowing toward the wells.

6. In Bouquet Canyon, the T values of the alluvium range from a low of 5400 gpd/ft to as great as 413,000 gpd/ft, which is the value computed from data pertaining to the SCWC-Clark well. Permeability of the alluvium in the immediate vicinity of this well is not known, but it may be as high as 4000 gpd/ft^2.

7. In the wide basinal area lying between Saugus and Castaic Junction, theoretical T values range from about 20,000 gpd/ft to approximately 450,000 gpd/ft. Permeability ranges from a low of 22 gpd/ft^2 to an extraordinary value of 5100 gpd/ft^2 in this same area. Geologically, one would not expect sediments to change either in composition, mode of deposition, or in post-depositional weathering to a degree sufficiently great enough to cause such an apparent disparity across such a short lateral distance. Again, such variation in T and P is likely related to well construction methods, depth of the well, well screen placement or deterioration of well casing and/or well screen encrustation.

8. In the area including Newhall, Saugus, and westerly for about two miles toward Castaic Junction are several wells which obtain groundwater from the Saugus

Formation. These wells are plotted and denoted by special symbols on Plate 7.

Saugus Formation wells exhibit T values ranging from about 10,000 gpd/ft to about 145,000 gpd/ft, and permeability values ranging from 13 gpd/ft^2 to 351 gpd/ft^2. Based on our knowledge of the Saugus Formation developed to date, the most reasonable explanation for the large difference in T & P values is not only the depth to which the Saugus well was drilled, but whether or not any of the wells obtain water from the more permeable alluvium, either by location of upper perforations or by water possibly moving down the gravel envelope from the alluvial sediments. In addition, we are not certain at this time as to the various types of perforations used in these Saugus Formation wells, whether or not the perforations were placed directly opposite the best potential aquifers encountered, whether or not the drilling muds were properly developed out of the original well, and whether or not chemical precipitates in the years of ensuing use have blocked off portions of the gravel pack and/or perforations.

9. It does not appear from the limited Saugus Formation data that theoretical T and P values are larger for the two Saugus wells (V-157 and V-158) that are located nearer the main Santa Clara River channel than for the remaining Saugus wells owned by others that are located along the east side of the South Fork near Newhall. Regardless of their locations, the alluvial deposits are clearly more transmissive and permeable than the Saugus Formation in these areas, and to the depths drilled to date.

GROUNDWATER QUALITY

Concentrations of dissolved mineral constituents in groundwater are influenced by the quantity and quality of groundwater which percolates into the groundwater reservoir. Once in the ground, the water quality is influenced by such factors as: the lithology and age of the sediments through which it flows; the rate of groundwater flow; the rates and locations of recharge; fluctuation in basin-wide water levels; well construction and abandonment techniques; methods of water

sampling; the locations for and qualities of artificially recharged waters; and the proximity to sources of degradation such as irrigation return waters and sewage and industrial discharges.

Identification of the chemical character of groundwater in the study area has been identified by the construction of trilinear analysis diagrams, graphs of changes in total dissolved solids (TDS) with time, and Stiff water quality pattern diagrams. Each of these will be discussed separately in the following paragraphs. For convenience, and in order to assist each purveyor, the water quality descriptions which follow are described on a purveyor-by-purveyor basis within each analysis type.

TDS values used in this study are for total filterable residues and not the higher values historically reported as the summation of constituents; this is consistent with TDS values currently reported by local laboratories.

Trilinear diagrams are prepared using the percent reactance values of the principal cations and anions listed in the original laboratory analysis of the well water. Figures 3.1 through 3.6 - Trilinear Analysis Diagrams - present the results of the required calculations for 28 wells drilled only in alluvium and for 11 wells which obtain groundwater only from the Saugus Formation. The data generally date from the late-1970's, or more recently, except for Los Angeles County data which are considerably older.

Newhall County Water District

As shown on Figure 3.1, five alluvium wells are plotted on the trilinear diagram. The resulting groundwater is calcium bicarbonate in character. Total dissolved solids (TDS) concentration ranges from 376 mg/l to 490 mg/l, while nitrate ion concentration (as NO_3) is zero in Castaic No. 2 and between 8 and 15 mg/l in the Pinetree group of wells. Castaic No. 2 well has a higher sulfate

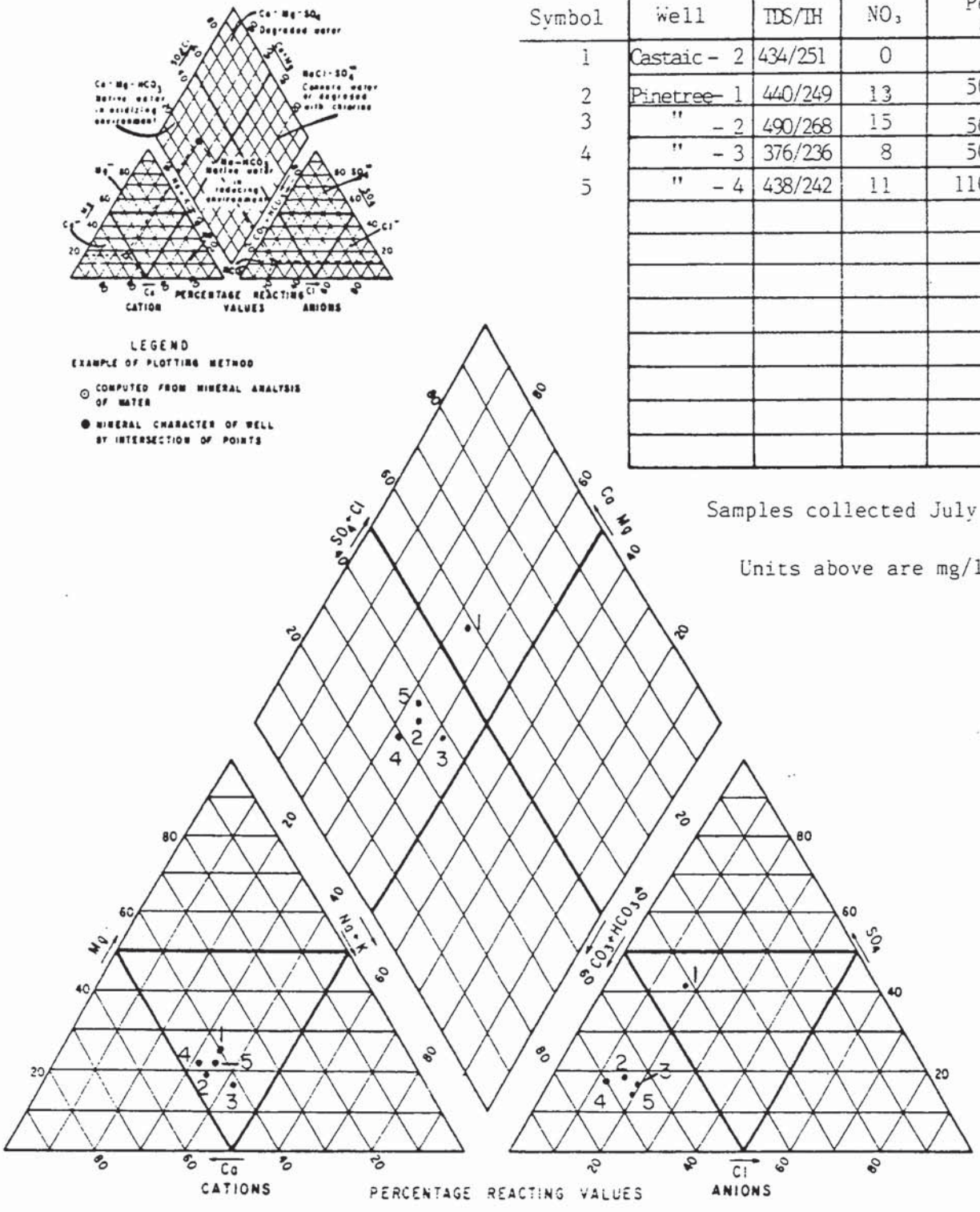
Figure 3.1

TRILINEAR DIAGRAM - Alluvium

Symbol	Well	TDS/TH	NO_3	Perfs. (ft)
1	Castaic - 2	434/251	0	?
2	Pinetree - 1	440/249	13	50-210
3	" - 2	490/268	15	50-130
4	" - 3	376/236	8	50-135
5	" - 4	438/242	11	110-185

Samples collected July 1984

Units above are mg/l



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Santa Clarita Water Co.

Figure 3.2

TRILINEAR DIAGRAM - Alluvium

Symbol	Well	TDS/TH	NO_3	Perfs. (ft)
1	Clark	581/330	32	?
2	Lost Cyn.	434/248	12	125-310 ?
3	Mitchell	460/241	8	76-246
4	N.Oaks West	510/307	22	38-126
5	Guida	515/301	35	56-150
6	Honby	422/287	18	50-202
7	Sand Cyn.	515/343	25	60-140

Sample 2 collected July 1982
1,3,4 collected June 1983
5,6,7 collected June 1980

Units above are mg/l

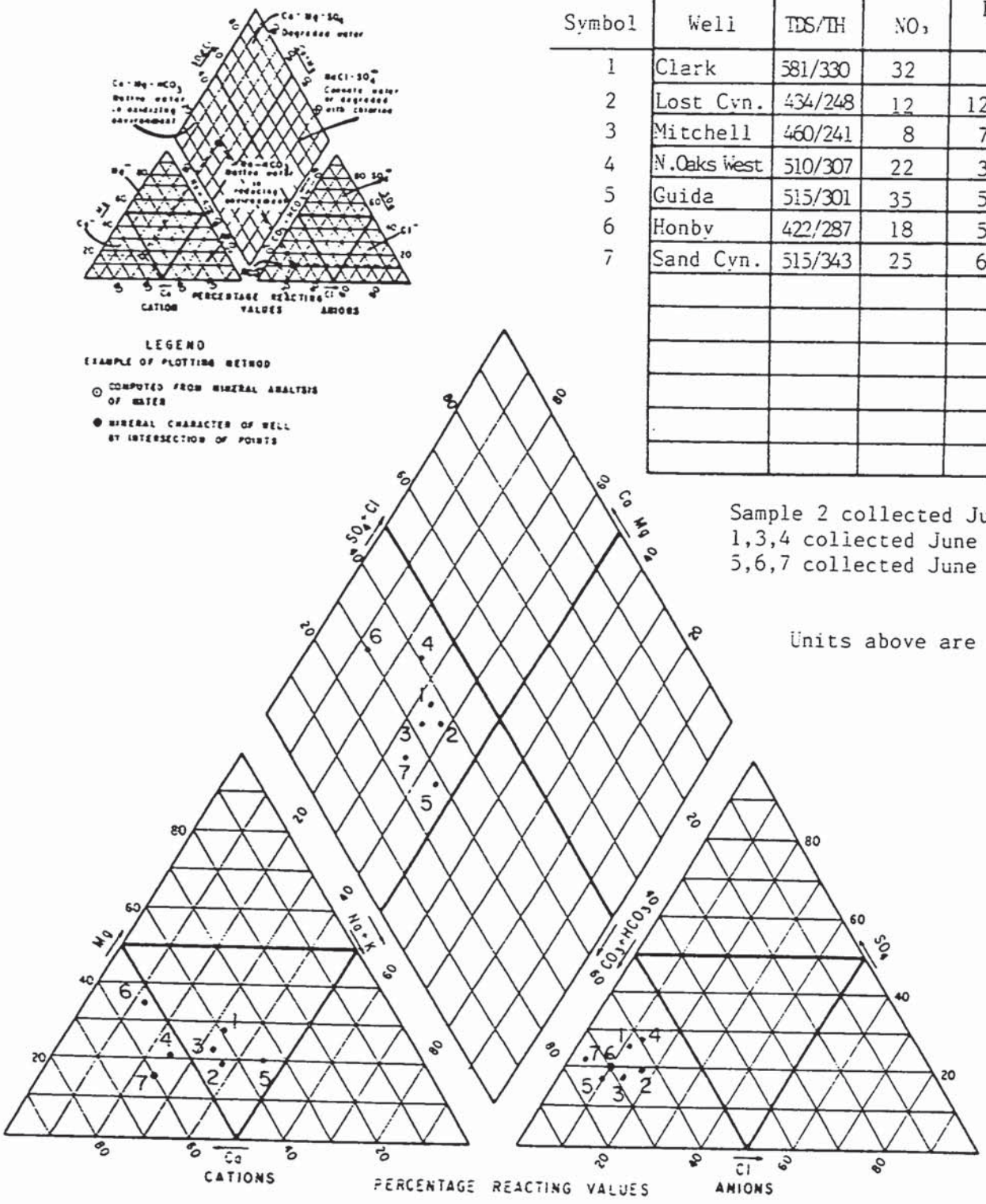
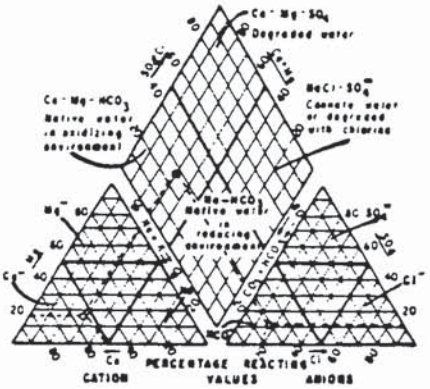


Figure 3.3

TRILINEAR DIAGRAM - Alluvium



LEGEND

EXAMPLE OF PLOTTING METHOD

⊙ COMPUTED FROM MINERAL ANALYSIS OF WATER

● MINERAL CHARACTER OF WELL BY INTERSECTION OF POINTS

Symbol	Well	TDS/TH	NO_3	Perfs. (ft)
1	E	830/438	15	12- 93
2	I	640/403	19	30-165
3	N-68	560/320	20	76-237
4	T2	490/295	18	50-138
5	U3	510/296	17	46-140
6	U4	520/309	17	30-130
7	Q2	510/285	18	76-126
8	D	790/425	7.8	60-136
*9	154	1027/593	34	45-1016

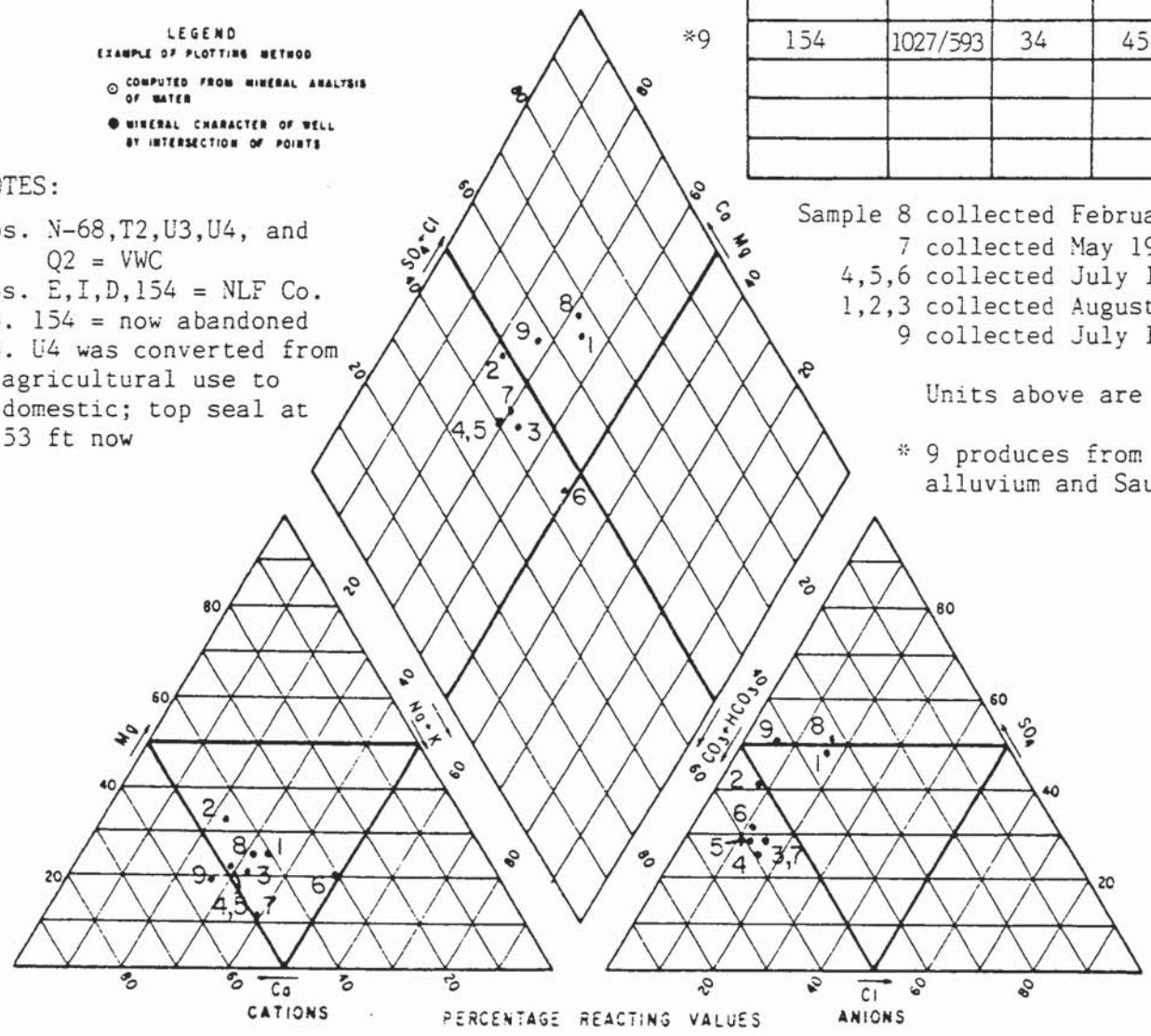
NOTES:

Nos. N-68,T2,U3,U4, and Q2 = VWC
Nos. E,I,D,154 = NLF Co.
No. 154 = now abandoned
No. U4 was converted from agricultural use to domestic; top seal at 53 ft now

Sample 8 collected February 1984
7 collected May 1984
4,5,6 collected July 1985
1,2,3 collected August 1985
9 collected July 1964

Units above are mg/l

* 9 produces from both alluvium and Saugus Fm



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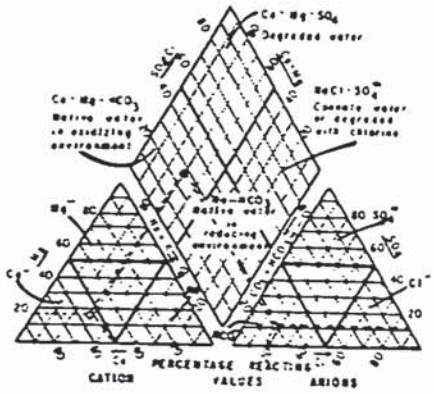
Los Angeles County,
Wayside (Pitchess) Honor Rancho
and Joe Scott Camp (Bouquet Cyn.)

Figure 3.4

TRILINEAR DIAGRAM - Alluvium



LEGEND

EXAMPLE OF PLOTTING METHOD

⊙ COMPUTED FROM MINERAL ANALYSIS OF WATER

● MINERAL CHARACTER OF WELL BY INTERSECTION OF POINTS

Symbol	Well	TDS/TH	NO_3	Perfs. (ft)
1	Wayside- 1	806/468	3	30-116
2	" 5	479/260	1	30-104
3	" 10	669/460	8	27-39, 50-100
4	" 11	828/504	8	50-100
5	" 17	474/270	0	35-110
6	" 18	685/392	2	58-133
7	Scott - 1	372/220	10	50- 90

Samples 1 - 6 collected Feb. 1974

7 collected March 1959

Units above are mg/l

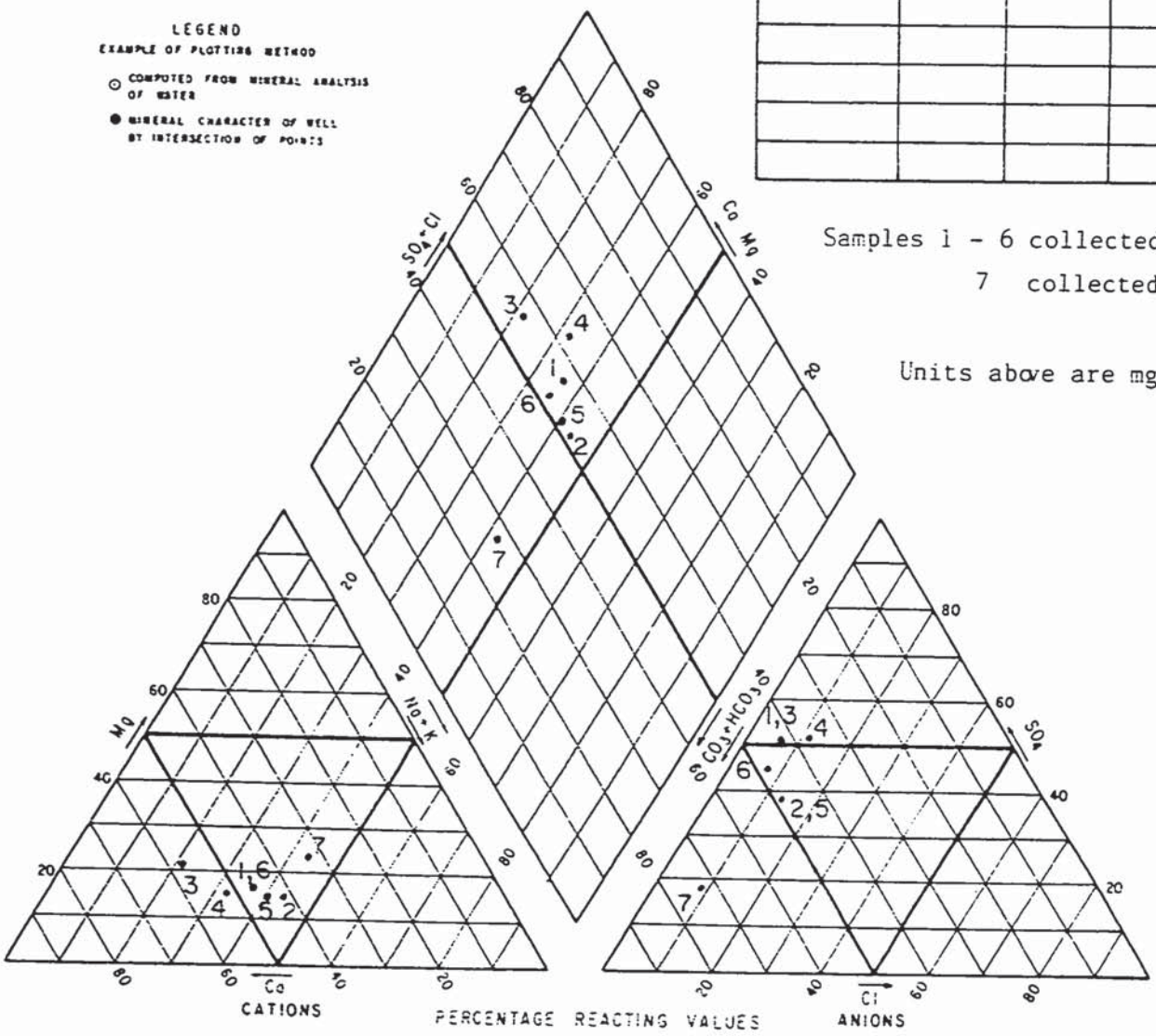
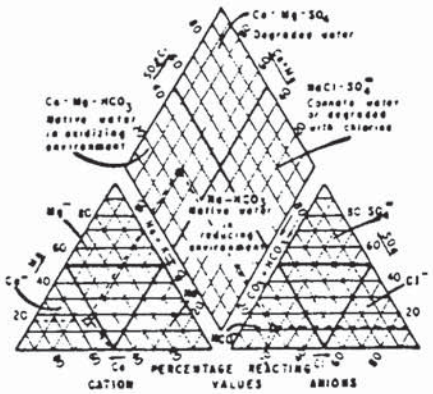


Figure 3.5

TRILINEAR DIAGRAM - Saugus Formation

Symbol	Well	TDS/TH	NO_3	Perfs. (ft)
1	7	478/238	5	520- 974
2	8	410/234	5	342- 970
3	9	636/380	0	280- 591
4	10	422/153	3	780-1550
5	11	552/349	23	200-1075
6	12	525/281	31	485-1280

Samples 1-5 collected July 1984
6 collected October 1985 from 485-500 ft zone
Units above are mg/l

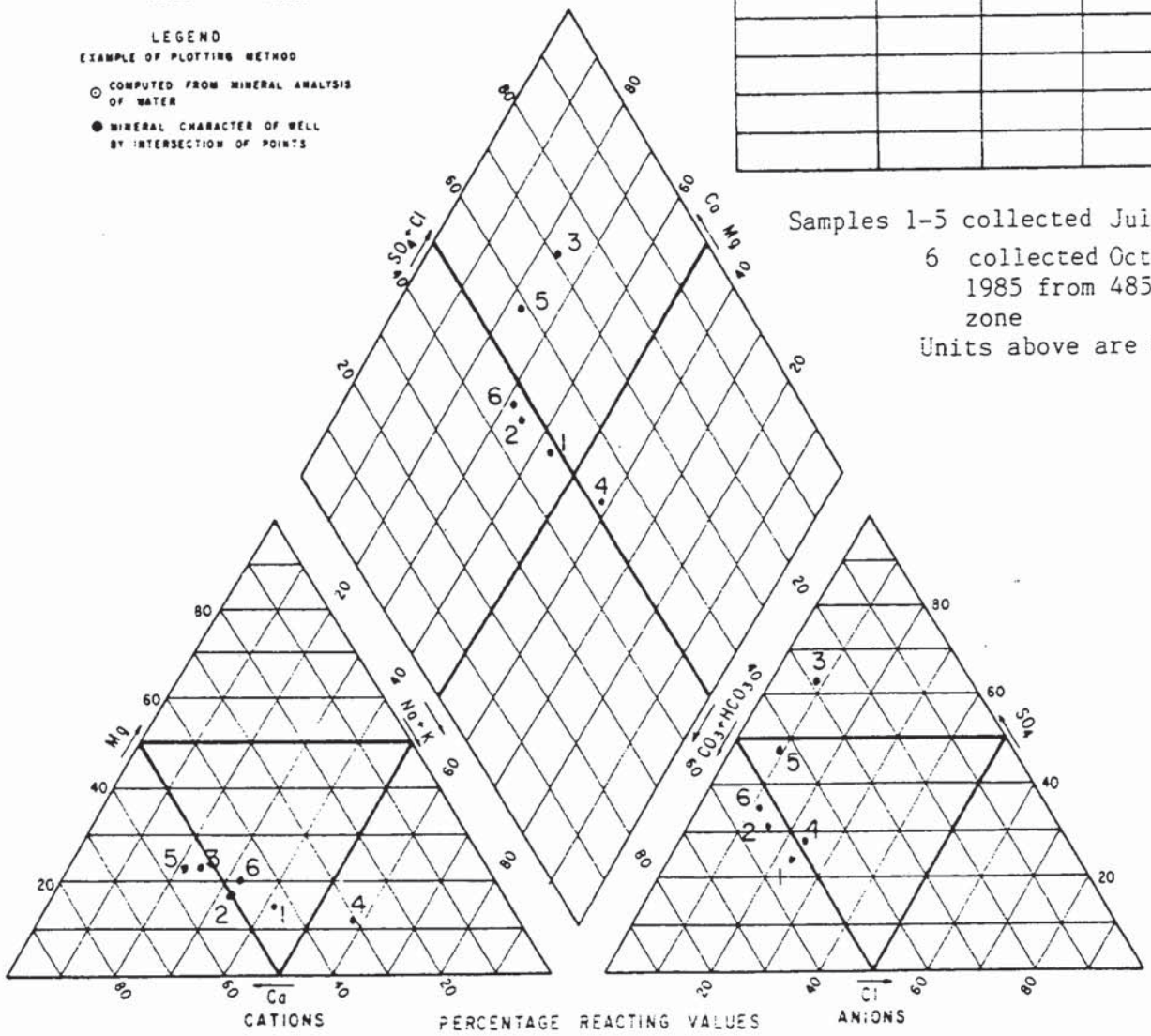


LEGEND

EXAMPLE OF PLOTTING METHOD

⊙ COMPUTED FROM MINERAL ANALYSIS OF WATER

● MINERAL CHARACTER OF WELL BY INTERSECTION OF POINTS



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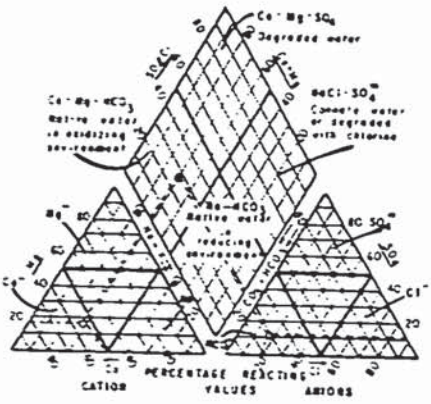
Valencia Water Co.
and
Newhall Land & Farming Co.

Figure 3.6

TRILINEAR DIAGRAM - Saugus Formation



LEGEND

EXAMPLE OF PLOTTING METHOD

⊙ COMPUTED FROM MINERAL ANALYSIS OF WATER

● MINERAL CHARACTER OF WELL BY INTERSECTION OF POINTS

Symbol	Well	TDS/TH	NO,	Perfs. (ft)
1	157	510/252	8	593-2014
2	160	690/403	11	950-2000
3	158	902/471	57	740-1600
4	156	1156/621	13	486-1805
*5	154	1027/593	34	45-1016

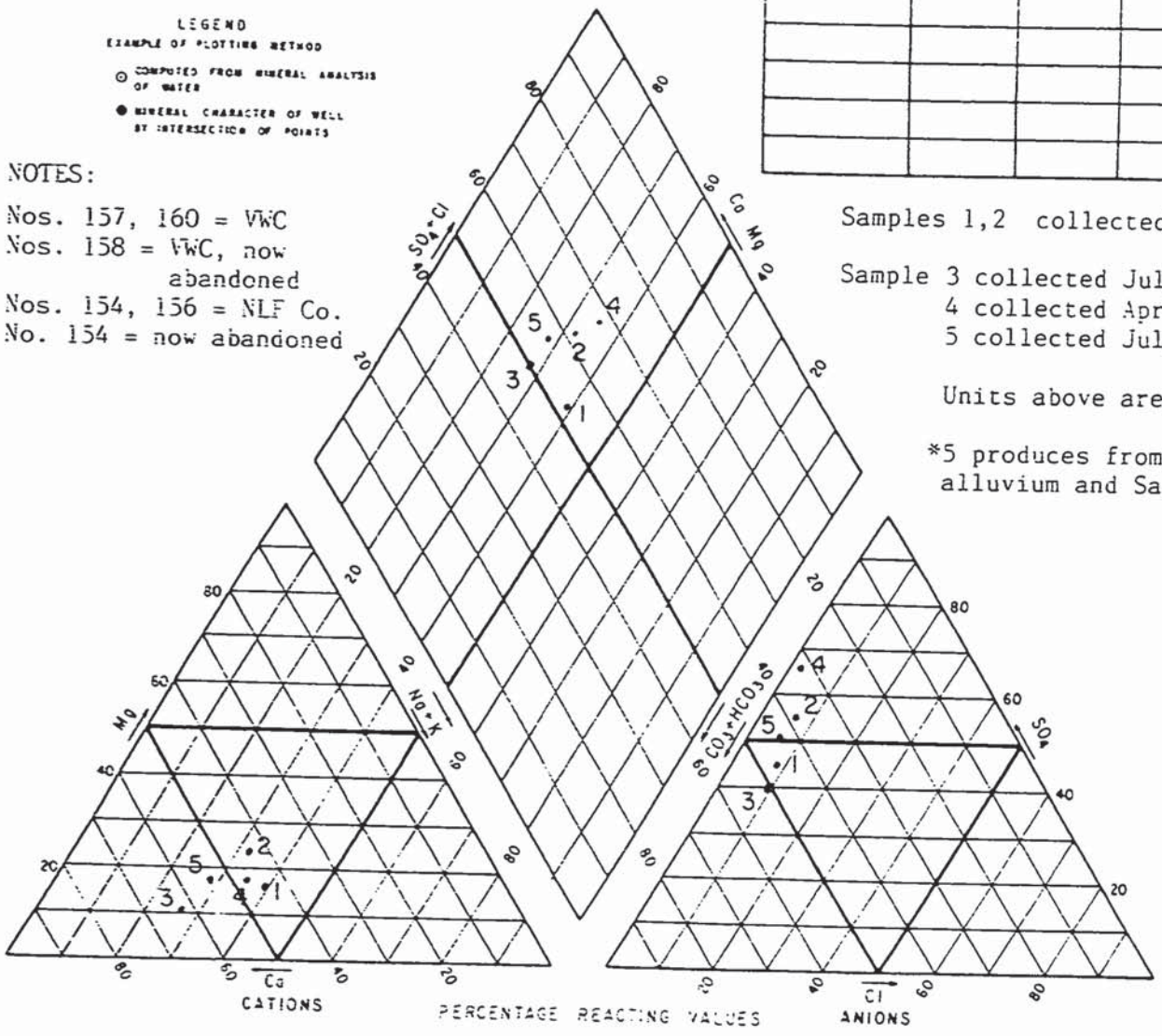
NOTES:

Nos. 157, 160 = VWC
Nos. 158 = VWC, now abandoned
Nos. 154, 156 = NLF Co.
No. 154 = now abandoned

Samples 1,2 collected August 1985
Sample 3 collected July 1981
4 collected April 1963
5 collected July 1964

Units above are mg/l

*5 produces from both alluvium and Saugus Fm



ion concentration, and its character has shifted slightly from the remaining wells.

The Saugus wells (NCWD Nos. 7 through 12, as seen on Figure 3.5) exhibit TDS values which range from 410 mg/l to 636 mg/l, obviously somewhat higher than alluvium wells. The water is also calcium- bicarbonate in character, but several of the wells are high in sulfate ion concentration. Nitrate levels range from 0 mg/l to 31 mg/l.

During construction of new Well No. 12, down-hole sampling of four aquifers was conducted in the open borehole between the depths of approximately 180 ft and 805 ft below ground surface. Total solids and nitrate concentrations for these four tested aquifers ranged from highs of 560 mg/l and 36 mg/l, respectively, for the 235- to 250-foot depth zone, to lows of 440 mg/l and 7 mg/l, respectively, for the 790- to 805-foot depth zone. Following these tests, the well was completed with perforations set only between 485 and 1280 ft. Because this well is not yet in operation, the quality of the final well blend is not available at this time.

Santa Clarita Water Company

Data for seven SCWC wells completed in alluvium are plotted on the trilinear diagram, Figure 3.2. As indicated thereon, alluvial waters are calcium bicarbonate in character, TDS ranges from 422 mg/l to 581 mg/l, and nitrates range between 8 and 35 mg/l.

Valencia Water Company and The Newhall Land & Farming Company

General mineral data for alluvial groundwater from nine Valencia Water Company and Newhall Land & Farming Company wells are depicted on Figure 3.3. As seen here, the collected groundwater is calcium bicarbonate in character but trends toward a calcium sulfate character in well Nos. D and 154 (this well produces from both alluvium and the Saugus Fm). Dissolved solids range from 490 mg/l to 830 mg/l while nitrate as NO_3 ranges from 7.8 mg/l to 34 mg/l. Perforations are very high in the alluvium; well E, for example, is perforated as high as 12 feet below ground surface. The deepest uppermost perforations are at a depth of only 76 feet below ground surface. It is the shallow perforations in the well casings that account for the high levels of NO_3 in these alluvial wells; most, if not all of these wells, lie in proximity to irrigated agricultural acreage and/or wastewater treatment plants.

Wells E, I, D, and 154 are owned by the Newhall Land & Farming Company while the remaining wells are domestic wells owned by Valencia Water Company.

The Valencia Water Company and the Newhall Land and Farming Company also produce groundwater from the Saugus Formation. As shown on Figure 3.6, chemical data for five Saugus wells are plotted on the trilinear diagram. The character of the groundwater from these five wells is calcium sulfate. Total dissolved solids range from a low of 510 mg/l to a high of 1156 mg/l. The groundwater pumped from well Nos. 154, 156, 157, 158, and 160 exhibited the highest values of TDS in the study area, based on the available data. Nitrate ion concentration in the Saugus Formation groundwater varies from 13 to 34 mg/l, and except for well No. 154, these wells are perforated at depths greater than 450 feet below ground surface. Well No. 154 is perforated in the interval 45-1016 feet, and this has the highest level of NO_3 (34 mg/l). This may be accounted for by the fact that this well produces groundwater from both the Saugus Formation and the alluvium with its potential for degradation from near-surface sources.

Wayside (Pitchess) Honor Rancho and Los Angeles County Waterworks District

Figure 3.4 presents data on seven wells owned and operated by the County Waterworks District. As depicted on the exhibit, most of the wells produce groundwater from the alluvium which is calcium sulfate in character; well Scott-1 produces groundwater which is of calcium bicarbonate character. Total dissolved solids of the groundwaters produced by these wells ranges from 474 to 828 mg/l. Nitrate ion concentration is very low, ranging from 0 to a maximum of 10 mg/l. Nitrates appear to be unusually low considering the fact that the wells are perforated high in the alluvium. In fact, three of the wells have upper perforations as shallow as 30 feet, or less, below ground surface. It is likely these seven wells also lie generally upgradient from irrigated agriculture and cattle grazing areas.

Assessment of possible water quality trends is facilitated by reference to graphs of TDS vs. time, as seen on Plates 6.1 through 6.4; the locations of wells for which data are presented thereon are shown on Plate 6.5. The discussion

which follows commences for wells at the westerly limits of the study area and progresses easterly in an upstream direction.

Well No. 4N/17W-14Q1, owned and operated by The Newhall Land & Farming Co., is a 135-foot deep alluvial well whose TDS record extends from 1960 to 1967. As indicated on the Plate 6.4, its TDS varies from a low of approximately 1025 mg/l (in 1961) to a high in excess of 1750 mg/l in 1966. Although peaks and valleys in TDS levels fluctuate markedly with time, a definite increase in salinity is discernible. Throughout most of the seven years of record, groundwater from this agricultural well exhibited TDS levels above the recommended maximum limit established for domestic use.

Well No. 4N/17W-1J1, known locally as Wayside Honor Rancho Well No. 11, is 100 feet deep and has a TDS record extending from 1960 to 1977. Alluvial TDS levels, as recorded, were in excess of 1000 mg/l in 1956, declined to a low of about 625 mg/l in 1962, rose to a level of about 1025 mg/l in 1964, declined to about 700 mg/l in 1967, and rose once again in 1970 to about 1000 mg/l. Since that time,, yearly fluctuations are less marked, typically ranging between about 650 and 825 mg/l (see Plate 6.4).

Compared to a hydrograph of water levels for a nearby well, 5N/17W-36A3 (Wayside No. 11), TDS responded inversely to precipitation (see Plate 6.4). That is, as water levels rose in the alluvium in response to direct and rapid infiltration of precipitation, TDS content tended to decline because of large dilution effects of recharge.

Well 4N/16W-17J1 (Valencia Water Co. Well No. 158) is 1608 feet deep, is perforated in the interval 740-1600 feet, and is a Saugus Formation well. Records of TDS for this well extend between 1962 and 1981. As indicated on Plate 6.2, TDS fluctuated from an all-time low of about 525 mg/l in 1962 to a

maximum of nearly 1200 mg/l in 1970. From this maximum, TDS value have declined to about 900 mg/l as reported in 1981. TDS values for Well No. 158 show much greater fluctuation than other Saugus Formation wells; however, it appears that neither the intense rainfalls of 1969 and 1977-78 nor the mid-1970's drought have had a direct impact on salinity levels in groundwater obtained from the Saugus Formation at this well site. The large fluctuations are somewhat unusual for a Saugus Formation Well and cannot be accounted for by climatic conditions or large volumes of water removed from storage. It is possible that recharge to the Saugus Formation by infiltration of precipitation and runoff lags behind the actual climatic conditions by a period of time (months or even years); more detailed analyses would be necessary to verify this possibility.

Well 4N/16W-21D1 (Valencia Water Co. Well No. 160) extracts water from the Saugus Formation. This well is 2000 ft deep and is perforated fromm 950-2000 ft below ground surface. Its quality record extends from 1964 to 1985 and is shown on Plate 6.2. TDS values generally were in the 600 to 700 mg/l range and do not show the great fluctuation in quality that is seen in alluvial wells. Thus, it appears that drought conditions during the 1970's and above-average rainfall after 1978 had little, if any, direct effect on water quality at this Saugus Formation well.

The Valencia Water Co. Well No. 157 (4N/16W-22M1) obtains groundwater from the Saugus Formation. This well is 2014 feet deep and is perforated in the interval 593-2014 feet below ground surface; its TDS record extends from 1962 to 1985 as seen on Plate 6.2. Groundwater here is characterized by a very mildly fluctuating TDS level which has historically been in the 400 to 500 mg/l range (residues). In 1962, TDS was about 450 mg/l; TDS then declined to about 410 mg/l in 1964,

rose about 60 mg/l in 1965, and thereafter remained in the 450 to 490 mg/l range until the 1985 historic high of 510 mg/l.

Well 4N/16W-14E2 (NL & F Co. Well No. R2-94) is an alluvial well, 130 feet in depth, and perforated in the interval of 40 to 128 feet below ground surface. During its TDS record of 1955 to 1982, TDS has fluctuated markedly from a high of about 1000 mg/l in 1964, to a low of 400 mg/l in 1980 (refer to Plate 6.3). The TDS levels are responding in later years to the increased magnitude of precipitation. One cannot directly explain, however, the low TDS value in 1975, a dry year, or the high TDS value in 1977-78, a wet year. It appears that TDS levels here have been declining with time and with filling of the alluviated portion of the groundwater basin.

Well No. 4N/15W-14J1 is located in the Upper Reach of the Santa Clara River Valley near the easterly limits of the study area. This alluvial well is 117 feet deep, and the perforation interval is unknown. Although the TDS record for the well is short and extends only from 1971 to 1982, the graph on Plate 6.1 does describe the characteristic fluctuation of TDS levels in the alluvium in response to rainfall. Note, for example, the approximate 200 mg/l decline in TDS values subsequent to the 1977-78 rainfall season. Prior to this time, TDS levels increased steadily. Note, also, that after the 1977-78 season, TDS values commenced to climb once again in response to a decrease in precipitation. There are apparently no agricultural areas near this well that could otherwise have impacted TDS levels.

To further document water quality and the spatial relationships in water quality differences across the study area, we have prepared Plate 8 - Map of Stiff Water Quality Diagrams - Groundwater. For these Stiff water quality pattern

diagrams, ionic concentrations are plotted for calcium, magnesium, sodium, bicarbonate, sulfate, and chloride in units of milliequivalents per liter. The major cations (Ca, Mg, Na) are plotted to the left of the centerline of each diagram, while the major anions (HCO_3, SO_4, Cl) are plotted to the right. The area and shape of each diagram are used as an indication of the chemical character and total dissolved solids concentration of the source. Stiff diagrams having relatively large total areas reflect greater TDS values, while changes in the pattern of the diagram itself reflect variations in the chemical character of the water.

From a cursory inspection of the Stiff diagrams plotted on Plate 8, it may be noted that, in general, alluvial groundwater west of Castaic Junction exhibits higher TDS values than groundwater east of Bouquet Junction or in the Newhall area. TDS concentrations west of Castaic Junction are characteristically in the 900-1000 mg/l range, while in the remainder of the river valley, and including the Newhall area, TDS ranges up to a maximum of about 650 mg/l and averages approximately 450 mg/l for groundwater within the alluvium. Along the reach of the river between its confluences with the South Fork and Castaic Creek, TDS levels are also elevated above most other reaches of the main valley.

Because the quality of the groundwater generally increases in TDS concentration as it moves westerly (downstream) along the Santa Clara River, it is logical to discuss water quality changes from an easterly to a westerly direction.

Groundwater in the alluvium in the vicinity of Lang has a calcium-bicarbonate character with a TDS concentration averaging about 440 mg/l. Nitrates(as NO_3) are relatively low, on the order of 8 to 25 mg/l, and the water is of consistent character with the minor exception of the Santa

Clarita Water Co. Sand Canyon Well which appears to have a lower sodium ion content.

Further to the west, near Solemint, alluvial groundwater in the No. Oaks West and Sierra Wells has TDS concentrations of 510 and 475 mg/l, respectively. The water is characteristically like the Sand Canyon Well as it has a lower sodium ion concentration. Nitrate ion values in the No. Oaks West and Sierra Wells; are 22 mg/l.

Groundwaters in the SCWC Honby and the Valencia Water Co. U3, U4, and T2 Wells are characteristically the same with TDS values ranging from 422 to 520 mg/l and all with nitrates (as NO_3) of 17 or 18 mg/l. In the vicinity of Saugus, the alluvial VWC N-68 well also displays the same general character, TDS, and nitrate concentrations as other alluvial wells along this reach of the Santa Clara River.

Moreover, SCWC wells Clark and Guida in Bouquet Canyon display the same quality pattern as the other wells, except that the NO_3 concentrations in these wells are 32 mg/l and 35 mg/l, respectively, which are among the highest NO_3 values of the wells shown on Plate 8.

Valencia Water Co. wells Nos. 157, 158, and 160 are Saugus Formation wells. They are located in the widest portion of the basin in the area between Saugus and Castaic Junction. Groundwater obtained from these wells is characterized by higher concentrations of calcium and sulfate ions than that in the alluvial groundwater. TDS values range from 510 to 902 mg/l, and nitrate as NO_3 ranges from 11 to 57 mg/l (in VWC No. 158) in these Saugus Formation producers.

Wells owned and operated by Newhall County Water District obtain groundwater from the Saugus Formation and, as shown on Plate 8, are located primarily in the south-central portion of the study area. TDS values of these Saugus wells range from 410 to 636 mg/l, and nitrates range from 0 to 31

mg/l; Well No. 9 reportedly produces groundwater containing hydrogen sulfide odors also. It is interesting to note that the water with the highest TDS value (636 mg/l in NCWD-11) is located farther south and thus upstream of the other wells in the South Fork of the Santa Clara River. Moreover, NCWD-11 lies closer to the base of the Saugus Formation than any other well in the region (see also the Hydrogeology Map for the Saugus Formation contact). The higher TDS in this region may be explained by the presence of fine grained sediments in this lower portion of the Saugus Formation, which tend to minimize groundwater recharge and flow velocities.

Immediately upstream of Saugus is Newhall Land & Farming Co. Well No. 154 which obtains groundwater from both the alluvium and the Saugus Formation. This well characteristically exhibits high calcium and high sulfate ion concentrations. TDS concentration is 1027 mg/l, and the NO_3 ion concentration of 34 mg/l is among the highest nitrate values shown on Plate 8.

Well No. 4N/16W-3E1, located in San Francisquito Canyon, is an alluvial well and displays a calcium-bicarbonate character, with a TDS value of 525 mg/l and with 0 mg/l nitrates. The non-detected NO_3 is somewhat surprising due to the known agricultural development in the vicinity of the well and the lack of a deep sanitary well seal.

Groundwater in upper Castaic Creek, about two miles downstream of Castaic Dam, is pumped by Newhall County Water District. Here, their Castaic No. 1 and Castaic No. 2 wells obtain alluvial groundwater with TDS values less than 500 mg/l and with very low nitrates (2 and 0 mg/l, respectively). Further downstream in Castaic Creek, the Wayside Honor Rancho operates a series of wells, three of which are shown on Plate 8. Well Nos. W-1, W-17, and W-18 are of the same general character and very low nitrate levels as the NCWD wells up-

stream. However, TDS values of the groundwater range up to 806 mg/l in these latter wells. Stiff diagrams for these three Honor Rancho wells clearly display the increase in the sulfate concentration in the downstream direction along Castaic Creek.

As shown by the Stiff pattern diagrams, the trilinear analyses, and the relative TDS values of wells across the study area, it is clear that groundwater quality in the alluvium west of and downstream from Castaic Junction is of higher salinity than that in any area upstream of this reach; the only possible exception may be from limited data which suggest high TDS levels also for the reach between the confluences of South Fork on the east and Castaic Creek on the west. This is not a result of recent activities. As early as 1968, DWR identified the fact that Eastern Basin quality was generally unacceptable for domestic purposes and was, in part, considered Class II for irrigation usage.

This quality problem is not surprising considering the fact that all upstream surface water and groundwater moves through this rather constricted locale. Potentially affecting the waters comprising these flows are: sewage effluents, irrigation return, oilfield activities, and even runoff from sedimentary rocks containing gypsum cements (Ca-Mg-SO_4). In addition, this reach of the river has shallow groundwater and high rates of evapotranspiration.

VOLATILE ORGANICS DATA

A recent report by the California Department of Health Services (April 1986) published the results of state-wide testing of large water systems for volatile organic chemicals. Within the Santa Clarita Valley, they tested a total of 22 active wells in 1985 from the major local purveyors. Review of the published results indicated that six of these wells were

determined to be contaminated with certain volatile organic compounds (VOC's); of these six, however, the individual VOC concentrations did not exceed their respective Maximum Contaminant Level (MCL).

Review of their tabulated data revealed volatile organic compounds in the following wells:

1. Santa Clarita Water Company (SCWC) Lost Canyon and Macmillen wells displayed 4.4 and 2.0 ug/l (ppb) of trichloroethylene (TCE), respectively.

2. SCWC Clark and No. Oaks West wells displayed chloroform at 12.0 and 10.0 ug/l, respectively.

3. SCWC Clark, Macmillen, and No. Oaks West wells displayed 1,1,1-trichloroethane (1,1,1-TCA) in concentrations of 12.0, 15.0, and 11.0 ug/l, respectively.

4. SCWC Clark and No. Oaks West wells had bromodichloromethane at 14.0 and 11.0 ug/l, respectively; these wells also showed dibromochloromethane at 10.0 and 5.0 ug/l, respectively; and bromoform at 9.0 and 4.0 ug/l, respectively.

5. NCWD Pinetree No. 2 displayed 1,2-dichloroethylene (1,2-DCE) at 4.8 ug/l and 1,1,1-TCA at 57.0 ug/l. Pinetree No. 1 had 1,1,1-TCA at 23.0 ug/l.

A few of these VOC's are considered to be solvent-like compounds (e.g., TCE and 1,1,1-TCA), while those addressed in No. 4 above are considered to be trihalomethanes (THM's). Though not certain in this case, chloroform is often a laboratory contaminant and may not actually occur in the groundwater at these well sites.

No independent assessment has been made during this study of the source(s) of the VOC's in the alluvial aquifer system along the river. The limited types of industries in that region are illustrated on a reconnaissance level on the Land Use Map (Plate 2). Limited testing conducted by others of runoff in the river reportedly has not routinely encountered VOC's either. Further work would be necessary to

identify possible source(s) of the VOC's in the alluvium in the above wells.

HYDROLOGY

WATERSHEDS

Plate 9 - Map of Watersheds and Drainages - has been prepared to illustrate the locations, alignments, and watershed divides for the principal tributaries of the Santa Clara River within the study area. A total of 13 such tributary watersheds were delineated: of these, seven drain southerly into the river (Tick Canyon, Mint Canyon, Bouquet Canyon, San Francisquito Canyon, Castaic Creek, Hasley Canyon, and San Martinez Chiquito Canyon), while the remaining six watersheds drain northerly into the river channel (Oak Spring Canyon, Sand Canyon, Placerita Canyon, South Fork-Santa Clara River, Pico Canyon, and Potrero Canyon). The subdivisions (tributaries) of these 13 major watersheds were listed previously on Table 1.

Also provided on Plate 9 are the average annual rainfall contours (isohyetal lines) as adapted from the LAFCD map of 1978 which depicted 100-year normal precipitation contours for the entire county.

As noted on Plate 9, the individual surface areas of the 13 watersheds range in size between that of Bouquet Canyon (a planimetered area of 35,063 acres) and that of Potrero Canyon (2826 acres). The Castaic Creek watershed for this project (a total of 24,132 acres) was taken from the watershed below the dam only. A summary of additional watershed characteristics, including surface areas, watershed elevations, long-term average precipitation, and recoverable water is provided on Table 4 - Summary of Watershed Data.

Table 4 - SUMMARY OF WATERSHED DATA

Watershed Name	Watershed Number on Map	Drainage Direction	Surface Area (acres)	Approximate Range in Elevation (feet)	Approximate Range in Long Term Average Precipitation (inches)	Approximate Amount of Recoverable Water (acre-feet) for K = 0.8[c]	Approximate Amount of Recoverable Water (acre-feet) for K = variable[d]	Percentage of Watershed in: Saugus Fm	Percentage of Watershed in: Older Rocks
Oak Spring	1	North	3,304	1680 to 4320	16.5 to 23	347	151	0	100
Sand Canyon	2	North	8,018	1560 to 4760	16.0 to 27	990	420	0	100
Placerita Canyon	3	North	6,193	1213 to 4003	16.0 to 24.5	582	421	53	47
South Fork, Santa Clara River	4	North	15,528	1209 to 3670	16.0 to 24.25	1539	890	31	69
Pico Canyon	5	North	3,897	1315 to 3645	15.0 to 21.5	297	149	23	77
Potrero Canyon	6	North	2,826	870 to 2375	15.5 to 18.0	209	94	0.8	99.2
Tick Canyon	7	South	3,672	1670 to 3045	12.75 to 14.0	136	61	0	100
Mint Canyon	8	South	18,801	1440 to 5180[b]	13.0 to 15.5	774	343	0.2	100
Bouquet Canyon	9	South	35,063	1173 to 4850	13.0 to 16.5	1513	807	16	84
San Francisquito Canyon	10	South	32,088	1110 to 4605	13.0 to 19.5	1874	960	12	88
Castaic Creek	11	South	24,132[a]	997 to 3544	13.0 to 20.75	1527	934	34	66
Hasley Canyon	12	South	5,570	995 to 2494	13.75 to 17.5	334	520	92	8
Martinez Chiquito Canyon	13	South	3,015	960 to 2400	15.0 to 17.0	161	101	39	61
TOTALS			162,307			10,283	5,851		

NOTES: (a) Watershed of Castaic Creek taken from below dam only.
(b) Highest elevation of any watershed in region, at Mt. McDill, elevation 5180 ft.
(c) K factor = 0.8 used for all watersheds.
(d) Different K factor used for each watershed, see tables of recoverable water in text.

See also Map of Watersheds and Drainages for locations of each watershed above.

Runoff in the Santa Clara River is gaged at a few locations within the study area. Virtually no information is available to document runoff (either annual or instantaneous totals) in the 13 major tributary canyons. An LACFCD-Water Conservation Division memorandum (Nov. 30, 1964) did provide an estimate of average annual runoff for several of these tributaries. Neither historically nor at the present have there been any regularly planned diversions of these surface runoff waters for beneficial use in the study area.

RECOVERABLE WATER

The availability of recoverable water, that is, the residual after evapotranspiration and natural water losses have been satisfied, has been calculated for the 13 main tributary drainages along the Santa Clara River in the study area on an average annual basis. Recoverable water represents both surface water outflow and the volume of water that is lost as seepage into groundwater storage. The procedure for making the recoverable water calculations on an average annual basis was adapted from work by Crippen (1965), and is based on empirical relationships between precipitation, potential evapotranspiration, natural water losses, and recoverable water for mountain basins of southern California.

In his work, Crippen (1965) used long-term records of precipitation and runoff from several typical mountain basins in southern California in order to make estimates of natural water loss and recoverable water in ungaged regions of generally similar characteristics. These available long-term data relate average annual water loss to annual precipitation, to evapotranspiration, and to the water-retaining capabilities of various geologic formations in the watershed basins.

As noted by Crippen (1965), recoverable water, being a residual of precipitation and natural water loss, is

relatively small in the climatic environment of southern California. From his analysis of several major watershed basins and their tributaries, Crippen determined that recoverable water ranged from one inch in a basin having an annual precipitation of 14 inches, to 19 inches in a basin having an annual precipitation of 42 inches. In general, the greater the precipitation, the greater the percentage of recoverable water. Typical watershed basins considered during the work by Crippen (1965) would include the coastal and mountain basins in the San Gabriel Mountains and the San Bernardino Mountains. Typical river basins evaluated in his studies included the Santa Ana River system, the Mojave River system, and the Whitewater River system.

Among his conclusions, Crippen noted that his method of estimating long-term recoverable water can be "considered applicable to long-term periods, perhaps 25 years or more" (1965). Because of the recognized great variability in the annual precipitation regime of southern california, Crippen further recognized that the study of these climatic variations (such as trends in annual precipitation, and the random or non-random grouping of wet and dry years) are not directly accounted for in his analytical method (1965).

Mean annual recoverable water calculations were made for the 13 major watersheds tributary to the Santa Clara River and which are delineated on Plate 9 and Tables 1 and 4. Data for each individual watershed that was used in the calculations of recoverable water are presented on Table Nos. 5.1 through 5.13 - Calculation of Recoverable Water. These amounts of recoverable water represent the approximate amount of water that is recoverable for each watershed, on a long-term average annual basis, at a location at the mouth of the watershed (i.e., at the confluence of the particular watershed and the channel of the Santa Clara River. In essence,

Table 5.1

CALCULATION OF RECOVERABLE WATER

Oak Spring Canyon - Watershed No. 1

Altitude (feet)	(a) Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	(b) Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	(c) R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	(d) Recoverable Water (ac-ft) for K = 0.35
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
4500-4000	13	.004	23.0 (.09)	45.0	.51	.09	4.05	3.24	3.51	1.54
4000-3500	128	.039	21.7 (.84)	48.3	.45	.06	2.90	2.32	24.75	10.88
3500-3000	860	.260	20.4(5.30)	51.7	.39	.04	2.07	1.65	118.25	51.60
3000-2500	877	.265	19.1(5.06)	53.7	.36	.03	1.61	1.29	94.28	40.93
2500-2000	619	.187	17.8(3.32)	55.5	.32	.02	1.12	.89	45.91	20.12
2000-1500	807	.244	16.5(4.03)	56.0	.29	.02	1.11	.89	59.85	26.23
TOTALS	3304	.999							347 (or 7% of total precipitation on the watershed)	151

Weighted Average ..... 18.64 inches or 5132 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

Table 5.2

CALCULATION OF RECOVERABLE WATER

Sand Canyon - Watershed No. 2

	(a)		(b)					(c)		(d)
Altitude (feet)	Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	Precipitation (inches)	Potential Evapotrans-piration (inches)	P/E	R/E	R (inches)	R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	Recoverable Water (ac-ft) for K = 0.35
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
5000-4500	25	.003	27.0 (.08)	42.6	.63	.15	6.39	5.11	11.07	4.85
4500-4000	319	.040	25.0(1.00)	45.0	.56	.10	4.50	3.60	95.70	42.00
4000-3500	665	.083	23.2(1.92)	48.3	.48	.07	3.38	2.70	149.62	65.39
3500-3000	1309	.163	21.4(3.48)	51.7	.41	.05	2.59	2.07	225.80	99.26
3000-2500	1649	.206	19.6(4.03)	53.7	.36	.03	1.61	1.29	177.26	76.95
2500-2000	1381	.172	17.8(3.06)	55.5	.32	.02	1.11	.89	102.42	44.88
2000-1500	2669	.333	16.0(5.32)	56.0	.29	.02	1.11	.89	197.95	86.75
TOTALS	8018	1.000							990 (or 8% of total precipitation on the watershed)	420

Weighted Average ..... 18.89 inches, or 12,621 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

Table 5.3

CALCULATION OF RECOVERABLE WATER

Placerita Canyon - Watershed No. 3

	(a)		(b)					(c)		(d)
Altitude (feet)	Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	Recoverable Water (ac-ft) for K = 0.58
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
4000-3500	151	.024	24.5 (.58)	48.3	.51	.09	4.35	3.65	45.93	31.71
3500-3000	373	.061	22.6(1.37)	51.7	.44	.06	3.10	2.48	77.09	55.95
3000-2500	560	.091	20.8(1.89)	53.7	.39	.04	2.15	1.72	80.27	58.33
2500-2000	1019	.166	19.1(3.17)	55.5	.34	.02	1.11	.89	75.57	54.35
2000-1500	2832	.461	17.7(8.15)	56.0	.32	.02	1.12	.89	210.04	153.40
1500-1000	1258	.205	16.0(3.28)	55.5	.29	.02	1.11	.89	93.30	67.09
TOTALS	6193	1.008							582 (or 6% of total precipitation on the watershed)	421

Weighted Average ..... 18.44 inches, or 9517 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

286025

Table 5.4

CALCULATION OF RECOVERABLE WATER

South Fork Santa Clara River - Watershed No. 4

	(a)		(b)					(c)		(d)
Altitude (feet)	Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	Recoverable Water (ac-ft) for K = 0.46
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
4000-3500	23	.002	24.3 (.04)	48.3	.50	.08	3.86	3.09	5.92	3.39
3500-3000	871	.055	22.8(1.25)	51.7	.44	.06	3.10	2.48	180.00	103.79
3000-2500	2045	.130	21.1(2.75)	53.7	.39	.04	2.15	1.72	293.11	168.71
2500-2000	2042	.193	19.4(3.74)	55.5	.35	.03	1.67	1.33	337.15	195.20
2000-1500	5521	.351	17.7(6.21)	56.0	.32	.02	1.12	.89	409.47	239.24
1500-1000	4226	.269	16.0(4.30)	55.5	.29	.02	1.11	.89	313.43	179.61
TOTALS	15,728	1.000							1539 (or 6% of total precipitation on the watershed)	890

Weighted Average ..... 18.29 inches, or 23,972 ac ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

Table 5.5

CALCULATION OF RECOVERABLE WATER

Pico Canyon - Watershed No. 5

	(a)		(b)					(c)		(d)
Altitude (feet)	Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	Recoverable Water (ac-ft) for K = 0.40
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
4000-3500	12	.003	21.5 (.06)	48.3	.45	.05	2.42	1.93	1.93	0.97
3500-3000	158	.041	20.2 (.82)	51.7	.39	.04	2.07	1.65	21.72	10.93
3000-2500	526	.135	18.9(2.55)	53.7	.35	.03	1.61	1.29	56.54	28.05
2500-2000	906	.233	17.6(4.10)	5.55	.32	.02	1.11	.89	67.19	33.22
2000-1500	1744	.448	16.3(7.30)	56.0	.29	.02	1.12	.89	129.34	65.40
1500-1000	551	.141	15.0(2.11)	55.5	.27	.01	.56	.45	20.66	10.10
TOTALS	3897	1.001							297 (or 5% of total precipitation on the watershed)	149

Weighted Average ..... 16.94 inches, or 5501 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

Table 5.6

CALCULATION OF RECOVERABLE WATER

Potrero Canyon - Watershed No. 6

Altitude (feet)	(a) Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	(b) Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	K (inches)	(c) R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	(d) Recoverable Water (ac-ft) for K = 0.46
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2500-2000	43	.015	18.0 (.27)	55.5	.32	.02	1.11	.89	3.19	1.43
2000-1500	589	.208	17.1(3.55)	56.0	.30	.02	1.12	.89	43.68	19.63
1500-1000	2096	.742	16.3(12.09)	55.5	.29	.02	1.11	.89	155.45	69.87
1000- 950	98	.035	15.5 (.54)	54.0	.29	.02	1.08	.86	7.02	3.19
TOTALS	2826	1.000							209 (or 5% of total precipitation on the watershed)	94

Weighted Average ..... 16.45 inches or 3874 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

S8605

Table 5.7

CALCULATION OF RECOVERABLE WATER

Tick Canyon - Watershed No. 7

	(a)		(b)					(c)		(d)
Altitude (feet)	Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	Recoverable Water (ac-ft) for K = 0.35
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3500-3000	4	.001	14.0 (.01)	51.7	.27	.01	.52	.42	0.14	0.06
3000-2500	718	.196	13.6(2.66)	53.7	.25	.01	.54	.43	25.73	11.37
2500-2000	1834	.500	13.2(6.60)	55.5	.24	.01	.56	.45	68.77	30.57
2000-1500	1116	.304	12.8(3.89)	56.0	.23	.01	.56	.45	41.85	18.60
TOTALS	3672	1.001							136 (or 3% of total precipitation on the watershed)	61

Weighted Average ..... 13.16 inches, or 4027 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

S8605

Table 5.8

CALCULATION OF RECOVERABLE WATER

Mint Canyon - Watershed No. 8

Altitude (feet)	(a) Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	(b) Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	(c) R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	(d) Recoverable Water (ac-ft) for K = 0.35
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
5500-5000	21	.001	15.5 (.01)	40.3	.38	.03	1.21	.96	1.68	0.74
5000-4500	541	.029	15.2 (.44)	42.6	.35	.03	1.28	1.02	45.98	20.29
4500-4000	996	.053	14.8 (.78)	45.0	.32	.02	.90	.72	59.76	26.56
4000-3500	1375	.073	14.5(1.05)	48.3	.30	.02	.97	.77	88.23	38.95
3500-3000	2480	.132	14.2(1.87)	51.7	.27	.01	.52	.41	84.73	37.20
3000-2500	5030	.268	13.9(3.72)	53.7	.26	.01	.54	.43	180.24	79.64
2500-2000	4553	.242	13.6(3.29)	55.5	.25	.01	.56	.45	170.74	75.88
2000-1500	3723	.198	13.3(2.63)	56.0	.24	.01	.56	.45	139.61	62.05
1500-1000	82	.004	13.0 (.05)	55.5	.23	.01	.56	.45	3.07	1.37
TOTALS	18,801	1.000							774 (or 4% of total precipitation on the watershed)	343

Weighted Average ..... 13.84 inches, or 21,684 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

Table 5.9

CALCULATION OF RECOVERABLE WATER

Bouquet Canyon - Watershed No. 9

	(a)		(b)					(c)		(d)
Altitude (feet)	Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	Precipitation (inches)	Potential Evapotrans-piration (inches)	P/E	R/E	R (inches)	R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	Recoverable Water (ac-ft) for K = 0.39
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
5000-4500	45	.001	16.5 (.01)	42.6	.39	.04	1.70	1.36	5.10	2.48
4500-4000	626	.018	16.0 (.28)	45.0	.35	.03	1.35	1.08	56.34	94.94
4000-3500	1121	.032	15.5 (.49)	48.3	.32	.02	.97	.77	71.93	35.50
3500-3000	4602	.131	15.0(1.96)	51.7	.29	.02	1.03	.82	314.47	153.40
3000-2500	6044	.172	14.5(2.49)	53.7	.27	.01	.54	.43	216.57	105.77
2500-2000	7085	.202	14.0(2.82)	55.5	.25	.01	.56	.45	265.68	129.89
2000-1500	10894	.311	13.5(4.19)	56.0	.24	.01	.56	.45	408.52	199.72
1500-1000	4646	.133	13.0(1.72)	55.5	.23	.01	.56	.45	174.22	85.18
TOTALS	35,063	1.000							1513 (or 4% of total precipitation on the watershed)	807

Weighted Average ..... 13.96 inches, or 40,790 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

S86C3

Table 5.10

CALCULATION OF RECOVERABLE WATER

San Francisquito Canyon - Watershed No. 10

Altitude (feet)	(a) Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	(b) Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	(c) R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	(d) Recoverable Water (ac-ft) for K = 0.38
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
5000-4500	28	.001	19.5 (.01)	42.6	.46	.06	2.56	2.05	4.78	2.26
4500-4000	1116	.035	18.4 (.64)	45.0	.41	.05	2.25	1.80	167.40	79.98
4000-3500	3549	.111	17.5(1.94)	48.3	.36	.03	1.45	1.16	343.07	162.66
3500-3000	6358	.198	16.6(3.28)	51.7	.32	.02	1.03	.82	434.46	206.64
3000-2500	8395	.262	15.7(4.11)	53.7	.29	.02	1.07	.85	450.36	286.83
2500-2000	4389	.137	14.8(2.02)	55.5	.27	.01	.56	.45	164.59	76.81
2000-1500	4161	.130	13.9(1.80)	56.0	.25	.01	.56	.45	156.04	72.82
1500-1000	4092	.128	13.0(1.66)	55.5	.23	.01	.56	.45	153.45	71.61
TOTALS	32,088	1.002							1874 (or 5% of total precipitation on the watershed)	960

Weighted Average ..... 15.46 inches, or 41,340 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

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Table 5.11

CALCULATION OF RECOVERABLE WATER

Castaic Creek - Watershed No. 11

Altitude (feet)	(a) Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	(b) Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	(c) R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	(d) Recoverable Water (ac-ft) for K = 0.49
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
3500-3000	188	.008	20.6 (.16)	51.7	.40	.04	2.07	1.65	25.85	15.82
3000-2500	1643	.068	19.0(1.29)	53.7	.35	.03	1.61	1.29	176.62	108.16
2500-2000	3597	.149	17.5(2.60)	55.5	.32	.02	1.11	.89	266.78	161.86
2000-1500	9730	.403	16.0(6.44)	56.0	.29	.02	1.12	.89	721.64	445.96
1500-1000	8964	.372	14.5(5.39)	55.5	.26	.01	.56	.45	336.15	201.69
1000- 950	10	.000	13.9 (0)	54.0	.24	.01	.54	.43	0.36	0.22
TOTALS	24,132	1.000							1527 (or 5% of total precipitation on the watershed)	934

Weighted Average ..... 15.88 inches, or 31,935 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

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Table 5.12

CALCULATION OF RECOVERABLE WATER

Hasley Canyon - Watershed No. 12

	(a)		(b)					(c)		(d)
Altitude (feet)	Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	Precipitation (inches)	Potential Evapotranspiration (inches)	P/E	R/E	R (inches)	R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	Recoverable Water (ac-ft) for K = 1.24
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2500-2000	619	.111	17.5(1.94)	55.5	.32	.02	1.11	.89	45.91	1.38
2000-1500	2806	.503	16.2(8.14)	56.0	.29	.02	1.12	.89	208.11	1.39
1500-1000	2135	.383	15.0(5.74)	55.5	.27	.01	.56	.45	80.06	0.69
1000- 950	10	.002	13.8 (.02)	54.0	.26	.01	.54	.43	0.36	0.67
TOTALS	5570	1.000							334 (or 5% of total precipitation on the watershed)	520

Weighted Average ..... 15.84 inches, or 7354 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ±3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

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Table 5.13

CALCULATION OF RECOVERABLE WATER

San Martinez Chiquito Canyon - Watershed No. 13

Altitude (feet)	(a) Area between Altitudes (acres)	Fraction of Basin between Given Altitudes	(b) Precipitation (inches)	Potential Evapotrans-piration (inches)	P/E	R/E	R (inches)	(c) R_1 (Adjusted) (inches)	Recoverable Water (ac-ft)	(d) Recoverable Water (ac-ft) for K = 0.50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2500--2000	133	.044	17.0 (.75)	55.5	.31	.02	1.11	.89	9.86	6.21
2000--1500	1184	.393	16.0(6.29)	56.0	.29	.02	1.12	.89	87.81	55.25
1500--1000	1698	.563	15.0(8.45)	55.5	.27	.01	.56	.45	63.68	39.62
TOTALS	3015	1.000							161 (or 4% of total precipitation on the watershed)	101

Weighted Average ..... 15.49 inches, or 3892 ac-ft of total precipitation on this watershed.

(a) Measured by Planimeter, considered accurate to ± 3 percent.

(b) Estimated from LACFCD isohyetal maps, 100-year normal precipitation.

(c) Used K = 0.8 for all watersheds to obtain Column 10 = Recoverable Water.

(d) Used different K value for each watershed.

recoverable water represents both surface flow runoff and water that infiltrates and becomes subsurface outflow from each watershed.

It should be noted on Tables 5.1 through 5.13 that two different K-values were used to provide a range of recoverable water from each of the watersheds. The K-value parameter was utilized by Crippen as a retention factor for a watershed and, thus, will vary with such factors as rock type in the hills, topography, etc. In his work (1965), Crippen computed K-values for 19 mountain basins in southern California and determined that the values ranged between 0.28 and 1.34. In essence, the larger the K-value, the greater will be the amount of recoverable water from a watershed. In contrast, a decrease in K-value is associated with a greater amount of natural water loss in a watershed (i.e., a reduced amount of recoverable water available) because, as defined, recoverable water is a residual of the total precipitation on and natural water loss from a watershed.

For our evaluation, a constant value of K = 0.8 was used initially for all watersheds to provide an estimate of the upper range of magnitude for the recoverable water calculations; a second calculation, using an independent K in the range of 0.35 to 1.24 was used for each watershed. The amounts of recoverable water for each watershed are shown on Tables 5.1 through 5.13, with a summary provided on Table 4.

Review of the data on these tables indicates:

1. The total area of the 13 tributary watersheds is 162,307 acres (253.6 square miles).

2. Northerly drainages lying south of the Santa Clara River tend to display higher maximum surface elevations and greater maximum long-term average precipitation than those drainages flowing southerly into the river.

3. The individual southerly drainages north of the river have larger surface areas than those watersheds which drain northerly into the river.

4. The long-term average annual recoverable water in the 13 watersheds ranges approximately between 1874 ac-ft/yr from San Francisquito Canyon and 136 ac-ft/yr from Tick Canyon, for a constant Crippen (1965) K-value of 0.8 for all 13 watersheds. The total approximate amount of recoverable water combined from all 13 watersheds is 10,283 ac-ft/yr (at K = 0.8).

5. Using a second, but variable, K-value for each watershed (see Table 5.1 through 5.13), the approximate average annual recoverable water for these watersheds now ranged approximately between only 960 ac-ft/yr (San Francisquito Canyon) and 61 ac-ft/yr (Tick Canyon). Using these variable K-values (see Tables 5.1 through 5.13), the resulting total average annual recoverable water from all 13 watersheds is only 5851 ac-ft/yr.

6. Using the K = 0.8 value, it is noted that the recoverable water from each watershed typically represents on the order of 3 to 8 percent of the total value of average annual precipitation on the respective watershed. The balance of the total rainfall is consumed by the natural water loss in the watershed (i.e., evapotranspiration).

7. Such low volumes are largely a reflection of the relatively small drainage areas and small annual precipitation values in the watersheds of each creek. These totals are, in general, consistent with findings by Crippen (1965) which showed that recoverable water is a relatively small part of the total water introduced by precipitation. For mountain basins, and particularly those partially underlain by relatively permeable Saugus Formation deposits and in areas where the mean annual precipitation is on the order of 20 to 25 inches per year, recoverable water is commonly on the order of less than one inch to about five inches from the watershed.

Lastly, to assess the magnitude of the actual surface runoff portion of annual recoverable water (recoverable water is surface runoff plus water that infiltrates and becomes groundwater underflow), one must deduct the estimated amount

of annual groundwater recharge from the total recoverable water calculated for each watershed. To do this, we estimated that 20 percent of the average annual recoverable water for each watershed is lost and becomes groundwater underflow.

Hence, for K = 0.8, the estimated amount of recoverable surface water that is available from each of the 13 watersheds at their respective confluences with the Santa Clara River ranges from 1499 ac-ft/yr for San Francisquito Canyon to 109 ac-ft/yr for Tick Canyon. If it were possible to construct facilities to catch the annual runoff at the mouths of each of the 13 watersheds, we estimate the total available collectable flow would have a long-term average of 8226 ac-ft/yr.

The low values of recoverable water calculated above for the major tributaries in the area are corroborated, to a large degree, by the findings of a field reconnaissance and aerial photographic interpretation of these canyons conducted by LACFCD (Memorandum, 1961). Results of that work revealed that: virtually all of these canyons supported only limited populations and agricultural development due to a lack of an adequate supply of water. Reportedly, some canyons like Dry Canyon had no wells at all, while Mint Canyon displayed one to three wells per household (however, these wells pumped "very little water"). Sand Canyon did support a moderate population at that time, but their water was supplied by a well near the Sulphur Spring School in the alluvium of the main river valley. In addition, not only were wells in Potrero and Salt Canyons considered of limited supply, but even local springs were useless because they produced "sulfurous and salty" water.

FLOOD HAZARD

To assess the relationship between flood hazards in the study area and potential recharge site selection, it was necessary to identify flood prone areas from available reports or maps. Such maps have been published for this portion of Los Angeles County as Flood Insurance Rate Maps (FIRM) by the U. S. Department of Housing and Urban Development (1980, 1981). These maps provide estimated boundaries for the 100-year floods for the Santa Clara River and for portions of its major tributaries. FIRM data for the 100-year flood have been adapted for this report onto Plate 10 - Map of Flood Hazards.

As indicated by flood boundaries on Plate 10, the potential 100-year flood zone is principally confined to the active channels of the Santa Clara River and the South Fork area; limited, narrow portions of several tributaries, including Mint, Bouquet, San Francisquito, and Sand Canyons also display flood hazards. Because the surface soils in the canyon bottoms are comprised principally by coarse-grained and unconsolidated materials, they are particularly susceptible to erosion and scour.

Though not specially denoted on Plate 10, it is known that portions of the main river valley and small local portions of some of the tributaries are confined now in concrete linings or culverts. This was done principally to control storm flows and to protect adjoining developments, roads or freeways from erosion. The bottoms of the linings and culverts do not contain weep holes to allow infiltration and deep percolation of low-water runoff.

SURFACE WATER QUALITY

Relative to groundwater quality, there is only meager information regarding surface water quality for the study area. That which does exist is sporadic in terms of the

sampling date and sampling location. It is at only two or three locations along the Santa Clara River where quality and/or runoff is monitored with any degree of frequency. Nonetheless, to grossly evaluate surface water quality, available laboratory data were collected and plotted as Stiff diagrams onto Plate 11 - Map of Surface Water Sampling Sites and Stiff Water Quality Diagrams. Stiff diagrams thereon date from January 1969, but represent the most recently available data, on a basin-wide basis, for most of the tributary canyons in the study area.

Review of Stiff pattern diagrams on Plate 11 indicates the following:

1. Surface water in the eastern portion of Santa Clara River is Ca-HCO_3 in character and has low TDS levels.

2. Further west along this river, near Bouquet Junction, water still has the Ca-HCO_3, but the enlarged pattern area indicates an increase in TDS.

3. Between Castaic Junction and County line, river flows have changed to Na-Ca-Cl-SO_4 or Na-SO_4 in character; large Stiff pattern area reveal greatly increased TDS values for flow in this reach of the river. Such increased values in this reach result from: irrigation returns; surface runoff of wastewater treatment plant effluent; and evapotranspiration of high groundwater levels and rising waters in this area.

4. Nitrates, though variable along the Santa Clara River, tend to be low (<10 mg/l).

5. Runoff in south-draining tributaries lying north of the river generally display Ca-HCO_3 characters also, but have TDS values slightly in excess of those in the nearest adjoining portion of the main river valley. Runoff in Castaic Valley had an anomalous Ca-SO_4-HCO_3 character, although the westerly side of this valley has reportedly displayed sulfurous groundwater as well.

6. Ca-SO_4 runoff is also noted (though with only moderate TDS) in flow in Newhall Creek channel southeast of Newhall. Farther north, within the South Fork of the

Santa Clara River, runoff is noted to be Ca-SO_4 in character also. However, in these locales, TDS is moderately high. Similar patterns and water character also occur in Pico Canyon a few miles west of Newhall.

Also presented on Plate 11 are the locations of the numerous surface water sampling sites that were visited on March 26-28, 1986. During that field reconnaissance, which closely followed an early spring storm, numerous canyons and creek channels were monitored, if flow existed, for field parameters of: electrical conductivity (EC) in umhos/cm; temperature (in ^{o}C); and estimated surface flow using the Darcy equation. A summary of data from the 28 surface water sampling sites where runoff was thusly monitored is presented on Table 6 - Surface Water Sampling Data.

The overall increase in TDS from east to west across the study area is also corroborated by the results of the field monitoring of EC values in March 1986. These EC values are directly proportional to TDS values, with approximate TDS value at any site being roughly equivalent to the EC value multiplied by a factor of 0.7.

As seen on Plate 11, thus, surface flow in the Santa Clara River has an EC = 689 umhos/cm (about 480 mg/l, TDS) near Lang, while three to four miles farther west along the river (near the confluence with Sand Canyon) the runoff has EC = 751 umhos/cm (525 mg/l, TDS). In these two areas, the runoff was estimated at about 10 cubic feet per second (10 cfs, or about 4500 gpm).

However, by the time the river intersects the Antelope Valley Freeway, all surface flow has percolated into the coarse grained alluvium (see site SW-4 on Table 6 and Plate 11). Moreover, as noted on Plate 11, the bed of the Santa Clara River was observed to remain dry for the entire reach between the Antelope Valley Freeway and Bouquet Junction. In addition, nearby tributary canyons, like Sand Canyon and Mint

Table 6 - SURFACE WATER SAMPLING DATA

Sampling Site No.	Estimated Flow (cfs)	Electrical Conductivity (EC) (umhos/cm)	Temperature (°C)
SW-1	10	689	18.1
SW-2	10.9	718	21.0
SW-3	7.3	751	23.3
SW-4	<1 gpm	734	30.8
SW-5	180-200 gpm	739	30.2
SW-6	2-3	1060	24.0
SW-7	11-14	1210	23.7
SW-8	1.1	789	24.3
SW-9	16-17	1350	22.7
SW-10	36-48	1640	23.6
SW-11	3-4	1350	22.3
SW-12	20 gpm	950	22.5
SW-13	12	1100	21.1
SW-14	45-50	1430	22.2
SW-15	1.2	1150	17.7
SW-16	2.5	2630	14.8
SW-17	1.5-2	2580	14.0
SW-18	1.5	2740	15.8
SW-19	3.5-4	2680	16.9
SW-20	175-225 gpm	3890	18.1
SW-21	40-60	1440	21.1
SW-22	5-6	657	21.7
SW-23	6-7	856	19.9
SW-24	100-200 gpm	1430	20.7
SW-25	20 gpm	1300	18.0
SW-26	2.5-3	760	18.8
SW-27	1.5-2	2150	22.7
SW-28	1.5	1030	16.6

NOTES:
1. Refer to Plate 11 in text for sampling locations.
2. Estimated flow is in cfs, unless otherwise noted.
3. Recent rains had occurred prior to sampling.
4. Sampling conducted March 26, 27, and 28, 1986.

Canyon, were also noted to be dry at this time (no surface runoff).

Sampling sites SW-6 and SW-7 at Bouquet Junction (near the trace of the San Gabriel fault, and near the discharge of effluent from the treatment plant) displayed surface flows of between 2 and 3 cfs and 11 to 14 cfs, respectively. Dry Canyon and Bouquet Canyon to the north revealed limited amounts of surface runoff; the lower portions of these canyons actually had no flow as a result of deep percolation into the alluvium. Site SW-24 in Bouquet Canyon had an EC = 1430 umhos/cm (a TDS of about 1000 mg/l).

To the south, in the South Fork of the Santa Clara River, the main creek channel between Saugus and Newhall was dry (see Plate 11). Local flows were observed in some of the tributaries to the South Fork, including: 175 to 225 gpm of runoff at SW-20 in Pico Canyon (EC = 3890 umhos/cm, or about 2700 mg/l as TDS); about 1.5 cfs in upper Newhall Creek (EC = 1030 umhos/cm, or about 720 mg/l as TDS); variable though generally low EC, TDS, and flow rates in Placerita Canyon (see SW-25, SW-26, and SW-8 in a downstream direction); and 1.5 to 2 cfs at SW-27 in the South Fork in Newhall (EC = 2150 umhos/cm, or about 1500 mg/l, TDS). It is notable that the highest overall EC (and TDS) values, reflection of very poor quality, were detected in the surface runoff in two tributaries of the South Fork: Pico Canyon, SW-20, previously described; at SW-19 in the South Fork southwest of Newhall (flow of 3.5 to 4 cfs, EC = 2680 umhos/cm, or about 1675 mg/l, TDS); and SW-16, SW-17, and SW-18 in Gavin Canyon along the Golden State Freeway, where flows were limited (1.5 to 2.5 cfs) but where EC ranged between 2580 and 2740 umhos/cm (approximate TDS values of 1600 to 1700 mg/l).

In the main Santa Clara River, between the confluence with South Fork and Castaic Junction, runoff remains variable

but high at SW-13 and SW-9 (more than 10 cfs), with EC increasing from 1100 umhos/cm (770 mg/l, TDS) at SW-13 to 1350 umhos/cm (950 mg/l, TDS) two miles downstream at SW-9. In this reach, only 20 gpm of runoff (at SW-20) was observed entering the river from San Francisquito Canyon on the north; EC and TDS of this small tributary flow were noted to be in lesser concentrations.

Within Castaic Creek, runoff was noted to infiltrate into the alluvium and increase in salinity between SW-22 on the north (flows of 5 to 6 cfs, of EC = 657 umhos/cm or TDS = 460 mg/l), and SW-15 on the south (flow of 1.2 cfs, EC = 1150 umhos/cm or about 800 mg/l).

The numerous conditions relating to irrigation returns, rising waters, high evapotranspiration, and sewage effluent runoff in the Santa Clara River west of Castaic Junction are exemplified by the high surface runoff (SW-11, a portion of the creek, 3 to 4 cfs; and SW-21, 40 to 60 cfs); and by the high EC and TDS values for these sites (EC = 1350 umhos/cm, or 950 mg/l TDS at SW-11; and EC = 1440 umhos/cm or 1000 mg/l TDS at SW-21). These waters were also observed to contain high levels of turbidity during the March 1986 field reconnaissance.

GEOHYDROLOGY

GENERAL STATEMENT

Within a groundwater basin, the storage capacity represents the total volume of water that can be held in underground storage at a given period of time and that can become readily available for extraction by wells. For the water table environment in the study area, groundwater in storage (storage capacity) depends on the total volume of the alluvial-type sediments that is or can become saturated in the groundwater reservoir, and on the specific yield of those sediments. Hence, groundwater in storage is a constantly changing value which fluctuates in response to both seasonal and long-term changes in recharge to and discharge from the groundwater reservoir. Obviously, a rising water table increases the thickness of the water-bearing section, which results in a greater volume of groundwater in storage, while the reverse is true for a declining water table.

To be usable, the void space or reservoir space for groundwater storage in a given volume of sediments must have at least two capabilities: it must be economically capable of being dewatered during periods of deficient surface supply; and it must be capable of being re-saturated either naturally or artificially during periods of excess surface supply. Thus, the groundwater reservoir must contain usable water, which may be defined as that having a satisfactory quality for prevailing beneficial uses and that occurring in sufficient quantity in the underground reservoir to be available without uneconomic yield or drawdown.

Within the study area, the amount of water available for use at the beginning of the pumping season is dependent entirely upon the amount of water which the formations will

yield by gravity when the water levels are depressed by pumping.

In this investigation, we were concerned not only with the quantity of water available for extraction, but also with the impact that this pumping could have on the entire groundwater basin. Hence, it was necessary to assess the quantity of groundwater in storage during drought conditions and the quantity of groundwater in storage during periods of average or above average rainfall; from these calculations it is then possible to determine the change in storage in response to the quantity of precipitation.

Lastly, the aquifer system within the study area is comprised of alluvial sediments derived from the surrounding highland areas and deposited as interfingering lenses of clays, silts, sands, gravels, and boulders. The materials vary in composition and grain size vertically as well as horizontally, and tracing of individual beds or units over very long distances is not possible. Because the aquifer system is both heterogeneous and non-isotropic, it was considered highly unreliable to merely select an average thickness for the alluvium and apply this value throughout the study area. Likewise it was deemed inadvisable to select one value of specific yield for all of the alluvium and utilize this single value for computational purposes.

GROUNDWATER STORAGE CAPACITY

To quantify the volume of groundwater in storage that is potentially available for extraction, it is necessary to multiply the total volume of water-bearing sediments by the specific yield of the various strata. In this assessment, specific yield represents the ratio of the volume of water which can be drained by gravity from a saturated stratum to

the unit volume of that stratum. The procedure for calculating storage capacity involved the following steps:

1. Subdivision of the study area into individual groundwater storage units.
2. Assessment of the total thickness of potentially saturated sediments in each storage unit.
3. Grouping of earth materials described on drillers' logs into categories based on grain size.
4. Assignment of specific yield values to each category of earth materials.
5. Computation of groundwater storage capacity (SC), using $SC = AmS_y$, where A = surface area of the storage unit, m = thickness of potentially saturated deposits in that unit, and S_y = the assigned specific yield.

STORAGE UNITS AND ALLUVIAL THICKNESSES

The first step in determining storage capacity is to subdivide the study area into individual groundwater storage units. To accomplish this, boundaries of the storage units were selected to coincide with either surface or subsurface geologic features of which topographic features such as canyon "narrows," obvious surface "divides" or similar features. The purpose of using such subdivisions was twofold: first, our study area was too large and had to be divided into smaller, more-easily managed units; and second, hydrogeologic features varied markedly throughout the investigation area.

As a result, four separate storage units were selected, each containing a few to several individual subunits. The storage units include: Upper Reach, Santa Clara River (Unit A, and containing ten separate subunits); Middle Reach, Santa Clara River (Unit B, and containing nine separate subunits); Lower Reach, Santa Clara River (Unit C, and containing six separate subunits); and South Fork, Santa Clara River

(Unit D, and containing two separate subunits). As illustrated on Plate 12 - Map of Groundwater Storage Units - the four basin units are of different areas and geometry. From review of this plate, it is noticed that we did not attempt to compute storage for any locales other than the alluviated areas. Thus, the alluvial contact displayed on our base maps, including Plate 12, represents the surface extent of the alluvium that is being studied for this investigation.

In order to assess the quantity of groundwater in storage at any given time, it was necessary to assign specific yield values to each subunit and to multiply this figure by the volume of saturated sediments in the subunit. The volume of saturated material is a product of the area of the individual subunit and the saturated thickness of the material underlying the particular subunit, multiplied by a correction factor to take into account the fact that: the sides of the subunits are not vertical; and the base of the subunit is not a horizontal plane. The total planimetered surface area in each subunit was reduced by 25 percent to account for the reduction in volume of the subunit caused by the sloping sides of the canyon walls which adjoin the alluvial channel.

To ascertain the thickness of the saturated material, it is necessary to determine the base of the fresh water-bearing sediments and the elevation of the water table at a specific time within each of the subunits. Maps depicting the elevation of the water table elevations for specific time periods (Spring 1945, 1957, and 1965 from LACFCD data; and Fall 1985 as seen on Plate 5) were used for these purposes. The initial period represents a water level high period which had been preceded by a series of years of excess precipitation; 1957 represents the beginning of our base period, while 1965

represents the all-time low water level period in the alluvium. The Fall 1985 data represent a moderate water level high, and display recent conditions.

Lastly, three important assumptions were used:

1. All surface boundaries (alluvium to the Saugus Formation, or bedrock, alluvium to faults) were considered to be sloping planes.

2. The depth to water in each storage unit was averaged across that unit to create a flat water table and a uniform thickness of saturated sediments across each particular unit.

3. The base of fresh water for each storage unit was averaged across that unit to create a flat bottom for each particular unit; however, the volume of saturated material was corrected, as described above.

SPECIFIC YIELD VALUES

As previously noted, specific yield in water table environments represents the quantity of water that a unit volume of the material will release from storage when drained by gravity. The part of the water that is not removed by gravity during drainage is held against the force of gravity by such conditions as molecular attraction and capillarity.

For this investigation, an analysis was made of the data contained in the logs of more than 300 water wells. From this information, it was determined that a correct range of specific yield values is from a low of 9 percent to a maximum of 16 percent. The higher values for specific yield were found to be restricted to only a few storage units. Once a determination was made of the specific yield values, each storage unit was assigned a single value which was considered to best represent that entire unit.

ESTIMATED QUANTITY OF GROUNDWATER IN STORAGE

The estimated quantity of groundwater in storage within the investigation area was computed by multiplying the area of each storage unit, by the saturated thickness of that storage subunit (based on the water table elevation for the particular year), and by the specific yield value, in percent, assigned to the subunit. Table Nos. 7.1 through 7.4 - Groundwater Storage Calculations - presents the results of our calculations of groundwater in storage for each of the four storage units in the study area for April 1945, November 1965, and Fall 1985 (the 1957 water level data are used for perennial yield calculations and will be discussed later). The theoretical maximum storage capacity of all the alluvium in the study area is shown also.

To provide a detailed summary breakdown of the groundwater in storage in the alluvium in all four storage units, the reader is referred to Table 8 - Summary of Groundwater Storage Calculations-Alluvial Aquifer System.

Review of these tables reveals the following for the alluvium:

1. The alluvial aquifer system in the Santa Clara River and its tributaries (see exposure area on Plate 12) has a total area of 16,410 acres (about 25.6 square miles).

2. Total groundwater in storage ranged from a high of approximately 201,000 acre-feet in April 1945, to a low of approximately 107,000 acre-feet in November 1965; the present (fall 1985) storage is approximately 176,400 acre-feet.

3. The total thickness of alluvium in the entire exposure area shown on Plate 12, if saturated, would contain a theoretical maximum storage capacity of 239,900 acre-feet.

4. Compared to this theoretical maximum storage capacity, April 1945 levels indicated the alluvial system was 84 percent of being completely "full," while during

Table 7.1 – GROUNDWATER STORAGE CALCULATIONS – Upper Reach, Santa Clara River

Storage Subunit Designation	Total Planimetered Surface Area of Alluvial Aquifers (acres)	Effective Surface Area of Subunit (acres)	Average Surface Elevation (feet)	Average Specific Yield (percent)	Average Elevation of Base of Alluvial Aquifers (feet)	Average Water Level Elevation April 1945 (feet)	Groundwater in Storage April 1945 (acre-feet)	Average Water Level Elevation November 1965 (feet)	Groundwater in Storage November 1965 (acre-feet)	Average Water Level Elevation Fall 1985 (feet)	Groundwater in Storage Fall 1985 (acre-feet)	Theoretical Maximum Groundwater Storage Capacity (acre-feet)
A1a	477	357	1675	19	1550	1645 est.	6,444	1570	1,356	1637	5,901	8,479
A1b	301	225	1567	17	1443	1554 est.	4,245	1475	1,224	1533	3,442	4,743
A1c	792	594	1475	15	1346	1464	10,513	1381	3,119	1438	8,167	11,494
A1d	1324	993	1338	14	1202	1330	17,795	1241	5,421	1309	14,875	18,907
A1e	559	419	1213	16	1072	1200	8,581	1125	3,553	1191	7,978	9,453
A2	263	197	1655	9	1505 est.	1590 est.	1,507	1510	89	1560 est.	975	2,660
A3a	325	243	1770	9	1680 est.	1730 est.	1,093	1687	153	1722	919	1,968
A3b	305	229	1630	13	1525 est.	1630 est.	3,125	1535	298	1575	1,489	3,126
A4a	158	119	1637	9	1570 est.	1630 est.	643	1580	107	1625	589	718
A4b	151	113	1500	13	1400	1475 est.	1,101	1410	147	1475	1,101	1,469
TOTALS	4655	3489					55,047		15,467		45,466	63,017

Table 7.2 – GROUNDWATER STORAGE CALCULATIONS – Middle Reach, Santa Clara River

Storage Subunit Designation	Total Planimetered Surface Area of Alluvial Aquifers (acres)	Effective Surface Area of Subunit (acres)	Average Surface Elevation (feet)	Average Specific Yield (percent)	Average Elevation of Base of Alluvial Aquifers (feet)	Average Water Level Elevation April 1945 (feet)	Groundwater in Storage April 1945 (acre-feet)	Average Water Level Elevation November 1965 (feet)	Groundwater in Storage November 1965 (acre-feet)	Average Water Level Elevation Fall 1985 (feet)	Groundwater in Storage Fall 1985 (acre-feet)	Theoretical Maximum Groundwater Storage Capacity (acre-feet)
B1a	1515	1136	1107	16	925 est.	1099	31,626	1037	20,357	1097	31,262	33,080
B1b	963	722	1039	15	900	1031	14,187	1000	10,830	1033	14,404	15,054
B2a	523	392	1495	9	1412 est.	1485 est.	2,575	1442	1,058	1470	2,046	2,928
B2b	352	264	1343	11	1225	1315 est.	2,613	1267	1,220	1320	2,759	3,427
B2c	472	353	1234	14	1115	1220	5,189	1137	1,087	1210	4,695	5,881
B3	186	140	1270	9	1150	1230	1,008	1186	454	1210 est.	756	1,512
B4a	236	177	1360	9	1245 est.	1302 est.	908	1262	271	1300	876	1,837
B4b	338	254	1252	12	1140	1220 est.	2,438	1177	1,128	1218	2,377	3,109
B4c	365	274	1161	14	1025	1155 est	4,987	1101	2,915	1151	4,833	5,217
TOTALS	4950	3712					65,531		39,320		64,008	72,040

NOTES: 1) See plate in text for locations of storage units and subunits.

2) Total planimetered surface area for each subunit has been reduced by 25% to account for reduction in volume of the subunit caused by sloping sides of the canyon walls adjoining the alluvium.

3) Water level contours for certain canyon areas were not available for 1945 and 1965 maps; water levels in table shown as "est." (estimated) were estimated by correlation to other years of record.

Table 7.3 - GROUNDWATER STORAGE CALCULATIONS - Lower Reach, Santa Clara River

Storage Subunit Designation	Total Planimetered Surface Area of Alluvial Aquifers (acres)	Effective Surface Area of Subunit (acres)	Average Surface Elevation (feet)	Average Specific Yield (percent)	Average Elevation of Base of Alluvial Aquifers (feet)	Average Water Level Elevation April 1945 (feet)	Groundwater in Storage April 1945 (acre-feet)	Average Water Level Elevation November 1965 (feet)	Groundwater in Storage November 1965 (acre-feet)	Average Water Level Elevation Fall 1985 (feet)	Groundwater in Storage Fall 1985 (acre-feet)	Theoretical Maximum Groundwater Storage Capacity (acre-feet)
C1a	565	424	983	15	816	980	9,158	957	7,696	970	8,522	9,349
C1b	445	334	931	14	804	927	5,751	906	4,770	921	5,471	5,939
C1c	718	539	873	13	750	865	8,058	852	7,147	847	6,797	8,619
C2a	1056	792	1173	16	1035	1150	14,572	1098	7,983	1110	9,504	17,487
C2b	1101	826	1062	16	940	1054	15,066	1022	10,837	1044	13,745	16,123
C3	320	240	1205	9	1050 est.	1085 est.	756	1065 est.	324	1080 est.	648	3,348
TOTALS	4205	3155					53,361		38,757		44,687	60,865

Table 7.4 - GROUNDWATER STORAGE CALCULATIONS - South Fork, Santa Clara River

Storage Subunit Designation	Total Planimetered Surface Area of Alluvial Aquifers (acres)	Effective Surface Area of Subunit (acres)	Average Surface Elevation (feet)	Average Specific Yield (percent)	Average Elevation of Base of Alluvial Aquifers (feet)	Average Water Level Elevation April 1945 (feet)	Groundwater in Storage April 1945 (acre-feet)	Average Water Level Elevation November 1965 (feet)	Groundwater in Storage November 1965 (acre-feet)	Average Water Level Elevation Fall 1985 (feet)	Groundwater in Storage Fall 1985 (acre feet)	Theoretical Maximum Groundwater Storage Capacity (acre-feet)
D1a	1610	1208	1260	12	1100	1171 est.	10,292	1138	5,508	1151	7,393	23,194
D1b	990	742	1170	14	970	1132 est.	16,829	1047	7,999	1113	14,855	20,776
TOTALS	2600	1950					27,121		13,507		22,248	43,970

NOTES: 1) See plate in text for locations of storage units and subunits.

2) Total planimetered surface area for each subunit has been reduced by 25% to account for reduction in volume of the subunit caused by sloping sides of the canyon walls adjoining the alluvium.

3) Water level contours for certain canyon areas were not available for 1945 and 1965 maps; water levels in table shown as "est." (estimated) were estimated by correlation to other years of record.

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Table 8 - SUMMARY OF GROUNDWATER STORAGE CALCULATIONS - ALLUVIAL AQUIFER SYSTEM

Storage Unit Name	Storage Unit Designation	Surface Area of Alluvial Aquifers in Storage Unit (ac)	Effective Surface Area of Subunit (ac)	Groundwater in Storage			Theoretical Maximum Storage Capacity (ac-ft)
				April 1945 (ac-ft)	Nov. 1965 (ac-ft)	Fall 1985 (ac-ft)	
Upper Reach, Santa Clara River	A Group	4655	3489	55,047	15,467	45,466	63,017
Middle Reach, Santa Clara River	B Group	4950	3712	65,531	39,320	64,008	72,040
Lower Reach, Santa Clara River	C Group	4205	3155	53,361	38,757	44,687	60,865
South Fork, Santa Clara River	D Group	2600	1950	27,121	13,507	22,248	43,970
	TOTALS	16,410	12,306	201,060	107,051	176,409	239,892

NOTES: 1) See plate in text for locations of storage units and subunits.
2) Effective surface area taken as 75% of the planimetered surface area of alluvial aquifer in each storage unit (see text).

November 1965 levels, the alluvial system was only 45 percent of being "full." Moreover, Fall 1985 levels reveal the alluvial system was 74 percent "full" at that time; an additional 63,480 acre-feet of groundwater are presently required to fill the alluvial aquifer system up to its theoretical maximum storage capacity.

5. From the April 1945 high to present Fall 1985 levels, groundwater in storage has declined by approximately 24,650 acre-feet, or 12 percent.

6. Between the November 1965 low and the present Fall 1985 levels, groundwater in storage has increased by approximately 69,400 acre-feet, or 65 percent.

The only other groundwater storage capacity data in the literature are available from LACFCD (May 1963, Memorandum) and Robson for the USGS analog model study (1972). LACFCD calculations showed a total volume of groundwater in storage in 1944 of 185,700 ac-ft. Our nearest value is for April 1945 and was 201,000 ac-ft; the approximate 15,000 ac-ft of difference is accounted for because each study undoubtedly used different surface areas and vertical depths of alluvium and because the 1945 water levels were slightly higher than the 1944 levels.

Robson data (USGS, 1972) show the following: a high storage of 210,000 ac-ft in 1945 and a low storage in 1963 of 142,000 ac-ft.The former value compares favorably with our April 1945 value; our November 1965 value is 25 percent lower than their 1963 level due to a continuance of water level declines between 1963 and 1965.

PERENNIAL YIELD ASSESSMENT

General Statement. The traditional or classical assessment of perennial yield is based on evaluation of all factors of the basic hydrologic equation: inflow minus outflow

equals change in storage. The inflow to a groundwater body consists of subsurface inflow, and deep percolation of precipitation and of water either injected or spread, which infiltrates into the ground, continuing beyond the root zone. The outflow from a groundwater body consists of subsurface outflow and extraction from the groundwater body. When the inflow is greater than the outflow, the amount of subsurface water in storage increases. Conversely, the amount of outflow that is greater than the inflow must come from groundwater stored in aquifers. The relationship of inflow, outflow, and change in storage is the subject of the present discussion.

The perennial yield, or sustained yield, is defined for this study as the amount of groundwater that can be pumped on a practical basis from the alluvial aquifer system without bringing about some undesirable result. Undesirable results from long-term pumpage in excess of the perennial yield could include: lowering of water levels beyond the bowl setting (pump intake) of existing wells; or introduction of poor quality waters from surrounding materials. In this investigation, we are concerned primarily with the determination of the quantity of water that can be pumped without permanently lowering groundwater levels in the alluvium.

Methods of Computing Perennial Yield. As stated, the "classic" method of evaluating the perennial yield of a groundwater basin involves the solving of the hydrologic equation. When simply stated, it is an accounting of the items of water supply and the items of water disposal. Stated in general terms, the hydrologic equation is:

> Surface inflow + Subsurface inflow + Precipitation + imported water + Decrease in surface storage + Decrease in groundwater storage =
>
> Surface outflow + Subsurface outflow + Consumptive use + Exported water + Increase in surface storage + Increase in groundwater storage.

Perhaps the most detailed perennial yield study made to date is the San Fernando Reference (1962). This study required approximately three years to complete and cost in excess of 2 million dollars. Its complexity and high cost has been a strong deterrent to the continued use of the "classic" method by the hydrogeologic community.

A brief discussion of two other more conventional methods of determining perennial yields is presented below:

1. The Hill Method involves the direct determination of perennial yield from fluctuations of the water table. This method involves plotting annual changes in basin groundwater levels against annual groundwater extractions. If data used to construct the graph are selected from periods of near-normal precipitation, the points can generally be fitted by a straight line.

   The annual groundwater extraction corresponding to a zero change in water levels equals the safe yield. However, it must be emphasized that the data used in the Hill Method can only be derived from historic periods of normal precipitation. Data from wet or dry climatic cycles will result in deviations from the normal annual recharge to the basin which may affect water levels. Water level fluctuations used in the Hill Method must be solely reflective of groundwater extractions.

2. The Pumpage and Change-in-Storage Method, as it is sometimes referred to, involves deriving perennial yield from pumpage and change in storage data over a representative climatic period. To employ this method, the geology of the groundwater basin must be well defined as to the areal extent of water-bearing materials and the average specific yield of this material. Also, areas of confined and unconfined groundwater occurrence must be accurately delineated. After the hydrogeologic characteristics of the basin have been defined, a representative climatic period is selected, from which pumpage and basin storage change values are derived. The selected cycle should not be preceded by a wet period in order to avoid so-called water-in-transit problems. Following selection of a representative climatic cycle, pumpage during the period is totalled and an average annual pumpage volume is calculated. The net change in groundwater storage occurring from the

beginning to the end of the selected period is then determined and an average annual change in storage is calculated. The annual perennial yield is then the algebraic sum of the calculated values of average annual pumpage and average annual storage change.

For this study, the pumpage and change-in-storage method was considered most suitable, and this method was applied in determining the perennial yield or the "sustained yield" for pumpage from the alluvial aquifers of the Santa Clarita Valley.

The only items required to be analyzed when applying the pumping and change-in-storage method in determination of perennial yield are the following.

1. Precipitation over the study area,
2. Annual groundwater extractions,
3. Volume of groundwater in storage.

Precipitation. In any watershed, the precipitation over the area is the original source of water supply. Therefore, precipitation data were used as the basis for determining both the base and mean periods of water supply. Ordinarily, the amount of precipitation varies considerably, both with time and areal distribution, and there is a corresponding variation in the amount of replenishment to the groundwater body. In the present instance, however, the area of investigation is rather small, precipitation does not vary widely over the valley floor, and the capacity of the groundwater body to store water is relatively limited.

Although seasonal variations in the replenishment to, and extractions from, the groundwater body affect the annual rise and fall in the water table, the volume of storage space for subsurface water within the valley has a moderating influence. In addition, the volume of storage space for subsurface water in the alluvial fill is sufficiently large to store water during periods of surplus water supply and to withdraw

water during periods of deficient water supply. These storage factors affect the long-term rise and fall of the water level elevations of groundwater. Thus, in the evaluation of the items of water supply, use, and disposal, a long-term period is considered more significant than shorter, wet or dry periods.

As mentioned previously, precipitation data were used in the selection of base and mean periods of water supply. The record of seasonal precipitation in the study area dates back to the 1928-29 rainfall season at the Saugus-Edison Substation Rainfall Station, and dates back to the 1946-47 season at the Mint Canyon Rainfall Station (see locations on Plate 6.5).

The seasonal precipitation at the Saugus Station was used because of its longer record. Seasonal precipitation at this station varied from a high of 34.77 inches in 1977-78 to a low to 5.25 inches in 1950-51. Over a number of years, the annual fluctuations in the record tend to recur in discernible cycles consisting of a period of several relatively wet years followed by several relatively dry years. Three such major precipitation cycles have occurred during the period of record, the first of which began in 1939-40. The latest cycle began as a rising curve in 1977-78, reached the high point in 1982-83, and its downward trend since then has continued into 1986 (refer to cumulative departure curve on Figure 2).

In the course of a hydrologic analysis such as this, it is necessary to select a base period which would include a major precipitation cycle and for which the required hydrologic data were available. In the selection of the base period, it was necessary that the period would be representative of the precipitation conditions during a long-time period. The period subsequent to 1928-29 was evaluated, and the 28-year period from 1957-58 to 1984-85 was selected (the average

precipitation in the Base Period is 13.79 inches). As may be observed on Figure 2, the average seasonal precipitation for the base period 1957-58 to 1982-83 was virtually equal to the mean seasonal precipitation of 13.5 inches for the period 1928-29 through 1984-85, which is considered to be the long-time period for this study.

In this investigation, precipitation was considered as the only source of water supply to the basin. Subsurface inflow from surrounding materials and the Saugus Formation was not included; also, no recharge of imported water was assumed. Therefore, fluctuations in water levels were reflective only of the amount of recharge to the basin sediments and the amount of groundwater produced from wells. Water well pumping was considered the only item to decrease the amount of water in storage because there was insufficient data during the base period to consider consumptive use of native vegetation or subsurface outflow, and most importantly of all, in our method of analysis for perennial yield, only change in groundwater storage during a selected base period was required.

Groundwater Production. Groundwater extractions in the area have historically been derived from two sources: alluvial wells and Saugus Formation wells. Plate 3 illustrates the location and 1985 production totals for the known alluvial wells and known Saugus Formation wells. The available data on water production were obtained from the files of the local water agencies, and these production data were utilized in our determination of the perennial yield of the alluvial materials which fill the groundwater basin in the area. It should be noted that some groundwater is known to be pumped from the alluvium by private pumpers. These users are not monitored, and

their annual extractions are not metered. Because the cumulative total production by these private pumpers is not considered to be large, it has not been included in our perennial yield assessment.

Prior to 1954, alluvial groundwater production accounted for almost 100 percent of the total water production in the study area. However, in 1954, this percentage decreased to approximately 95 percent because in that year Newhall County Water District constructed the first of six wells which tap the Saugus Formation for domestic use. By 1985, production from the Saugus Formation approached 16 percent of total groundwater extractions (refer also to Table 2).

In recent years, there have been several shifts in the supply/demand usage of water in the region. Groundwater extractions from the Saugus Formation have gradually increased to about 15 percent of the total local production, while total extractions (alluvium plus Saugus Formation) have declined slightly. Water usage has shifted toward a greater proportion for urban uses, with a reduction for agricultural uses, as the region has become urbanized. In the future, it is projected that local alluvium production will remain relatively constant with more water going to urban uses as the agriculture is phased out, and there will be greater use of groundwater from the Saugus Formation.

Urbanization has had a rather startling impact on the availability of areas for recharge, however. All recharge to the aquifer system does not occur in the low-flow channels of the river and its tributaries, but infiltrates over much of the alluviated areas which are not within the flood channels of the Santa Clara River system. Paving of these areas has, and will continue to reduce the net effective area for natural recharge to the underlying groundwater system.

Change in Groundwater Storage. Change in groundwater storage is that amount of groundwater in the rock or sediments that increases or decreases over a specified length of time. During the drought years 1945 to 1977, water levels in the Santa Clarita Valley fell, and during the years of excessive precipitation, 1977-78 to 1982-83, water levels rose until the underground storage area was essentially filled and additional water flowed out of the basin. The difference in the elevation of the water table in the alluvium, or the amount of groundwater in storage at the beginning and at the end of the selected base period of study, reflects the surplus or the deficiency that occurred in the alluvium over the base period.

Computation of the change in groundwater stored in the alluvial aquifer at the beginning and at the end of the base period required a determination of several factors including the volume of sediments available, the saturated thickness of these sediments, and the specific yield of the alluvial materials which store, transmit, accept, and release groundwater to pumping wells. This has been provided previously in the report section discussing groundwater storage.

Computation of Perennial Yield. In summary, the steps required to compute the perennial yield of the Santa Clarita alluvial aquifer system are as follows:

1. Select the base and mean hydrologic periods.
2. Determine the average annual quantity of groundwater extracted by wells from the alluvial sediments.
3. Find the difference between the quantity of groundwater in storage at the beginning and at the end of the selected base period.
4. Find the average annual change in storage from the value found in Step 3.
5. The perennial yield is then the algebraic sum of the

calculated values of average annual pumpage and average annual change in storage.

To determine the average annual groundwater production from the alluvial sediments in the Valley, files at the major water purveyors concerning present and historic production were obtained. These data vary widely in their apparent level of accuracy. For example, some of the data do not date back to 1957-58, other data are based on electrical consumption at the pump and not on actual metered gallonage, while other data are only estimates based on the number of persons using the water. Regardless, during the 28-year base period 1957-58 to 1984-85, we estimate the average annual groundwater production from the alluvial sediments in the Santa Clarita Valley to have been approximately in the range of 31,000 to 32,000 acre-feet per year.

In addition, at the beginning of the base period, the quantity of groundwater stored in the alluvial sediments was calculated to be approximately 159,688 acre-feet. By 1985, the quantity of groundwater in storage in the alluvium had been increased to 176,409 acre-feet (see Table 8). The increase in the quantity of water in storage in the alluvium is thus 16,721 acre-feet. This increase is the total quantity of groundwater added to storage during the 28-year Base Period as a result of excess precipitation. Hence, the average annual net change in groundwater in storage was determined by dividing the total quantity of water added to storage by the length of the Base Period, or +597 acre-feet per year.

The perennial yield is the quantity of groundwater what can be pumped annually without any change in groundwater levels or net change in groundwater in storage over the Base Period. This may be computed by determining the average annual pumping during the Base Period (31,000 to 32,000 acre-feet), and adding or subtracting from this value, that amount

of groundwater which represented the average annual change in storage.

Because there was more water in storage at the end of the Base Period (1985) than at the beginning of the Base Period (1958), the annual net change in storage (+597 ac-ft) must be added to the average annual pumping (31,000 to 32,000 ac-ft). Thus, the practical or perennial yield of the alluvial sediments in the Santa Clarita Valley area is in the range of 31,600 to 32,600 ac-ft/yr.

Review of the literature indicates other values of perennial yield by different investigators. These other values include: a DWR (June 1964 and February 1979) value of 23,100 ac-ft/yr for the Eastern Basin, although they do not state whether this number is solely for the alluvium or for both the alluvium and the Saugus Formation; Hackel and Associates (1964), who reported a combined annual yield of 33,250 ac-ft/yr for both the alluvium and the Saugus Formation; and Bookman-Edmonston Engineering, Inc. (1976 and 1983) who report a value of 35,100 to 35,200 ac-ft/yr, as modified from USGS data, for the yield of the alluvium. Variations in these numbers relate to differences in total outcrop area of the alluvium being considered and to differences in the base period of study selected by each investigator.

SOILS CONDITIONS AND ARTIFICIAL RECHARGE

GENERAL RECHARGE METHODS

By definition, artificial recharge is the practice of deliberately augmenting the natural processes of infiltration of precipitation and streamflow through soils materials, thereby replenishing a groundwater reservoir via man-made

works. Such works are typically designed to maintain infiltration rates, increase the wetted area, and increase the period of infiltration beyond that which would exist in the soils under natural conditions. Of the numerous methods available to recharge a groundwater basin, most involve variations of two basic methods: permitting water to infiltrate directly at ground surface, or pumping the water down wells to physically inject it below ground surface. Concomitant downgradient installation of new extraction wells (or use of existing pumping wells) may be used with either basic method in order to minimize the lateral and vertical migration of the water being spread.

In the water spreading method, the method recommended for use in this study, large areas of land ,may be flooded, basins constructed, ditches and furrows excavated, or existing stream channels modified in order to accept waters for infiltration. For the well injection method, relatively large diameter pits or shafts may be utilized, or deeply screened wells may be constructed to accept waters for injection.

Regardless of the method employed, it is the purpose of artificial recharge projects to do one or more of the following: combat adverse conditions such as increased pumping lifts resulting from overdraft of the groundwater reservoir; increase conservation of local surface runoff; store water in the off-season for use during periods of high demand; increase the amount of groundwater available for use; and provide increased flexibility to the local water system in terms of its development and operations schemes.

RELATIVE SOIL INFILTRATION CHARACTERISTICS

Before direct precipitation, surface runoff, or artificially recharged waters can enter and recharge a groundwater reservoir, the water must be capable of infiltrating the soil.

Key factors affecting the rate at which water enters the soil include the soil types present and the antecedent moisture condition in that soil. In addition, urbanization, in the form of paved surfaces, houses, and paved creek channels, tends to reduce the volume of water infiltrating by serving to direct the available recharge to other locales.

The infiltration rate, or the maximum rate at which a soil will absorb water, has been determined for study area soils by the U. S. Soil Conservation Service (1978); these data have been used for purposes of this report.

Synthesis of soil classifications and percolation rates of study area soils provided in Soil Conservation Service reports was necessary to provide a first-order approximation of which soils in the region would be most conducive to recharging the local river valley. For this purpose, Plate 13 - Map of Soil Infiltration Rates - has been prepared. As shown, four separate groups of soils, based on their relative infiltration characteristics, are revealed: Group A soils accept water most readily, generally at rates greater than 6 inches per hour (in/hr); Group B soils accept water generally at rates from 2 to 6.3 in/hr; Group C soils have relatively moderate acceptance rates, generally less than 2 in/hr; and Group D soils which exhibit infiltration rates ranging from 0.06 to 0.63 in/hr. It must be recognized that data adapted onto Plate 13 provide information for only the upper five feet of any soil in the study area.

Data on Plate 13 show that Group A soils (rates of 6.3 in/hr or greater, that is, about 90 gallons per day per square foot (gpd/ft^2) occur principally along the active creek channels. The fact that the creek channels expose coarse grained sediments is corroborated by direct observation of these sediments during the field reconnaissance of the region.

Much of the study area displays more limited infiltration rates of 2 to 6.3 in/hr or less (i.e., Group B and C soils); as noted on Plate 13, these soils also occur on the elevated mesas along the margins of these subunits. Large areas of Group C soils (rates of 2 in/hr or less) occur as terrace-type materials, mostly on the south side of the river. Lastly, Group D soils occupy the more elevated portions of the area of investigation.

PERCENT CLAY DATA

As discussed in other portions of this report, groundwater stored in the aquifer system in the region has entered the various groundwater subunits by: infiltration of surface runoff from adjoining mountain masses; deep percolation of direct rainfall on the valley floor; and deep percolation of water by human activities such as irrigation returns and sewage returns. Because this portion of the report deals with the ability of water to reach the aquifer systems and then mix with groundwater already in storage, it was necessary to illustrate how the water could move through the shallow soil zone shown on Plate 13 and then vertically downward to the zone of saturation.

The basis for the method used is that the lower clay content in the sediments between ground surface and the zone of saturation, the greater will be the permeability and the easier it will be for the water to percolate vertically downward. Conversely, as clay concentrations increase in the subsurface, permeability is reduced, resulting in decreased flow velocities (both horizontally and vertically) for the water.

To provide a general assessment of the vertical flow of recharging water to the saturated zone in the study area, Plate 14 - Percent Clay Map - was prepared. This plate displays the general areal extent, configuration, and thickness

of fine-grained strata (principally silt and clay) to maximum depths of 50 feet in the study area. Data and contours on this plate were developed upon examination of the upper 50 feet of earth materials described on available drillers' logs.

For each lithologic unit, the driller's description of the sediment penetrated was used to estimate the percentage of the various sediments present. For example, "clay" was assigned a value of 100 percent, "silt" was assigned a 50 percent value, while "sand" was assigned a value of 0 percent. For this assessment, substantial subjective judgment was required to assign the various percentages due to the extreme variability of descriptive terms used by the different drillers. Once the percentage has been assigned for each driller's term, the total percentage of sediments was calculated for each depth interval being considered: that is, the 0- to 25-foot zone and the 25- to 50-foot zone.

Plate 14 delineates the distribution of sediments in the depth zones of 0 to 25 feet and 25 to 50 feet below ground surface. This plate also includes percent clay contours in the 0- to 25-foot depth zone. As indicated thereon, two numbers (as a numerator and a denominator) are provided for each well for which data are available. The upper number (in the numerator) identifies the percent clay in the zone 0-25 feet below ground surface, and is the basis for constructing the contours shown on the map. The second number (in the denominator) refers to the percent clay computed in the 25-50-foot zone. Because the percent clay in the 0-25-foot range would control the infiltration rate of recharged water at selected surface sites, it was considered important to provide contours of equal percentage of clay in this upper depth zone.

Most noticeable on Plate 14 is the high percent clay value in the 0-25-foot zone in the Newhall area, in the area

southeast of Castaic Junction, in the area immediately upstream from Del Valle, in the Sulphur Springs locale, and in the upper reaches of Mint Canyon.

Areas of virtually no clay or little clay in the uppermost 25 feet of alluvium, as identified on available drillers' logs, occur along the reach of the Santa Clara River upstream of Bouquet Junction, in the vicinity of Solemint, in upper San Francisquito Canyon, and generally in the area west of Saugus.

TYPICAL CONDITIONS AND RESTRICTIONS

Where moderate to high rates of infiltration exist and can be maintained, spreading basins usually are the most effective method of recharge. To maximize infiltration rates, it is important to:

a. Select an area where surface soils have relatively high permeability;

b. Maintain a high water level (a high head) in the spreading basin;

c. Use cyclic recharge in the basin to permit drying and rejuvenation between each spreading operation;

d. Remove organic matter, suspended sediments, and solids from the water prior to spreading operations;

e. Prevent extensive plant and algal growths in the basin.

Where such soils exist, recharge at ground surface can be conducted either in properly designed and constructed spreading basins or along intermittent creek channels and washes that exist in the region.

Regardless of whether the recharge is effected through surface infiltration methods or subsurface injection, several general restrictions must be considered, including:

1. There must be adequate available storage capacity in the basin to accommodate the anticipated volume of recharge.

   Based on Fall 1985 water levels, there is a theoretical maximum of about 63,500 ac-ft of available storage between ground surface and Fall 1985 water levels. This value assumes that water levels can be raised to ground surface in each storage zone, a condition which could and should never be realized. The actual level to which groundwater levels can be artificially raised by the spreading or injection of water without producing detrimental effects is difficult to establish.

2. Sediment transmissivity in the unsaturated zone must be sufficient to allow extraction from areas being recharged.

   Theoretical T values depicted on Plate 7 represent the transmissivity of a particular well which has been drilled in the alluvial aquifer system. It, therefore, represents the T value of the aquifer at that particular point. As seen on Plate 7, aquifer T values along the Santa Clara River are generally high (>100,000 gpd/ft), and locally as high as 500,000 gpd/ft.

3. The basin must be sufficiently watertight to minimize loss from the system.

   Groundwater contours (Plate 5) show groundwater historically moves westerly along the main channel of the Santa Clara River across most subunits with no completely effective groundwater barrier. In those alluvial areas along the river east of the easternmost exposure area of the Saugus Formation (see contacts on Plate 4), nonwater-bearing bedrock underlies the alluvium and is exposed on the adjoining hills. In these reaches of the river, water spread in the alluvium will not be lost to the underlying bedrock in significant amounts.

   In those reaches of the river farther west which are directly underlain by alluvium and then Saugus Formation materials, some losses of water, depending on water levels, may be expected downward through the alluvium and into the Saugus Formation. It is not possible to define the amounts of these losses at this time.

Unless groundwater levels are raised to ground surface, there will be no evaporative losses from artificially raised water levels (exclusive of normal evaporation from spreading basins). Only if volumes are used which are greatly in excess of those being proposed for artificial recharge in the study area and, concomitantly, these excessive volumes are combined with a series of above-average rainfall years, would there be any potential to lose recharge water by creating rising water at ground surface in the locale. Use of extraction wells downstream of the recharge facilities will help preclude basin outflow and waterlogged conditions created by the artificially recharged water.

4. The sediments in the basin must be relatively permeable and no thick, areally extensive clays can occur in the near-surface environment (the latter applies to spreading basins).

   Though no in-situ field testing or laboratory testing of aquifer materials has been conducted, the available specific capacity and yield data suggest that aquifer materials possess the necessary characteristics. Due to the geologic history of the area and the numerous sources of deposition for basin-wide sediments, it is likely that the strata are lenticular and tend to interfinger. Thus, thick and areally extensive confining clay beds probably do not occur. This has been corroborated by the information presented on the percent clay map, Plate 14, previously discussed.

5. Soil percolation rates should be adequate for the anticipated volumes of recharge.

   Inspection of Plate 13 indicates that soil percolation rates in the investigation area range from 0.06 to 20 inches per hour. Areas selected for potential artificial recharge facilities would generally have infiltration rates that are greater than 6 inches per hour.

6. Economic considerations dictate that extraction wells be situated at locations compatible with expected use.

   This criterion is important to minimize transmission costs and pipeline lengths. The need for pump stations or a gravity system depends on the relative surface elevations of the recharge and extraction sites and the ultimate points of use. Extraction wells

should not only be down-gradient of the recharge facilities, but should have high Q/s performance and high efficiency.

7. The quality of the recharge water and the natural groundwater must be compatible.

   TDS and TH ranges previously discussed showed that surface flows and groundwater are grossly similar. Also, the chemical character of nearly all the waters in the eastern half of the study area is calcium-bicarbonate. Other quality parameters such as suspended solids, trace metals, COD and BOD should also be considered, but data for detailed comparison are lacking. Minimizing suspended solids (turbidity) is particularly critical to the ultimate success of artificial recharge operations.

PRELIMINARY ARTIFICIAL RECHARGE SITE SELECTION

When the data from Plate 14 was superimposed with soil infiltration rate data depicted on Plate 13, Plate 15 - Map of Preliminary Surface Spreading Areas - was developed. In effect, Plate 15 has utilized both infiltration rate data and percent clay data for the upper portion of the alluvium along the Santa Clara River to designate potential sites where soil infiltration rates are at a maximum, and where there is a minimum of clay in the soil to a depth of at least 25 feet.

The river areas specially denoted on Plate 15 represent locations considered as potentially suitable for artificial recharge by surface spreading basins. No field inspection was made of these sites, and no information was obtained regarding: ownership and availability of property; proposed future land use in the area; or problems that may be associated with designation of areas as flood prone. These preliminary sites which optimize general field conditions in the region must be field verified on a site-specific basis prior to initiating full-scale site development.

Other reaches of the river and its tributaries in the study area also revealed a theoretical feasibility to be recharged based on superposition of data from Plates 13 and 14. However, these particular reaches were not specially denoted on Plate 15 for consideration as future surface spreading areas because of such factors as proximity to wastewater treatment plants and proximity to known water quality problems in the alluvium. Such reaches include: Castaic Creek just north of its confluence with the Santa Clara River; San Francisquito Creek north of its confluence with the river; and the area in the river just west of Bouquet Junction.

Determining whether artificial groundwater recharge is physically possible in these areas requires analysis of the geologic nature and structure of the area. In addition, information pertaining to the water-transmitting properties of the subsurface aquifers must be obtained and evaluated.

In groundwater basins where aquifers are of recent alluvial origin, the recharge capacity is controlled by the layering of the material. It is directly related to the porous granular nature and mode of deposition of the soils at the surface, and aquifers beneath the surface, because it is through them that the water must flow and in which it is stored. These are, in turn, related to the geologic origin of these materials, the grading or sorting in particle sizes associated with the transport processes of deposition of the layer, the conditions at the time of deposition, and secondary chemical changes that have occurred in place.

Water is transmitted best in the larger pores of the coarser grained sand and gravel layers in the alluvium of the Santa Clara River because these materials have a high hydraulic conductivity (permeability). The smaller, more numerous pores of sandy aquifers will provide the greatest volume

for water storage, thus having a high specific yield or fillable void space. The silts and clays in the alluvium contain a large volume of very small pores, but since little flow can occur within them (very low hydraulic conductivity), they act as confining layers and provide little storage potential. Moreover, these finer grained strata release water from storage less readily than the coarser grained layers.

In December 1970, the U. S. Department of Agriculture published a report, "Ground-Water Hydrology." Included in this document is a comprehensive discussion of those items that must be evaluated when selecting a site for artificially recharging a groundwater basin. In addition to determining infiltration rates of the soil profile, which has been accomplished, and determining the quantity of clay that may exist immediately beneath the proposed recharge site, which has also been completed, they recommend that the following studies be made of a potential recharge facility:

1. Identify the depth and cause of the first water table.
2. Conduct field measurement of soil intake rates.
3. Measure future water intake by pilot recharge studies.
4. Conduct aquifer tests on new and/or existing, nearby water wells.
5. Determine chemical constituents affecting water quality.
6. Determine biological factors affecting water quality.
7. Identify possible operational problems.

Because the cost involved in assessing the suitability of a site for artificial recharge is quite high, the investigative work is generally phased. Phase I of such an investigation would be limited to construction of several 25- to

50-foot deep auger borings to determine the nature and characteristics of the sediments which lie below the soil profile (the upper 4 to 5 feet). Usually four or five borings per site are sufficient for a site on the order of 5 to 15 acres in extent. Larger sites must include additional borings to ensure that adequate coverage has been made.

Subsequent to evaluating the data obtained from the Phase I effort, deeper test hole locations are selected. These test holes may be as deep as 200 feet, or the maximum estimated thickness of the alluvial sediments in the area. The overall purpose of the deep test holes is to identify possible subsurface horizontal barriers that may direct the recharged water to undesirable localities. If no such horizontal barriers exist, or if they are so deep that they would have no detrimental impact on infiltrating waters, Phase III studies may be undertaken.

Phase III investigations would include determination of the aquifer constants of transmissivity, permeability, and flow gradients. Knowledge of these parameters is essential in order to ensure that the recharged water will not mound beneath the recharge facility to such an extent that the "mound" may rise to the surface at some point downstream and discharge from the basin as surface water. In addition, information will be provided for determining the quantity of water that can effectively be placed into the groundwater basin from the facility.

Coincident with Phases II and III, will be actual field tests to determine soil intake rates which are necessary to select sites by intake rate comparison, to obtain recharge rates for engineering design, measurements of effect of surface treatment for maintenance and surface modification, and assessments of the chemical compatibility of the recharge water and local groundwater.

Because the intake rate of soil is a dynamic and transitional quality that depends on the interplay of many physical, chemical and biological reactions, an accurate prediction of the future intake from any current measurement is doubtful. For this reason, the rate can be measured accurately only during actual recharge. A Phase IV investigation would be constructing, operating, and testing a Pilot Recharge Program at one or more selected sites.

CONCLUSIONS AND RECOMMENDATIONS

1.0 FEASIBILITY

Based on review and analyses of existing data, the perennial yield of the alluvial sediments in the Santa Clara River Valley has been quantified and it has been determined that it is hydrogeologically feasible to utilize the alluvium for underground storage of artificially recharged water. The alluvium of the Santa Clara River has considerably more available storage volume, based on Spring 1985 water levels, than the volumes of water from various sources that might be available for spreading. Regions along the river east of Bouquet Junction have been delineated which appear to be potentially amenable for recharge by surface spreading basins. Recovery wells located immediately downgradient from the spreading basins could be constructed in the future to extract the infiltrating recharge waters for beneficial use. The principal use of spreading basins would be to ensure that the perennial yield of the alluvium is achieved and maintained.

Sources for recharge waters include surface runoff in the Santa Clara River and imported water from the State Water Project, and possibly even discharge from the Bouquet Junction treatment plant. Only relatively small volumes of runoff are available from local watersheds draining into the river. The methods, costs, and assorted engineering details for collecting and directing waters for recharge purposes have not been addressed in this study.

The 1972 U. S. Geological Survey analog model of the basin has been dismantled and is no longer available for any purpose.

2.0 HYDROGEOLOGY

2.1 Groundwater Basin. Alluvium and the Saugus Formation comprise the groundwater reservoir of the Eastern Basin. River alluvium ranges to a maximum thickness of 200 feet and is comprised of coarse-grained and permeable materials that are readily subject to scour and erosion.

2.2 Water Levels. Water table conditions exist in the alluvium. Historically, and at present, groundwater in the alluvium flows from east to west across the study area. In most of the alluvium east of Bouquet Junction, April 1945 represents the all-time water level high, while November 1965 represents the all-time low; the early-1960's represent lower water levels in the alluvium west of Bouquet Junction.

Fall 1985 levels are 10 to 30 feet lower than the 1945 levels. Present depths to water in most of the alluvium range approximately between 20 and 60 ft below ground surface, except in the valley west of Castaic Junction where ground water levels have historically remained close to ground surface.

2.3 Water Quality. A calcium-bicarbonate character and TDS values in the range of 400 to 800 mg/l are considered representative of alluvial waters east of Bouquet Junction. In the reach of the river between Bouquet Junction and Castaic Junction, alluvial water is still calcium-bicarbonate in character but has TDS in excess of 1000 to 1500 mg/l. In the reach west of Castaic Junction, groundwater has been and continues to be degraded to a sodium-sulfate character, with typical TDS values of 800

to 1000 mg/l, or more. Nitrate values are variable throughout the alluvium. Certain volatile organic compounds in low concentrations have been detected at various times in a few wells in the alluvium, mainly easterly of Bouquet Junction. There does not appear to be any long-term and continuous definitive trends toward poorer groundwater quality discernible from available data.

Shallow alluvial wells, wells with shallow perforations and/or wells with inadequate cement seals will be affected more rapidly and to a greater degree by surface spills and contamination than wells with the opposite conditions. Groundwater west of Castaic Junction is considered degraded because of: irrigation returns; surface inflow from rocks containing gypsum and other salts; high evapotranspiration due to shallow groundwater levels and rising water; large wastewater plant surface runoff; and little flushing action from upstream waters of better quality. These quality problems are compounded because of the existence of finer-grained sediments in this area which serve to minimize groundwater flow velocities and reduce the flushing action of groundwater flow.

In future periods of above-average precipitation, effluents from the two sewage plants will not tend to percolate into the alluvium, but rather will tend to leave the area as direct surface runoff. In future dry periods, effluent from the Bouquet Canyon plant will tend to percolate into the groundwater, whereas effluent from the Valencia plant will still tend to leave the area as surface runoff because of the typically high groundwater levels and surface flows in the lower reach of the river.

2.4 Saugus Formation. Saugus Formation water quality is generally Ca-HCO_3 in character, though occasionally high SO_4 does occur; typical TDS values are 400 to 800 mg/l.

Nitrates and volatile organic compounds generally do not exist, except in deep wells which contain only shallow surface seals. Due to similarities in overall quality and to certain similar water level responses, and in consideration of the composition and geologic contact between the two formations, it is highly probable that hydraulic continuity exists between the alluvium and the Saugus Formation within which it is in direct contact. In certain areas, where claystone and shale beds directly underlie the alluvium, hydraulic continuity would be greatly reduced.

Typical theoretical transmissivity values in the Saugus Formation are 10,000 to 145,000 gpd/ft, while those in the alluvium are 250,000 to 500,000 gpd/ft.

2.5 Faults. The northwesterly-trending San Gabriel fault is considered at least potentially active based on recent data by others. It does create a partial barrier to groundwater flow in the alluvium near Bouquet Junction; water levels are 25 to 30 ft higher on the east side of the fault.

This fault clearly offsets the base of the Saugus Formation and, hence, the base of fresh water; Saugus Formation thicknesses range approximately between 1500 ft north of the fault to at least 5000 ft on the south.

3.0 HYDROLOGY

3.1 Watersheds. Thirteen major watersheds having a combined drainage area of nearly 255 square miles were studied. Northward-draining watersheds have higher surface elevations and greater long-term rainfall than southward-draining watersheds; the latter drainages have larger individual watershed areas.

3.2 Recoverable Water. The combined long-term average annual recoverable water from the 13 watersheds is approximately 10,300 ac-ft/yr; this represents about 8 percent of the total precipitation on these watersheds. The balance of the total rainfall is consumed by natural water losses (evapotranspiration).

Because recoverable water represents surface water outflow and water lost as seepage into groundwater storage, we reduced total recoverable water by 20 percent to account for water lost into groundwater storage. Thus, the amount of recoverable surface water that is available from each of the 13 watersheds at their respective confluences with the Santa Clara River ranges approximately from 110 ac-ft/yr at Tick Canyon to 1500 ac-ft/yr for San Francisquito Canyon. The total recoverable surface water runoff from all 13 watersheds, available on a long-term average basis, is about 8200 ac-ft/yr.

3.3 Surface Water Quality. Surface water quality was found to be grossly similar to that in the alluvial groundwaters; hence, near Lang on the east, surface water is Ca-HCO_3 in character, while near County line it has a Na-SO_4 character. TDS also increases from east to west.

A limited March 1986 sampling of runoff following a spring storm corroborated the increased TDS values on the west. Certain quality problems are also evident in Castaic Creek, and the upper portions of the South Fork of the Santa Clara River.

4.0 GEOHYDROLOGY

4.1 Groundwater Storage Capacity. Using a total surface area of alluvium in the study area of 16,410 acres, a specific yield of 9 to 16 percent, and variable alluvial thicknesses based on basin location (maximum thickness of

200 ft), we calculated the following storage capacities in the alluvium: 201,000 ac-ft in April 1945 (basin high); 107,000 ac-ft in November 1965 (basin low); 176,400 ac-ft (current, Fall 1985); and theoretical maximum possible of 239,900 ac-ft.

Hence, April 1945 groundwater levels were at 84 percent of being "full," while November 1965 was only 45 percent of being "full." In Fall 1985, the basin is 75 percent "full"; an additional 63,480 ac-ft of water are presently capable of being added to the groundwater reservoir to fill it to its theoretical maximum storage capacity. Problems will develop in the basin if water levels were ever raised to the theoretical maximum storage capacity.

4.2 Perennial Yield. To calculate perennial yield, we used the pumpage and change-in-storage method. For our 28-year base period (1957-58 to 1984-85), the cumulative departure from the mean precipitation curve displayed a balanced, long-term precipitation; during this period, groundwater in storage was found to increase by 600 ac-ft/yr.

Based on incomplete and occasionally contradictory groundwater extraction data for the region, we estimate the average annual production from the alluvium to be 31,000 to 32,000 ac-ft/yr.

Hence, the practical or perennial yield of the alluvium aquifer system along the Santa Clarita River Valley is the sum of the long-term production plus the increase in storage during the base period, or a total of approximately 31,600 to 32,600 ac-ft/yr.

In 1985, the four major domestic purveyors and the main agricultural user of groundwater produced 28,995 ac-ft from a total of 67 active wells. Of these totals,

59 active wells produced 24,103 ac-ft from the alluvium, while the remaining 8 wells produced 4892 ac-ft from the Saugus Formation.

5.0 ARTIFICIAL RECHARGE

5.1 Potential Sites. By selecting only those alluvial materials having both the highest soil infiltration rates and the least amount of clay in the subsurface, we have preliminarily selected the optimum potential sites along the river which appear amenable for artificial recharge by spreading basins. These areas lie along the Santa Clara River, easterly from Bouquet Junction. Future recovery wells will undoubtedly need to be located immediately downgradient from future spreading basins in the river in order to optimize the quality of the recaptured water.

These preliminary sites optimize general field conditions, but they must be field verified on a site-specific basis prior to initiating full-scale site development and basin design. Our text provides a phased-approach to the additional exploratory studies required.

To further enhance recharge in the area, the potential for natural percolation of surface runoff in the river should be maintained either by not lining future reaches of the river, or by providing holes in existing lined channels, or by utilizing holes in channels considered for lining in the future.

Direct injection of water into the alluvium by construction of numerous injection wells is not considered as readily feasible as is the construction of spreading basins. Furthermore, it is not considered feasible to construct dams to capture for recharge purposes the total of approximately 8200 ac-ft/yr of surface runoff from all

13 major watersheds that are tributary to the Santa Clara River.

5.2 Basin Effects. Potential benefits of maximizing groundwater in storage in the alluvium are: reduced pumping lifts and related costs; reduced chances for getting aerated/cascading water and of having to lower the pump bowls during periods of drought; reduced costs for future alluvial wells due to decreased total depths; possible dilution of degraded irrigation returns and sewage effluents; and reduced opportunity for deep percolation of sewage effluents and increased direct surface runoff of these waters from the basin.

The potential detriments of maximizing groundwater in storage in the alluvium are: increased loss of water via subsurface outflow to Ventura County; reduced storage capacity for natural recharge by infiltration of low-flow surface runoff; increased chance for contamination by accidental surface spills or leaks; reduced circulation of groundwater otherwise induced by pumping extractions; potential for increased areas of rising water and increased loss of water by evapotranspiration from these new areas and from already existing rising water areas; increased deep percolation of water to the Saugus Forma-tion due to increased heads in the alluvium; restricted use of arable lands by reducing the potential for leaching of salts; increased problems for structural foundations and for deep excavations; and increased chance for liquefaction in the sandy alluvium caused by seismic events.

5.3 Sources of Water. Sources of water for potential use in artificial spreading basins could include: storm water runoff; water in the river during low-flow conditions; water specially purchased from the State Water Project; and possibly even water from the wastewater

treatment plant near Bouquet Junction. Use of reclaimed water for recharge purposes will tend to increase the TDS in the alluvium; typical effluents will have a TDS of about 600 to 640 mg/l. Increasd use of State Project Water in the area will tend to reduce TDS in the alluvium because State water has a typical TDS of 220 to 440 mg/l.

Based on data developed for recoverable water from the 13 major tributary watersheds in the area, it does not appear feasible to consider constructing catchment facilities to capture runoff from these canyons for spreading in the river.

6.0 GROUNDWATER MANAGEMENT

6.1 Groundwater Production. Existing groundwater extraction data are incomplete and often contradictory. Furthermore, not all water purveyors meter their production for all individual wells. In addition, the number, locations, and production from privately-owned wells in the basin are not known.

To verify the perennial yield values established in this report, we recommend the following:

a. Each purveyor should carefully research and review its historic groundwater production from all wells; calculate and/or estimate its production from each well on a calendar year basis for the period 1957-58 to the present.

b. Continue to file accurate extractions for each well on a calendar year basis with the State.

6.2 Monitoring. To establish more complete groundwater data for the region, we recommend the following:

a. Accurately establish the locations of each well on USGS quadrangle maps.

b. Attempt to correlate individual drillers' logs with known well locations, with DWR numbers, and with LACFCD

numbers; we have considerable information on this to aid in this program.

c. Establish a permanent reference point on all wells from which future depth-to-water measurements can be taken; use a surveyor to obtain accurate elevations for these reference points.

d. Monitor water levels on a regular basis (once or twice per month); ensure that these are true static levels, not partial recovery levels.

e. When abandoning wells, make sure that accurate records are kept as to which well, its location, etc., and the methods used for abandonment.

f. Verify that active wells have State-approved sanitary seals; remove from active service those domestically-used wells which do not meet minimum sealing standards; consider abandonment of those wells with high perforations in the alluvium.

g. Conduct Edison efficiency tests on a regular basis in all wells.

h. Plot water level hydrographs and graphs of specific capacity vs. time for all wells; monitor water for inorganic and organic constituents on a regular basis.

i. Conduct a well canvass of the entire region to verify the existence, location, viability and usage of all municipal and private wells.

j. Establish a key well monitoring program for both alluvial and Saugus wells.

k. Because of the propensity of the alluvium to be easily contaminated, become cognizant of present and future land use in and along the alluvium; work with the RWQCB to recognize landfill problems, runoff from hazardous waste sites, and even migration of gasoline from leaky underground service station tanks. Such potential sources of contamination can also adversely affect the Saugus Formation especially where exposed at the surface. Locate all industrial dischargers on a map and determine the types and amounts of such discharges.

l. Coordinate, with the appropriate regulatory agencies, current and future planned programs for lining flood

control channels; maximize the potential for recharge in the river by allowing for percolation of low-flow runoff in future lining operation plans.

m. Current well spacing in existing alluvial wells is permissable due to the high T and P values in these sediments; future drill site selection, drilling methods, well design, and construction should consider local hydrogeologic conditions and should be conducted by a qualified hydrogeologist.

The attachments which complete this report are listed in the Table of Contents.

Respectfully submitted,

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Appendix 5.21M

Hydrogeologic Assessment of the Saugus Formation

Richard C. Slade

February 1988

VOLUME I — REPORT TEXT

HYDROGEOLOGIC ASSESSMENT

OF THE

SAUGUS FORMATION
in the
SANTA CLARA VALLEY
of
LOS ANGELES COUNTY, CALIFORNIA

FOR

CASTAIC LAKE WATER AGENCY

LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 36 — VAL VERDE

NEWHALL COUNTY WATER DISTRICT

SANTA CLARITA WATER COMPANY

VALENCIA WATER COMPANY

FEBRUARY 1988

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February 10, 1988

Mr. Robert Sagehorn, General Manager
Castaic Lake Water Agency
23560 Lyons Avenue, Suite 225
Newhall, California 91321

Job S8701

Subject: Executive Summary
Hydrogeologic Assessment of the
Saugus Formation in the Santa Clara
Valley of Los Angeles County, California

Dear Mr. Sagehorn:

I am pleased to present this Final Volume I report of our hydrogeologic investigation of the Saugus Formation which underlies a large portion of the Santa Clara Valley area of Los Angeles County, California. This study was undertaken to evaluate the Saugus Formation, specifically: local groundwater levels and water quality; its groundwater storage capacity; the thickness of water-bearing strata; and the gross feasibility of further groundwater development from the formation.

Work on this project included collecting and reviewing pertinent data from numerous sources, conducting limited aquifer testing, providing detailed hydrogeologic analyses of available and field-generated data, and writing and preparing this report of investigation. Documenting this report are figures and tables, and a list of references reviewed. A separately bound Volume II of this report, provided in two sections, contains all plates.

Principal conclusions and recommendations include:

1. Alluvial deposits and the Saugus Formation comprise the water-bearing sediments of the Eastern Groundwater Basin of Los Angeles County.

2. The maximum thickness of water-bearing Saugus deposits that contain fresh water varies from 1500 ft northerly of the San Gabriel fault, to 5000 ft southerly of the Holser fault, to 5500 ft in the area between the two faults.

3. Cumulative thickness of potentially usable aquifer sands available to future water wells varies from 400 ft maximum combined thickness northerly of the San Gabriel fault, to 1200 ft maximum cumulative thickness southerly of the Holser fault, to 1400 ft maximum cumulative thickness between the two faults. For these determinations, we have included only the potentially usable sand/gravel aquifers between the depths of 500 ft and: either the base of the Saugus Formation; or the base of fresh water in the Saugus Formation; or a maximum depth of 2500 ft, whichever is shallower.

4. Aquifer transmissivity ranges from 80,000 to 160,000 gpd/ft and is representative of potentially good aquifers. Storativity is low, representative of a confined aquifer system.

5. Recent groundwater level data are available only for the area southerly of the Holser fault; these data show a groundwater flow direction to the northwest. Recent 1987 piezometric surface elevations are 50 to 100 ft above those for 1967, a generally low water level period. The degree to which the two local faults have created barriers to groundwater flow in the Saugus Formation is unknown.

6. Saugus Formation groundwater generally is either of calcium-bicarbonate or calcium-magnesium-sulfate character. Future wells should have acceptable water quality, particularly those located nearer the central portions of the basin.

7. Numerous active and abandoned oil fields exist in the study area. Most petroleum production is from rocks older and stratigraphically below the Saugus Formation. Several oil fields have hydrocarbons and/or high groundwater salinities in at least the lower portion of the Saugus Formation.

8. Usable groundwater in storage is calculated to be approximately 1.41 million ac-ft, representing the volume of groundwater stored only in the potentially usable Saugus aquifers in the 500-foot to 2500-foot depth zone for this study.

9. Principal recharge sources to the Saugus Formation are: direct precipitation on exposed Saugus Formation and terrace deposit materials; and direct infiltration from overlying saturated alluvium within the Santa Clara River channel.

Combined potential recharge from these two sources may range between approximately 20,000 to 22,000 ac-ft/yr in wet periods and 11,000 to 13,000 ac-ft/yr in dry periods. These determinations provide a preliminary estimate of the maxium amount of recharge to the Saugus, and should not be construed as a rigorous determination of the perennial yield of the Saugus Formation.

10. Historically, only 22 wells are known to have been drilled sufficiently deep to produce groundwater from the Saugus Formation. During the historic period of record from 1954 through 1986, local purveyors (NCWD, combined NLF and VWC, and SCWC) have produced a total of approximately 154,000 ac-ft of Saugus Formation groundwater, virtually all from the area south of the Holser fault. Average production for the 33 years of available data has been about 4660 ac-ft/yr.

11. Of the 22 known Saugus Formation wells, 8 were actively producing in 1986. Combined 1986 Saugus Formation production by the local purveyors was 5532 ac-ft. Saugus production by private owners (ranches, industries, etc.) is considered negligible (less than a total of 100 ac-ft/yr).

12. It is hydrogeologically feasible to develop additional groundwater supplies from Saugus Formation aquifers. Production from properly sited and constructed future Saugus wells is not expected to adversely impact the overlying alluvium.

13. General priority locations for new wells are provided, but a detailed evaluation should be conducted prior to drilling on a site-by-site basis. New wells should be spaced at least 1000 ft apart.

New wells in the region southerly of the San Gabriel fault are anticipated to have an operational yield on the order of 1500 to 2000 gpm. Anticipated well depths in this region are between 1500 and 2500 ft. Wells located to the north of this fault will be shallower and will have lower yields.

14. Construction costs for a contractor to drill, case, develop, and test pump one new well on the order of 1500 ft in depth will likely be on the order of $250,000 to $300,000. Additional costs will be for: pumping and chlorination

equipment; electrical equipment and transmission lines; property and/or rights-of-way; and for necessary hydrogeologic services during construction.

15. Groundwater management recommendations are provided in order to establish a more complete groundwater data base for the region.

It has been a pleasure to have worked on this investigation with your agency and the other involved purveyors. This opportunity to have been of service is appreciated.

Very truly yours,

Richard C. Slade
Registered Professional Hydrogeologist

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NOTE: The above Plates are separately bound in Volume II. Volume II consists of two separately bound sections.

INTRODUCTION

GENERAL STATEMENT

Presented in this Volume I report are the findings, conclusions and recommendations of our assessment of the hydrogeologic conditions and the groundwater in storage within the sediments of the Saugus Formation which underlie the environs of the Santa Clara Valley in Los Angeles County, California. As depicted on Figure 1 - Location Map, the 208 square mile, rectangular-shaped base map area includes the entire mapped area of surface exposures of the Saugus Formation. This area extends approximately 16 miles in an east-west direction between Mint Canyon on the east and the Los Angeles-Ventura County line on the west, and approximately 13 miles in a north-south direction between Castaic Dam on the north and San Fernando Pass-Fremont Pass on the south. Situated within this main study area are the communities of Castaic, Canyon Country, Newhall, Saugus, and Valencia.

This Volume I report has been provided with a list of references which have been specifically reviewed and/or cited during the course of this study. Volume II, separately bound, presents the plates which accompany this report.

PURPOSE AND SCOPE

This hydrogeologic study has been undertaken to assess the hydrogeologic conditions within the Saugus Formation which underlies the Santa Clara Valley. Specifically addressed in this report are: anassessment of groundwater levels and water quality within these Saugus Formation sediments; a determination of their groundwater storage capacity; identification of the thickness of potentially water-bearing strata within the

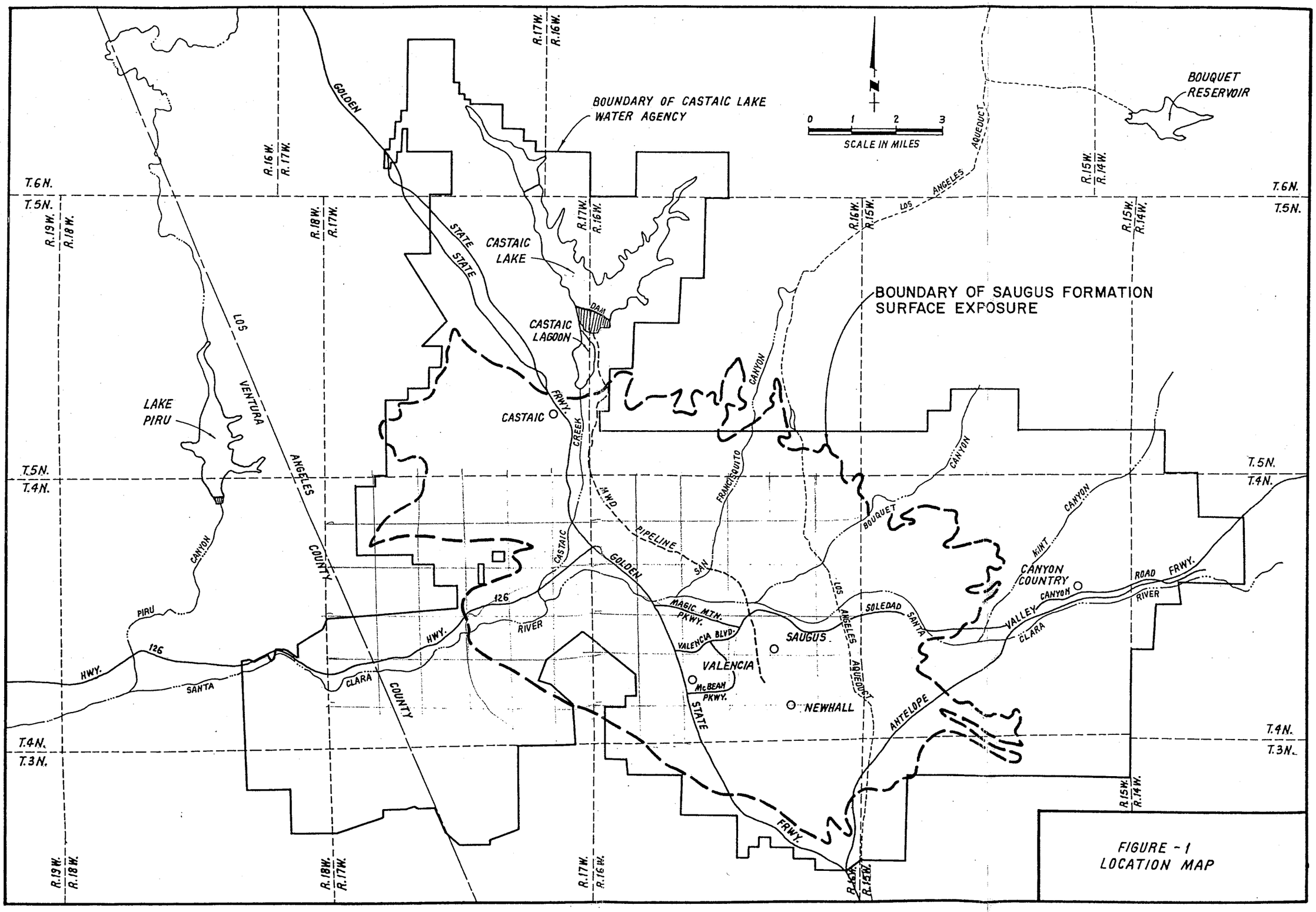


FIGURE - 1
LOCATION MAP

formation; and a determination of the gross feasibility of further groundwater development from these sediments.

This project has been conducted for: the Castaic Lake Water Agency, which has contracts with the State of California to purchase water from the State Water Project in order to wholesale it to the four retail purveyors in the area; and the four retail purveyors of domestic water, these being the Los Angeles County Waterworks District No. 36-Val Verde (LACWWD), the Newhall County Water District (NCWD); the Santa Clarita Water Company (SCWC); and the Valencia Water Company (VWC). The Newhall Land and Farming Company (NLF) is the largest agricultural user of groundwater in the region.

The scope of work for this study was outlined in nine separate tasks in our letter of proposal to Mr. Robert Sagehorn, General Manager, Castaic Lake Water Agency, dated January 26, 1987. This report represents the culmination of work on those nine tasks. A summary of the work tasks for the Saugus Formation study is as follows:

Task 1 - Acquisition of Basic Data
- A. Reports and Geologic Information
- B. Subsurface Data

Task 2 - Preliminary Data Analysis
- A. Surface Geology
- B. Subsurface Geology
- C. Existing Water Wells

Task 3 - Field Reconnaissance and Well Testing
- A. Field Reconnaissance
- B. Conduct Aquifer Tests
- C. Analyze Field Data
- D. Quantify Aquifer Characteristics

Task 4 - Detailed Electric Log Analysis
- A. Use oil well and water well E-logs
- B. Determine total footage of aquifer sands
- C. Provide contour maps of total aquifer thickness

D. Evaluate theoretical salinity from oil well electric logs

Task 5 - Detailed Hydrogeologic Analysis
- A. Evaluate specific capacity and aquifer transmissivity
- B. Identify groundwater flow directions and flow gradients
- C. Ascertain water quality and quality problems
- D. Evaluate relative tendency for corrosion or encrustation in wells
- E. Assess significance of faults on Saugus Formation aquifers

Task 6 - Assessment of Groundwater in Storage
- A. Assign specific yield values
- B. Provide estimates of total and usable groundwater in storage to 2500 feet in depth

Task 7 - Analyses and Reports
- A. Data Analyses
- B. Write and prepare report, with all graphics

Task 8 - Preliminary Well Site Selection
- A. Identify areas within the Saugus Formation for future test holes or wells
- B. Identify areas where wells are not feasible
- C. Provide preliminary design for wells
- D. Provide preliminary guidelines for construction methods

Task 9 - Meetings and Consultation
- A. Prepare for and attend meetings with the water purveyors

Analyses for this project relied on available background data, including reports and electric log data from wildcat oil wells and water wells, and data generated by field work conducted specifically for this project. No subsurface exploration or laboratory testing was conducted for this study. Reports specifically reviewed for this project are shown on the list of References Reviewed.

Field work consisted of conducting 24-hour, constant discharge aquifer tests in five different Saugus Formation wells. Both water level drawdown and recovery data were collected in these wells. These tests were performed between March 4 and April 3, 1987, and provided the basis for our assessment of the aquifer characteristics of transmissivity and storativity.

Throughout the remainder of this report, there will be numerous discussions of water wells in the region. The four retail purveyors in the area utilize wells drilled into the shallow alluvial aquifers and/or the underlying Saugus Formation to meet all or part of their domestic water requirements. Of these purveyors, the Los Angeles County Waterworks District No. 36-Val Verde and the Newhall County Water District are public agencies, while the Santa Clarita Water Company and the Valencia Water Company are privately-owned water companies. The main agricultural user of groundwater, The Newhall Land and Farming Company, is privately owned also. All of these purveyors, with the exception of the Waterworks District, have had one or more wells which produced or still produces groundwater from the Saugus Formation. The Peter Pitchess Honor Rancho (previous known as Wayside Honor Rancho) is a separate entity within the Waterworks District which has relied, and continues to rely upon wells completed only into the shallow alluvial aquifer system of the Santa Clara Valley area. Additional details of the Saugus Formation wells owned by the water purveyors are presented later in this text.

In addition to the aforementioned Saugus Formation wells, there may still exist a few wells historically drilled and/or operated by private landowners, ranches, industries, and/or commercial developments in the region. A determination

of the number, location, and current viability of these privately-owned Saugus Formation wells was not within the scope of work for this project. However, it is believed that the vast majority of pumpage from the Saugus Formation is by the retail purveyors and The Newhall Land and Farming Company. Any undocumented pumpage from the Saugus Formation is considered relatively insignificant (a combined total of 100 ac-ft/yr, or less).

Throughout this report and accompanying plates, the terms "wildcat oil wells" and "oil wells" are used interchangeably, for simplicity, with the more technically recognized term "exploration and development oil wells."

This report has been written for the Castaic Lake Water Agency and the four retail water purveyors and with specific application to the hydrogeologic assessment of the Saugus Formation aquifer system within the Santa Clara Valley. The report has been prepared in accordance with the care and skill generally exercised by reputable professionals, under similar circumstances, in this or similar localities. No other warranty, either expressed or implied, is made as to the professional advice presented herein.

AVAILABILITY OF BASIC DATA

Previous Studies. As noted in our recent hydrogeologic investigation of the local alluvial aquifer system (Slade, December 1986), the study area overlies numerous oil fields and there has been a long history of published and unpublished geologic reports and maps dealing with surface and subsurface geologic conditions in the hills and mountains surrounding the Santa Clara Valley. The earliest works date from the period 1902 to 1924 (importantly, Kew, 1924) and provided

the initial efforts at naming and mapping the surface exposures of the stratigraphic units and structure in the region.

With the discovery of larger oil fields between the late-1930's and the late-1940's, there was a renewed interest in the geology and the potential for additional petroleum development. Mapping by such workers as Bailey (1954) and Crowell (1954) added considerable detail to the known stratigraphy and to major structures such as the San Gabriel fault. Other particularly significant geologic reports include those by Winterer and Durham for the U. S. Geological Survey (1962) and by Oakeshott (1958) for the California Division of Mines and Geology. Adaptation of the geologic maps provided in these latter reports has permitted the preparation of Plate 3 - Hydrogeologic Map - in this report.

Most importantly, the limits of geologic exposures of the Saugus Formation as utilized on all plates in this report have been updated with the most recently published geologic data available for the area (principally, Nelligan, 1978; Stitt, 1980; Weber, 1982; Saul and Wootton, 1983; Smith, 1984; and Treiman, in press).

Considerable information is available to document much of the history of the oil field development in the greater Santa Clara Valley. The preponderance of these reports have been published by the California Division of Oil and Gas. From its Ventura office, the Division of Oil and Gas maintains comprehensive files on the well histories and geophysical electric logs for the innumerable wildcat and producing oil wells in the region. Electric log data from the repository were updated by review and collection of additional electric log data from local wildcat oil wells from the files of The Newhall Land and Farming Company.

Published hydrogeologic data for the study area and, especially, for the Saugus Formation, are particularly meager. With the exception of the prior efforts by the U. S. Geological Survey (1972) and by this investigator (Slade, July 1986), there have been essentially no previously published studies detailing aquifer characteristics, well testing, water level fluctuation or groundwater variations in Saugus Formation water wells in the region. Adding to the problem of a lack of existing hydrogeologic data for the Saugus Formation, is the fact that only about 22 water wells are known to have been drilled and completed into this formation. Information concerning these wells is provided throughout the balance of this report.

Water Well Logs. As shown on Plate 1 - Well Location Map - all known Saugus Formation water wells have been drilled southerly of one or both of the two faults which diagonally transect the study area. Subsurface data for the region of the Saugus Formation lying northerly of these faults results wholly from interpretation of electric logs of wildcat oil wells drilled in that area. Data concerning the known Saugus wells are summarized later in this report on Table 1 - Summary of Saugus Formation Well Data.

As noted by the special symbols used on Plate 1, geophysical electric logs exist for 11 of the 22 Saugus Formation water wells. None of these wells, however, has penetrated the entire thickness of the Saugus Formation; none is considered to have penetrated to the local base of fresh water either. The number, location, and viability of any privately-owned Saugus wells in the region are wholly unknown, with the lone exception being the limited information available for the "Smiser" well in Section 4 of T3N, R16W. It should be noted

that the locations shown for NC-1 through NC-6 are only approximate due to a lack of data for these wells.

Water Level and Water Quality Data. Long-term accumulations of water level and water quality data are not available for all of the Saugus wells in the region. In general, these data date from the late-1950's or the early-1960's. Virtually no data exist for the oldest known Saugus wells, that is, Newhall County Water District Nos. 1 through 6.

In addition, data gaps of from several months to a few years in duration exist for many of the available records. Scrutiny of the water level data occasionally reveals measurements which are anomalously low and which are considered not to be directly related to climatological fluctuations. Such anomalies are considered to relate to either monitoring error, the reporting of pumping levels or partial recovery levels instead of true static (non-pumping levels), or the monitoring of a water level in a well affected by mutual drawdown interference from another, nearby well.

For our assessment of water level and water quality, we have plotted hydrographs and graphs of total dissolved solids versus time for five Saugus wells, and have prepared water level contour maps for Summer-Fall 1967 and for March 1987. These graphs are discussed later in this report.

Groundwater Extraction Data. Historic groundwater extraction data on an annual basis have been collected from the Newhall County Water District, the Valencia Water Company, the Santa Clarita Water Company, and The Newhall Land and Farming Company. These data have been tabulated for each purveyor and, in addition, have been totalled and graphed versus time to assess any possible connection with long-term water levels and/or water quality in the Saugus Formation with time.

Oil Well Data. Because of the rarity of local water wells being completed inn the Saugus Formation, and to better understand the subsurface relationships within this areally extensive formation, we collected several hundred electric logs from exploration and development oil wells in the area. Data were obtained from the California Division of Oil & Gas and from The Newhall Land & Farming Co. Initial discussions on these data were provided in the letter-report prepared by this investigator for the Upper Santa Clara Water Committee (Slade, July 1986).

Agencies Contacted. Data repositories and persons contacted for Saugus Formation information during this investigation included the following:

1. Castaic Lake Water Agency: Mr. Robert Sagehorn. Data collected included numerous unpublished engineering reports for the area.

2. Newhall County Water District (NC): Messrs. Jim Jinks and Jean DiAngelous. Data provided included well logs, electric logs, historic and current water levels and water quality data, and groundwater extraction data for NC wells.

3. The Newhall Land & Farming Company (NLF): Mr. Dan Masnada. Data collected included well logs, electric logs, water level and water quality data, and groundwater extraction data for NLF wells. Access to the oil well data on file with this company was provided also.

4. Santa Clarita Water Company (SC): Messrs. William Manetta and Dennis Rolfe. Well data collected included well logs, water level and water quality data, well location information, and groundwater extraction data for their lone Saugus well.

5. Valencia Water Company (V): Mr. Richard Hackney. Well data collected included well logs and electric logs, historic and current water level and water quality data, well location information, and groundwater extraction data for their wells.

6. Los Angeles County Flood Control District: Mr. George Farag. Well logs historically drilled in the area, and historic water level data for Saugus Formation wells.

7. California Department of Water Resources: Mr. Ed Lowe. Data collected included historic water level and water quality data, and water well location maps.

8. California Division of Oil & Gas: office staff. Data collected included information on additional wildcat oil wells (electric logs), location of abandoned and active oil fields, wildcat well location maps, and reports published on the various oil fields in the region.

AREA OF INVESTIGATION

PROJECT LOCATION AND PHYSICAL FEATURES

Figure 1 - Location Map - shows that the rectangularly-shaped base map area includes approximately 208-square miles adjacent to the Santa Clara River in northwestern Los Angeles County. Representing the focus of this study is the Saugus Formation, a series of interbedded sandstone, siltstone, and claystone layers which are exposed within an approximate 53-square mile area in the hills surrounding the river valley, as seen on Figure 1.

Geomorphically, the study area is comprised by the broad flat valley of the Santa Clara River and the low-lying mountains which border the north and south sides of this river valley. Typical elevations along the river valley in the region range from about 1400 ft near Mint Canyon on the east to about 800 ft at County line on the west. The overall river gradient across the area is on the order of 0.008 ft/ft (about 42 feet per mile). Maximum elevations in the hills north of

the river valley are on the order of 2500 to 3000 ft. In contrast, maximum elevations to the south are typically 4000 ft in the San Gabriel Mountains (generally the area easterly of Interstate Highway 5), and 3000 ft in the Santa Susana Mountains (the area westerly of Interstate 5).

Principal communities in the study area include: Newhall and Valencia in the south-central region; Val Verde in the west; Castaic in the northwest; Saugus in the central portion; and Canyon Country in the east.

LAND USE

Land use in the area can be characterized as semi-urban, locally losing its rural atmosphere in recent years as urbanization and commercial/industrial development continue. The scenic and recreational values of the region continue to increase, both with usage along the unlined portions of the Santa Clara River with its sandy banks and local riparian habitats, and within the Castaic Lake area to the north.

Significant areas in the hillsides surrounding the Santa Clara River are dominated by oilfield activities. The oil resources and their development in the region are well documented in the literature, with the original oil wells dating back to the late-19th Century. Further discussions on the petroleum development in the area are in the Regional Geology section of this report. Among the other land uses that may impact local groundwater resources are: the various old and new industrial/manufacturing facilities; testing laboratories; abandoned and/or currently active landfills; agricultural areas; and unsewered regions. Additional details of the local land use (including a Land Use Map) are provided in Slade (December 1986).

CLIMATE

Characterizing the local climate is a semi-arid, Mediterranean-type climate that exhibits long, dry summers and relatively short, wet winters. Valley temperatures typically range from maximums of approximately 100°F in the summer to occasional minimums of approximately 30°F in the winter. Mean monthly temperatures range between approximately 77°F in the summer to 48°F in the winter.

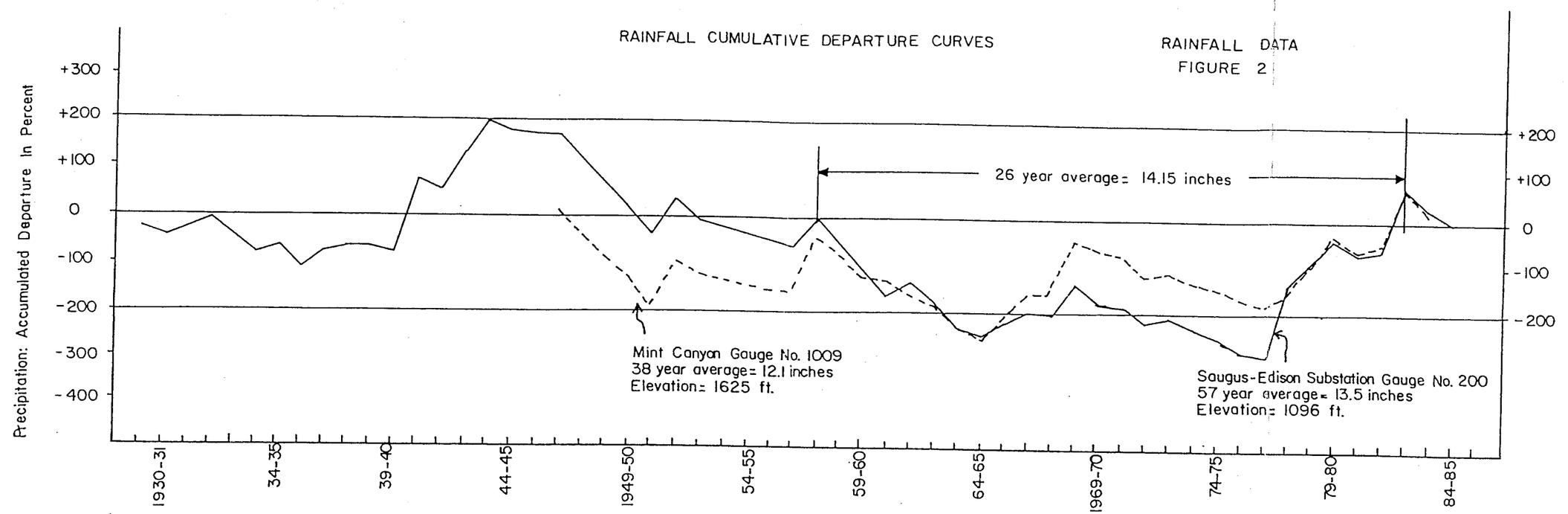
Figure 2 - Rainfall Data - presents a graph of annual precipitation for Los Angeles County Flood Control District Station No. 200 (elevation 1065 ft, near Castaic Junction) for the period 1928-29 through 1986-87; and graphs of the cumulative departure from the mean precipitation for that gage and for Station No. 1009 near Mint Canyon (elevation 1645 ft). Station No. 200 lies near the center of the outcrop area of the Saugus Formation while Station No. 1009 is located near the eastern boundary of this outcrop area.

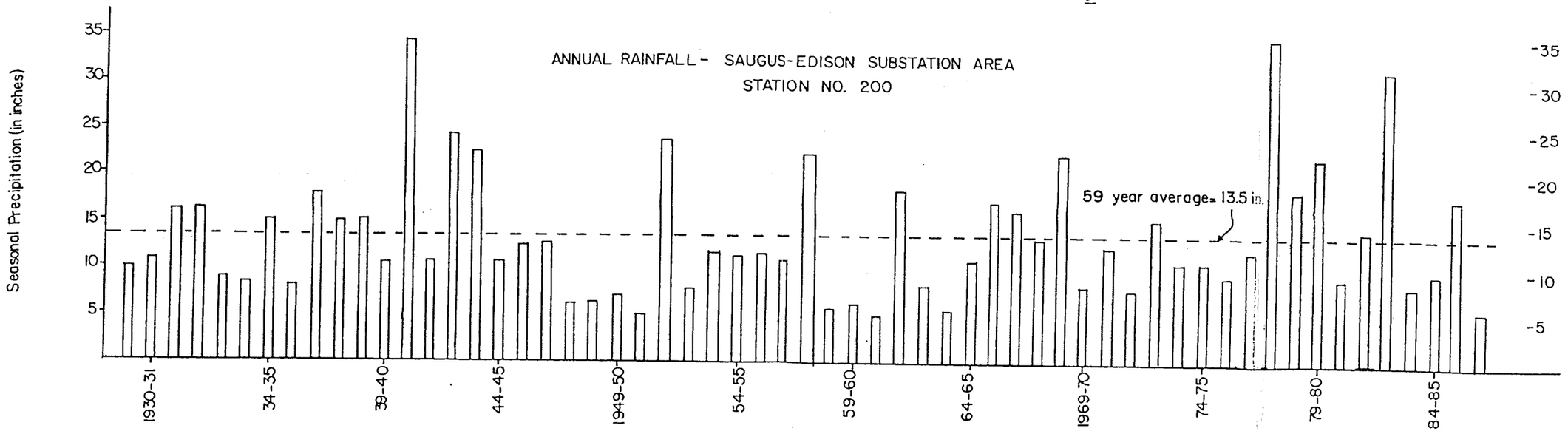
Average precipitation in the area for the entire Station No. 200 base period is 13.5 inches. Historic high and low rainfall at this gage have ranged between 34.77 inches in 1977-78 (34.43 inches was recorded in 1940-41) and 5.09 inches in 1960-61 (5.25 inches was recorded in 1950-51). Slightly lower averages and totals were recorded by Station No. 1009 during its base period which began in 1946-47. Approximately 80 percent of the average annual precipitation in the valley occurs between November and March. Most notable on Figure 2 is that annual precipitation does fluctuate widely from area to area and from year to year.

The slopes of the cumulative departure curves on Figure 2 also reveal pronounced periods of dry years followed by periods of wet years. No fixed cycle of precipitation is discernible on these graphs, however. For these departure

RAINFALL CUMULATIVE DEPARTURE CURVES

RAINFALL DATA
FIGURE 2





curves, a positive slope for the curves indicates above-normal rainfall, while a negative slope indicates below-normal precipitation, regardless of the position of the curve with respect to the ordinate representing the long-term mean (i.e., the zero percent cumulative departure).

For example, the period 1935-36 through 1943-44 on the cumulative departure curve for the Saugus-Edison gage is characterized by positive (upward to the right) slopes; this represents a hydrologically wet period which was characterized by an accumulation of years of average or above average precipitation.

In contrast, the period 1944-45 through 1964-65 on the curves for both rainfall stations displays a protracted, hydrologically dry period that was characterized by an accumulation of generally average or below average rainfall (a negative or downward-sloping curve). Since 1964-65, the curves for both rain gages reveal a generally upward trend up through 1983-84 and, hence, an overall period of excess precipitation.

The cumulative departure curves shown on Figure 2 were adapted directly from our previous report (Slade, December 1986) and are not updated. Any changes required to update these curves would be very slight and are not considered important to the present study. The histogram of annual rainfall at the Saugus-Edison Substation shown on Figure 2 has been updated to include data through the 1986-87 rainfall year.

DRAINAGE

Providing regional drainage across this portion of Los Angeles County, and continuing westerly across Ventura County to the Pacific Ocean, is the Santa Clara River. This river includes a watershed of several hundred square miles and has

its headwaters in Soledad Canyon in north-central Los Angeles County.

Principal tributaries draining in a southerly direction to their confluence with the Santa Clara River include, from east to west: Mint Canyon, Bouquet Canyon, San Francisquito Canyon, and Castaic Creek Canyon. Principal tributaries which drain in a northerly direction toward their confluence with the Santa Clara River include, from east to west: Oak Spring Canyon, Sand Canyon, and Potrero Canyon.

The South Fork of the Santa Clara River, which drains in a northerly direction toward its confluence with the main course of the Santa Clara River (just west of Bouquet Junction), has as its main tributaries: Placerita Creek Canyon; Newhall Creek Canyon; and Pico Canyon.

Because the headwater areas of these drainages do not extend into high mountainous areas, and because the local climates preclude the buildup of large snowpacks in the watersheds, flow in all the stream canyons is considered to be ephemeral only and, thus, diminishes rapidly after most rainfall events. Springs, areas of rising water, and even outflows from local wastewater treatment facilities tend to maintain flows even in the summer months in several locations along the Santa Clara River.

LOCAL WATER PURVEYORS

The study area lies within lands served by the Castaic Lake Water Agency. Domestic water purveyors located within the Agency boundary include Los Angeles County Waterworks District No. 36, Newhall County Water District, Santa Clarita Water Company, and the Valencia Water Company. Also included in the present study is The Newhall Land and Farming Company which also owns and operates numerous wells in the region to

supply water to meet their agricultural demands. Los Angeles County Waterworks District No. 36 and Newhall County Water District represent public agencies, while the Santa Clarita Water Company and the Valencia Water Company are privately owned.

Table 1 - Summary of Saugus Formation Water Wells - has been prepared to list all known Saugus Formation wells in the region that have been drilled for the above listed purveyors and The Newhall Land & Farming Company (NLF); the list includes one known, privately-owned and -drilled Saugus Formation well (Smiser well). As shown, there have been a total of 22 Saugus wells drilled historically in the study area, including: 12 by NCWD; 5 by NLF; 3 by VWC; one by SCWC; and one by a private owner. The locations of these wells are shown on Plate 1 - Well Location Map.

Notable on Plate 1 is that these 22 wells, with the exception of V-158, have all been drilled southerly of the surface traces of the two faults (San Gabriel and Holser faults) which traverse the study area. Well V-158 was drilled between the two faults. As a result, there are no actual hydrogeologic field test data available from any water wells for the Saugus Formation northerly of San Gabriel fault.

Of particular interest on Table 1 are the following:

a. Historically drilled Saugus wells have ranged in depth, where known, between approximately 370 ft and 2008 ft; most wells are in the general depth range of 1000 to 1500 ft.

b. Uppermost perforations for these wells begin at depths ranging between 29 ft and 950 ft.

c. Any well in the creek channels, as shown on Plate 1, in which perforations begin at a depth of approximately 200 ft or less, is considered to obtain groundwater from the alluvium as well as from the Saugus

TABLE 1 - SUMMARY OF SAUGUS FORMATION WATER WELLS

WELL OWNER	LOCAL NUMBER	STATE NUMBER (T/R-Section)	APPROX. SURFACE ELEV. ft	TOTAL DEPTH (ft)	DEPTH INTERVAL OF PERFORATIONS (ft)	TYPE OF PERFORATIONS	YEAR AND METHOD OF DRILLING	DEPTH OF CONCRETE SANITARY SEAL (ft)	APPROX. DEPTH SETTING TO TOP OF PUMP BOWLS (ft)	STATUS IN 1986	1986 GROUNDWATER PRODUCTION (ac-ft)
NC	1	3N/16W-2R	1365	Unknown	Unknown	Knife Cut	1944 Cable Tool	Unknown	160	Destroyed	-
NC	2	-11C	1395	Unknown	Unknown	Knife Cut	1940 Cable Tool	Unknown	160	Destroyed	-
NC	3	-11J?	1450	504	230-500 Interspersed	Knife Cut	1930 Cable Tool	Unknown	Unknown	Destroyed	-
NC	4	-11C	1385	570	134-567 Interspersed	Knife Cut	1947 Cable Tool	Unknown	Unknown	Destroyed	-
NC	5	-2B or 4N/16W-35Q	1270	610	135-550 Interspersed	Knife Cut	1948 Cable Tool	Unknown	170	Destroyed	-
NC	6	3N/16W-2L ?	1370	370	120-230, 330-360	Knife Cut	1949 Cable Tool	Unknown	300	Destroyed	-
✓ NC	7	4N/16W-35L1	1252	994	520-974 Interspersed	Knife Cut	1954 Cable Tool	No Cement	261	Active	275.9
✓ NC	8	-35M2	1237	984	342-970 Interspersed	Knife Cut	1954 Cable Tool	No Cement	280	Active	225.3
✓ NC	9	3N/16W-2R2	1352	675	280-591	Louvers	1957 Rotary	81	230	Active Standby Use	116.5
NC	10	4N/16W-34A3	1205	1555	780-1544	Louvers	1961 Rotary	98	320	Active	740.7
NC	11	-27J3	1195	1136	200-1075	Louvers	1973 Rev.Rotary	150	340	Active	2237.0
✓ NC	12	-34R4	1210	1340	485-1280	Louvers	1985 Rev.Rotary	420	No Pump	Inactive	0
NLF	154	4N/16W-27H5	1187	1129	29-1003 Interspersed	Louvers	1960 Rotary	Unknown	270	Destroyed (1982-83)	-
NLF	155	-27R2	1190	1515	108-1468 Interspersed	Louvers	1960 Rotary	Unknown	240	Destroyed (1978-79)	-
✓ NLF	156	4N/17W-13J1	1053	1805	320-1800 Interspersed	Vertical Slots	1961 Rotary	15	210	Active	20 (est.)
NLF	159	4N/16W-33L1	1290	1950	662-1900	Louvers	1962 Rotary	Unknown	500	Inactive	0
NLF	P-2	3N/16W-3D	1245	1300	450-1290	*	1958	Unknown	500	Destroyed (1967)	-
✓ V	157	4N/16W-22M1	1150	2008	586-2008	Vertical Slots	1962 Rotary	15	220	Active	779.9
V	158	-17J1	1098	1608	740-1605	Vertical Slots	1962 Rotary	15	-	Destroyed (1984-85)	-
✓ V	160	-21D1	1099	2000	950-2000	Louvers	1964 Rotary	65	200	Active	1137.4
SC	Lombardi (23)	3N/16W-4R2	1280	1150	260-1130	Unknown	Before 1966 Unknown	Unknown	-	Destroyed (1982)	-
PRIVATE	SMISER	3N/16W-4	1300	1000	Unknown	Unknown	1978 Rotary	Unknown	Unknown	Active	Unknown (likely small)

NOTES: NC = Newhall County Water District
NLF = Newhall Land and Farming Company
SC = Santa Clarita Water Company
V = Valencia

* Knife cut and vertical slots; drilled by cable and rotary

Formation. This would include NC-4, NC-5, NC-6, possibly NC-11, NLF-154,, and NLF-155; there are no perforation data available for NC-1 and NC-2, or for the Smiser well.

d. The deepest perforations in any of the Saugus wells end at a depth of 2008 ft; many wells have perforations ending in the 1000- to 1800-ft depth range.

e. The older Saugus wells (pre-1960) were drilled by the cable tool method and are provided with hydraulically-cut (knife-cut) perforations; a few wells (NLF P-2, V-157, and V-158) have vertical slot perforations; the remaining wells have been drilled by direct rotary drilling methods and are provided with louvered perforations.

f. Though data are limited, most wells have little or no concrete sanitary seal; State laws for domestic water wells require a minimum of a 50-foot deep seal. NC-11 and NC-12, the two newest wells in the group (drilled in 1973 and 1985, respectively) were provided with 150- and 420-foot long cement seals.

g. Of the 22 known wells, 11 are known to be totally destroyed, 8 are active pumpers owned by the purveyors, one is on active/standby use only (NC-9), one has yet to be furnished with a permanent pump (NC-12), and one is inactive (NLF-159). The private Smiser well is considered to be active but its production is likely small.

Table 2 - Historic Saugus Formation Groundwater Production - has been prepared to document all known historic Saugus Formation water well extractions. Data on Table 2 are presented as annual totals for each of the purveyors, by well number. It should be noted that no production data are available at all for NC-1 through NC-6, or for the Smiser well; historic pumpage from these wells and any other private Saugus Formation wells that may exist is considered to be relatively insignificant (a combined total of 100 ac-ft/yr, or less).

Notable from Table 2 data are the following:

CALENDAR YEAR	NEWHALL COUNTY WATER DISTRICT WELLS						
	No.7	No.8	No.9	No.10	No.11	No.12	NCW SUBTO
	Drl.1954	Drl.1954					
1954	275	275					55
1955	297	297					59
1956	323	323	Drl.1957				64
1957	278	278	139				69
1958	280	165	182				62
1959	314 est	245 est	160 est				720
1960	352	326	141	Drl.1961			81
1961	302	201	68	412			98
1962	159	27	16	936			113
1963	244	80	25	812			116
1964	339	198	37	857			143
1965	220	210	90	1071			159
1966	229	234	47	1091			160
1967	216	401	122	815			[illegible]
1968	288	420	196	992			[illegible]
1969	413	414	221	760			180
1970	312	410	328	1060			211
1971	373	317	292	1105			208
1972	323	373	246	1228			217
1973	366	369	299	843	Drl.1973		187
1974	354	431	237	912	30		196
1975	352	372	70	1004	187		198
1976	332	382	0	634	738		208
1977	307	467	184	750	170		187
1978	287	402	9	826	300		182
1979	451	613	0	602	658		232
1980	417	455	0	814	753		243
1981	396	449	0	905	869		261
1982	350	319	0	1286	715		267
1983	310	342	0	1155	670		247
1984	355	317	120	1006	1157		295
1985	330	311	192	816	1783	Drl.1985	343
1986	276	225	116	741	2237	0	

NOTE: Production records do not exist or are unavailable for NCWD Nos. 1
these wells were generally small producers and were placed on inact
status by the early-1960's. Dates of destruction for these wells a

TABLE 2 - HISTORIC SAUGUS FORMATION GROUNDWATER PRODUCTION, IN ACRE FEE

		THE NEWHALL LAND & FARMING CO. and VALENCIA WATER CO.						
o.12	NCWD SUBTOTAL	No.154	No.155	No.156	No.157	No.158	No.159	No.16
	550							
	594							
	646							
	695							
	627							
	720 est.	Drl.1960	Drl.1960					
	819	903	821					
	983	882	940	Drl.1961	Drl.1962			
	1138	721	528	134	749	Drl.1962	Drl.1962	
	1161	621	538	200	982	126	805	Drl.19
	1431	700	951	217	1565	244	1041	135
	1591	743	936	80	1379	97	594	830
	1601	1092	1787	115	1281	304	634	536
	1554	287	1111	173	1236	91	515	967
	1896	523	910	179	864	159	484	1679
	1808	1132	863	167	828	315	621	1969
	2110	961	0	268	0	354	523	2211
	2087	816	0	133	1029	131	462	1125
	2170	1200	0	117	2188	0	352	1772
	1877	75	0	9	1776	96	20	1853
	1964	82	0	0	2001	74	20	1853
	1985	799	0	0	1852	0	0	1826
	2086	480 est	0	0	1612	0	0	1800
	1878	164	0	20	683	0	0	1265
	1824	0	Dest.	20	1755	0	0	1270
	2324	0	-	20	722	213	0	1702
	2439	0	-	20	635	47	0	1572
	2619	0	-	25	552	200	0	1577
	2670	Dest.	-	20	824	0	0	574
	2477	-	-	20	409	0	0	636
	2955	-	-	20	668	0	0	806
.1985	3432	-	-	20	511	Dest.	0	929
0	3595	-	-	20	780	-	0	1137

NCWD Nos. 1 through 6;
ced on inactive
nese wells are unknown.

:RE FEET

ER CO. WELLS			SANTA CLARITA WATER COMPANY WELL	TOTAL YEARLY PRODUCTION FROM SAUGUS FM.
No.160	P-2	NLF & VWC SUBTOTAL	LOMBARDI (23)	
				550
				594
				646
	Drl.1958		Drilling date unknown	695
	100	100		727
	140	140		860 est.
	0	1724		2543
	0	1822	No	2805
	0	2132	Data	3270
Drl.1964	0	3272		4433
135	0	4853		6284
830	0	4659	0	6250
536	0	5749	200	7550
967	Dest.	4380	395	6329
1679	-	4798	395 est.	7089 est.
1969	-	5895	393	8096
2211	-	4317	691	7118
1125	-	3696	640	6423
1772	-	5629	509	8308
1853	-	3829	529	6235
1853	-	4030	569	6563
1826	-	4477	662	7124
1800	-	3892	585	6563 est.
1265	-	2132	583	4593
1270	-	3025	153	5002
1702	-	2657	0	4981
1572	-	2274	0	4713
1577	-	2354	0	4973
574	-	1418	Destroyed	4088
636	-	1065	-	3542
806	-	1494	-	4449
929	-	1460	-	4892
1137	-	1937	-	5532

a. Available Saugus Formation production records date from 1954.

b. Historic annual production from the Saugus wells has ranged from a low of 550 ac-ft in 1954 to a high of 8308 ac-ft in 1972.

c. Early extractions, prior to 1960, did not exceed 1000 ac-ft/year, but since that time, production volumes have ranged between approximately 2500 ac-ft/yr and 8300 ac-ft/yr.

d. During the period of record (1954 to 1986), a total of 153,820 ac-ft of groundwater have been extracted from water wells in the Saugus Formation. Approximately 38 percent of this total has been produced by NCWD. Combined production from VWC and NLF represents approximately 58 percent of this total volume while the remaining 4 percent was produced by the now-destroyed SCWC-Lombardi well (well 23).

e. Because it is not possible to deduct production volumes from the alluvial portions of the Saugus wells on Table 1 (wells with perforations above approximately 200 ft in depth produce from both the alluvium and the Saugus Formation), we are considering that all production volumes shown on Table 2 to be from the Saugus Formation only.

To illustrate the spatial variability of recent groundwater production from the Saugus Formation, we have prepared Plate 2 - Map of Groundwater Production for 1986. The locations, owners and well numbers for each of the eight Saugus wells that were actively producing groundwater in 1986 are shown on Plate 2, together with their respective production in ac-ft for that year; though likely active in 1986, production data for the privately-owned Smiser well are not available. Total production for 1986 was 5532 ac-ft, and was comprised by 3595 ac-ft from NCWD, and 1937 ac-ft from the combined production from NLF and VWC (see also Tables 1 and 2).

The largest producers in 1986 included NC-11 (2237 ac-ft) which is located along the South Fork of the Santa Clara River, and V-160 (1137 ac-ft) which lies along the south side of the Santa Clara River Valley, approximately one-half mile east of Interstate 5. As noted on Plate 2, there was no Saugus production in 1986 by any wells north of the Holser and San Gabriel faults.

GROUNDWATER BASIN BOUNDARIES

As discussed in detail in Slade (December 1986), the California Department of Water Resources (1980) has established the names and boundary locations for the various groundwater basins along the course of the Santa Clara Valley in both Los Angeles and Ventura Counties. Typical basin boundaries were selected on the basis of such features as faults, groundwater divides, and exposures of bedrock in the hills. Where none of these types of features existed, arbitrary or even political divides were selected as local groundwater basin boundaries.

Based on Department of Water Resources work, the areal extent of the Saugus Formation, which comprises the focus of this investigation, together with the alluvial sediments along the river and major tributaries were placed within the Eastern Groundwater Basin of the Santa Clara River Valley Basin of Los Angeles County. The current mapped exposure limits of the Saugus Formation as shown on Plate 1 differ slightly from those developed by DWR (1980) but have been compiled from more recent and more detailed geologic field mapping by others. In essence, the mapped limits of the Saugus Formation shown on the plates in this report form the northern and southern boundaries of the Eastern Groundwater Basin. Eastern and

western boundaries of this basin extend beyond the mapped limits of the Saugus Formation, but only where the groundwater basin consists solely of alluvium.

Also included within this groundwater basin are the alluvial deposits which lie along the Santa Clara River and its major tributaries, and the thin terrace deposits which mantle the flatter ridges on the hills adjoining the various creek channels. These sediments are underlain by the Saugus Formation in much of the region. The exposures of the alluvium (Qal) and the terrace deposits (Qt) in the area are shown on Plate 3 - Hydrogeology Map. Details of the hydrogeologic conditions of these alluvial sediments in the Santa Clara River Valley are presented in a recent report by this investigator (Slade, December 1986). The total surface of the mapped exposures of the Saugus Formation, terrace deposits and alluvium shown on our base maps is 85.56 square miles. Of this amount, alluvium comprises 27.14 sq. mi., terrace deposits have 5.61 sq. mi., while the remaining 52.81 sq. mi. represent exposures of the Saugus Formation.

REGIONAL GEOLOGY

GENERAL STATEMENT

The Eastern Groundwater Basin is part of the eastern Ventura depositional basin, an east-west trending, elongated structural trough which extends from the Santa Clara Valley westward to the Pacific Ocean. With few exceptions, associated geologic structures within the Ventura depositional basin (anticlinal and synclinal folds as well as faults) also trend generally east-west. The eastern part of the Ventura basin, in which the study area is located, is transected by the

northwest-trending San Gabriel fault, a major structural feature that is part of the San Andreas system of right-lateral faults.

Approximately 30,000 feet of marine and continental (non-marine) sediments have been deposited in this portion of the Ventura basin during the past 50 million years. The Eastern Groundwater Basin, the focus of this study, is composed primarily of the continental, water-bearing Saugus Formation deposits. Saugus Formation deposits attain a maximum thickness of approximately 8500 feet in the region, this occurring near the center of the basin.

The fresh water-bearing deposits in the Eastern Groundwater Basin include: unconsolidated sediments (sands, gravels, silts, and clays) constituting the alluvium of present-day alluvial fans, river channels and creeks; and the underlying, partially consolidated sedimentary rocks (sandstones, conglomerates, siltstones, and shales) comprising the older stream-terrace deposits and strata within the Saugus and Upper Pico Formations. Deposition of the freshwater-bearing sediments began in the late Pliocene epoch (about 3 million years ago) and has continued, for the most part, to the present.

The hydrogeology of the unconsolidated alluvial deposits in the Eastern Groundwater Basin is discussed in a report prepared previously by this office (Slade, December 1986) for the Upper Santa Clara Water Committee. The present investigation (this report) focuses on the hydrogeology of the Saugus Formation which attains an approximate maximum thickness of 8500 feet in the central part of the Eastern Groundwater Basin; of this amount, only the upper 5500 ft are considered to be fresh water-bearing.

STRUCTURAL GEOLOGY

Introduction. The Eastern Groundwater Basin is transected by two major faults, the Holser fault and the San Gabriel fault. The surface traces of these structures are shown on the Hydrogeology Map - Plate 3. Both faults have had a significant impact on the present thickness and continuity of the fresh water-bearing deposits and, in particular, deposits constituting the Saugus Formation.

The location of faults shown on most maps contained in this report represent the surface traces of these faults. Exceptions to this are found later in this report on Plates 5, 6, and 9. These three exceptions generally show the locations of the faults at depth where they intersect the base of the Saugus Formation; these locations differ from the surface traces because the fault planes are not vertical. The surface trace of the western segment of the Holser fault, in the area where the Saugus Formation (map symbol QTs) north of the fault has been offset and juxtaposed in surface outcrops against the Pico Formation (map symbol Tp), south of the fault, is shown on all of the maps in this report. The selection of fault traces, as shown on each individual map (surface traces vs. subsurface traces), was made for the purpose of increasing the usefulness of depth-dependent data relative to the locations of the faults at depth, as well as other considerations.

Holser Fault. The Holser fault is primarily an east-west trending, south-dipping reverse fault where strata south of the fault have been displaced upward relative to the strata north of the fault. The surface trace of the fault, shown on Plate 3, extends from San Martinez Chiquito Canyon eastward to the San Gabriel fault east of Saugus. It is likely that a significant left-lateral component of movement has also occurred such that strata north of the fault have been displaced

westward relative to strata south of the fault. Taking into account both the vertical and horizontal components of movement, the Holser fault is best described as a left-lateral reverse fault. The dip of the plane of the fault (inclination downward from the horizontal) is to the south and varies between 45 degrees and 70 degrees, more commonly from 60 to 70 degrees.

Data from oil wells near the western boundary of the study area indicate that correlative rocks of Pliocene age have been offset vertically approximately 5000 feet across the Holser fault. It is evident from the Hydrogeology Map that Saugus strata north of the fault have been juxtaposed against older strata of the Pico Formation south of the fault. The amount of vertical offset of the base of the Saugus Formation in the vicinity of San Martinez Chiquito Canyon is on the order of 4000 feet; over 3100 feet of vertical offset of the base of the Saugus Formation can be inferred from Hydrogeologic Section C-C' - Plate 4. Some of this offset is due to the left-lateral component of movement along the fault. The amount of left-lateral offset of the base of the Saugus Formation, apparent on Plate 3, is about four miles. A comprehensive analysis of the movement history along the Holser fault (or any fault) must take into consideration many geologic as well as geometric factors and is beyond the scope of this report.

The surface trace of the Holser fault has been mapped throughout the region on the basis of its surface expressions (Winterer and Durham, 1962; Nelligan, 1978; and Weber, 1982). Weber's work suggests that the Holser fault comprises a zone of several subparallel faults that project to the ground surface along the general trend of the Santa Clara River in the vicinity of Castaic Junction. The location of the Holser

fault in the subsurface is based on data from exploration and development oil wells (Driggs and Sampson, 1951; Winterer and Durham, 1962; Lande, 1964; Nelligan, 1978; and Hill, unpublished, 1984-87). For simplicity, we have mapped the Holser fault as a single strand through the central portion of the Santa Clara basin.

In the western part of the Santa Clara basin, the area where strata of the Saugus Formation north of the fault have been juxtaposed against strata of the Pico Formation south of the fault, the Holser fault undoubtedly forms an effective groundwater barrier at depth. As indicated on Hydrogeologic Section C-C', the difference in elevation of the base of the fresh-water-bearing deposits on opposite sides of the fault may be as much as 1800 feet.

Farther east, in the central part of the basin, where Saugus strata have been juxtaposed against similar Saugus strata across the Holser fault, the fault does not appear to be a significant groundwater barrier. Our opinion is based on the apparent continuity of the fresh water-bearing deposits and, in particular, the continuity of the base of the fresh water-bearing deposits as interpreted from exploration and development oil wells near the fault. Our interpretation is shown on Hydrogeologic Sections D-D' and E-E' - Plate 4, and on Plate 5 - Thickness of Fresh Water-Bearing Deposits.

San Gabriel Fault. The San Gabriel fault is a northwest-trending, steeply-dipping fault in the San Andreas system of right-lateral strike-slip faults. The history of movement along the fault is complex, both in regard to the timing and sense (horizontal vs. vertical) of movement. The surface trace of the fault as shown on Plate 3, trends northwesterly across the central portion of the study area, bisecting the Santa Clara basin. Work by numerous investigators (such as

Crowell, 1954; Oakeshott, 1958; Nelligan, 1978; Schlaefer, 1978; Stitt, 1980; Weber, 1982; Saul and Wootton, 1983; and Ehlig, 1986) reveal that this major structure consists of a series of steeply northeast-dipping faults with primarily right-lateral movement; rocks on the northerly side of the fault have been displaced to the southeast relative to rocks on the southerly side of the fault. Also, rocks on the northerly side of the fault have generally been uplifted relative to rocks on the southerly side of the fault.

As shown on Hydrogeologic Sections D-D', E-E', and F-F', the base of the Saugus Formation northeast of the fault has been uplifted as much as 100 feet to 2600 feet locally relative to the base of the Saugus southwest of the fault. The San Gabriel fault has been mapped through the region because of such strong topographic and geologic expressions as: the fault alignment is very apparent on aerial photographs; it has displaced geologic formations (including the Saugus Formation); it has offset drainage patterns; and it has induced folding in many rock units. Control on the subsurface location of the fault is well documented by data from local oil wells.

Recent work by Ehlig (1986), which includes details of geologic logging of exploratory trenches across the fault, has also corroborated the fact that the fault is a zone of faulting, ranging from a single plane with only minor development of fault gouge, to a zone as much as a half-mile wide containing numerous faults, complex folds and intense shearing and brecciation. This fault is also considered to create at least a partial barrier to groundwater flow as will be discussed later in this text.

Other recent work by Cotton (1986), Kahle (in press), Treiman (in progress) and Weber (in progress), document that

the San Gabriel fault has experienced Holocene activity (within the past 10,000 to 11,000 years) although the cause of this activity is still being debated in the geologic community. Reportedly, the fault had its origins during the Middle Miocene epoch (about 15 million years ago) and, since that time, had induced right-lateral offsets in the rocks as great as 40 miles; its overall estimated mapped length is 80 miles.

Several other faults that cut the Saugus Formation have been mapped by previous workers (Winterer and Durham, 1962; Nelligan, 1978; Stitt, 1980; Weber, 1982; Saul and Wootton, 1983; and Smith, 1984). These structures are not shown on Plate 3 because we do not believe that they have a significant impact on the hydrogeologic characteristics of the Saugus Formation. It is not considered prudent, however, to locate a water well on the trace of a known fault as the hydrogeologic characteristics of the rocks may be affected by the fault, locally.

Folds. Several major anticlinal folds (upwarping of strata) and synclinal folds (downwarping of strata) have affected the Saugus Formation as well as older rocks in the Eastern Groundwater Basin. The axes of a few of the more principal of these folds are shown on the Hydrogeologic Map. These locations are based on previous surface and subsurface geological mapping by others (Winterer and Durham, 1962; Nelligan, 1978; Schlaefer, 1978; Stitt, 1980; Weber, 1982; Saul and Wootton, 1983; and Smith, 1984) and on our subsurface mapping of the base of the Saugus Formation.

The axes of major fold structures in the Eastern Groundwater Basin generally trend east-west to northwesterly and plunge toward the central portion of the basin as indicated by the arrows on the fold axes shown on Plate 3. The

plunge of a fold is the inclination of the fold axis (the crest of the fold) downward from the horizontal.

In the northeastern part of the basin, the area northeast of the San Gabriel fault, there are at least three major synclines and two major anticlines, all of which plunge in a westerly direction toward the San Gabriel fault. Both the total thickness of the Saugus Formation and the thickness of fresh water-bearing deposits within the Saugus are affected by these folds, as illustrated on Hydrogeologic Sections B-B', E-E', and F-F'. The greatest thickness attained by the Saugus Formation northeast of the San Gabriel fault (approximately 2000 feet) occurs adjacent to the fault and along the synclinal axes (see Plates 3 and 5). The fresh water-bearing deposits of the Saugus Formation attain a maximum thickness of approximately 1500 feet in the area northeast of the San Gabriel fault.

In the central part of the Eastern Groundwater Basin, the area north of the Holser fault and west of the San Gabriel fault, the thickest Saugus strata lie along the axis of a southeasterly-plunging syncline north of and parallel to Hasley Canyon. The syncline turns abruptly to the northeast south of Villa Canyon. Near its eastern terminus, the syncline merges with a southeasterly-plunging synclinal trough that trends through the Castaic Junction area paralleling Interstate Highway 5 and the San Gabriel fault. This synclinal trough coincides with the deepest part of the Eastern Groundwater Basin; the Saugus Formation in this area attains a thickness of about 8500 ft. The fresh water-bearing deposits comprising the upper part of the Saugus in this area attain a maximum thickness of approximately 5500 feet as indicated on the map showing thickness of fresh water-bearing deposits (Plate 5). The southeasterly-plunging anticline whose axis

lies south of and parallel to Hasley Canyon is another major structural feature in the area. Beds in the south flank of this structure dip beneath the south-dipping Holser fault as shown on Hydrogeologic Section C-C'.

The major folds in the southwestern portion of the Eastern Groundwater Basin, the area south of the Holser fault and southwest of the San Gabriel fault, include two synclines shown on Plate 3. These structures generally define a broad northwest-plunging trough with its axis oriented parallel to the San Gabriel fault. This trough is shown on Hydrogeologic Sections E-E' and F-F'. In the area immediately south of the Holser fault, the complete Saugus Formation along the axis of the trough attains a maximum thickness of about 7500 feet. The fresh water-bearing deposits comprising the upper Saugus strata in this area attain a maximum thickness of about 5000 feet as shown on Plate 5. Thus, the lower 2500 feet of Saugus strata in this area (i.e., between depths of 5000 and 7500 ft) contain groundwater of unacceptable quality.

The impact of the major fold structures on the hydrogeologic characteristics of the Saugus Formation are considered insignificant except for local areas. For example, the elevation of the base of the Saugus Formation along the crest of an anticlinal fold may be such that a deep well at a specific location would penetrate the base of the Saugus at relatively shallow depths as compared to wells located along the axes of adjacent synclinal folds. Hydrogeologic Section C-C' illustrates this example.

Locally, such as along the southwestern margin of the study area and adjacent to the San Gabriel fault, the Saugus beds are steeply-dipping (as much as 70 degrees or higher) as

a result of folding and faulting. Depending on the hydrogeologic characteristics of the Saugus strata in such areas, the lateral movement of groundwater might be affected.

SAUGUS FORMATION

Previous Work. Hershey (1902) recognized non-marine rocks near the town of Saugus which he referred to as the "Saugus division" of the late Pliocene series. Eldrige and Arnold (1907) included these rocks in their Fernando Formation. Kew (1924) divided the Fernando of Eldridge and Arnold (1907) into the early Pliocene Pico Formation and the late Pliocene Saugus Formation. Winterer and Durham (1962) characterized the Saugus of the eastern Ventura depositional basin as including a lower shallow-marine to brackish water member (Sunshine Ranch) and an upper unnamed non-marine member. Oakeshott (1958) had earlier included the Sunshine Ranch as the upper member of his Pico Formation. The nomenclature of Winterer and Durham (1962) is applied to the Saugus Formation for the purpose of this study.

A considerable effort was made during this investigation to define the basal contact of the Saugus Formation in a manner that is consistent throughout the area and to determine the stratigraphic relationship between the Saugus and underlying Pico Formation. Our conclusions are: (1) that the stratigraphic relationship between these formations is not the same throughout the study area; and (2) the distinctions are important in understanding the hydrogeology of the basin.

In order to define the areal extent of the Saugus Formation in the study area, we relied primarily on previous surface geological mapping by Oakeshott (1958), Winterer and Durham (1962), Nelligan (1978), Stitt (1980), Saul and Wootton (1983), and Smith (1984). To define the base of the Saugus

Formation in the subsurface, we relied primarily on our own interpretation and correlation of approximately 200 electric logs and various other data from exploration and development oil wells, and water wells as well as on previous geological investigations by Winterer and Durham (1962), Nelligan (1978), Schlaefer (1978), and Stitt (1980). The total number of electric logs used to define the base of the Saugus Formation (including logs in reports by others) is approximately 800.

Environment of Deposition. Underlying Holocene alluvium (map symbol Qal) and/or terrace deposits (map symbol Qt) in the study area is the Saugus Formation of late Pliocene-early Pleistocene geologic age. As reported by most previous investigators, the Saugus Formation is considered to be primarily of continental (non-marine) origin, having been deposited as channel, floodplain, and lacustrine (lake) sediments and as alluvial fan materials by local ancestral rivers and creeks. Because of their primarily continental mode of origin, Saugus strata, with rare exception, tend to lack definitive fossils. Near its base, the Saugus Formation is reported to contain shallow-water marine fossils locally.

Review of historic and recent literature regarding the Saugus Formation reveals significant disagreement among previous workers regarding the placement of the base of the formation; i.e., principally in regard to its contact with the underlying Pico Formation. The disagreements result from such factors as the similarity in sediment characteristics in the lower Saugus-upper Pico beds, the absence of definitive index fossils in sediments near the contact, and rapid lateral and vertical changes (facies changes) in upper Pico and lower Saugus strata.

Some previous investigators consider the lower portion of the Saugus Formation to be composed of interfingering shal-

low-water marine to brackish water marine deposits. The interfingering nature of these deposits may have resulted from changes in climate, tectonic uplift and subsidence, and/or minor fluctuations in sea level which caused the sea to alternately transgress and regress upon the surrounding land surface. These deposits are interpreted to grade vertically upward to continental (non-marine) deposits, and downward as well as westerly into deep-water marine strata of the Pico Formation.

The shallow-water marine to brackish water facies of the Saugus is designated the Sunshine Ranch member (the lowermost member) of the Saugus Formation. Some previous workers have chosen to include the Sunshine Ranch member in the upper part of the Pico Formation, but this assignment is generally not followed today. For the purpose of this study, the Sunshine Ranch member comprises the shallow-water marine to brackish water deposits, as well as non-marine deposits, within the lower portion of the Saugus Formation. Due to the gradational and interfingering relationship of the lower Saugus and upper Pico strata, the contact between these formations has been defined and mapped somewhat arbitrarily in the field by previous workers. Such a contact is difficult if not impossible to distinguish on the basis of electric logs of oil wells, especially in the southwestern part of the study area.

The Sunshine Ranch member of the Saugus Formation contains fresh water locally as does the upper part of the Pico Formation. For this reason and because more recent workers generally include the Sunshine Ranch strata in the Saugus Formation, the Sunshine Ranch is considered part of the Saugus Formation for the purpose of this study. The Sunshine Ranch member is not differentiated from the rest of the Saugus Formation on the maps or hydrogeologic sections in this report.

It is now clearly understood from previous work by others and from our own investigation that the contact between the Pico and Saugus Formations is, for the most part, gradational, especially in the southwestern part of he study area, and represents a transition from a marine to a continental environment of deposition throughout the region.

The sea in which the strata of the Pico Formation were deposited receded westward in response to tectonic uplift of the area. As the sea retreated, creeks and rivers that developed in the highlands to the north, east, and south carried coarse-grained sediments (sands and gravels) and fine-grained floodplain deposits (fine sands, silts, and clays) and deposited them in the area once covered by the sea. Drainage patterns in the area have changed throughout the long period of deposition of the Saugus Formation, both in response to local tectonic deformation (folding and faulting) and to differences in properties of the rocks (such as resistance to erosion) on which the drainage channels developed.

The coarsest deposits (sands and gravels) of the Saugus Formation were deposited in the main channels comprising the ancient drainage systems. These coarse-grained channel deposits constitute the best aquifers within the present-day Saugus Formation. As the locations of the channels changed during the 3 million-year period of deposition of the Saugus strata, the distribution of the coarse-grained channel deposits also changed, both laterally and vertically (in space and time).

The coarse-grained facies (sands and gravels) of the Saugus Formation can be distinguished from the fine-grained facies (silts and clays) on the basis of their electric log signatures. From our analysis of the electric logs used in this regional study, it is evident that the coarse-grained

channel deposits (the best potential aquifers) predominate in some portions of the basin, whereas the fine-grained deposits predominate in other parts of the basin. The lateral transition from predominantly coarse-grained deposits to predominantly fine-grained deposits may occur over relatively short distances in some parts of the basin. Acquisition and interpretation of additional electric logs (if available) from oil wells in the vicinity of future water well sites selected on the basis of our regional study would provide better definition and confirmation of the areas where the coarse-grained deposits predominate.

Plate 6 - Potential Aquifers, Sand Thickness Map - was prepared to show the cumulative thickness of sands and gravels anticipated to be available to yield water to future Saugus Formation water wells; relatively thin isolated layers of sand and gravel, together with all finer-grained siltstone and claystone layers in this 500 to 2500 ft depth zone of interest are not included. This Plate, in a very general sense, defines the principal areas where the ancient Saugus channels have remained approximately in the same locations during the period of time that it took to accumulate the 2000 feet of Saugus strata within the depth zone of interest (500 feet to 2500 feet) of this study. The thickest accumulations of sands as seen on Plate 6 roughly coincide with present-day major river channels, such as the channels of the south fork and main fork of the Santa Clara River and Castaic Creek, southwesterly of the San Gabriel fault.

Plate 6 differs from Plate 5 - Thickness of Fresh Water-Bearing Deposits - in that Plate 5 shows the entire thickness of all Saugus Formation sediments, including siltstone and claystone, which either contain fresh water or, if saturated, would contain fresh water from ground surface to the

base of fresh water as interpreted from electric logs. As stated earlier, Plate 5 thickness contours exclude all Saugus strata near the base of the formation which are considered to contain poor quality groundwater on the basis of electric log analyses.

For the purpose of discussing the characteristics of the Saugus Formation, we have subdivided the Eastern Groundwater Basin into three portions which are separated from one another by major faults: a northeastern portion which comprises the area northeast of the San Gabriel fault; a central portion which lies north of the Holser fault and west of the San Gabriel fault; and a southwestern portion which lies south of the Holser fault and west of the San Gabriel fault. These three areas are discussed below under separate headings.

Northeastern Portion, Eastern Groundwater Basin (Northeast of San Gabriel Fault). In the northeastern portion of the Eastern Groundwater Basin, the area northeast of the San Gabriel fault, strata of the Saugus Formation have been deposited unconformably upon older rocks of the Pico, Castaic, Towsley, and Mint Canyon Formations as shown on Hydrogeologic Sections B-B', D-D', E-E', and F-F'. This means that the older strata which underlie the Saugus are not parallel to the Saugus strata; the basal contact of the Saugus is, therefore, an angular unconformity. A period of time elapsed during which the older strata were deformed by folding and faulting before deposition of the Saugus beds commenced.

Because the basal contact of the Saugus with underlying formations is an angular unconformity, the base of the Saugus is, for the most part, easily identified on electric logs of oil wells. Some difficulty arises, however, especially where basal sands and conglomerates of the Saugus For-

mation overlie sands and conglomerates comprising the upper Pico or Towsley Formation, locally.

According to Stitt (1980), outcrops of the Saugus Formation in the Castaic area are all part of the non-marine Saugus. The Sunshine Ranch lithology (physical character of the rock) was recognized in the subsurface by Stitt but was not differentiated because he could not correlate the Sunshine Ranch member consistently between wells in the area. The upper part of the Saugus Formation in the Castaic area consists of continental (non-marine), red-brown sandstone and conglomerate interbedded with red-green siltstone. The lower part of the Saugus consists of brackish to marine siltstone and conglomerate.

Schlaefer (1978) made a study of the Saugus Formation in the area southeast of Castaic and northwest of Bouquet Canyon, and included the Honor Rancho Oil Field. In surface exposures, the Saugus Formation is composed of light gray, tan to maroon, coarse- to fine-grained, unconsolidated to loosely consolidated, cobble to pebble gravel, sand, and silt. In the subsurface, the shallow marine to brackish water Sunshine Ranch member can be distinguished from the non-marine member by lithologic descriptions from oil well cuttings and cores, and on the basis of electric log characteristics. An electric log signature of jagged, high amplitude resistivity and moderate spontaneous potential distinguishes the non-marine member of the Saugus Formation from the low amplitude resistivity and spontaneous potential of the underlying siltstones of the Sunshine Ranch member.

A basal, massive, fine-grained to medium-grained sandstone and pebble conglomerate of the Sunshine Ranch member rests unconformably on the Pico Formation throughout the western part of the area studied by Schlaefer. The angular uncon-

formity between the Pico and Saugus Formations is locally distinct east of the San Gabriel fault and within the fault zone except where the basal sandstone and conglomerate of the Saugus directly overlie sandstone and conglomerate of the upper Pico Formation.

Smith (1984) made a geologic study to the east of the area investigated by Schlaefer (1978), and included the northeastern part of the Eastern Groundwater Basin east of San Francisquito Canyon and north of Bouquet Canyon. The Saugus Formation in this area rests unconformably on older rocks of the Castaic Formation. Only the upper, coarse-grained facies of the Saugus is present in this area, the Sunshine Ranch member apparently pinches out to the east in the eastern part of the area studied by Schlaefer (1978).

The Saugus Formation in the area studied by Smith is composed entirely of fluvial beds (sediments deposited by streams, rivers, creeks) which in outcrop are buff or tan to brown conglomeratic arkosic (containing primarily quartz and 25 percent or more of feldspar) sandstone, muddy arkosic sandstone, conglomerate, and clayey siltstone. The underlying strata comprising the Castaic Formation are shallow-water marine beds of shale, sandstone, and minor conglomerate. Gypsiferous ($CaSO_4$) clay is present in the upper part of the formation and may be a source of sulfate ions in groundwater, locally.

The southeastern part of the Eastern Groundwater Basin northeast of the San Gabriel fault and south of Bouquet and Plum Canyons has been studied by Nelligan (1978), Saul and Wootton (1983), and Treiman (in progress). Both the non-marine upper Saugus and brackish to marine to non-marine lower Saugus beds are present in the western and southern part of

this area. The base of the Saugus in the subsurface, as defined by Nelligan on the basis of electric logs, was adopted (with few exceptions) for this study; the base of the Saugus in outcrop was, for the most part, taken from Saul and Wootton.

In the southeastern part of the basin immediately east of the San Gabriel fault, the Sunshine Ranch member of the Saugus unconformably overlies marine strata of the Towsley and/or Pico Formations (Tt-Tp on Hydrogeologic Sections B-B' and F-F'). These latter rocks are difficult, if not impossible, to differentiate by their electric log character and, therefore, have not been differentiated for this study. Farther to the northeast, the Saugus unconformably overlies the Castaic and Mint Canyon Formations, locally.

According to Saul and Wootton (1983), the basal part of the Sunshine Ranch member consists of a non-marine facies, locally composed of poorly to moderately consolidated arkosic sandstone and conglomerate; beds are generally massive to poorly bedded. The upper part of the Sunshine Ranch consists predominantly of poorly-consolidated, gray-green siltstone and mudstone. Thin beds of white, sandy limestone and nodular limestone are common.

The Sunshine Ranch member is overlain by a generally fine-grained, non-marine unit consisting predominantly of poorly consolidated silty and sandy claystone interbedded with gray arkosic sandstone. This fine-grained facies is overlain by a coarse-grained unit, the lowermost part of the Saugus, composed generally of poorly sorted, gray to light yellow and reddish-brown weathering, sandstone and sandy conglomerate interbedded with minor amounts of sandy siltstone. These rocks are moderately to poorly consolidated, and are lightly cemented with calcium carbonate ($CaCO_3$).

The Saugus Formation in the northeastern part of the Eastern Groundwater Basin northeast of the San Gabriel fault attains a maximum thickness of nearly 2000 feet (refer to Plate 5) in two areas adjacent to and immediately northeast of the fault; these areas coincide with the axes of two major synclines shown on the Hydrogelogy Map, and are located about one-half mile south of Wayside Canyon and one mile east of Bouquet Junction, respectively.

The nearly 2000-foot maximum thickness of the Saugus Formation northeast of the San Gabriel fault is in marked contrast to the 8500-foot maximum thickness of the Saugus southwest of the fault as shown on Plate 5. This difference in thickness is believed to have been primarily the result of uplift and subsequent erosion of upper Saugus strata northeast of the San Gabriel fault in response to a vertical (upward) component of movement (uplift) of the crustal block on the northeast side of the fault relative to the block on the southwest side of the fault. Consequently, as is evident on the Hydrogeologic Sections, the fresh water-bearing Saugus strata northeast of the San Gabriel fault are much thinner than the fresh water-bearing Saugus strata southwest of the fault.

Central Portion Eastern Groundwater Basin - (North of Holser Fault and West of San Gabriel Fault). In the central part of the Eastern Groundwater Basin, the area north of the Holser fault and west of the San Gabriel fault, strata of the Saugus Formation have been deposited disconformably upon older rocks of the Pico Formation (Hydrogeologic Sections A-A' and C-C'). This means that beds within the upper Pico and lower Saugus are essentially parallel to one another. The contact between the formations, however, represents a hiatus, a period of time during which there was no deposition of Saugus strata

onto the Pico. Also, there was relatively little deformation (folding and faulting) of the Pico during this period.

The base of the Saugus Formation in the northwestern part of the basin was placed at the top of the marine strata of Pliocene age by Stitt (1980), where paleontological reports were available. This paleontological pick was found to correspond with a reasonably good electric log signature. The base of the Saugus as defined by Stitt was adopted for the northwestern part of the basin for the purpose of this study.

The spontaneous-potential and resistivity curves for rocks in the lower part of the Saugus in the northwestern part of the basin commonly exhibit a gradual upward increase in amplitude, indicating a coarsening-upward vertical sequence from siltstone to sandstone. This characteristic of the Saugus is illustrated by the electric log of wildcat oil well 34Ja on Hydrogeologic Section C-C'. The coarse-grained facies of the upper Saugus becomes much thicker in a southeasterly direction; consequently, the entire portion of the Saugus within the depth zone of interest for this project (500 feet to 2500 feet) becomes generally coarse-grained in a southeasterly direction. Electric log correlation of the Pico-Saugus contact is locally difficult where the upper Pico is conglomeratic.

The upper part of the Saugus Formation in the northwestern part of the basin consists of red-brown conglomerate, sandstone, and red-green siltstone; the lower part is composed of brackish to marine siltstone and conglomerate. The Saugus attains a maximum thickness of approximately 8500 feet in the area of the Santa Clara River, one and one-half miles southwest of Castaic Junction (see Plate 5).

Southwestern Portion, Eastern Groundwater Basin (South of Holser Fault and West of San Gabriel Fault). Strata that

comprise the lower part of the Saugus Formation in the southwestern part of the Eastern Groundwater Basin, the area south of the Holser fault and west of the San Gabriel fault, are generally conformable and gradational with strata that comprise the upper Pico Formation. North of the western portion of Pico Canyon, the contact of the Saugus and Pico Formations can be traced for about two miles as an angular discordance. In the vicinity of Placerita Canyon, the Saugus also rests unconformably on the Pico. Elsewhere, the contact is placed rather arbitrarily at the upper limit of the abundantly fossiliferous beds of the Pico Formation. Beds within the lower Saugus Formation generally interfinger with beds within the upper Pico Formation. The non-marine to brackish-water to shallow-water marine sediments in the lower part of the Saugus grade in a southwesterly to westerly direction into shallow-water marine sands and conglomerates in the upper part of the Pico Formation. The marine to brackish strata in the lower Saugus also grade upward to non-marine deposits that comprise the upper Saugus Formation. According to Winterer and Durham (1962) the chief distinction between the Pico and Saugus Formations in the southwestern part of the basin is a change in color of the siltstone beds from olive-gray to light bluish gray in the Pico and to greenish gray in the Saugus.

In the area south of the Holser fault and west of the San Gabriel fault, the Saugus Formation consists primarily of lenticular units of light colored, loosely consolidated, poorly bedded, ill-sorted conglomerate, conglomeratic sandstone, and sandstone alternating with beds of greenish gray siltstone, silty sandstone, and light brown to moderate reddish brown sandy siltstone and claystone. The proportion of greenish gray beds is greater in the lower part; the proportion of reddish brown beds is greater in the upper part of the

formation. The maximum thickness of Saugus strata in the southwestern part of the basin (one mile southeast of the interchange of Interstate Highway 5 and Saugus Ventura Road) is approximately 7500 feet. The maximum thickness of fresh water-bearing strata in the same area is about 5000 feet as indicated on Plate 5.

From our interpretation of oil well electric logs, it is apparent that conglomeratic to sandy deposits of the upper Pico Formation as well as strata in the overlying Saugus Formation are fresh water bearing throughout the southwestern portion of the Santa Clara basin. The fresh water-bearing deposits of the upper Pico Formation are discussed in a subsequent section of this report.

PICO FORMATION (South of Holser Fault and West of San Gabriel Fault).

A somewhat surprising result of this study is the recognition of fresh water-bearing sands and conglomerates in the upper part of the Pico Formation in the southwestern portion of the Eastern Groundwater Basin, that is, in the area south of the Holser fault and west of the San Gabriel fault.

According to Winterer and Durham (1962), the Pico Formation consists chiefly of olive-gray and bluish gray siltstone and fine-grained silty sandstone, and light colored sandstone and conglomerate. Concretions (hard nodules) cemented with ankerite, Ca (Mg, Fe, Mn) CO_3, are common in the siltstone. However, in the southwestern part of the Eastern Groundwater Basin, south of the Holser fault and west of the San Gabriel fault, the upper part of the Pico is dominantly sandstone and conglomerate. These sediments commonly contain shells of marine mollusks.

The Pico Formation is entirely marine but interfingers at the top with marine, brackish-water, lagoonal, and non-marine beds of the lower Saugus Formation. Due to this interfingering relationship, the Pico-Saugus contact was designated and mapped somewhat arbitrarily by Winterer and Durham (1962), at least locally. Minor fluctuations in the position of the shoreline, together with the general retreat of the sea westward as the basin filled with sediment, resulted in the interfingering relationship of the marine and non-marine beds.

On the basis of our interpretation of electric logs of oil wells, as illustrated on Hydrogeologic Sections A-A', C-C', D-D', E-E', and F-F', and on Plate 5, it is evident that the fresh water-bearing deposits of the upper Pico Formation in the southwestern part of the Eastern Groundwater Basin are from 600 to as much as 3000 feet in total thickness. The thickness contour lines shown on Plate 5, have been omitted from the map where they fall outside the Saugus Formation edge line (Pico-Saugus contact). The amount of thickness of the fresh water-bearing Pico deposits is indicated on Plate 5; however, in two wells located southerly of the Pico-Saugus contact. Upper Pico strata in the northeastern, central, and southeastern portions of the Eastern Groundwater Basin generally do not contain fresh water. Strata comprising the lower part of the Pico Formation, likewise, are not fresh water-bearing anywhere within the study area.

Because the focus of this study is on the Saugus Formation, we did not undertake a comprehensive investigation of the hydrogeology of the Pico Formation. Its effectiveness as a groundwater storage reservoir and its capacity to yield water to wells, therefore, are not known.

OLDER ROCKS

Underlying the Saugus and Pico Formations in the study area are a series of older, consolidated and cemented sedimentary rocks of Tertiary geologic age which are, in turn, underlain by an assemblage of crystalline rocks of pre-Tertiary age. For the most part, the sedimentary rocks are exposed along the flanks of the hills and mountains which border the Santa Clara Valley, while the geologically older crystalline metamorphic and igneous rocks crop out in the upper watershed areas of the Sierra Pelona and the San Gabriel Mountains (see Plate 3).

Previous geologic investigators in the region (including Oakeshott, 1958, Winterer and Durham, 1962, Nelligan, 1978, Schlaeter, 1978, Stitt, 1980, and Saul and Wootton, 1983) have recognized a differing stratigraphy in the region, depending on which side of the San Gabriel fault is being evaluated. Based on the work of these and other investigators, Slade (December 1986, Table 3 and Plate 4 therein) prepared a table and a map which briefly describes these rocks and displays their mapped areal extent.

Due to their cemented and/or crystalline nature, the above rocks possess only secondary porosity and may contain groundwater only along bedding planes, joints, shears or fractures. As a result, and because of their structural complexity and low permeability, these rocks are not considered capable of yielding water readily to wells. Moreover, they have a very limited storage capacity, and their ability to provide long-term sustained yields to wells is unpredictable. These cemented and/or crystalline rocks are not considered part of the groundwater reservoir in the study area. There will be no further discussions of these rocks in this report.

OIL AND GAS OCCURRENCE AND PRODUCTION

Historical Development. According to Winterer and Durham (1962), early travelers in California found that the Indians were using oil and tar collected from many natural seeps near the present town of Newhall. By 1850, oil from seeps in Pico Canyon was being distilled at nearby San Fernando Mission to produce lamp oil for lighting purposes. As early as 1869-70, a spring-pole hole was drilled to a depth of 140 feet on the axis of the Pico anticline in Pico Canyon. The well was reported to have flowed from 70 to 75 barrels of oil per day. Not until 1875 was another attempt made to drill a well in the area--a spring-pole hole on the axis of the Pico anticline. This well, which had an initial daily production of two barrels per day is considered to be the beginning of the California oil industry.

The California Star Oil Works Company was organized to develop the oil resources of the Pico Canyon area, and they built the first oil refinery in California (near Newhall) in 1876. Although exploration continued in the area until the early 1900's, no new discoveries of importance were made until discovery of oil and natural gas in the Newhall-Potrero field in 1937.

Since the discovery of the Newhall-Potrero field, ten major oil and gas fields as well as several small oil and gas pools have been developed. The active and abandoned fields are shown later in this report on Plate 10. Although development of existing fields has continued to the present, no new major discoveries have been made since discovery of the Wayside Canyon field in 1962. Exploration has continued intermittently, however, in search of pools on the flanks of existing fields as well as deep pools in the downthrown blocks of major faults (such as the Holser fault), and in other areas of

the basin where deep structural or stratigraphic traps for oil have been postulated.

Current-day development of existing oil fields includes: step-out drilling on the flanks of oil pools; drilling of in-field wells to develop deeper pools; workover of existing wells; and secondary recovery projects, such as water-flooding (injecting waste water from oil wells or water from water wells); injection of waste water into waste disposal wells; cyclic-steam injection; diluent injection (using a solvent to mobilize low API gravity oil*); gas-injection; and fire-flooding (involves igniting the hydrocarbons in a producing zone and injecting air to maintain combustion). The Honor Rancho (southeast) field northwest of Castaic Junction is presently being used for storage of natural gas which is injected into abandoned oil and gas producing zones at depth and recovered as needed.

Oil Fields with Shallow Production. Most of the oil and gas production in the Eastern Groundwater Basin area is from deep reservoirs in formations that are geologically older and stratigraphically below the Saugus Formation. Six fields of particular interest to this study have production from relatively shallow reservoirs in the basal part of the Saugus Formation and/or reservoirs in the upper part of the Pico and/or Towsley Formations, immediately below the basal Saugus strata. Table 3 - Summary of Local Oil Fields and Production Zones - lists the active and abandoned oil fields in the area underlain by the Saugus Formation, the formations in which the shallowest oil and(or) gas reservoirs occur, and the average

*API gravity is the standard American Petroleum Institute method of specifying the density of crude petroleum. The density in degrees API is equal to (141.5/P) minus 131.5 where P is the specific gravity of the oil measured at 60° Fahrenheit.

RCS

Table 3
Summary of Local Oil Fields and Production Zones

Oil Field	Shallowest Producing Formation	Average Depth of Shallowest Producing Oil Reservoir (in feet)
Bouquet Canyon (abandoned)	Mint Canyon	2340
* Castaic Hills	Saugus (basal sands)	4000
Castaic Junction	Modelo-Towsley (undifferentiated)	8400
* Charlie Canyon (abandoned)	Saugus (basal sands)	600
Del Valle	Pico	3800
Hasley Canyon	Towsley	4800
Honor Rancho (main area)	Modelo-Towsley (undifferentiated)	3800
Honor Rancho (south-east area)	Modelo	10,000
Lyon Canyon	Modelo	9100
* Newhall (Tunnel Area)	Upper Towsley-Pico (undifferentiated)	600
* Newhall (Elsemere Area)	Upper Towsley-Pico (undifferentiated)	780
Newhall (Townsite Area)	Modelo	2700
Newhall-Potrero	Modelo	6500
Oak Canyon	Modelo	2400
* Placerita	Upper Pico-basal Saugus sands	600
Saugus	Modelo	9500
* Tapia	Upper Pico-basal Saugus sands	1000
* Wayside Canyon sands	Upper Pico-basal Saugus	1500

* Oil fields with production from sands witin the basal part of the Saugus Formation or from sands immediately underlying the Saugus Formation.

depth of the shallowest reservoirs. The oil fields are shown on Plate 10.

Water wells which are drilled in the vicinity of oil fields with shallow production and which are completed within the lower strata of the Saugus Formation are likely to encounter hydrocarbons or waters with relatively high salinities. Such oil fields and their environs include the Castaic Hills, Charlie Canyon, Newhall (Tunnel Area and Elsemere Area), Placerita, Tapia, and Wayside Canyon fields (refer to Plate 10).

Data obtained from the California Division of Oil and Gas indicate that most of the waste water from oil field operations is disposed of by injection into the underlying rock formations via waste-water injection wells. In the past, however, waste water has been discharged into ponds and allowed to evaporate and to percolate into underlying strata (such as at the Tapia field), or has been discharged into local drainage channels (such as at the Placerita field). The present methods of waste water disposal at the oil fields in the Eastern Groundwater Basin were not investigated in detail as part of this study.

The drilling and completion of water wells in the vicinity of oil fields, where the shallowest producing reservoirs are deep and are well below the total depth of the water wells, may be feasible depending on local oil field completions, abandonment, and waste disposal practices. A comprehensive investigation of the completion and abandonment practices at the various oil fields in the area was beyond the scope of this study.

GROUNDWATER GEOLOGY

GENERAL STATEMENT

Geologic materials depicted on the Hydrogeology Map have been divided according to their relative water-bearing characteristics, that is, to their relative ability to contain, transmit, and yield groundwater to wells. As such, two divisions are recognized: a water-bearing sediment group and a nonwater-bearing rock group. Plate 3 provides the exposures and areal extents of these materials, together with local geologic structure, including representative bedding attitudes and the alignment of major faults and folds.

Depending on water levels, the water-bearing sediments can become saturated, thereby permitting them to provide water to wells. Thus, they constitute the groundwater reservoir of the study area, and, in effect, they are wholly included within the lateral and vertical boundaries of the Eastern Groundwater Basin along the Santa Clara Valley of Los Angeles County.

Water-bearing sediments in the study area are comprised by: undifferentiated alluvial or valley fill deposits which underlie the Santa Clara River and its tributaries; and partially consolidated, older sediments assigned to the Saugus Formation which are exposed on the hills surrounding the river valley and which also underlie the river and its tributaries in the area. Hence, the water-bearing sediments consist of Holocene alluvium (map symbol, Qal), terrace deposits (Qt), and the group of geologically older sediments known as the Saugus Formation (QTs).

ALLUVIAL DEPOSITS

The undifferentiated alluvial-type deposits are Pleistocene to Holocene (Recent) in geologic age and, generally, are exposed in the study area as follows: on the valley floor as floodplain deposits and stream channel deposits; as alluvial fans near the mouths of canyons draining the adjoining hills; as elevated terraces along the margins of the basin; and as terraces in the low foothills which adjoin the main river valley. For the most part, these water-bearing strata are geologically younger, more permeable, less consolidated, and less structurally deformed than the nonwater-bearing, underlying bedrock.

These sediments, as a group, have been penetrated to various depths by the large number of wells in the basin and historically have provided virtually all the groundwater extracted by these wells. Analysis of available drillers' logs clearly reveals that these sediments are composed of extensively interlayered and interfingered mixtures of gravel, sand, silt, and clay, with variable concentrations of cobbles and boulders.

The maximum thickness of alluvium varies along the Santa Clara River, but generally is considered to be on the order of 200 feet. Typically, the alluvium tends to be thickest near the central portion of the river, and thins or pinches out as the flanks of the adjoining hills are approached. Alluvial thicknesses in the tributary canyons are considered to be less than that in the main river valley. The planimetered area represented by the alluvial deposit exposures shown on our base maps is 27.14 sq. mi.

TERRACE DEPOSITS

Terrace deposits (Older alluvium) of late-Pleistocene age has also been mapped in the area by others to include the thin veneer of sediments that have been elevated onto mesas and terraces along the main river valley. These terrace deposits (map symbol, Qt, on Plate 3) are considered to be of the same general composition as Holocene alluvium and were formed in much the same manner. Regional uplift and continued downcutting of the creeks and washes have left these terrace deposits elevated with respect to current stream gradients. In general, the terrace sediments are more deeply weathered and characteristically reddish-brown in color. Because of their topographically elevated position in the study area, these sediments, although potentially water-bearing, are considered to be of very limited use as a water resource; they nearly always lie above the regional water table. The planimetered area represented by terrace deposit exposures shown on our base maps is 5.61 sq. mi.

SAUGUS FORMATION

Groundwater Occurrence, Recharge and Discharge.

Groundwater within the 52.81 sq. mi. surface area of exposures of the Saugus Formation of the Eastern Groundwater Basin occurs under confined (artesian) conditions. Evidence for this includes: the high piezometric levels encountered in the Saugus wells during field testing (in some cases, the piezometric level was as much as a few hundred feet higher than the uppermost level of well perforations); and a value for the aquifer parameter of storativity which is considered to be low and thus representative of typical confined conditions (refer also the the Aquifer Parameters section of this report).

Natural sources of recharge to the Saugus Formation include: infiltration of direct precipitation on the outcrop area of these strata in the hills; deep percolation of groundwater from the saturated portions of the alluvium into Saugus strata, wherever the two formations are juxtaposed; and subsurface inflow from the older rocks adjoining Saugus strata. The relative magnitude of the first two of these possible recharge sources has been quantified for this investigation (refer to Recharge Potential in the Geohydrology Section). Due to a lack of requisite data, the potential recharge to the Saugus from older rocks has not been quantified for this investigation.

Additional, but more limited, sources of recharge to the Saugus are considered man-made and would include: deep percolation of irrigation returns from agricultural acreage located either on terrace deposits overlying the Saugus or on Saugus beds directly; and deep percolation of seepage from unsewered areas on or near the hillsides. Infiltration of wastewater treatment plant effluent is not considered to directly recharge the Saugus because the effluent is released as surface flow to the Santa Clara River within the alluvium.

No artificial recharge operations either by direct surface spreading basins or by deep well injection, have been historically utilized in the hillsides to make use of excess surface runoff for purposes of recharging Saugus aquifers. No water from the State Water Project has been used for artificial recharge purposes either.

Outflow or discharge from the Saugus Formation occurs by water well extractions and subsurface outflow to downstream strata. As previously discussed, the eight active Saugus wells in 1986 produced a total of 5532 acre-feet. Average Saugus production since records became available in 1954 has

been about 4660 ac-ft/yr. Pumpage records from the single known privately-owned Saugus well (the Smiser well) were not available to this study; its annual production, if and when active, likely would be less than 100 ac-ft/yr.

Subsurface outflow to older beds below the Saugus Formation likely occurs on the west side of the study area, and mainly into the more permeable units in the upper Pico Formation. The magnitude of this subsurface outflow could not be quantified for this study due to a lack of requisite data. Evapotranspiration from areas of high groundwater or from areas of phreatophytic growth (reeds, etc.) on Saugus strata is considered negligible.

Water Levels. To assess groundwater levels and flow directions in the Saugus Formation, we obtained non-pumping water levels for Saugus wells from the various purveyors and from our own field work, corrected those water levels to a mean sea level datum, and then prepared contour lines for equal elevations of groundwater. In essence, because Saugus aquifers are confined, these water level contours represent the piezometric (pressure) level of the various Saugus aquifers.

Because the existing Saugus wells contain long lengths of continuously perforated casing, groundwater enters the well bore from all strata encountered by the well. Hence, it is not possible to define the head or flow direction for individual aquifers in the region. Also, because there is not an even distribution of Saugus wells in the study area, there are large data gaps, such as in the entire Saugus Formation area northerly of the San Gabriel fault. In such areas, preparing groundwater elevation contours is obviously not possible.

For our assessment of piezometric levels in the Saugus, we have prepared Plate 7 - Contour Map of Generalized

Groundwater Elevations--Summer-Fall, 1967, and Plate 8 - Contour Map of Groundwater Elevations--March, 1987. Plate 7 represents the earliest time period for which adequate water level data were available to construct a water level map; this Summer-Fall, 1967 time period corresponds to a general water level low period in the region. Plate 8 represents the most recently available data and corresponds to a moderately high water level period in the region. Both maps are annotated with the well location, ownership and well number, and the respective piezometric water level elevation.

Data on Plate 7 indicate the following:

a. Only sparse data are historically available and to prepare this map, it was necessary to use data for the summer and fall of 1967.

b. Ten wells were used in the complilation, with nine of these lying south of the Holser fault and one (V-158) lying in the area between the two faults. No water level data exist for the region northerly of the San Gabriel fault.

c. Groundwater elevations (piezometric levels) south of the Holser fault range roughly between 1100 ft near Newhall on the south and approximately 950 ft at well NLF-156 on the northwest near the Holser fault. As seen by the broad arrows on the map, such data suggest a northerly to northwesterly groundwater flow direction for Saugus wells in the vicinity of the South Fork of the Santa Clara River.

d. West of V-160, groundwater appears to follow a more westerly flow direction, subparallel to the trace of the Holser fault.

e. The groundwater gradient in the South Fork region is about 0.005 ft/ft (28 ft/mi), even though localized undulations in the contour values are readily apparent. The reasons for the undulations are not known with certainty, but likely reflect differences in water levels in various wells over the few months' time period of data delineated on the map.

f. A water level low (to elevation 915 ft) is seen at NLF-155, but this likely reflects either a partial recovery level instead of a true fully-recovered, non-pumping level and/or a monitoring error.

g. Our interpretation of the piezometric surface data for V-158, located between the two faults, suggests a northwesterly flow direction for groundwater in this area. It also appears that the Holser fault provides at least a partial barrier to groundwater flow within at least the deeper portions of the Saugus Formation, as evidenced by the different piezometric levels between V-158 on the north and V-160 on the south.

Data on Plate 8 reveal:

a. There are only nine wells for which data exist, these all being located southerly of the Holser fault.

b. No current water level data exist for the area of the Saugus Formation between the two faults or northerly of the San Gabriel fault.

c. Groundwater elevations (piezometric surfaces) near Newhall range from 1300 ft on the south to 1100 ft on the north; groundwater flow direction, as indicated by the broad arrow is to the northwest.

d. The groundwater gradient in the Newhall area is approximately 0.017 ft/ft, or about 90 ft/mi.

e. Based on sparse data, the groundwater gradient northwest of Newhall appears to flatten noticeably as the Holser fault is approached near well V-160. In the area between Newhall and V-160, groundwater still appears to move northwesterly, but with an apparent gradient of only 0.0037 ft/ft (19 ft/mi).

Hydrographs. Hydrographs from five wells in the region (NC-9 and -10, and V-157, -158, and -160) have been prepared on Figures 4.1 and 4.2 - Histograms of Selected Wells - in order to reveal fluctuations in non-pumping water levels (piezometric water levels) with time. Also shown on these figures are plots of specific capacity vs. time, elevation of

NEWHALL COUNTY WATER DISTRICT NO. 10

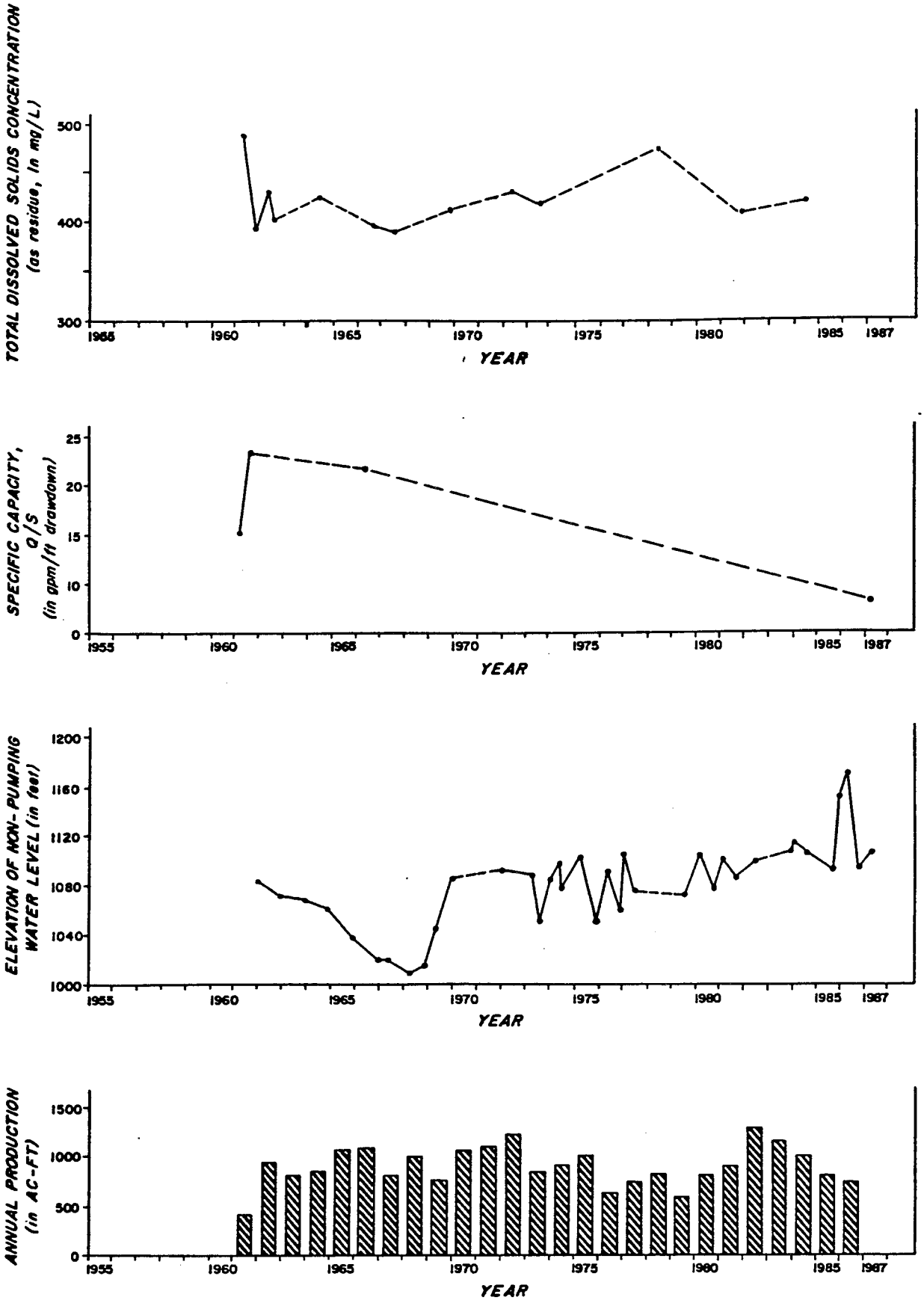
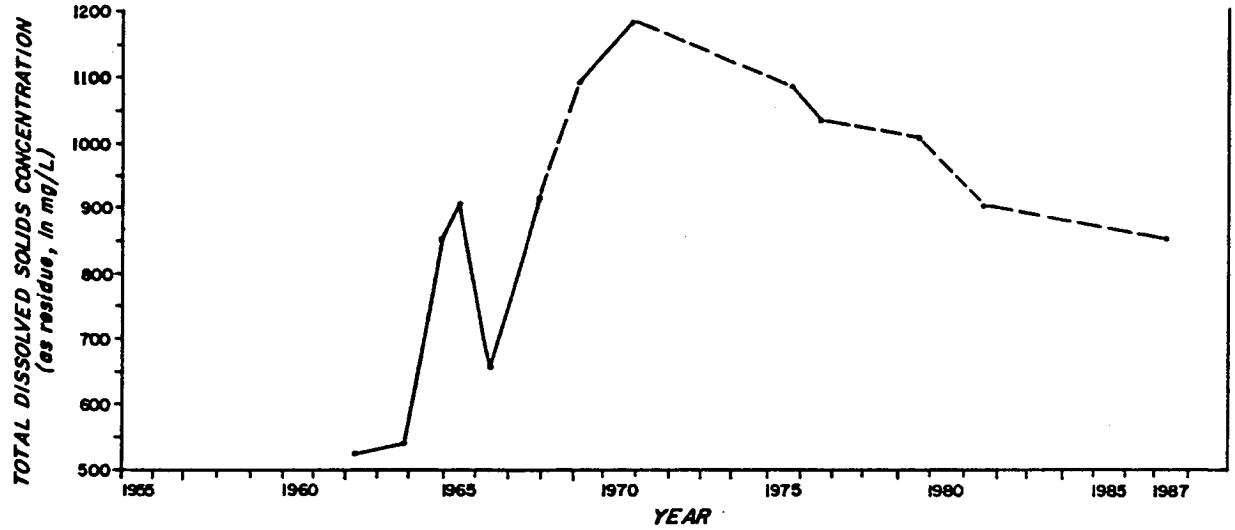
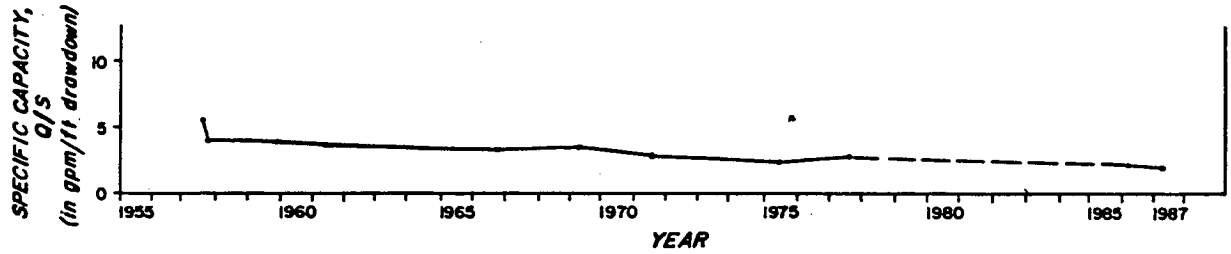
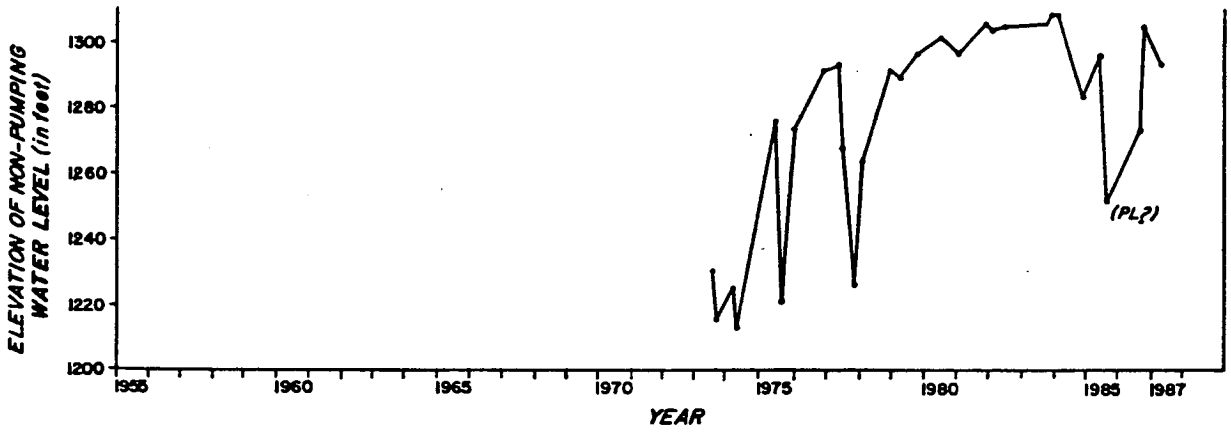


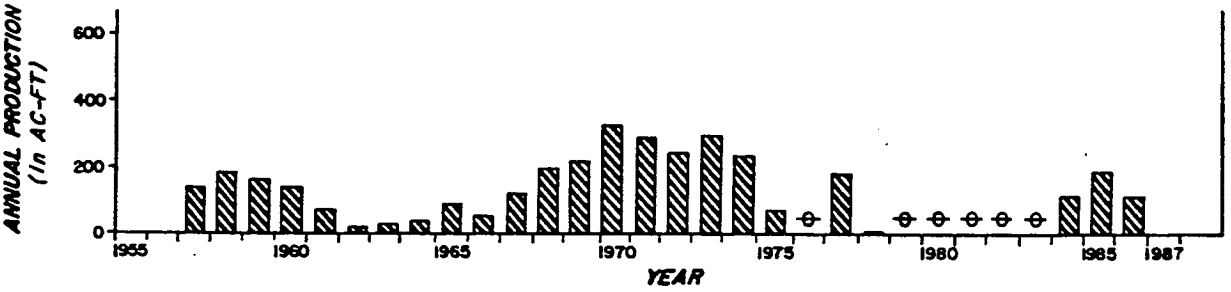
FIGURE 4.1 - HISTOGRAMS OF SELECTED WELLS

NEWHALL COUNTY WATER DISTRICT NO. 9









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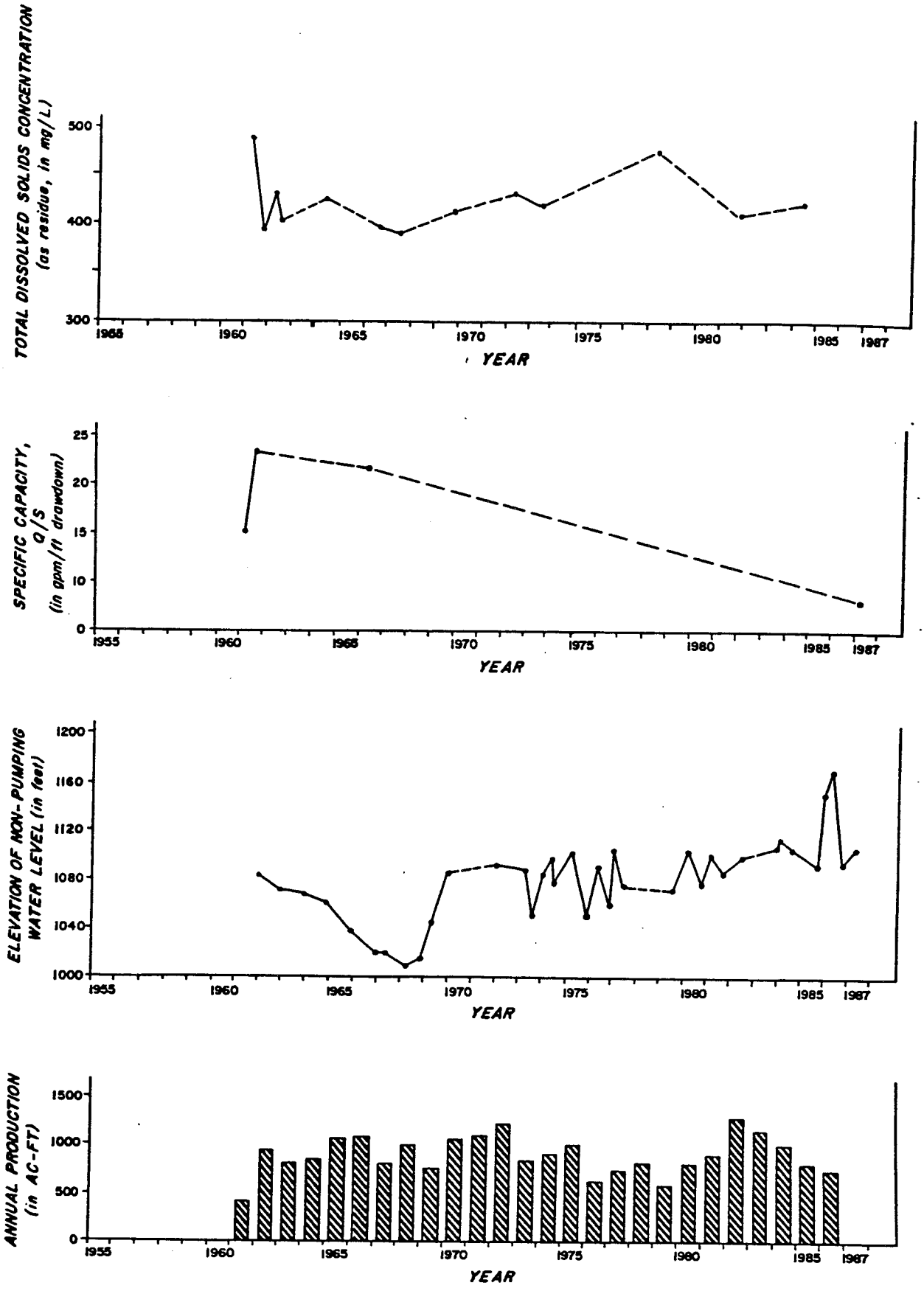
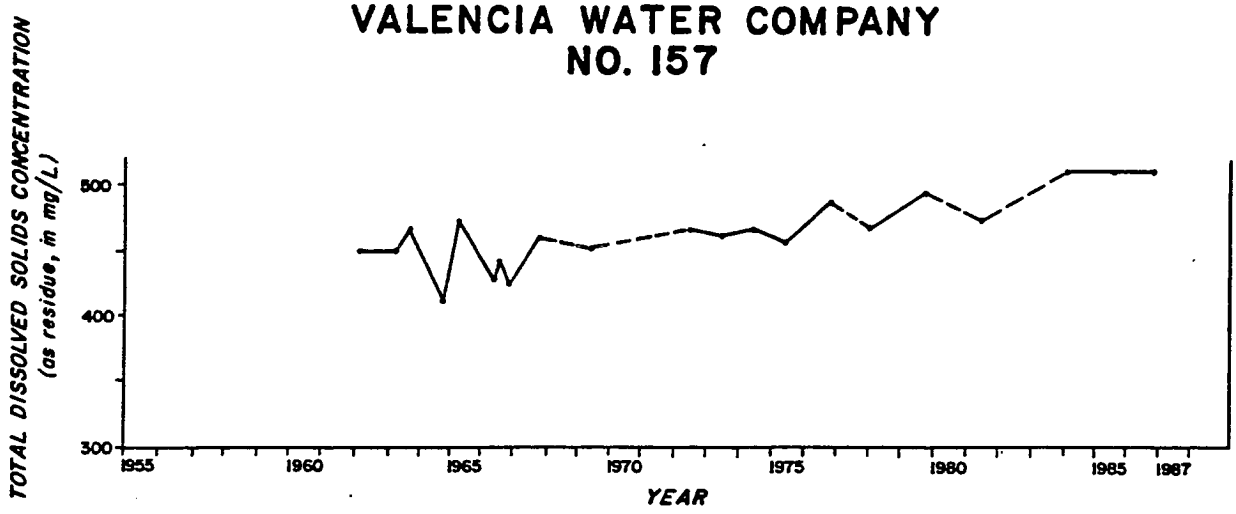
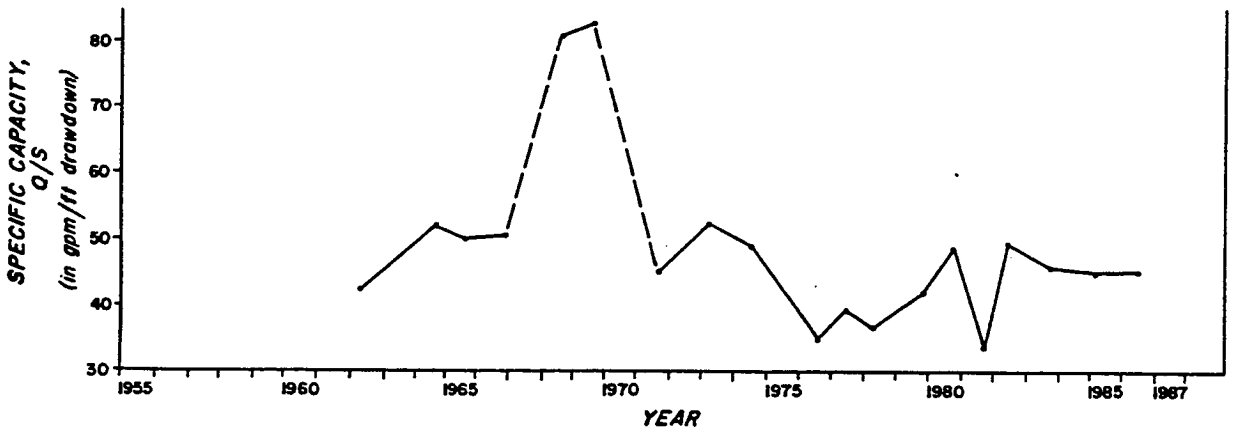
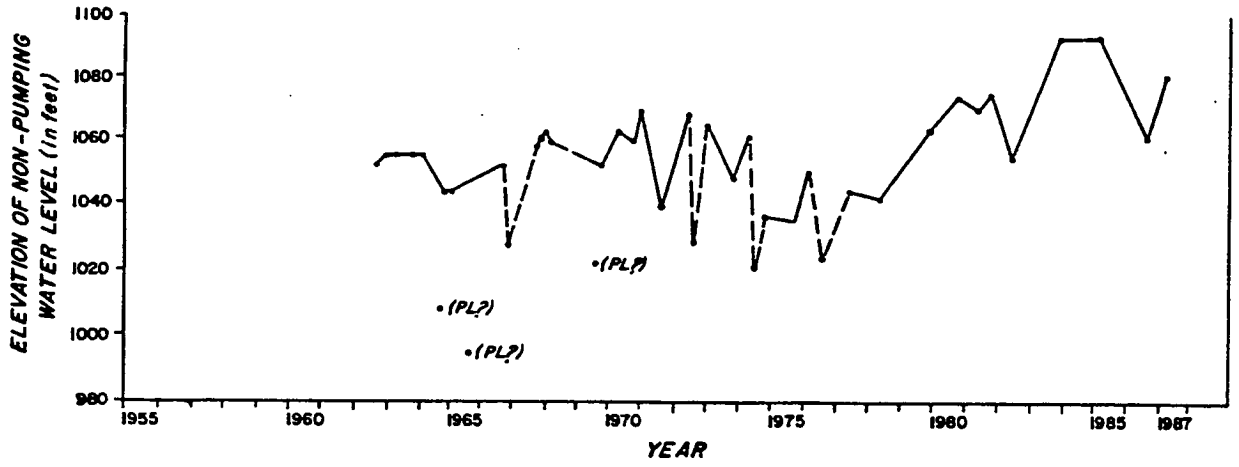


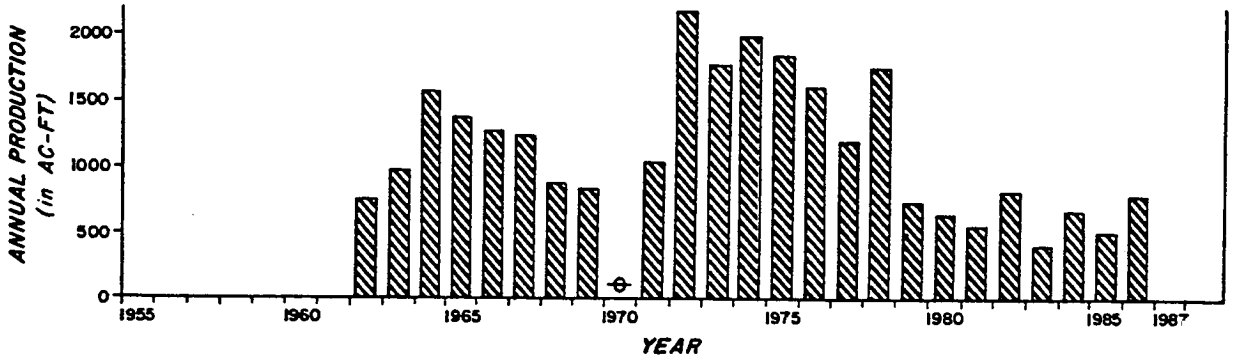
FIGURE 4.1 - HISTOGRAMS OF SELECTED WELLS

VALENCIA WATER COMPANY
NO. 157

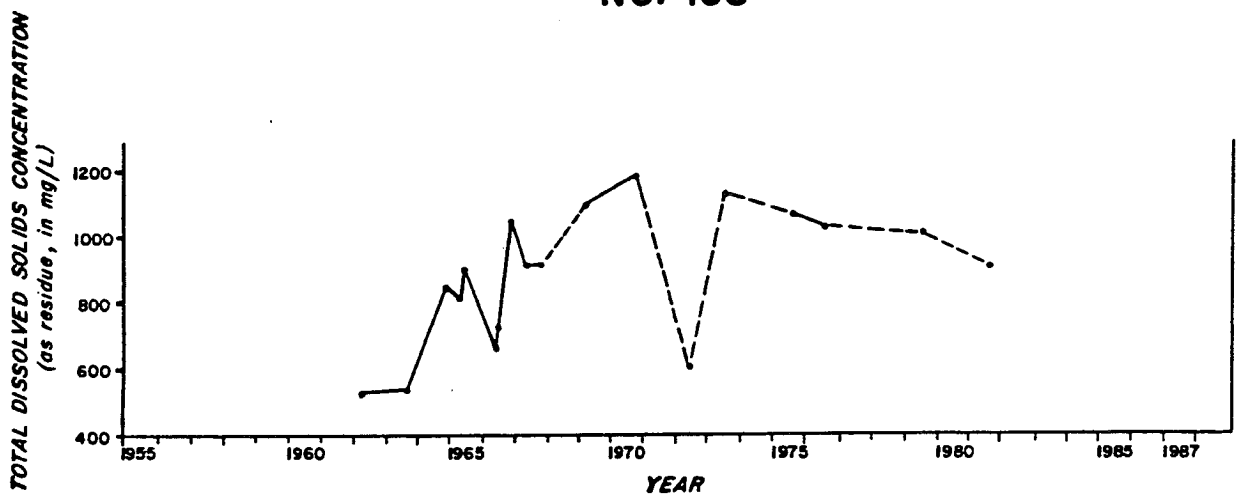


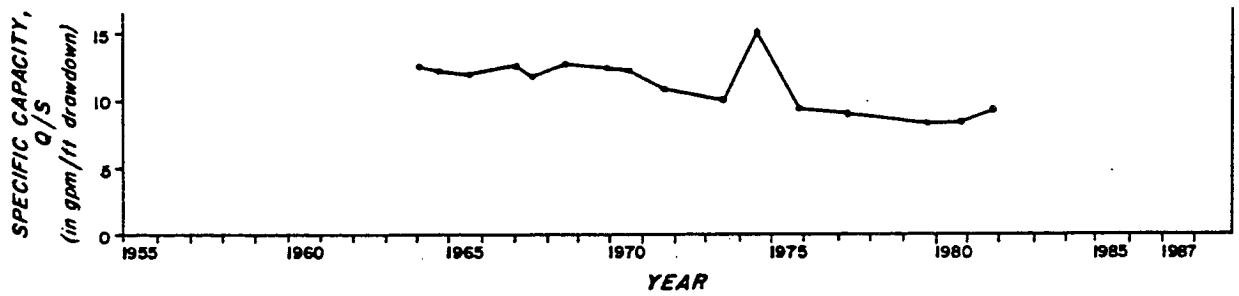


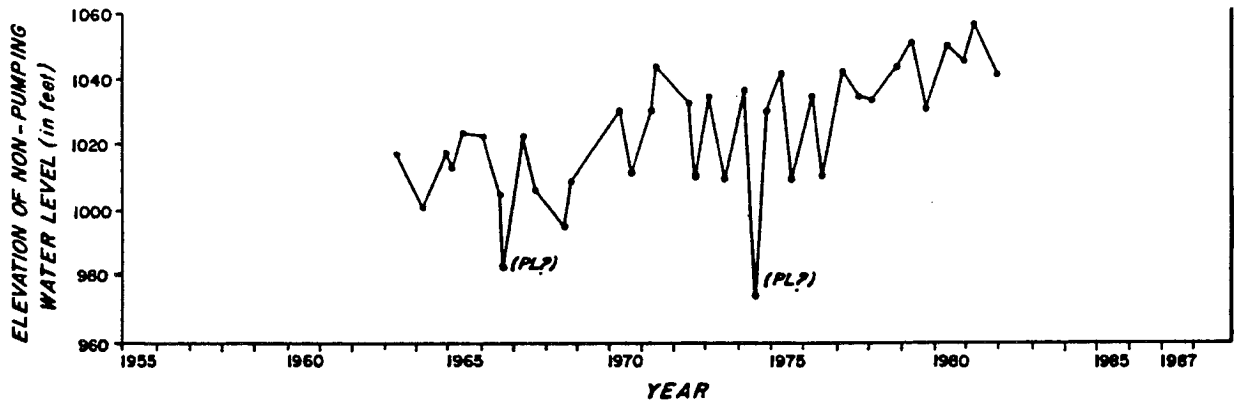


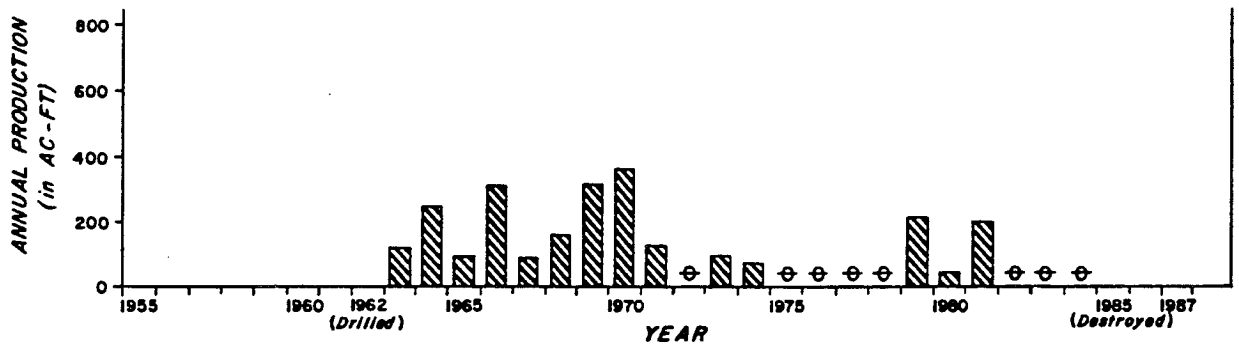


VALENCIA WATER COMPANY
NO. 158









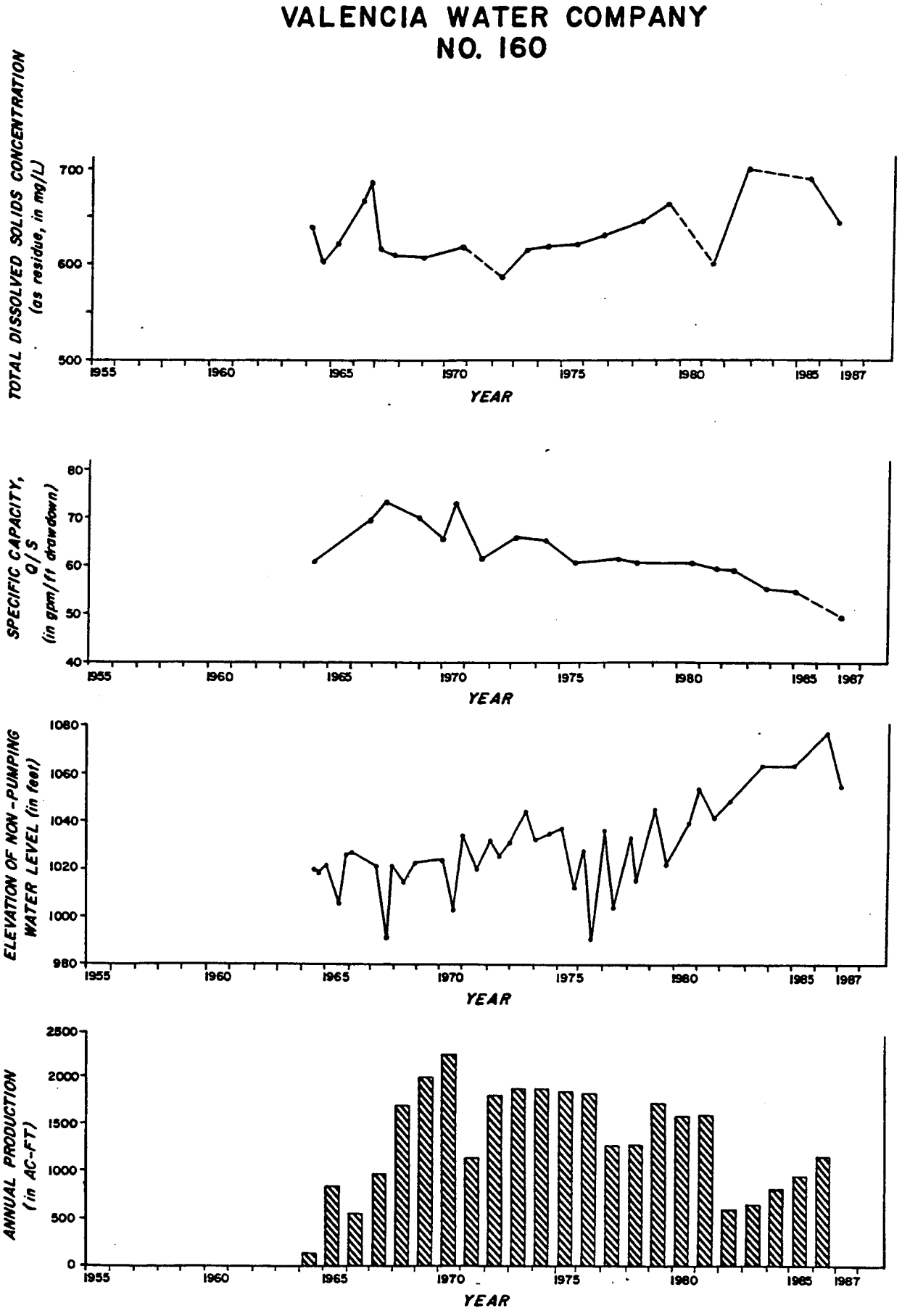


FIGURE 4.2 - HISTOGRAMS OF SELECTED WELLS

non-pumping water levels vs. time, and annual groundwater production for each respective well. For comparison, a histogram of total Saugus Formation groundwater production by all purveyors during the period of record (1954 through 1986) is also shown.

Review of the piezometric water levels vs. time on Figures 4.1 and 4.2 indicates:

a. All five wells display a trend of rising levels during the period of record. None of the records pre-dates the early- to mid-1960's, however.

b. During the period of record, water wevel rises have ranged from roughly 0.5 ft/yr in V-157 to about 4 ft/yr in NC-10.

c. Superimposed on this long-term trend are the seasonal variations in piezometric levels. Typically, spring levels are 20 to 40 feet higher than water levels measured later in the particular year.

d. Certain water level lows (e.g., in 1977 or 1985 in NC-9, or in 1966 or 1974 in V-158) represent pumping levels or partial recovery levels or monitoring errors, and thus are not true non-pumping piezometric levels.

e. There are no definitive trends between water quality or groundwater production and piezometric levels with time displayed on any of the histograms. The reasons for the long-term rise in water levels in each well coupled with the concomitant decline in specific capacity during the same period are unrelated.

Aquifer Parameters. To assess well yields, mutual well drawdown interference and/or well spacing criteria for future wells, it is necessary to first evaluate the water transmitting, or hydraulic properties of the aquifer(s). These properties, which include transmissivity and storativity, are strongly influenced by the arrangement, sorting, shape, and size of the individual sediment grains and intergranular void spaces which comprise the aquifers. Transmis-

sivity (symbol T, in units of gallons per day per vertical foot of aquifer, gpd/ft) and storativity (symbol S, in cubic feet of water per square foot of aquifer per foot of head, ft^3/ft^3, and thus dimensionless) are typically derived from analyses of water level drawdown and recovery tests in pumping and observation wells (i.e., from aquifer tests).

Of the eight Saugus wells known to be actively used in 1986, five wells were selected to be pumping wells for our aquifer test program. Our selection of the wells in which to conduct the aquifer tests for this project was based on numerous factors, including:

a) location and spatial relationship within the groundwater basin and proximity to faults and other potential barriers to groundwater flow;

b) the depth interval of perforated casing;

c) the efficiency, age, and condition of the wells;

d) availability and proximity of potential observation wells; and

e) coordination with the purveyors to consider pumping demand schedules and logistical problems in shutting down/turning on the wells for prescribed periods of time.

The five wells used for our tests were NC-7, -9, and -10, and V-157 and -160. For each pumping well, it had been hoped to utilize other nearby wells (either in the Saugus Formation or in the alluvium) as observation wells during each test in order to collect additional water level data. The principal criteria in selecting potential observation wells would be proximity to the aquifer test pumping well and ensuring that the observation well was not pumping (i.e., that static, non-pumping conditions existed in the observation well throughout the aquifer test).

In most cases, however, it was not possible to utilize observation wells because: there are too few Saugus Formation wells in the region; these wells are generally spaced too far apart to be useful as observation wells; and it was often too difficult to shut down the highly active alluvial wells because of local agricultural demands. Table 4 - Summary of Aquifer Test Data - shows the pumping and observation wells used during the aquifer tests, the dates and durations of the tests, and the quantitative results of these tests using both graphical and computer methods. As shown on Table 4, the five aquifer tests were conducted between March 4 and April 3, 1987. With the exception of V-160, the tested wells were pumped continuously at constant discharge rates for 24 hours, and then shut down and allowed to recover for at least 24 hours. Typical pumping rates were in the range of 256 gpm (NC-9) to 2562 gpm (V-160).

The reader is referred to Appendix A - Aquifer Testing - for additional details of test logistics during the aquifer tests, and for details concerning our quantitative analyses of the data. Individual graphs of the field drawdown and recovery data are presented in Appendix A as Figures A-1 through A-12.

Review of the data on Table 4 reveals the following:

1. T values range from lows of approximately 3000 to 4100 gpd/ft in NC-9 to highs of approximately 157,000 to 182,000 gpd/ft in V-160. NC-9 is the most southerly of the wells tested and is located nearest the edge of the Saugus Formation structural basin; whereas V-160 is the most northerly of the tested wells and is nearest to the center of the structural basin.

2. T values increase toward the center of the structural basin; that is, toward the area of younger Saugus Formation strata, between NC-9 on the south and V-160 on the north.

TABLE 4 - SUMMARY OF AQUIFER TEST DATA

DATE OF TEST	TYPE OF TEST	LENGTH OF TEST (mins)	PUMPING WELL	PUMPING RATE (gpm)	WELL MONITORED	METHOD OF ANALYSIS (1)	AQUIFER VALUES T (gpd/ft)	AQUIFER VALUES S (2) (cu ft/cu ft)	SPECIFIC CAPACITY (gpm/ft)
3/4/87	Drawdown	1440	NC 7	341	NC 7	G	33,300	-	3.1
						C	26,400	-	
		1440	NC 7	341	NC 8	(3)	-	-	
3/5/87	Recovery	1500	NC 7	341	NC 7	G	20,700	-	-
						C	23,300	-	
		1490	NC 7	341	NC 8	(3)	-	-	
3/10/87	Drawdown	1440	NC 10	364	NC 10	G	31,000	-	8.3
						C	28,500	-	
		1440	NC 10	364	NC 12	G	57,500	0.00087	
						C	57,700	0.00091	
3/11/87	Recovery	1480	NC 10	364	NC 10	G	35,300	-	-
						C	38,400	-	
		1490	NC 10	364	NC 12	G	54,000	-	
						G	59,300	0.00080	
						C	61,500	0.00076	
3/17/87	Drawdown	1460	NC 9	256	NC 9	G	4,100	-	1.9
						C	3,700	-	
3/18/87	Recovery	1500	NC 9	256	NC 9	G	3,300	-	-
						C	3,000	-	
3/24/87	Drawdown	720	V 160	2562	V 160	G	169,000	-	49.8
						C	163,000	-	
3/24/87	Recovery	850	V 160	2562	V 160	G	157,000	-	-
						C	182,000	-	
4/1/87	Drawdown	1440	V 157	1347	V 157	(4)	-	-	-
		1440	V 157	1347	V N-68	(5)	-	-	
		1440	V 157	1347	NLF K-2	(5)	-	-	
		1440	V 157	1347	Private (H1)	(5)	-	-	
4/2/87	Recovery	1520	V 157	1347	V 157	G	88,900	-	-
		1530	V 157	1347	V N-68	(5)	-	-	
		1540	V 157	1347	NLF K-2	(5)	-	-	
		1540	V 157	1347	Private (H1)	(5)	-	-	

NOTES: (1) G = Graphical (semi-log) solution; C = "Theisfit" computer program solution.
(2 S value cannot be determined by pumping well measurements; an observation well is required
(3) Not analyzed; observation well NC 8 showed no change due to pumping of NC 7 1200 ft away.
(4) Not analyzed; pumping levels not obtainable due to mechanical problem with well.
(5) Not analyzed; observation wells perforated in alluvium showed no change due to pumping of V 157.
V N-68 = 2000 ft from V 157
NLF K-2 = 1700 ft from V 157
Private (H1) = 2300 ft from V 157

3. The range in values for any particular well results from other factors, including age and condition of the well, types of perforations in the well, chemical precipitates in the well, local aquifer conditions, consolidation and/or cementing in the local sediments, and proximity to the Santa Clara River and to the two major faults in the basin.

The other major aquifer parameter, storativity or storage coefficient (S), cannot be determined directly from water level data from the pumping well alone; monitoring data from observation well(s) near the pumping well are required. As shown on Table 4, the only observation well to display drawdown due to pumping in a nearby well was NC-12. This recently drilled (1985) well is 157 ft from pumping well NC-10 and, at the time of aquifer testing in NC-10, was not yet equipped with its own pump and motor. No drawdown interference was monitored in any of the alluvial wells (N-68, NLF K-2, or private well H-1) which were monitored as observation wells during the aquifer test of Saugus Formation well V-157.

As shown on Table 4, S values ranged from 0.00076 to 0.00091. Storativity is a dimensionless quantity involving a volume of water per volume of aquifer. S values between 0.00005 and 0.005 are considered typical of confined aquifers.

Specific capacity, a measure of the gallons per minute per foot of drawdown in the well (units of gpm/ft) was calculated for aquifer test wells using the final drawdown measurements at the end of the 24-hour pumping tests and the average pumping rate during these constant discharge drawdown tests. Resultant specific capacity values (also listed on Table 4) range from 1.9 gpm/ft to NC-9, to 3.1 gpm/ft for NC-7, to 8.3 gpm/ft for NC-10; and to 49.8 gpm/ft for V-160. Specific capacity for V-157 was indeterminant because a mechanical problem in this well prevented measurement of accurate pumping levels.

Specific capacity values for NC-9 and NC-7 are slightly lower but consistent with those obtained from the most recent available Edison Company efficiency tests (2.3 gpm/ft in 1975 for NC-9 and 3.9 gpm/ft in 1986 for NC-7). At V-160, the current value is somewhat lower than the most recent (1981) Edison test value of 59.7 gpm/ft. The current specific capacity value for NC-10 is considerably lower than the 21.6 gpm/ft value obtained in 1966, the most recent Edison test data available. This large difference is due to a combination of: the aquifer test pumping rate being much lower than the normal operational rate; possible buildup of chemical precipitates in the gravel pack and on the perforations; and possible mechanical problems in the well and/or pump.

To further corroborate the magnitude of the transmissivity, we also used an empirical method, namely, the modified Thiem equation. With this approach, the theoretical value of T is assessed by relating T to the actual specific capacity from well data. For the confined aquifer conditions found within the Saugus Formation, the empirical relationship is approximately:

Theoretical T = 2000 Q/s, where

Q/s = specific capacity
Q = well yield, in gpm
s = amount of drawdown, in ft, created in the well by that pumping rate
2000 = an empirical constant.

Theoretical T values were thus calculated using specific capacity data obtained from our recent aquifer testing. For comparison and to demonstrate the effects of well age and condition, theoretical T values also were calculated for specific capacity data obtained from the earliest available Edison pump efficiency tests (these date from one month to 2-1/2

years after well construction). The following tabulation lists the theoretical T values obtained using these two data sources. These values can be compared to T values computed from actual aquifer tests by reference to Table 4.

THEORETICAL TRANSMISSIVITY (gpd/ft)

Well	From 1987 Specific Capacity Data	From Earliest Edison Test Data
NC-9	3,800	8,000
NC-7	6,200	13,400
NC-10	16,600	46,200
V-157	Not determined	84,800
V-160	99,600	139,200

For NC-9, the 1987 theoretical T is consistent with the actual T values determined from aquifer testing. Recent 1987 theoretical T values for NC-7, NC-10, and V-160 are approximately 25 percent, 50 percent, and 60 percent, respectively, of representative actual T values for those wells.

Theoretical T values for early Edison test data are generally higher and closer to actual aquifer test T values than are the 1987 theoretical T values, thus showing effects of age and condition of the wells. Such conditions as encrustation of the well perforations and of the gravel pack will cause increased head losses (drawdown) in the well and thus reduced specific capacity.

The above values of theoretical T are considered to represent the overall transmissivity of all aquifers penetrated/perforated by the well to its particular total depth. Because aquifer T values are additive, it follows that if wells were drilled into deeper water-bearing zones within the

local groundwater reservoir, then the overall T value would increase at that particular location.

As mentioned previously, NC-12 was the only observation well to display drawdown due to pumping in one of the tested wells. NC-12 is located 157 ft from pumping well NC-10. Saugus Formation observation well NC-8 is located about 1200 ft from well NC-7 and displayed only minor water level fluctuations during the aquifer test; these fluctuations in NC-8 could not be attributed, with any degree of certainty, to drawdown and recovery in NC-7. No other Saugus Formation wells exist near enough to any of the tested wells to have been considered for observation well use.

Prior to and during drawdown and recovery testing at V-157, the three nearest alluvial wells were monitored: inactive well NLF K-2, located 1700 ft to the north; active well V N-68, 2000 ft to the north; and private well H1, located 2300 ft to the northwest. These shallow wells (less than 250 ft deep) showed no response due to pumping and recovery in V-157 (perforated between 586 and 2008 ft depths). In fact, during approximately 51 hours of measurement, water levels in these three wells rose slightly but steadily between 0.16 and 0.18 ft.

To evaluate possible time related changes in specific capacity for selected wells, we have plotted specific capacity versus time for wells NC-9 and NC-10, and for V-157, V-158, and V-160 on Figures 4.1 and 4.2. These data graphs suggest:

a. Specific capacity in NC-9 (located near the southern edge of the groundwater basin) is low (<6 gpm/ft) and has displayed a slow but generally continuous decline with time; recent 1986 and 1987 Q/s values are approximately 2 gpm/ft. This decline results from encrustation of the perforations and gravel pack.

b. For NC-10, specific capacity data are meager but tend to reveal a continuous decline from 1960-61 to 1987, from a high of approximately 22 gpm/ft to a low of 9 gpm/ft, respectively. Encrustation is suspected to be the cause.

c. In V-157, specific capacity appears to have remained approximately the same with time, even though there have been wide fluctuations from one year to another. Early values in 1961-62 were approximately 40 gpm/ft, while values in the 1980's were on the order of 43 gpm/ft. Large variations (such as in 1970 or 1981) likely relate to errors in water level monitoring (partial recovery levels were obtained, not true non-pumping levels).

d. For V-158, specific capacity declined slightly but continuously with time. Original values in 1963 were about 13 gpm/ft, but by 1981, Q/s had declined to about 9 gpm/ft (roughly a 30 percent decline with time). The high reading of 1974 is a water level monitoring error. Encrustation is the principal reason for the declinining Q/s.

e. Specific capacity in V-160 also has declined steadily with time, from values on the order of 60 to 70 gpm/ft in the mid- to late-1960's to 50 gpm/ft in 1985; encrustation is thought to be the main cause. Early increases in Q/s from 1965 to 1970 may be related to poor well development when the well was initially drilled; subsequent pumping and non-pumping during early years of use actually served to remove additional drilling fluids from the well bore, thus increasing the specific capacity.

f. There does not appear to be any correlation between specific capacity value and trends in TDS, water levels and/or groundwater production versus time for these wells.

Predicted Future Drawdown. Based on representative values for aquifer parameters and pumping rates that were obtained from the aquifer tests, design values for T and S have been assigned in order to establish the magnitude of drawdown interference anticipated in new wells and the magnitude of future well spacing in the area. This method employs the Theis

equation which is well documented in the literature and is frequently utilized to define the theoretical distance-drawdown relationships between nearby wells.

Theoretical values have been calculated for drawdown in a single pumping well and for drawdown at radial distances of 1000 and 2000 ft from the pumping well, and for continuous pumping times of three months, six months, and one year. Based on our quantitative analyses of the aquifer test data, we also selected the following representative values for our assessment of distance-drawdown criteria: pumping rates of 500 gpm, 1500 gpm, and 2500 gpm; T values of 40,000 gpd/ft, 90,000 gpd/ft, and 150,000 gpd/ft; and S = 0.0008.

Table 5 - Predicted Future Drawdown - has been prepared to present the results of the calculations using the aforementioned variables. All drawdown data on Table 5 , including that in the pumping well and that at radial distances of 1000 and 2000 ft from the pumping well are assumed to be due only to that single pumping well.

Use of Table 5 for a single pumping well is as follows. For example, for an aquifer transmissivity of 90,000 gpd/ft, one well pumping continuously at 1500 gpm for six months would induce a drawdown in this well (self-induced drawdown) of approximately 43 ft. If the pumping rate were increased to 2500 gpm, the resulting self-induced drawdown would be approximately 72 ft after six months of pumping.

If another pumping well were to be located at either of these distances from the first pumping well, the drawdown influence of the first well at the second site would then be added to the self-induced drawdown at the second site in order to predict future drawdown at that second site. This additive procedure would also apply to any additional drawdown at the first well due to pumping at the second site.

TABLE 5 - PREDICTED FUTURE DRAWDOWN

Transmissivity at Pumping Well (gpd/ft)	Theoretical Drawdown (ft)								
	at 500 gpm			at 1500 gpm			at 2500 gpm		
	3 mos.	6 mos.	1 yr.	3 mos.	6 mos.	1 yr.	3 mos.	6 mos.	1 yr.
	in Pumping Well								
40,000	30	31	32	90	93	96	151	155	161
90,000	14	14	15	42	43	44	70	72	74
150,000	9	9	9	26	26	27	43	44	45
	at 1,000 ft from Pumping Well								
40,000	10	11	12	31	34	37	52	57	62
90,000	5	6	6	15	17	17	26	28	30
150,000	3	4	4	10	11	11	16	18	19
	at 2,000 ft from Pumping Well								
40,000	8	9	10	25	28	31	42	47	52
90,000	4	5	5	13	14	16	21	23	26
150,000	3	3	3	8	9	10	14	15	16

Use of Table 5 for multiple well pumpage is as follows. For example, for an aquifer T of 90,000 gpd/ft, one well pumping continuously at 1500 gpm for six months creates a self-induced drawdown of 43 ft and an additional interference drawdown of 17 ft at a radial distance outward from this well of 1000 ft. If an identical well were similarly pumping at this 1000-ft distance, total drawdown in each well would be: its own self-induced drawdown of 43 ft plus the interference drawdown of 17 ft created by pumping the other well; total drawdown is thus 60 ft in each well.

Groundwater Quality. To evaluate the chemical character of Saugus Formation water quality, we have prepared Figures 3.1 and 3.2 - Trilinear Analyses Diagrams. These diagrams are constructed using the relative percentages of the primary cations and anions in the water, with the percentages being based on the total equivalents per million of each major ion as determined in the water laboratory. Data shown on Figures 3.1 and 3.2 date from the late-1970's to 1987 for wells owned by NCWD and/or SCWC (Fig. 3.1), and from the late-1950's to 1985 for wells owned by NLF and/or VWC (Fig. 3.2). It should be noted that several of the wells listed on Figure 3.2 are used for agricultural purposes and, thus, do not require frequent quality testing, and/or have been abandoned and thus are no longer in use at all.

TDS values shown on Figures 3.1 and 3.2 and used elsewhere in this study are for total filterable residues and not the higher values of summation of individual ions as historically reported in the past. This approach is consistent with TDS values currently reported by local laboratories.

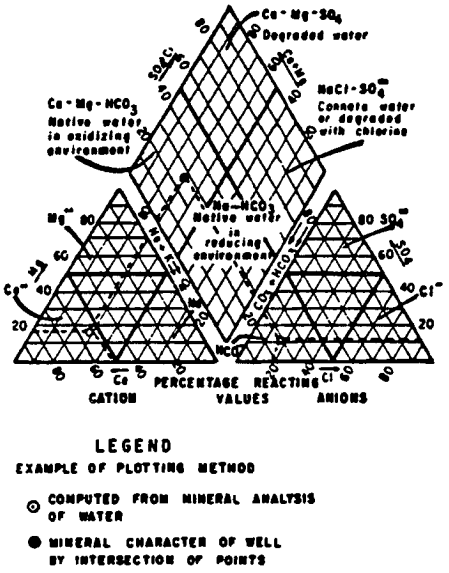
Figure 3.1 data are for six existing Saugus wells owned by NCWD, one destroyed well previously owned by SCWC

S8701

Newhall County Water Dist.
and
Santa Clarita Water Co.

Figure 3.1

TRILINEAR DIAGRAM - Saugus Formation



LEGEND

EXAMPLE OF PLOTTING METHOD

⊙ COMPUTED FROM MINERAL ANALYSIS OF WATER

● MINERAL CHARACTER OF WELL BY INTERSECTION OF POINTS

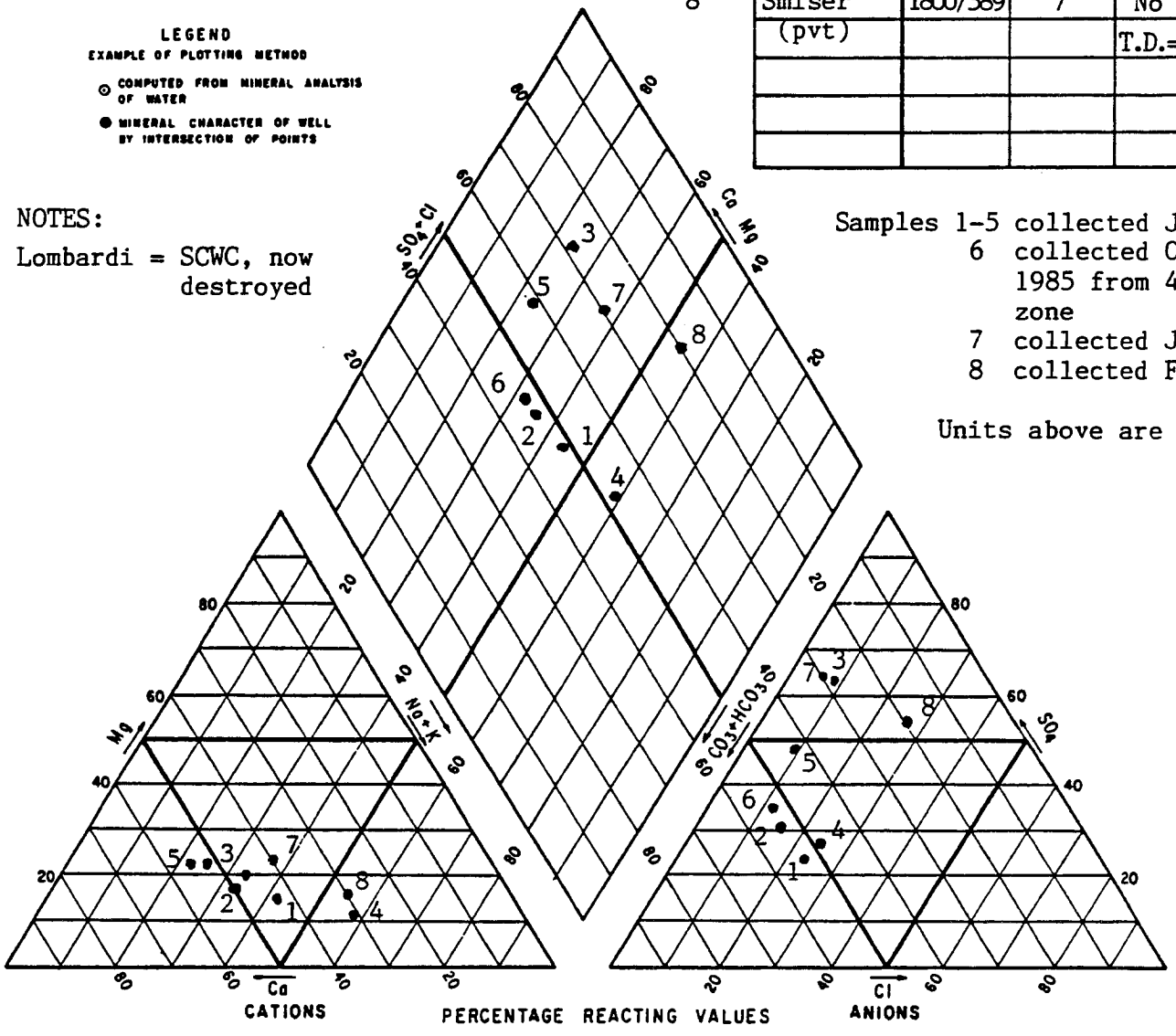
Symbol	Well	TDS/TH	NO_3	Perfs. (ft)
1	NCWD- 7	478/238	5	520- 974
2	- 8	410/234	5	342- 970
3	- 9	636/380	0	280- 591
4	-10	422/153	3	780-1550
5	-11	552/349	23	200-1075
6	-12	525/281	31	485-1280
7	SCWC Lombardi	766/395	8	260-1130
8	Smiser (pvt)	1800/589	7	No Data T.D.=1000 ft

NOTES:

Lombardi = SCWC, now destroyed

Samples 1-5 collected July 1984
6 collected October 1985 from 485-500 ft zone
7 collected June 1977
8 collected Feb. 1987

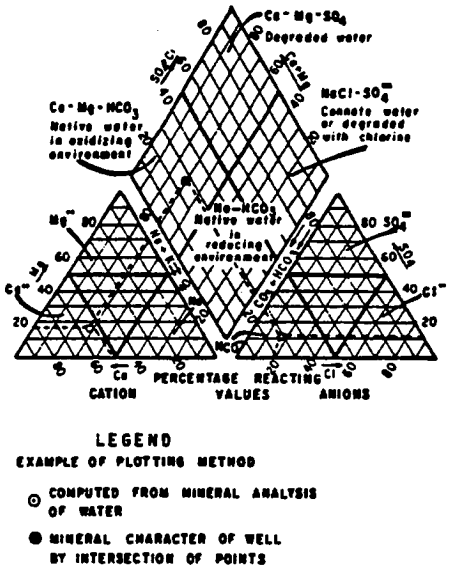
Units above are mg/l



S8701

Valencia Water Co.
and
Newhall Land & Farming Co.

Figure 3.2
TRILINEAR DIAGRAM - Saugus Formation



Symbol	Well	TDS/TH	NO_3	Perfs. (ft)
1	157	510/252	8	586-2008
2	160	690/403	11	950-2000
3	158	902/471	57	740-1605
4	156	1156/621	13	320-1800
*5	154	1027/593	34	29-1003
6	155	656/349	16	108-1468
7	159	1010/392	0	662-1900
8	P-2	1554/919	20	450-1290

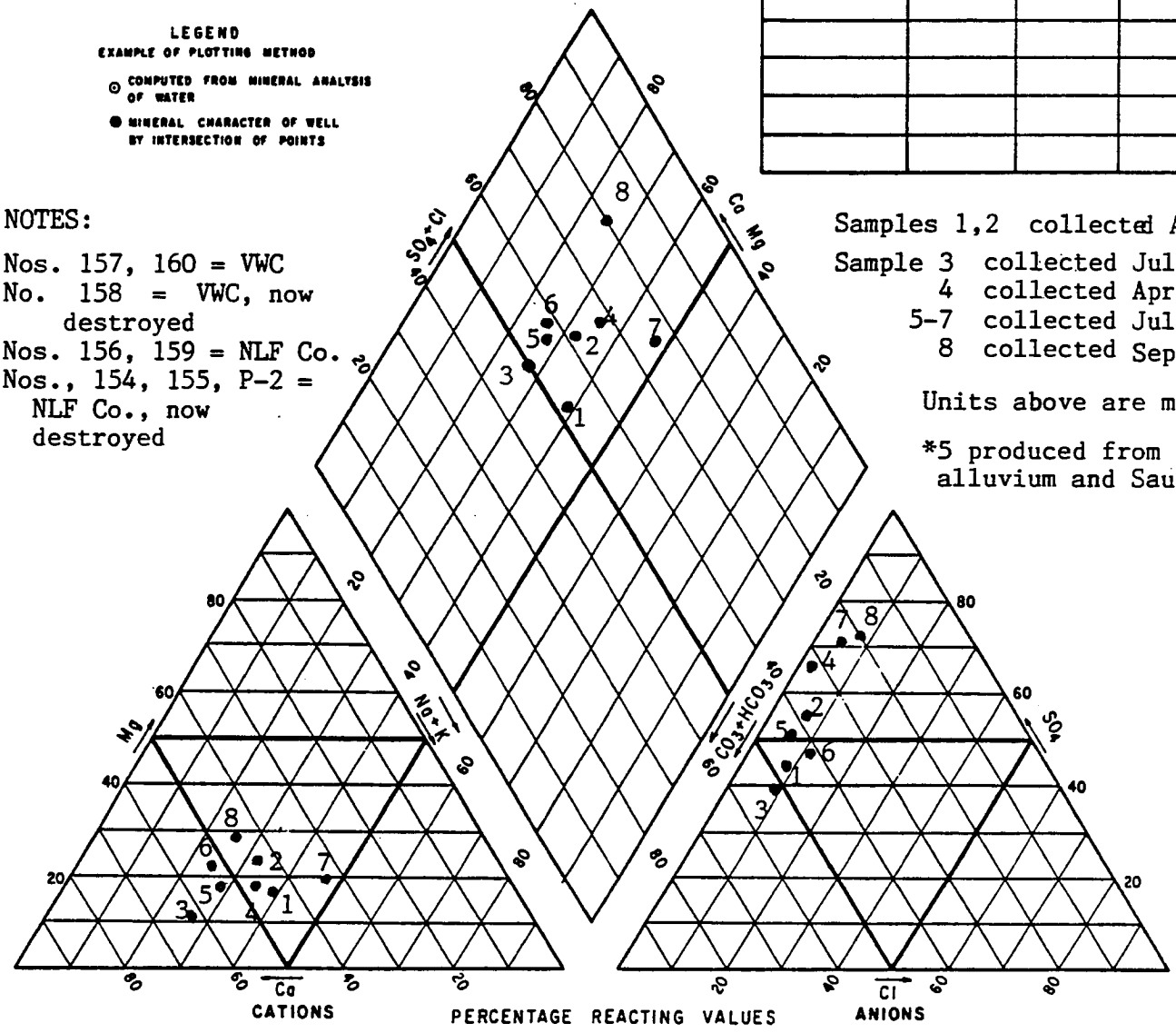
NOTES:

Nos. 157, 160 = VWC
No. 158 = VWC, now destroyed
Nos. 156, 159 = NLF Co.
Nos., 154, 155, P-2 = NLF Co., now destroyed

Samples 1,2 collected Aug. 1985
Sample 3 collected July 1981
4 collected April 1963
5-7 collected July 1964
8 collected Sept. 1959

Units above are mg/l

*5 produced from both alluvium and Saugus Fm.



(Lombardi well), and the only privately-owned well (Smiser well).

a. NC-7, -8, -10 and -12 display a calcium bicarbonate character which is representative of a natural subsurface environment of oxidizing conditions. In such an environment there is good movement and circulation of groundwater. In these wells, total dissolved solids (TDS) and total hardness (TH) are typically on the order of 410 to 525 mg/l and 153 to 281 mg/l, respectively.

b. In contrast, NC-9 and SC-Lombardi, located farther south in the basin, display a calcium-magnesium sulfate (calcium-magnesium sulfate) character on Figure 3.1 which may be representative of natural waters high in sulfate. Field monitoring during aquifer testing of NC-9 in the spring of 1987 detected the presence of a slight hydrogen sulfide odor in the discharge at the well head. There are no available laboratory data to define the concentration of hydrogen sulfide in this well, however. These two wells have TDS values of 636 and 766 mg/l, respectively, and TH values of 380 and 395 mg/l, respectively.

c. The Smiser well (symbol No. 8) is also located near the southern edge of the groundwater basin. It displays a slightly anomalous sodium-chloride sulfate character, possibly related to connate waters deep within the Saugus Formation. Because of its location very near the edge of the basin, and due to its approximately 1000-foot depth, this well probably produces, in part, from the Sunshine Ranch member of the Saugus Formation and likely is very near the top of the Pico Formation in this area. TDS and TH values are very high (1800 mg/l and 589 mg/l, respectively).

d. NC-11 also shows a calcium-magnesium sulfate character, but it is farther out into the basin than NC-9 and SC-Lombardi which have the same character. Its sulfate character, however, is probably not related to the penetration of NC-11 into the basal Saugus (its basinal location and well depth preclude this). Instead, because NC-11 has high perforations (beginning at 200 ft), and no deep cement seal, it obtains some production from the alluvium which is known to have sulfate.

e. NC-10, the well with the deepest level of uppermost perforations (perforations beginning at 780 ft) has a low TDS (422 mg/l) and a very low TH (153 mg/l) compared to the other wells shown on Figure 3.1.

f. None of these wells has a nitrate problem because no values are in excess of the State limit of 45 mg/l.

Data on Figure 3.2 reveals:

a. Wells nearer the center of the basin (such as V-157, -158 and -160) show a slight calcium-magnesium sulfate character, only slightly removed from the calcium bicarbonate character.

b. Wells NLF-159 and P-2 are located near the southern edge of the groundwater basin; they display the same calcium-magnesium sulfate character as other wells in this area (NC-9, SC-Lombardi). Neither well is deep enough to penetrate the full thickness of Saugus strata, however.

c. TDS values are generally high for all wells, ranging approximately between 500 and 1260 mg/l during the period of record; TH values ranged approximately between 250 and 950 mg/l.

d. Uppermost perforations in these wells, as a group, begin at depths below 320 ft, with the exception of NLF-154 (begin at 29 ft) and NLF-155 (begin at 108). The latter two wells, when active, did produce from the alluvium as well as from the Saugus Formation.

e. Gravel packs in the wells rise above the uppermost perforations and continue to near ground surface; where known, cement seals are only very shallow. Hence, these wells may obtain some groundwater from the allivium via leakage down the gravel pack, even though the perforations are deep.

f. V-158 displayed nitrate of 57 mg/l in July 1981, a value which exceeds State limits. However, this is almost certainly due to the lack of a deep cement seal rather than ambient high background levels of nitrate deep in the Saugus Formation.

Graphs of TDS vs. time are presented as histograms on Figures 4.1 and 4.2 for wells NC-9 and -10, and for V-157, -158, and -160. Notable on these TDS vs. time graphs are the following:

a. There appears to be a general increase in TDS in all five wells vs. time.

b. Generally, the amount of TDS increase with time for each well is approximately: 300 to 400 mg/l in Nc-9; 20 to 30 mg/l in NC-10; 50 to 75 mg/l in V-157; 300 to 350 mg/l in V-158; and 40 to 70 mg/l in V-160.

c. With the possible exception of NC-9, these wells display no relationship between increasing TDS values and water level elevations and/or groundwater production. For NC-9, the high TDS values of the early-1970's may correlate with concomitant years of high production in this well coupled with generally low water levels. As water levels decline in this southerly portion of the basin, more of the groundwater produced would be derived from the lowermost portions of the formation and, hence, would result in quality impairment.

To assess the relative potential of the Saugus Formation groundwater to either corrode or encrust steel well casing, the Langelier Calcium Carbonate Saturation Index and the Ryznar Stability Index were calculated for 16 wells from laboratory data dating between 1963 and 1987 (requisite data do not exist for NC-1,-2,-3,-4,-5, or -6, all of which were destroyed years ago). Though the calculations and tabulations are not presented herein, the resulting index values are:

a. +0.02 to +0.70 for the Langelier Index. Here, the larger the positive value, the greater is the tendency for the water to deposit calcium bicarbonate and, hence, cause encrustation; a large negative value indicates a tendency to dissolve calcium bicarbonate (hence, cause corrosion). With this index, the water has a slight tendency to induce encrustation.

b. 6.1 to 7.4 for the Ryznar Index. With this index, low values are considered to be encrustating, while high values tend to indicate corrosive conditions. Ryznar value in the range of 7 to 9 are generally considered to be neither severely corrosive nor heavily encrustating.

Theoretical Water Quality. Estimates of groundwater quality (TDS, total dissolved solids) can be made using data derived from the spontaneous-potential (SP) and resistivity curves of electrical logs (E-logs) of oil and water wells, provided that certain properties of the drilling mud are also known. Various methods are discussed by Mougne (1978, and personal communication, 1987), Guyod (1966), Jones and Buford (1951), and Bryan (1950).

Important properties of the mud include: type of mud, mud weight, viscosity, temperature, and mud resistivity (Rm) and resistivity of the mud filtrate (Rmf). Calculations are made to determine the resistivity of the water (Rw) within the aquifers. The water-resistivity values are then converted to hypothetical salinity values on the basis of experimentally derived resistivity-salinity curves for various types of groundwaters (bicarbonate, sulfate, chloride waters).

Our initial approach was to apply the various methods of estimating water quality (TDS) to the Saugus water wells for which there are electric logs and laboratory data on water chemistry. Unfortunately, the properties of the drilling mud for all but one of the Saugus water wells are not known, so we could not apply the calculations to individual water wells for the purpose of calibrating our method. Therefore, we calculated TDS values using E-logs and mud data from oil wells in the vicinity of the water wells and compared the theoretical TDS values from the oil wells with the known water chemistry from the nearby water wells.

We calculated theoretical TDS values for two different depth zones in the Saugus: a shallow zone (500 feet to 1000 feet in depth) and a deep zone (2000 feet to 2500 feet in depth). These two depth zones were selected to represent both the shallowest and deepest aquifer zones available for casing perforations in potential future water wells. Additional intermediate depth zones were not selected for several reasons. Degraded groundwater quality generally results from either man-influenced, near-surface activities or from deeper natural formation properties. If, for example, both the shallow and deep zones display similar character, an intermediate zone at the same site also can be expected to display a like character. Theoretical quality determinations are intended to be used as general guidelines only. This intended usage as well as the inaccuracies inherent in the method make theoretical quality determinations for intermediate depth zones an unnecessary, and likely unwarranted, level of interpretation.

Results of the theoretical calculations show values from the oil wells ranged from 20 percent lower TDS values than in nearby water wells to 30 percent higher TDS values than in nearby water wells. Our calculated theoretical TDS values, therefore, may be within approximately plus or minus 20 to 30 percent of the actual TDS values. Other factors also affect the accuracy of the TDS calculations.

A minimum of one wildcat electric log, as available, was reviewed for each square mile section of land within the Saugus Formation study area. These well locations and their relative degree of theoretical salinity [TDS, in mg/l or ppm, which is specially shown wherever TDS is less than (<)800 ppm mg/l] for both the shallow depth zone and the deep depth zone, are illustrated on Plate 9 - Theoretical Water Quality. On that plate, regions having TDS <800 ppm in the shallow zone

only (500 to 1000 ft) are lightly shaded with a regularly-spaced dot pattern; regions having TDS <800 ppm in the deep zone only (2000 ft to 2500 ft) are hachured; regions having TDS <800 ppm in both the shallow zone and the deep zone are shaded with an irregularly-spaced dot pattern. Finally, regions within the Saugus Formation exposure area that have no data, or that display theoretical TDS >800 ppm in either both depth zones or in the shallow zone where no deep zone exists are left open and unshaded.

Of particular interest on Plate 9 is the following:

a. The region northeasterly of the San Gabriel fault zone has only a limited thickness of Saugus beds; only small portions of the Saugus has theoretical TDS <800 ppm, these occurring mainly near San Francisquito Canyon.

b. In the region between the San Gabriel and Holser faults, large areas have water of generally good quality (<800 ppm) in both the shallow (500 ft to 1000 ft) zone and the deep zone (2000 ft to 2500 ft). In the area north of Hasley Canyon and west of Interstate 5, theoretical TDS values in excess of 800 ppm occur in both the shallow and deep Saugus zones being evaluated.

c. For the region southerly of the Holser fault, groundwater of generally good quality (<800 ppm of theoretical TDS) is also seen to be widespread in both the shallow and deep zone. However, the deep zone area of good quality is less areally extensive, particularly in the region to the west, south, and east of Newhall. In this region, only the shallower Saugus aquifers appear to have theoretical TDS <800 ppm. Also, the region northerly of Pico Canyon and west of Interstate 5 does not display groundwater of theoretical TDS <800 ppm in either the shallow or the deep zone.

In general, the calculated values for theoretical TDS from oil well data are in relatively good agreement with actual TDS values determined from laboratory testing of water well samples for Saugus Formation wells in the Newhall-Saugus

area. However, Plate 9 information should be used only as a guide to water quality; water quality is likely to vary locally from that shown on the Plate. For example, the water in water well NLF-156 south of Castaic Junction has measured TDS values as high as 1157 ppm; the perforated interval is from 320 to 1800 feet. Plate 9 indicates that the area around NLF-156 should have <800 ppm of theoretical TDS in both the shallow and deep Saugus aquifers. It should be noted that direct comparison from theoretical TDS to actual laboratory-generated TDS values from existing wells is difficult because most Saugus water wells have either very shallow upper perforations (thus they produce groundwater from the alluvium also) or they have very shallow cement sanitary seals (thus they allow inflow of alluvial groundwater into the gravel pack), or both.

THICKNESS AND DISTRIBUTION OF FRESH WATER-BEARING DEPOSITS

The base of the fresh water-bearing deposits was determined from electric logs (E-logs) of about 250 oil wells scattered throughout the Eastern Groundwater Basin. For the most part, the base of fresh water was identified from the resistivity curves.

In some portions of the basin, the vertical transition from saline (salt water) to fresh water is very abrupt and unambiguous. In other parts of the basin, the transition from salt water to fresh water is gradual and may occur over a vertical distance of hundreds of feet. in such cases, the base of fresh water was chosen, insofar as possible, at the top of the zone of transition from salt water to fresh water.

The reliability of using the E-logs to identify the base of the fresh water-bearing deposits depends on many factors: the properties (mineralogy, cementation, etc.) of the deposits; the type of fluids and gases in the pore spaces (water, oil, gas); the chemistry and resistivity of the drilling mud; formation temperature; the kinds of supplemental data available to the interpreter (well histories, lithologic logs, drilling mud chemistry); and the interpreter's experience in the area or basin of interest. Our approach was to obtain a representative number of E-logs (at least one per square mile, if available), interpret the E-logs, make a preliminary contour map (base of fresh water) to identify areas where data were ambiguous or where additional data were needed, obtain additional E-logs and other data, integrate the new data and reinterpret the E-logs as necessary, re-contour the data and finalize the base of fresh water work map.

Plate 5 shows our interpretation of the thickness of fresh water-bearing deposits within the Eastern Groundwater

Basin. The thickness contour lines are shown only where they fall within the area underlain by the Saugus Formation. As discussed elsewhere in this report, the upper part of the Pico Formation which underlies the Saugus Formation was found to contain fresh water in the southwestern part of the basin, the area south of the Holser fault and west of the San Gabriel fault. Plate 4 - Hydrogeologic Sections - also shows the base of the fresh water-bearing deposits. The fresh water-bearing deposits are thickest southwesterly of the San Gabriel fault: 5500 ft as compared to 1500 ft northeasterly of the fault.

This investigation focused on the future development potential of the deep aquifers within the Saugus Formation. The depth of interest, which ranges from 500 ft to a maximum 2500 ft below ground surface, was chosen on the basis of economic, hyrogeologic, and water quality considerations. The depth zone of interest shown on the Hydrogeologic Sections comprises the fresh water-bearing strata of the Saugus Formation: (1) between the depths of 500 ft and 2500 ft (where the base of the fresh water-bearing Saugus strata is greater than 2500 ft in depth); (2) between 500 ft and the base of the fresh water-bearing deposits within the Saugus Formation (where the base of the fresh water-bearing Saugus strata is less than 2500 ft in depth); or (3) between 500 ft and the base of the Saugus Formation (where the base of the Saugus Formation is less than 2500 ft in depth and the base of the fresh water-bearing deposits is within the Pico Formation which underlies the Saugus Formation).

A comparison of our map of the thickness of fresh water-bearing deposits with data published by the Division of Oil and Gas (D.O.G.) indicates discrepancies in some areas. The D.O.G. publishes data on the base of fresh water-bearing

deposits in the areas underlain by oil fields. In some areas, our map indicates that the fresh water-bearing deposits are significantly thicker (deeper) than indicated by the Division of Oil and Gas. The implication is that drilling, completion, abandonment, and waste-water disposal practices at some oil fields and in areas of wildcat exploratory drilling may need to be modified in the future in order to protect the deep fresh-water resource within the Eastern Groundwater Basin.

STORAGE CAPACITY - SAUGUS FORMATION

BACKGROUND INFORMATION

The groundwater reservoir for this study is represented solely by the Saugus Formation of the Eastern Groundwater Basin. Surface exposures for this formation occupy a surface area of approximately 53 square miles (sq.mi.) (the base maps for each plate in this report delineate this outcrop area). In addition, the fresh water-bearing portion of the formation extends to a maximum depth on the order of 5500 ft (in the area between the Holser and San Gabriel faults). As shown on our base maps, an additional 5.61 sq.mi. of area in the basin are mantled by surface exposures of terrace deposits, while the remaining 27.14 sq. mi. of the local groundwater basin are represented by surface exposures of alluvium.

Within a groundwater reservoir having water table conditions, the storage capacity typically represents the total volume of water that can be held in underground storage at a given period of time and that can become readily available for extraction by wells. However, the Saugus Formation displays artesian (confined) groundwater conditions, wherein its

aquifers are under pressure. Because of this, the determination of groundwater in storage in these aquifers is not as time dependent as it is for the alluvial aquifers that exhibit water table conditions.

Hence, for the purposes of this study we have calculated the groundwater storage capacity of Saugus aquifers recognizing they are confined. Water levels, as represented by the piezometric surface in wells perforating Saugus aquifers, will rise considerably above the top of the uppermost perforated aquifer zone. In essence, individual sandy aquifers at depth remain "full" and pressurized so long as the piezometric surface remains above the aquifer. Pumping, in essence, causes a pressure reduction (a lowering of the piezometric head) wherein water is "squeezed" from the confined aquifer. It is not until the piezometric surface is lowered to the top of the confined aquifer that groundwater is literally removed from storage in the aquifer.

For this report, we have determined the usable groundwater in storage for the Saugus Formation. Usable groundwater in storage will be defined as the quantity (volume) of groundwater, in acre-feet, that occurs in Saugus aquifers in the study area. To be usable, the water must be economically obtainable to wells (i.e., such items as well yield, drawdown, or drilling depths should not be excessive); and the water must be of satisfactory quality for beneficial use.

Future Saugus wells, as evidenced by several existing wells, should have acceptable well yields and drawdowns. Because of the very uneven distribution of Saugus water wells in the area, there are no quality data for large areas of Saugus exposures. For these exposure areas, we have assessed the theoretical water quality of future wells based on review of existing wildcat oil wells.

Lastly, we have had to select those depth zones within the Saugus Formation to which, using present technology, it is still considered feasible to drill and complete a water well. The maximum thickness of the groundwater reservoir for the Saugus Formation which may contain groundwater of acceptable quality varies from 1500 ft northerly of the San Gabriel fault, to 5500 ft between the San Gabriel and Holser faults, to 5000 ft southerly of the Holser fault (see Plate 5). Even though the aquifers are confined and the resultant piezometric levels from even very deep wells are expected to be within one to three hundred feet below ground surface, we do not believe it is necessary to drill to 5500 ft to get adequate water. Below the depths discussed above are older Saugus strata or other formations which contain groundwater of unacceptable quality.

Furthermore, we have limited our analysis of groundwater in storage to only the sand and/or gravel zones (as noted on electric logs) within the Saugus Formation, and only to such aquifers which occur in our so-called zone of interest, that is, between the depths of 500 ft (the uppermost zones to be perforated, thus precluding interference with any alluvial wells and potential quality degradation from surface contamination) and: 2500 ft; or the base of fresh water within the Saugus Formation; whichever is encountered first.

For our calculations, we also considered the fact that the Saugus Formation is comprised by generally well-bedded strata which vary in grain size and character from shales to siltstones to sandstones to conglomerates. Thus, to calculate groundwater in storage it was considered unreliable to mearly select an average zone of interest thickness for the entire Saugus Formation and to apply this value throughout the study area. Likewise, it was deemed inadvisable to select one value

of specific yield for all Saugus strata and to utilize this single value for computational purposes.

METHODOLOGY

To quantify the volume of usable groundwater in storage that is potentially available for extraction, it is necessary to multiply the total volume of potential aquifers by the specific yield of these aquifers. In this assessment, specific yield represents the ratio of the volume of water which can be drained by gravity from a potential aquifer to the unit volume of that stratum. Our procedure for calculating usable storage capacity involved the following steps.

1. Identifying of potential Saugus aquifers.
2. Defining the total thickness of these potential aquifers in the basin.
3. Preparing contours of equal thickness of these potential aquifers in the basin.
4. Subdividing the groundwater basin into individual storage units and thickness zones.
5. Assigning specific yield values to the potential aquifers.
6. Computing the usable groundwater storage capacity (SC), using the formula SC = AmSy, where A = surface area of the storage unit, m = thickness of potential aquifers in that unit, and Sy = the assigned specific yield.

POTENTIAL SAUGUS AQUIFERS

Work here involved reviewing at least one electric log, if available, for each square mile section of land within the Saugus Formation boundaries. Based on electric log signatures, we delineated on each log the footage of individual sand or gravel zones only. These relatively coarse-grained

strata were thus considered as the only potential aquifers within the Saugus Formation. In this way, we eliminated from consideration of groundwater in storage all remaining portions of the Saugus, i.e., all siltstones, shales, and other fine-grained strata.

For the thickness of a sand or gravel layer to be counted in our calculation, it was determined that the layer had to be at least 10 feet thick; in this way, the layer was considered usable and could receive perforations in a future water well. If the sand or gravel layer was less than 10 ft thick and/or if it were bounded by clays greater than 10 ft thick, it was determined that the sand was isolated and that no future well perforations would be placed here; such a sand layer was also not counted for our calculations. Similarly, sands less than 30 ft in thickness that were bounded by clays more than 30 feet thick were considered isolated also and, hence, were not counted in our total sand footage calculations.

TOTAL THICKNESS OF POTENTIAL AQUIFERS

Using the electric logs, we then totalled the footage of all relatively coarse-grained beds (sands and gravels); this total footage at each well data point then became the total amount (i.e., total thickness) of potential aquifers in the zone of interest available for a future water well at each site.

CONTOURS OF POTENTIAL AQUIFER THICKNESS

For this, it was necessary to plot the location of each electric log data point on a map (Plate 6), together with its total footage of sand as identified from the electric log.

Contour lines of equal sand thickness, in feet, were then prepared as seen on Plate 6. Variations in the locations and patterns of these contours are a direct reflection of such conditions as: changes in both the vertical and horizontal locations of the ancient stream courses which deposited these coarse grained Saugus strata during geologic time; and the effects of faulting and folding of these sediments following deposition.

STORAGE UNITS AND THICKNESS ZONES

Due to the size of the study area, the outcrop area of the Saugus Formation had to be divided into smaller, more easily managed units. To do this, we divided the outcrop area into three main groundwater storage units. Selection of these three units was based on the same boundaries (i.e., the faults) as were our discussions of the Saugus Formation in the Regional Geology section. Hence, Storage Unit No. 1 lies northerly of the San Gabriel fault; Unit No. 2 is located between the San Gabriel and Holser faults; and Storage Unit No. 3 lies southerly of the Holser fault.

To further ease computations and to more readily planimeter surface areas, we then subdivided each storage unit into several individual storage subunits. The surface area of each subunit was then planimetered, with these areas then being summed to define the total surface area of each storage unit.

For example, Storage Unit No. 2 which lies between the San Gabriel and Holser faults, was divided into 15 subunits (Subunit Nos. 1-A through 2-O); these subunits range from 632 acres to 1749 acres in surface area. For simplicity, individual subunit locations and letter designations have not been drafted onto Plate 6.

It was also important to determine the average thickness of potential aquifer sands for each subunit. To do this, we planimetered the surface area in each subunit between the various sand thickness contours on Plate 6. For example, Storage Subunit 2B is traversed by the 0- to 400-foot and the 400- to 800-foot sand thickness contour lines. The area of the thickness zone 0 to 400 feet was planimetered and was assigned an average thickness of 200 feet due to the distribution of data points and contours. The area of thickness zone 400 to 800 feet was planimetered and was assigned an average thickness of 600 feet due to its distribution of data point and contours.

In all, 28 individual subunits were delineated within the three groundwater storage units of the Saugus Formation. Each was further subdivided on the basis of total sand thickness intervals, resulting in forty separate computations to derive the total amounts of usable groundwater in storage in the Saugus Formation.

SPECIFIC YIELD VALUES

Because the Saugus Formation aquifer sands vary horizontally and vertically in location and grain size distribution, it was necessary to assign different specific yield values to these aquifers based on their location in the overall reservoir. Moreover, because of the vertical displacement effects of the proximal faults, it is known that outcrop areas of the Saugus Formation on different sides of these faults are of different age. These age differences were also considered in our assignment of specific yields.

Based on the above, it was our opinion that a realistic range of specific yield values in the various subunits is from a low of 5 percent to a high of 8 percent. By way of

comparison, our assignment of specific yield values for the alluvium which overlies the Saugus Formation ranged between 9 and 16 percent (Slade, December 1986).

USABLE GROUNDWATER IN STORAGE

This final step calculated the total estimated volume of usable groundwater in storage in the Saugus Formation by multiplying the total surface area of each storage unit, by the average sand thickness of each sand thickness interval within each of the subunits, by the specific yield value assigned to that sand thickness interval.

Table 6 - Summary of Usable Groundwater in Storage - presents the results of our computations. It identifies the usable quantity (volume) of groundwater in storage in the Saugus Formation between the depth limits of 500 feet and either: 2500 feet; or the base of fresh water within the Saugus Formation, whichever is shallower. As seen on Table 6, the total estimated amount of groundwater in storage in the sands and gravels which constitute the potential aquifers within the Saugus Formation is approximately 1.41 million acre-feet. Storage Unit No. 1 (northerly of the San Gabriel fault) has approximately 130,500 acre-feet of usable groundwater in storage (about 9 percent of the total); Unit No. 2 (between the two faults) and Unit No. 3 (southerly of the Holser fault) each has approximately 641,000 acre-feet of usable groundwater in storage (about 45 percent of the total for each).

In comparison to the calculated 1.41 million acre-feet of usable groundwater in storage in the sand and gravel aquifers of the Saugus, Robson (1972) for the U. S. Geological Survey reported a total storage capacity for the entire Saugus Formation of approximately 6 million acre-feet.

TABLE 6 - SUMMARY OF USABLE GROUNDWATER IN STORAGE

STORAGE UNIT NO.	LOCATION OF STORAGE UNIT	STORAGE SUBUNIT DESIGNATIONS	TOTAL SURFACE AREA (acres)	RANGE OF SAND THICKNESS (ft)	RANGE OF SPECIFIC YIELDS (%)	USABLE GROUNDWATER IN STORAGE (ac-ft)
1	Northerly of San Gabriel fault	1A - 1Db	7,607	0 to 440	7	130,540
2	Between the two faults	2A - 2O	13,980	0 to 1400	5-8	641,330
3	Southerly of Holser fault	3A - 3H	16,501	0 to 1240	5-8	641,240
		TOTALS	39,088			1,413,110

RECHARGE POTENTIAL

For the Saugus aquifers to be viable sources of groundwater, they must not only have sufficient groundwater in storage but they must also be capable of being recharged. Potential recharge sources include: deep percolation of direct precipitation on the outcrop area of the Saugus Formation, including deep percolation of precipitation on outcrops of terrace deposits which thinly veneer the Saugus; and direct infiltration from the saturated portions of the alluvium of the Santa Clara River that overlie Saugus strata. The following paragraphs provide our methodology used in assessing the magnitude of each type of potential recharge.

Within the mapped area of Plate 3, the total surface area of Saugus Formation exposures is 52.81 square miles while that of the terrace deposits is 5.61 square miles. This represents a combined surface for the two formations of 58.42 square miles, or 37,390 acres. Review of isohyets (equal precipitation contours) of the 100-year normal precipitation for the region presented in Slade (December 1986, Plate 9), reveals that a reasonable value for average annual precipitation on Saugus and terrace deposits outcrops is approximately 15 inches (1.25 ft). Thus, on a long-term average annual basis, total precipitation falling on Saugus and terrace deposits materials is approximately 46,750 ac-ft/yr.

To evaluate how much of this volume might be available for deep percolation, it is to be recognized that infiltration will vary according to many parameters, such as topography, slope, type and cementation of strata, grain sizes, rainfall intensity, evaporation, transpiration, etc. For the purposes of this project and because definitive values for most of

these variables are not available in the literature, it is estimated herein that the long-term average deep percolation is on the order of 10 to 15 percent of the long-term average annual precipitation. Our calculation excludes potential recharge to the Saugus via direct precipitation onto the alluvium in the region.

The second form of potential recharge is direct infiltration into the Saugus from the saturated portions of the alluvium in the Santa Clara River where it directly overlies the Saugus Formation. For this assessment, we are assuming several conditions, including:

1. Direct infiltration from saturated alluvium to the Saugus occurs only from the alluvium of the Santa Clara River; thus, we are excluding the additional recharge that would occur into the Saugus Formation by direct infiltration from the saturated portions of the alluvial deposits of all creek channels that are tributary to the Santa Clara River. That is, we are NOT including in our calculations the potential recharge to the Saugus from saturated portions of the alluvium in such tributaries as Castaic Creek, San Francisquito Canyon, or even South Fork Santa Clara River.

2. Regardless of whether or not surface flow is present in the Santa Clara River, the subjacent alluvium, at least in its lower portion, is always saturated. This is readily recognized by review of hydrogrphs, water level conturs and calculations of groundwater in storage presented for the alluvium in Slade (December 1986); even in the water level lows of 1965 in the alluvium, the lower portions of the Santa Clara River alluvium contained groundwater.

3. Since groundwater levels in the alluvium fluctuate in response to general wet and dry cycles, it was considered important to assess the magnitude of deep percolation from the alluvium in contrasting hydrogeologic periods. As a result, we selected for comparison the historic water level high in the alluvium (April 1945) and the historic water level low in the alluvium (November 1965), based on review of Slade (December 1986).

4. Other conditions incorporated into our assessment were such items as the variations in permeability of the strata, variations in the saturated thickness of the alluvium in different reaches of the river valley, changes in the groundwater gradient along different reaches of the valley, and variations in the width of the valley in the region.

5. The recharge to the Saugus is in the form of repressurization of the confined aquifers; such repressurization will tend to maintain current piezometric levels in wells.

On the long-term average annual basis, results of the requisite calculations show the following:

1. Deep percolation of direct precipitation onto Saugus and terrace deposits outcrops that is available for potential recharge to the Saugus is on the order of 4700 ac-ft/yr to 7000 ac-ft/yr.

2. Maximum direct infiltration from the saturated portions of the river alluvium into the Saugus likely occurred during the water level highs of April 1945 and totaled approximately 15,200 ac-ft/yr.

3. In contrast, the minimum direct infiltration from the saturated portions of the alluvium into the Saugus likely occurred during the water level lows of November 1965 and totaled approximately 6100 ac-ft/yr.

Thus, total potential recharge to the Saugus represents the sum of the deep percolation of direct precipitation and direct infiltration.

Hence, the overall magnitude of potential recharge to the Saugus Formation (i.e., as a re-pressurization of the confined aquifers), recognizing the aforedescribed assumptions and conditions, ranges approximately between: 19,900 and 22,200 ac-ft/yr in water level high periods like 1945; and 10,800 to 13,100 ac-ft/yr in water level low periods like 1965.

WELL CONSTRUCTION

ALTERNATIVE DRILLING METHODS.

There are three basic methods for drilling municipal-supply water wells in the study area. The key issues for each method are summarized as follows:

1. Cable-tool Method: This is one of the oldest methods used for constructing wells. Wells in the study area drilled prior to the mid-1950's were drilled by this method. It is considered to be particularly effective in unconsolidated alluvial deposits containing abundant cobbles and boulders. However, drilling proceeds very slowly by this method and drilling to adequate depths into the Saugus Formation would be very difficult. Additional drawbacks include: because casing is driven continuously as drilling proceeds, perforations must be punched through the casing after the casing is at total depth of the well--this results in irregular perforation openings, poor control of sand, probable formation damage, and inefficient entrance of water into the well; and because steel casing is always in the hole during drilling, no geophysical electric log survey can be conducted, thus precluding accurate definition of aquifer systems.

   Because of these drawbacks, the cable-tool method should not be used for drilling any new wells and thus its further consideration is not deemed appropriate in this report.

2. Direct Rotary Method: This process involves a rotating drill bit and circulating drilling fluids (generally clay-based) to remove cuttings from the borehole; cuttings travel up the borehole in the annular space between the drill pipe and the wall of the borehole.

   This method permits drilling of a small diameter pilot hole (often 8 to 12 inches) which can then be electric logged. With these data, the well screens and gravel pack can be carefully selected, while the pilot hole is being reamed, and then installed to the final depth of the well. Proper screen slot width and gravel pack

selection will preclude sanding problems and optimize well efficiency.

Drilling fluids can control unconsolidated deposits in the hole, although concentrations of boulders, particularly at relatively shallow depths, can slow drilling progress noticeably. Penetration rate in more typical alluvial deposits may often be in the range of 15 to 30 feet per hour, while drilling rates in the Saugus Formation may be on the order of 5 to 10 ft/hr. Poor control of drilling fluid additives in the borehole can damage the aquifers and create development problems.

3. Reverse Circulation Rotary Method: This method is similar to the direct rotary process, except: the drilling fluid is often only water, and it is circulated down the annular space between the drill pipe and borehole walls and up the drill pipe with the cuttings in suspension.

   Typical pilot holes are 16 to 18 inches in diameter and permit electric log surveys also. Screens and gravel packs can be designed during reaming operations and then installed in the borehole, thereby providing the same benefits as the direct rotary method.

   Because the reverse process drills a larger diameter pilot hole, the drilling process is generally slower than the direct method: penetration rates of 4 to 8 feet per hour are not uncommon. Furthermore, continuous water supplies for drilling by this method may be as high as 100 to 300 gallons per minute, or more, if the unsaturated deposits in the upper portion of the hole are particularly porous and permeable. Large boulders are also troublesome, particularly if encountered in shallow deposits. Because clay-based mud additives are generally not used as the circulating fluid in reverse-drilled holes, the final completed well is often easier to develop compared to direct mud rotary-drilled holes.

QUALITY SAMPLING

Following geologic logging and electric logging of the pilot hole, two or three potential aquifers will be selected

from which water samples will be collected by special techniques within the open borehole. Such down-hole aquifer water sampling is necessary to assess quality at depth.

WELL CASINGS

The next step is the final design of the well casing (the casing completion). This casing completion consists of the pump housing casing, the blank (nonperforated) well casing, and the perforated casing (well screen). Key elements of each are summarized as follows:

1. Pump housing casing: This is the uppermost casing in the well and forms the section within which the pumping equipment will be located. The diameter and depth of the pump housing must be selected to accommodate the desired well yield, the anticipated specific capacity of the well, and the long-term water level (pressure) declines in the basin due to drought. Appropriate casing diameters must be selected to provide adequate clearance for the pump bowls and minimum head losses for uphole water flow.

2. Blank well casing: This is the blank (unperforated) well casing that is situated between the pump housing casing and the well screen. It can also be placed between sections of perforated casing in order to blank-off non-productive aquicludes and/or zones of inferior water quality.

   Blank casing must be selected with appropriate diameters and strengths to meet the anticipated well yields and depth settings of the wells. Corrosion resistance could be a consideration if groundwater quality is adverse.

3. Perforated casing: Casing perforations which provide efficient and sand-free production of groundwater are necessary. Well screens (wire-wrapped, continuous V-shaped slots) or shutter-type (louvered) perforations are the most commonly used varieties in southern California. As stated previously, the down-hole perforating of casing in cable-tool drilling is not considered a viable alternative.

Casing perforation widths are selected to retain the gravel pack around the casing; the gravel pack is selected to preclude entrance of fine-grained sediments in the formation from entering the well. Casing perforations should be selected to optimize intake area (the open area in the perforations per unit length of casing), thereby minimizing head losses associated with the entrance of water into the well. As with the blank casing, the diameters and strengths of the perforated casing must be selected to meet the anticipated yields and depth settings of the wells.

WELL DEVELOPMENT

Thorough development of the completed well is one of the most critical elements in providing a high-efficiency well. Well development is necessary to: reduce the damage to the aquifers caused by fluid/mud invasion during drilling; and increase the porosity and permeability of the gravel pack and local aquifers by stabilizing them and by removing fine-grained materials from the interstices between the sand/gravel grains.

Development techniques include bailing, swabbing, surge block-simultaneous airlifting, and test pumping. The use of a short surge block with simultaneous airlifting in each section of the well perforations is considered the most effective technique for proper mechanical well development. Pumping development, by using the deep well test pump to alternately pump and surge, is made especially effective when preceded by the aforementioned mechanical development. In addition, chemical well development is sometimes necessary to help disperse residual wall cake at the borehole/gravel pack interface; this is done by the application of appropriate

chemicals into the well and forcing them out through the perforations and into the gravel pack, generally prior to mechanical development. Chemical development is especially desirable when a clay-based drilling fluid has been used.

CONCLUSIONS AND RECOMMENDATIONS

1.0 FEASIBILITY

Based on review and analyses of existing data and of limited field testing of selected water wells, it is our opinion that it is hydrogeologically feasible to develop additional groundwater supplies from aquifers within the Saugus Formation. Due to the nature of the existing Saugus Formation hydrogeologic data base, it is considered important to drill and test exploratory pilot holes before completing them as permanent water wells.

Average annual volumes of Saugus groundwater production have been determined, as has been the usable volume of groundwater in storage in selected sand and gravel aquifers within the upper, usable portions of this formation. Also defined were the general directions of groundwater flow, current piezometric levels for the artesian system itself, and general aquifer parameters and water quality.

Regions within the Saugus Formation outcrop area have been identified where it is considered most feasible to drill and test these exploratory pilot borings. Should geologic and geophysical logging, and down-hole water quality sampling of these borings validate the findings of this report, then the pilot holes can be immediately reamed out and completed as production water wells. Guidelines for drilling and completing the test

holes/wells are provided herein. Once a well site is selected from the priority regions for drilling, a site-specific letter-report should be issued to verify local anticipated conditions which are essential to prepare site-specific, well construction specifications.

It was not within the scope of work for this hydrogeologic assessment of the Saugus Formation to determine its perennial yield. Our preliminary evaluation of the potential recharge to the Saugus should not be construed as a rigorous determination of its perennial yield. Additional hydrogeologic data, and factual data from greater portions of the Saugus outcrop area are needed to obtain a realistic appraisal of its perennial yield.

Though not specifically studied for this project, "banking" of surplus surface water or imported water is not likely as feasible within the Saugus Formation as it is for the alluvial sediments in the valley. Slade; December 1986, provides information on artificially recharging ("banking") within the alluvial deposits.

2.0 DATA BASE FOR SAUGUS FORMATION

2.1 Water Wells. Historically, only 22 wells have been drilled sufficiently deep to produce groundwater from the Saugus Formation. Of this number, only eight were active producers in 1986; one was not yet equipped with a pump; the remaining 13 wells were either destroyed or considered inactive on standby use only.

There are no active wells presently located between the Holser and San Gabriel faults or north of the San Gabriel fault, and no Saugus water wells have ever been drilled north of the San Gabriel fault. No water well

has ever fully penetrated the full thickness of the Saugus Formation in the area. The three newest Saugus wells were drilled in 1973, 1978 (a private well), and 1985. All other wells pre-date the mid-1960's.

Of the still usable wells, all were drilled by rotary methods, except two (NC-7 and NC-8), which were drilled by cable tool methods. The rotary-drilled wells generally have louvered-type perforations (two have vertically slotted casing); the cable tool wells have knife-cut perforations. Vertical slots and knife-cut perforations are considered to be antiquated designs. Well screens and/or louvered casings provide more open area, less head loss, and higher well efficiency.

Where data are available, and with the exception of NC-12 (420-foot deep cement seal), none of the usable Saugus wells has a deep cement surface seal. Most seal depths are less than 100 feet in length and, because they have gravel packs which extend up to the base of these seals, it is apparent that some portion of the groundwater production from such wells is from the overlying alluvium.

3.0 HYDROGEOLOGY

3.1 Local Groundwater Basin. Alluvial deposits and the Saugus Formation comprise the water-bearing sediments of the groundwater reservoir of the Eastern Groundwater Basin. River alluvium, which is discussed in detail in a separate report by this investigator ranges in thickness to a maximum of 200 ft. The mapped extent of the surface exposures of the alluvium and terrace deposits is 32.75 square miles.

The Saugus Formation, a series of interbedded sandstone, siltstone and shale strata, underlies the alluvium along the river and its numerous tributaries and is also exposed on the surrounding hills. The mapped extent of Saugus strata in the region is 52.81 square miles.

The base of the Saugus on the northwest, north, and northeast sides of the basin is well defined. It is not as well defined on the southeast, south, and southwest sides of the basin where it interfingers with the marine Pico Formation.

Based on fault blocks created in the basin by the Holser and San Gabriel faults, the study area was divided into three separate regions. The maximum thickness of fresh water-bearing deposits in these regions varies from 1500 ft northerly of the San Gabriel fault, to 5500 between the two faults, to 5000 ft southerly of the Holser fault. In this latter area, it is probable that the upper portion of the underlying Pico Formation locally contains fresh groundwater also.

3.2 Aquifer Sands. Instead of relying on the total thickness of Saugus Formation for its groundwater potential, we determined the total footage of relatively coarse-grained potential aquifers (sand and/or gravel zones, as identified from electric log signatures) throughout the outcrop area of the Saugus, data permitting.

Furthermore, these potential sand/gravel aquifers were tabulated only between the depths of 500 feet and: either the base of the Saugus Formation; or the base of fresh water in the Saugus Formation; or a maximum depth of 2500 ft, whichever is shallower. The 500-foot minimum depth level was selected to preclude interference with

groundwater in the shallow alluvium, should future Saugus wells be drilled. The maximum depth level was dependent on local faulting and geology conditions, i.e., on where the three particular Saugus depth zone regions occur relative to the two local faults.

Thus, northerly of the San Gabriel fault, the maximum combined thickness of potential aquifer sands is 400 ft, as identified between a depth of 500 ft and the base of the Saugus Formation. Between the two faults, the maximum combined thickness of potential aquifer sands is 1400 ft, as identified between the depths of 500 ft and 2500 ft. Southerly of the Holser fault, the maximum combined thickness of potential aquifer sands is 1200 ft, as identified between the depths of 500 ft and 2500 ft.

3.3 Groundwater Production. Groundwater production from Saugus strata apparently began in the area in 1954 by NCWD. During the period 1954 through 1986, local purveyors (NCWD, combined NLF and VWC, and SCWC) have produced a total of approximately 154,000 acre-feet of Saugus Formation groundwater. Average production during the 33 years of available data has been about 4660 ac-ft/yr. Virtually all of the historic production has been from the area south of the Holser fault.

Combined production from the local purveyors in 1986 was 5532 ac-ft. Production from the only non-purveyor well in the area (the Smiser well) is not known but is likely less than 100 ac-ft/yr.

3.4 Groundwater Occurrence and Water Levels. Groundwater occurs in the Saugus Formation under artesian (confined) conditions. Thus, water levels in existing or future Saugus wells are (will be) represented by piezometric (or pressure) surfaces that are (will be) as much

as several hundred feet above the top of the uppermost well perforations. Pumping reduces the pressure (piezometric level) locally in the Saugus Formation and provides groundwater to the well.

Current 1987 piezometric levels are available only for the area southerly of the Holser fault and show groundwater flows to the northwest. Typical 1987 piezometric surface elevations are from 1200 to 1050 ft above sea level, and thus, are 50 to 100 ft above comparable levels dating from 1967.

Hydrographs show piezometer levels have been rising slowly but steadily in Saugus wells since records began in the mid- to late-1960's. The reasons for this are difficult to define due to a lack of long-term water level data and lack of stress on the entire aquifer system. Some of the rise may be due to increased recharge from the concomitant period of above-average rainfall, and from increased discharges to the river from wastewater treatment plants. Moreover, because some of the wells have shallow gravel packs extending up into the alluvium, it is possible that some of the water level rises actually are occurring as a result of increased recharge to the alluvium which percolates down the pack into the perforations.

Although the two local faults can be expected to form at least partial barriers to groundwater flow (at least in the lower portions of the Saugus), available water level data are inadequate to verify this possibility.

3.5 Groundwater Quality. Saugus Formation quality is either of calcium bicarbonate or calcium-magnesium sulfate character. Near the lateral margins of the basin or

near the base of the formation within the basin, the overall quality will deteriorate; increases in TDS, sulphate and even the presence of hydrogen sulfide can be expected in these areas. Future wells to 2500-foot depths appear to have acceptable quality particularly nearer the central portions of the basin. Nitrates and volatile organic compounds are not expected in future, properly constructed wells.

3.6 Aquifer Parameters. Based on our field aquifer tests of efficient wells, aquifer transmissivity is considered to be in the range of 80,000 to 160,000 gpd/ft. Such values are indicative of fair to good aquifers. Storativity values determined from the tests are approximately 0.0007 to 0.0009 ft/ft, and are characteristic of confined systems. Transmissivity is higher in the upper (younger) portions of the Saugus compared to the deeper (older) portions of this formation.

Typical well yields are on the order of 1500 gpm, with specific capacities of 10 to 50 gpm per foot of drawdown. Theoretical T values developed from specific capacity (Q/s) data are approximately 20,000 to 100,000 gpd/ft. Because current specific capacity values are lower than the earliest available Q/s data for each respective well, it is probable that well efficiencies have declined with time; this occurs from encrustation developing on the gravel pack and well perforations and from siltation in and around the gravel pack.

4.0 OIL FIELD DATA

Numerous active and abandoned oil fields exist in the study area. A large number of producing, abandoned,

and wildcat oil wells have been drilled also; interpretation of electric log data from several hundred of these wells were used to define the thickness of water-bearing deposits, the footage of potential aquifer sands, and the theoretical water quality in future wells.

Oil fields with hydrocarbons and/or high salinities in at least the lower portion of the Saugus Formation include: Castaic Hills, Charlie Canyon, Newhall (Tunnel Area and Elsemere Area), Placerita, Tapia, and Wayside Canyon (refer to locations on Plate 10). Most petroleum production is from rocks older and stratigraphically below the Saugus Formation.

It is also known that secondary recovery is practiced and that waste water injection is performed in several oil fields. A determination of the locations and depths of such practices, and the qualities of such waste waters was beyond the scope of this study. We believe it is important to determine the effects of such practices on the siting and pumping of future Saugus wells.

5.0 USABLE GROUNDWATER IN STORAGE

The calculated amount of usable groundwater in storage is approximately 1.41 million ac-ft. Usable groundwater in storage represents the volume of groundwater stored only in the potential aquifers (sand and gravel layers only) within the Saugus Formation. Our calculations disregard any possible storage in all finer grained layers of claystone, shale and/or siltstone.

These potential aquifers occur beneath a projected surface area of approximately 39,000 acres (61 square miles) within the mapped area on Plate 1. Furthermore,

to be considered as usable, these potential aquifers were selected from electric logs and only between the depths of 500 ft (to preclude capturing groundwater from the alluvium) and: the base of fresh water in the Saugus Formation; or a maximum depth of 2500 ft (the deepest existing Saugus well is 2000 ft deep), whichever is shallower.

Current groundwater production (1986) represented only 0.40 percent of the total volume of usable storage in the Saugus Formtion.

6.0 POTENTIAL RECHARGE

Principal recharge sources to the Saugus for our calculations were deep percolation of direct precipitation solely on the outcrop area of the Saugus Formation and terrace deposits; and direct infiltration from saturated alluvium within only the Santa Clara River channel and only where this alluvium directly overlies Saugus strata. Such calculations provided an estimate of the minimum amount of recharge to the Saugus.

As a preliminary estimate, we believe the combined potential sources from these two sources ranges between approximately 20,000 and 22,000 ac-ft/yr in wet periods and 11,000 to 13,000 ac-ft/yr in dry periods.

Such potential recharge causes a re-pressurization of the confined Saugus aquifers. Historic extractions have caused no discernible or definitive trends in the piezometric levels of graphed wells since records began. Piezometric levels have been rising in wells since the late-1960's, possibly as a result of recharge from years of excess rainfall in this period.

This preliminary assessment of the minimum amount of potential recharge to the Saugus Formation incorporates only portions of the two main forms of deep percolation and recharge into these strata. As such, this preliminary assessment should not be construed as a rigorous determination of the perennial yield of the Saugus, with such determination not being a part of the scope of work.

Furthermore, because so much of the Saugus Formation (both laterally and vertically) contains no active water wells and/or has never contained any water wells, the vast majority of the aquifer system has never been stressed; indeed, for much of the region, there are no definitive hydrogeologic data at all. A meaningful evaluation of the perennial yield of this formation must await, as yet unavailable, long-term water level and water quality data and a data base that includes actual data from wells northerly of the Holser and San Gabriel faults.

It is also noteworthy that the natural losses of groundwater via subsurface leakage from the alluvium into underlying strata, including the Saugus Formation, occur continuously and wherever there are relatively permeable strata underlying saturated alluvium; even in dry years, the lower portions of the alluvium still contain groundwater. The leakage losses are natural and cannot be terminated because it would require an infinite number of wells to totally dewater all of the alluvium on a permanent basis.

In our method of assessing the perennial yield of the overlying alluvium (Slade, December 1986), we considered only the change in water levels vs. groundwater extraction from the alluvium for a specific

time period. These water levels are known to change in response to many conditions, including rainfall, basin inflow, and basin outflow (losses). Thence, inherent to the perennial yield assessment of alluvium are the natural losses from the alluvium to the Saugus Formation.

7.0 NEW WELLS

7.1 Priority Locations. Plate 10 - Recommended Drilling Areas - has been prepared on a regional basis to show general locations, on a first-order priority, for new wells. Available data have been analyzed to provide these regional priority locations to be considered for future wells by the purveyors.

However, prior to drilling, it is recommended that a site-specific evaluation be provided of electric logs proximal to any prospective future well site in order to confirm the distribution and continuity of coarse-grained channel deposits. This is also important because zones of deposition of coarse grained Saugus strata are known to have varied widely in geologic time, both vertically and horizontally. Such site-specific subsurface data can be briefly reviewed and summarized in a letter to provide final details for test hole/final well specifications.

If more than one well is desired in a given area, construction should be conducted in phases, with the first well drilled, completed, developed, and thoroughly tested prior to selecting the final sites and design criteria for additional wells in that given area. New wells should be spaced at least 1000 ft apart, based on mutual drawdown interference criteria.

7.2 Anticipated Yields. New Saugus Formation water wells in the region southerly of the San Gabriel fault

are anticipated to have an operational yield on the order of 1500 to 2000 gpm. Future yields from wells located northerly of this fault will be less because of the reduced thickness of aquifer sands and because this region is comprised by the lower (older) portion of the Saugus Formation.

Production from future Saugus Formation wells, provided they are properly sited, and constructed with deep cement seals and deep uppermost perforations, is not expected to adversely impact the alluvium.

7.3 Potential Quality Problems. It must be recognized that there are inherent risks in the construction of new wells in this entire region due to the possibility of encountering contaminants in groundwater relating to petroleum occurrences, prior industrial and/or manufacturing facilities, or natural conditions such as the presence of hydrogen sulfide, iron, or manganese. Modern well design, utilizing deep cement sanitary seals and selective placement of well screen, will help preclude potential quality problems that may have affected shallower aquifer zones from surface or near-surface sources.

The opportunity does exist during pilot hole drilling to conduct limited down-hole water sampling of individual aquifers in the open borehole in an effort to determine whether or not contamination exists at the well site; however, collecting conclusive data by this procedure is difficult. That is, such select aquifer sampling is typically conducted by airlifting techniques and can cost on the order of $10,000 to $15,000 per aquifer test zone for mobilization and airlifting alone. Airlifting, however, is not considered appropriate for sampling of

volatile organic compounds. Moreover, airlifting typically is conducted at low rates of discharge (100 gpm or so) and for relatively short time periods (less that 3 to 4 hours). Long-term pumping (several hours to a day or more) is not possible in an open borehole under such circumstances due to the risks of collapsing the borehole and losing the sampling equipment.

A contamination plume, if it existed, would have to be virtually at the well site in order to be intercepted by such short-term down-hole sampling. A more distant plume could require hours, days, weeks or even months of pumping at high rates to be intercepted, assuming such a plume exists at all. Naturally occurring inorganic water quality problems should be identified by such testing since these contaminants are within the entire aquifer itself.

7.4 Well Depths and Construction Methods. New wells southerly of the San Gabriel fault are anticipated to be in the range of about 1500 ft to 2500 ft in depth. Wells northerly of this fault will be shallower. Either direct rotary or reverse circulation drilling techniques can be used to drill new wells. Cable-tool drilling is not recommended.

A potential problem will be the availability of water for drilling purposes, especially for the reverse circulation method, which may require 100 to 300 or more gallons per minute of continuous supply. If the direct rotary method is used, particular care must be given to control of drilling fluid properties so as to not induce permanent damage to the aquifers.

Detailed geologic mud logs should be prepared from drill-cuttings data as monitored by field geologists dur-

ing the drilling. At the completion of the pilot bore, an electric log survey is essential in order to define available aquifers and potential locations for the well perforations.

Due to the possible presence of oil and natural gas (including hydrogen sulfide) within the groundwater basin, it is recommended that gas monitoring devices be used during the drilling of future pilot holes.

7.5 Casing Sizes and Materials. For the anticipated 1500 to 2000 gpm operational yield from each well, new wells can be provided with 18- or 20-inch steel casing to house the pump, and 14- or 16-inch pump bowls. Such casing and pump equipment will minimize friction loss in the casing and could permit short-term pumping at higher yields if supported by aquifer characteristics.

To permit some cost savings, especially in drilling, the blank well casing and well screen placed below the pump housing casing can be reduced to only 14 or 16 inches in diameter. A 2- to 5-foot section of reducer pipe is used to connect the 18- or 20-inch pump housing casing to the lower sections of 14- to 16-inch casing and screen. Existing groundwater quality data for Saugus Formation wells to 2000 feet in depth suggest that new wells will not require the use of special well casing materials.

To optimize well efficiency and open area in the perforated intervals, it is recommended that wire-wrapped, continuous V-shaped slot well screen be used. The uppermost zone of perforations will be placed as deeply as practical in order to preclude potential drawdown and quality problems. Such well screen will also preclude sanding conditions in new wells.

Proper selection and placement of a gravel pack is essential also. The use of a deep cement seal in the annulus (approx. 450 ft in length) is recommended to preclude interference with groundwater in nearby alluvium and to minimize potential for shallow quality problems.

Well screen slot widths and gravel pack grain sizes are to be selected based on analysis and grain size distributionn of the drill cuttings. Total length of well screen is expected to be on the order of 500 to 800 ft. Slot sizes in the 0.050- to 0.080-inch range are anticipated for new wells. Monterey-type, clean, highly rounded and spherical sand is a preferred gravel pack material; a 6 x 12 gradation is anticipated.

7.6 Construction Costs. Approximate costs for a contractor to drill, install casing, develop, and test pump one new well on the order of 1500 ft in depth will likely be on the order of $250,000 to $300,000. A more detailed and refined breakdown of costs can be provided when the site(s) for eventual wells is(are) selected.

In addition to the drilling costs, there also will be costs for the final pumping equipment, chlorination facilities, electrical appurtenances, and transmission lines, property and/or rights-of-way for the new wells, and for required hydrogeologic services during construction.

7.7 Anticipated Well and Aquifer Characteristics. Based on field work data and available existing data collected for this project, the following represent anticipated well and aquifer parameter values for new wells constructed within the recommended drilling areas (Plate 10) and having the anticipated depth and construction features discussed above:

Operational Yield	1500 to 2000 gpm
Total Depth	1500 to 2000 feet
Total Length of Perforated Casing	500 to 800 feet
Specific Capacity	20 to 50 gpm/ft drawdown
Transmissivity	75,000 to 125,000 gpd/ft

8.0 GROUNDWATER MANAGEMENT

To establish more complete groundwater data for the region, we recommend the following:

a. Accurately establish the locations of each well on USGS quadrangle maps.

b. Establish a permanent reference point on all wells from which future depth-to-water measurements can be taken; use a surveyor to obtain accurate elevations for these reference points.

c. Monitor water levels on a regular basis to an accuracy of 0.01 foot (once or twice per month); ensure that these are true static levels, not partial recovery levels, by allowing the well to remain idle for at least 8 hours prior to obtaining the non-pumping water level.

d. When abandoning wells, make sure that accurate records are kept as to which well, its location, etc., and the methods used for abandonment.

e. Verify sanitary seals on active wells to help ensure that water quality meets State standards for domestive usage at all times.

f. Conduct Edison efficiency tests on a regular basis in all wells; consider rehabilitating wells and/or pumps when efficiency and specific capacity decline.

g. Plot water level hydrographs and graphs of specific capacity vs. time for all wells; monitor water for inorganic and organic constituents on a regular basis.

h. Perform operation and maintenance (O & M) on the wells on a regular basis. Such O & M is essential to maintain well efficiency and to return declining specific capacities to their original values. The wells should be periodically surged in order to prevent clogging of the gravel pack by silt or clay.

i. Become cognizant of present and future land use in the area; work with the RWQCB to recognize landfill problems, runoff from hazardous waste sites, and even migration of gasoline from leaky underground service station tanks. Such potential sources of contamination can adversely affect the alluvium and the surface exposures of the Saugus Formation. Locate all industrial dischargers on a map and determine the types and amounts of such discharges.

j. Meet with the State Division of Oil & Gas to establish compatible resource development practices, particularly in the vicinity of those oil fields having shallow hydrocarbon production and/or shallow injection. Such practices could adversely affect the long-term development of groundwater from the Saugus Formation.

The attachments which complete this report are listed in the Table of Contents. Report plates are provided in Volume II.

Respectfully submitted,

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APPENDIX A

AQUIFER TESTING

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APPENDIX A

AQUIFER TESTING

During the period from March 4 to April 3, 1987, pumping tests were conducted in five of the eight actively pumping purveyor-owned Saugus Formation wells. Based on joint meetings with the involved agencies to resolve local logistical and well usage problems, the following criteria were established for the tests:

1. All pumping and observation wells were to be shut down at least 24 hours prior to the monitoring and testing;
2. Pumping duration was to be 24 hours;
3. Pumping discharge rate was to be kept constant; and
4. Recovery test duration was to be at least 24 hours.

With the exception of V-160, all the tested wells were pumped at a constant discharge rate for 24 hours (1440 minutes) then shut off and allowed to recover for at least 24 hours. During this approximately 48-hour period. drawdown and recovery measurements were taken in the pumping well and, where possible, in the observation wells. In all cases, pumping and observation wells had not been pumped for a minimum of 24 hours prior to the start of test pumping.

V-160 could only be pumped for 12 hours due to a limited storage tank capacity, high pumping rate, and a relatively low water demand on the test day. Also due to water storage and demand limitations, NC-10 was pumped at an average rate of 364 gpm; in normal operation, this well pumps about 1100 gpm.

Pumping rates were maintained as constant as possible in all the wells, with slight adjustments to valving or engine speed (NC-10) as necessary to allow for rate variations due to

changes in head, back pressure, and other factors. All pumping and recovery water levels were monitored using a two-wire electric tape sounder and an engineer's tape, measuring the levels below the reference point to $\pm$ 0.01 ft.

During each of the pumping tests, the discharge was periodically sampled and tested in the field for temperature and electrical conductivity. Physical observations such as water clarity and odor were noted also.

Wherever possible, attempts were made to utilize proximal wells as observation wells during the aquifer test in order to monitor for any possible drawdown interference effects created by the aquifer test pumping well. As shown on Table 4 in the text, two of the aquifer test wells each had one proximal Saugus Formation observation well, while a third aquifer test well had three proximal alluvial wells in which water level monitoring could be conducted. The remaining 2 aquifer test wells had no nearby observation holes.

As mentioned, only five of the eight Saugus Formation wells active in 1986 were tested in the above methods. The three wells not tested during our field program included: NC-11, which is in nearly constant operation and is located near other agency wells (NC-10, NC-12) and, thus, would not add significantly to the areal data base; NLF-156 which has a small submersible pump and is the sole water source for six or eight homes; and NC-8 which had the pump removed for well survey and rehabilitation.

Data acquired during test pumping and recovery was used to calculate aquifer transmissivity or the aquifer's ability to transmit water. Aquifer transmissivity (T) is defined as the rate of flow in gallons per day through a section of aquifer whose height is the thickness of the aquifer and whose width is one foot, when the hydraulic gradient is one

foot. Data analyses were conducted using the Cooper-Jacob modification of the Theis non-equilibrium well formula and the "Theisfit" computer program.

The assumptions inherent in applying the non-equilibrium formula should be emphasized because they are often overlooked which can lead to erroneous results. The assumptions include:

1. The aquifer is homogeneous, isotropic, of uniform thickness, and of infinite areal extent.
2. The well is pumped at a constant discharge rate.
3. The pumped well penetrates the entire aquifer, and flow is everywhere horizontal within the aquifer to the well.
4. The well diameter is infinitesimal so that storage within the well can be neglected.
5. Water removed from storage is discharged instantaneously with decline of head.

These assumptions are seldom entirely satisfied under field conditions; nonetheless, they should be considered when applying these formulas.

The Cooper-Jacob solution may be used to calculate transmissivity when either time elapsed since pumping began is large or when the distance from the well is small. The Cooper-Jacob solution is a semi-logarithmic graphical solution using time and drawdown data. The slope of the resultant line can be used to calculate transmissivity from the formula:

$$T = \frac{264Q}{s}$$

Where: T = transmissivity, in gpd/ft
Q = discharge in gpm
s = change in drawdown over one log cycle, in ft = slope of line

The Cooper-Jacob solution may also be used similarly for recovery tests, graphing a ratio of t/t' (elapsed time since pumping began/elapsed time since pumping ceased) versus

residual drawdown data. The formula differs slightly from that shown above in that

$$T = \frac{264Q}{s'}$$

Where: s' = change in residual drawdown over one log cycle, in ft = slope of line.

The "Theisfit" computer program fits the Theis equation to experimental pumping test data by using a least squares procedure. In order to use this drawdown test program for recovery test data, recovery data were input in the form of vertical distance of water level recovery versus time since pumping ceased.

Storativity, or storage coefficient, is a dimensionless quantity involving a volume of water per volume of aquifer (symbol S, in cubic feet of water per square foot of aquifer per foot of head, and thus dimensionless). S is derived from drawdown and recovery test data measured in an observation well that is affected by pumping in a nearby well.

Drawdown and recovery data for the five tested wells are plotted on Figures A-1 through A-12 in this Appendix. Transmissivity values determined from these figures are shown on Table 4 in the text as well as on the figures. Where possible, transmissivity values were used to calculate storativity using the formula:

$$S = 0.3T\ t_o/r^2$$

Where:

t_o = time intercept of the straight line at zero drawdown, in days; and
r = distance, in feet, from pumped well to observation well where drawdown measurements were made. 157 ft in this case.

Additionally, the "Theisfit" computer program provided S values from drawdown and recovery data for this well.

WELL NUMBER : NCWD #7
TYPE AND DATE OF TEST : Drawdown Test, 3/4/87
CALCULATED TRANSMISSIVITY = 33,300 GPD/FT

NON-PUMPING WATER LEVEL = 116.97 FT
PUMPING RATE = 341 GPM

S8701

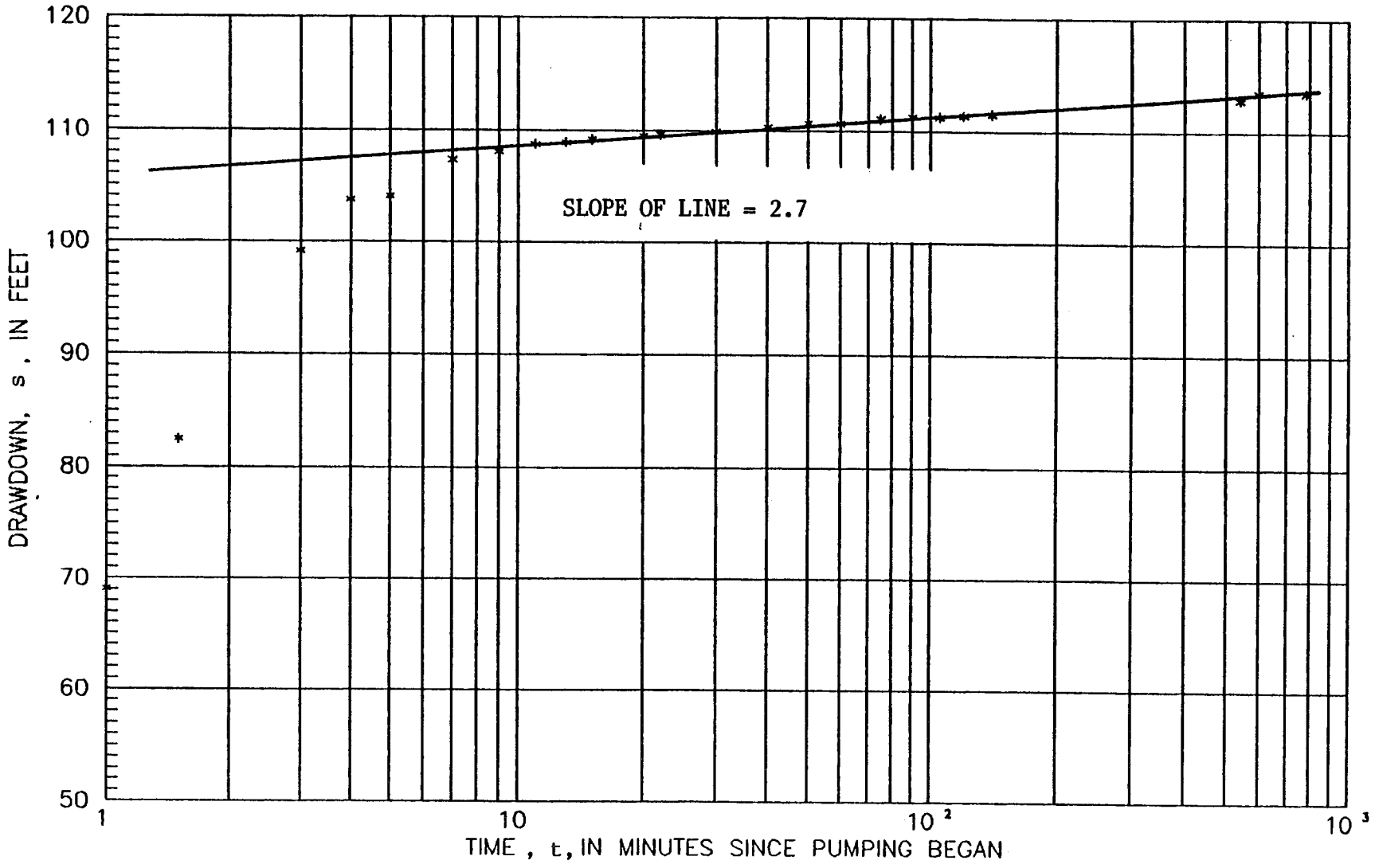


Figure A-1
DATA FOR NC-7

RCS

WELL NUMBER : NCWD #7
TYPE AND DATE OF TEST : Residual Drawdown 3/5/87
CALCULATED TRANSMISSIVITY = 20,700 GPD/FT

NON-PUMPING WATER LEVEL = 116.97 FT
PUMPING RATE = 341 GPM

S8701

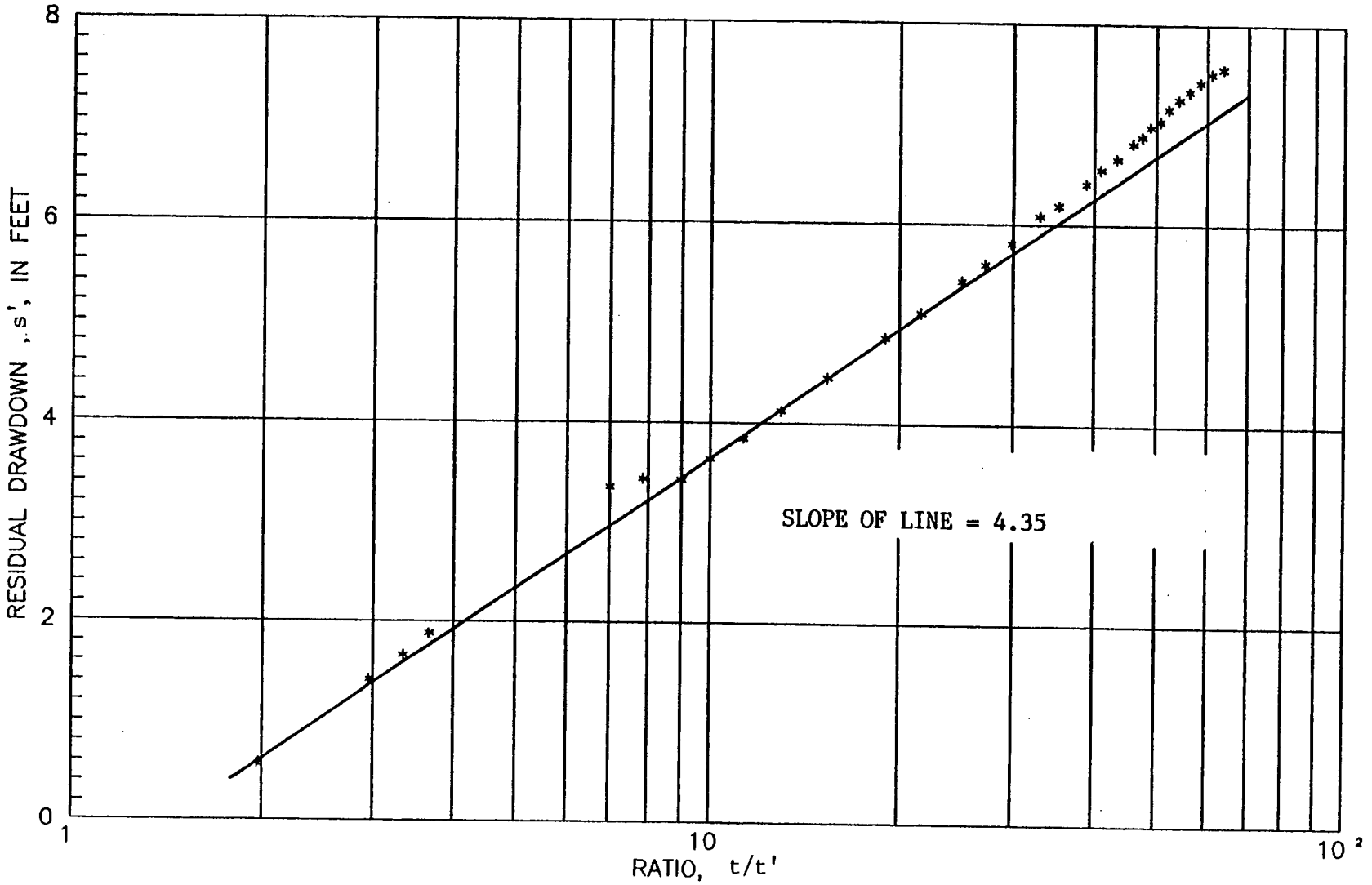


Figure A-2
DATA FOR NC-7

RCS

WELL NUMBER : NCWD #9
TYPE AND DATE OF TEST : Drawdown Test, 3/17/87
CALCULATED TRANSMISSIVITY = 4,100 GPD/FT

NON-PUMPING WATER LEVEL = 61.10 FT
PUMPING RATE = 256 GPM

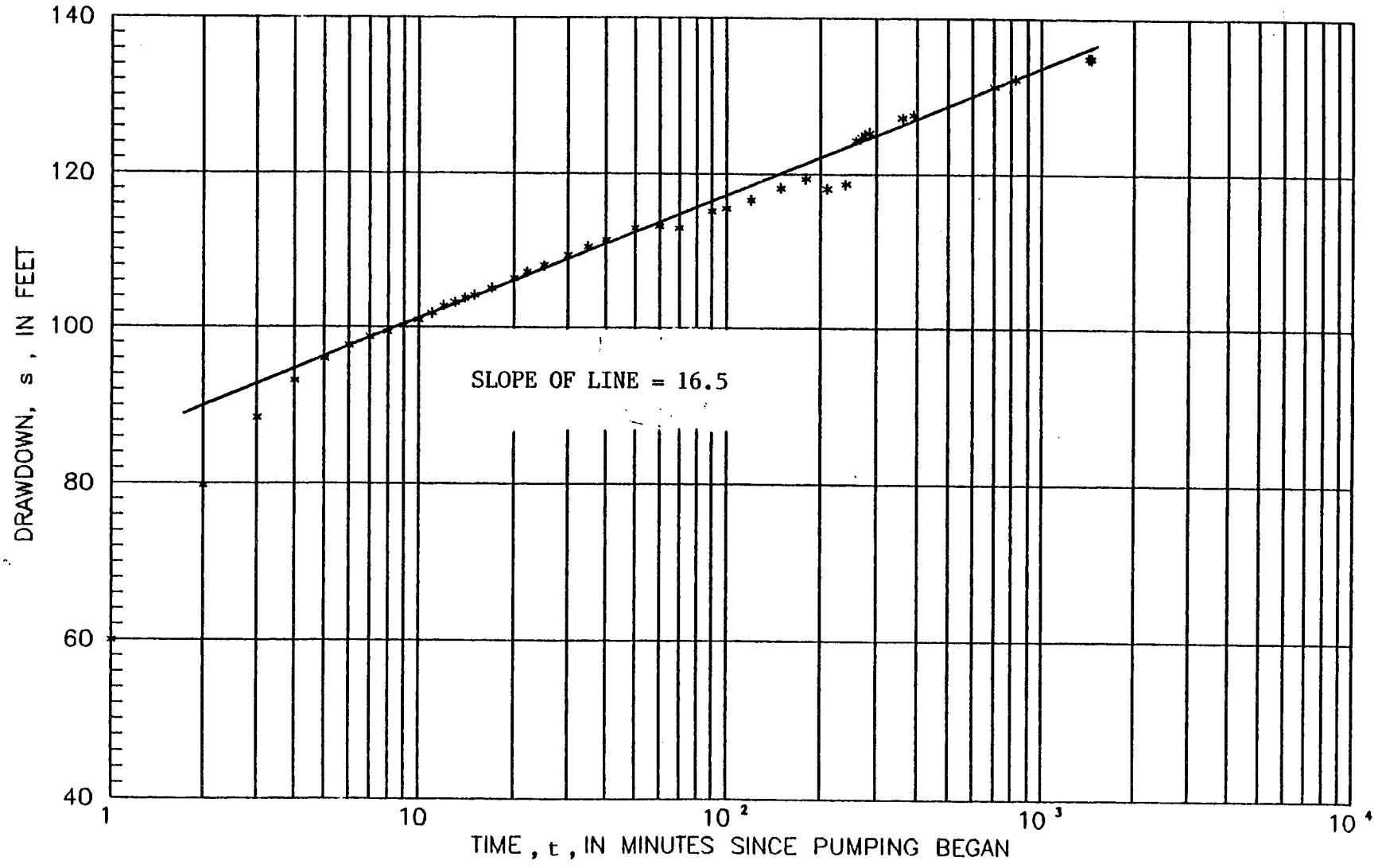


Figure A-3
DATA FOR NC-9

S8701

WELL NUMBER : NCWD #9
TYPE AND DATE OF TEST : Residual Drawdown 3/18/87
CALCULATED TRANSMISSIVITY = 3,300 GPD/FT

NON-PUMPING WATER LEVEL = 61.10 FT
PUMPING RATE = 256 GPM

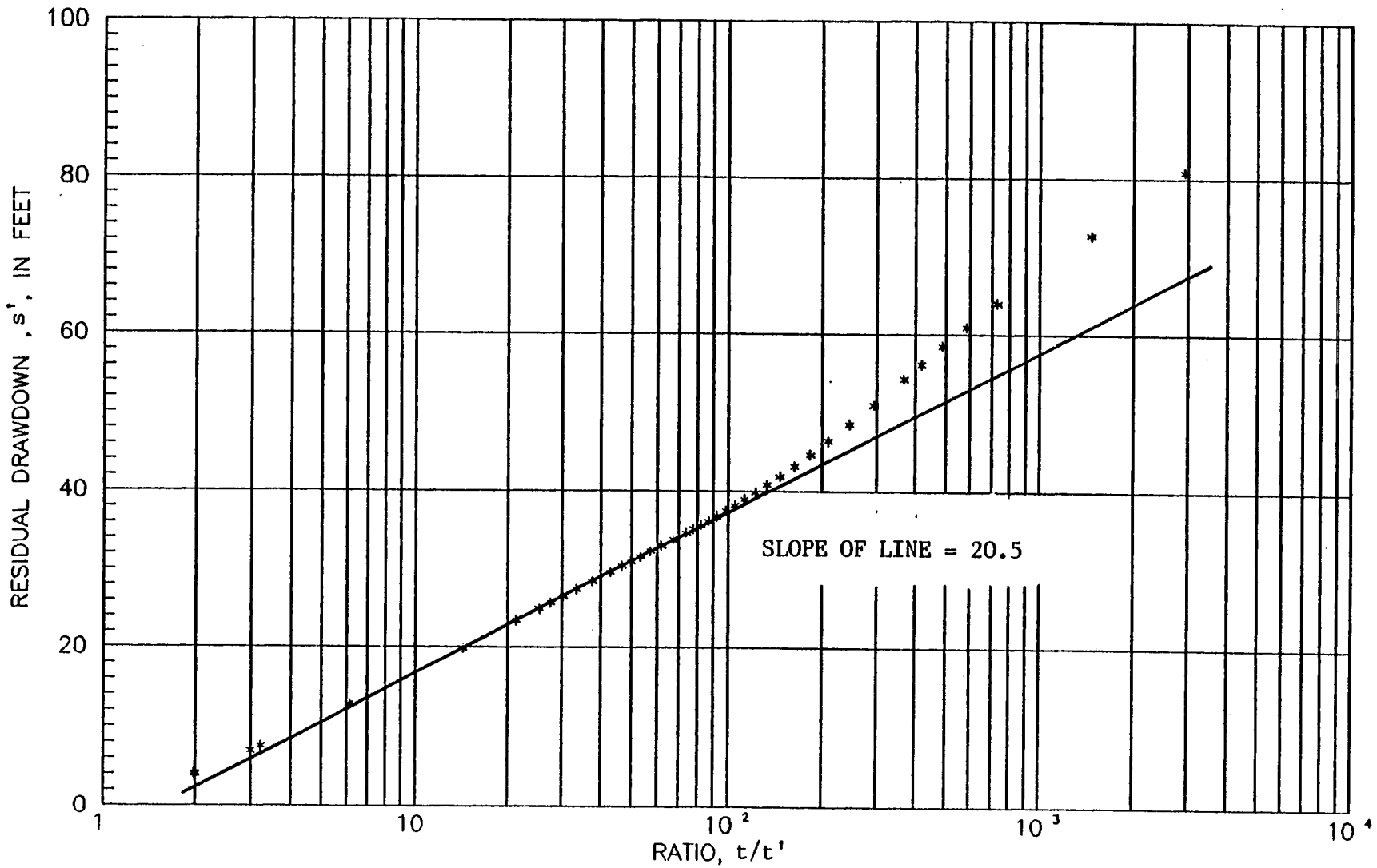


Figure A-4
DATA FOR NC-9

S8701

WELL NUMBER : NCWD #10
TYPE AND DATE OF TEST : Drawdown Test, 3/10/87
CALCULATED TRANSMISSIVITY = 31,000 GPD/FT

NON-PUMPING WATER LEVEL = 87.49 FT
PUMPING RATE = 364 GPM

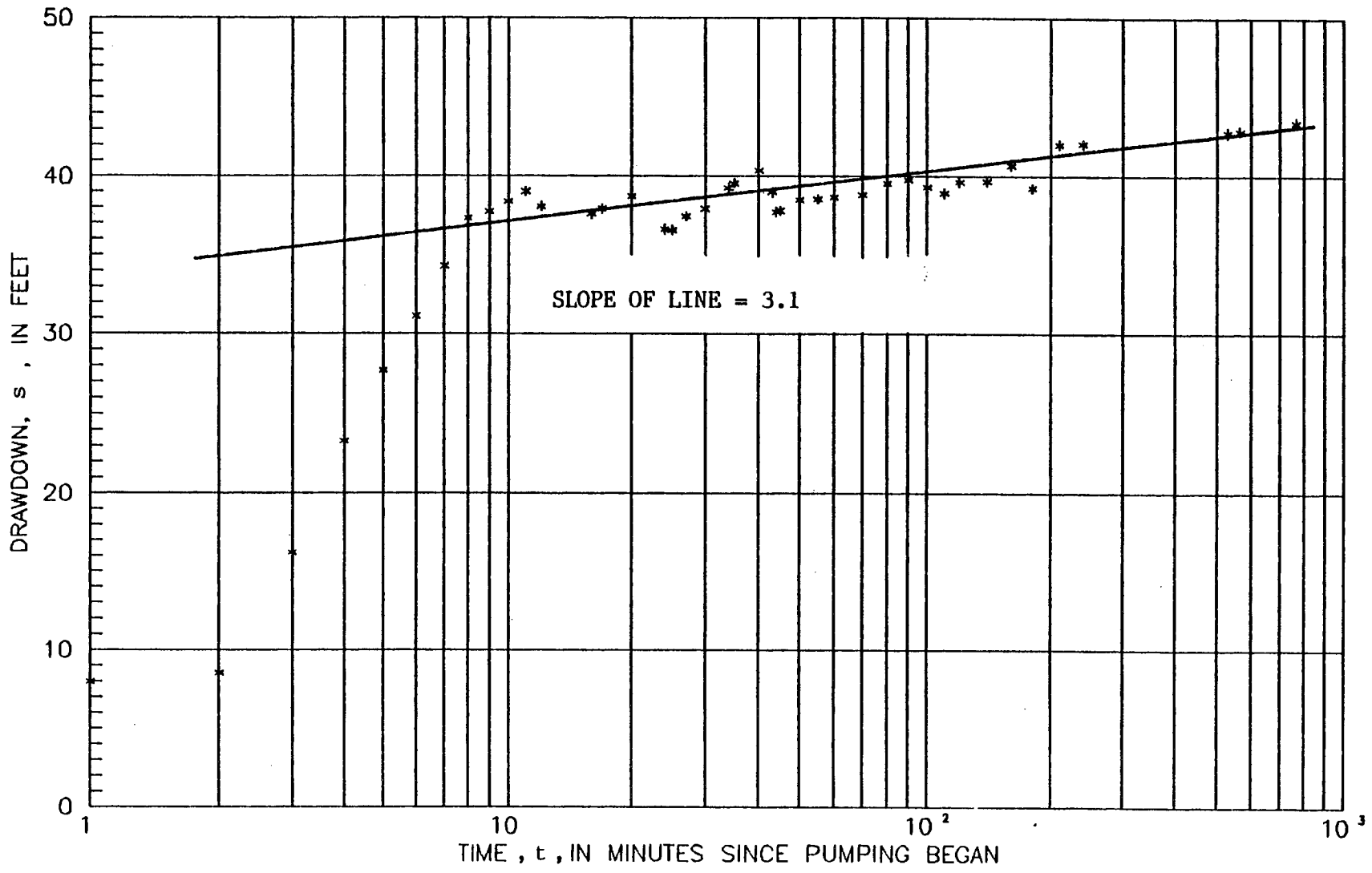


Figure A-5
DATA FOR NC-10

S8701

WELL NUMBER : NCWD #10 NON-PUMPING WATER LEVEL = 87.49 FT
TYPE AND DATE OF TEST : Residual Drawdown 3/11/87 PUMPING RATE = 364 GPM
CALCULATED TRANSMISSIVITY = 35,300 GPD/FT

S8701

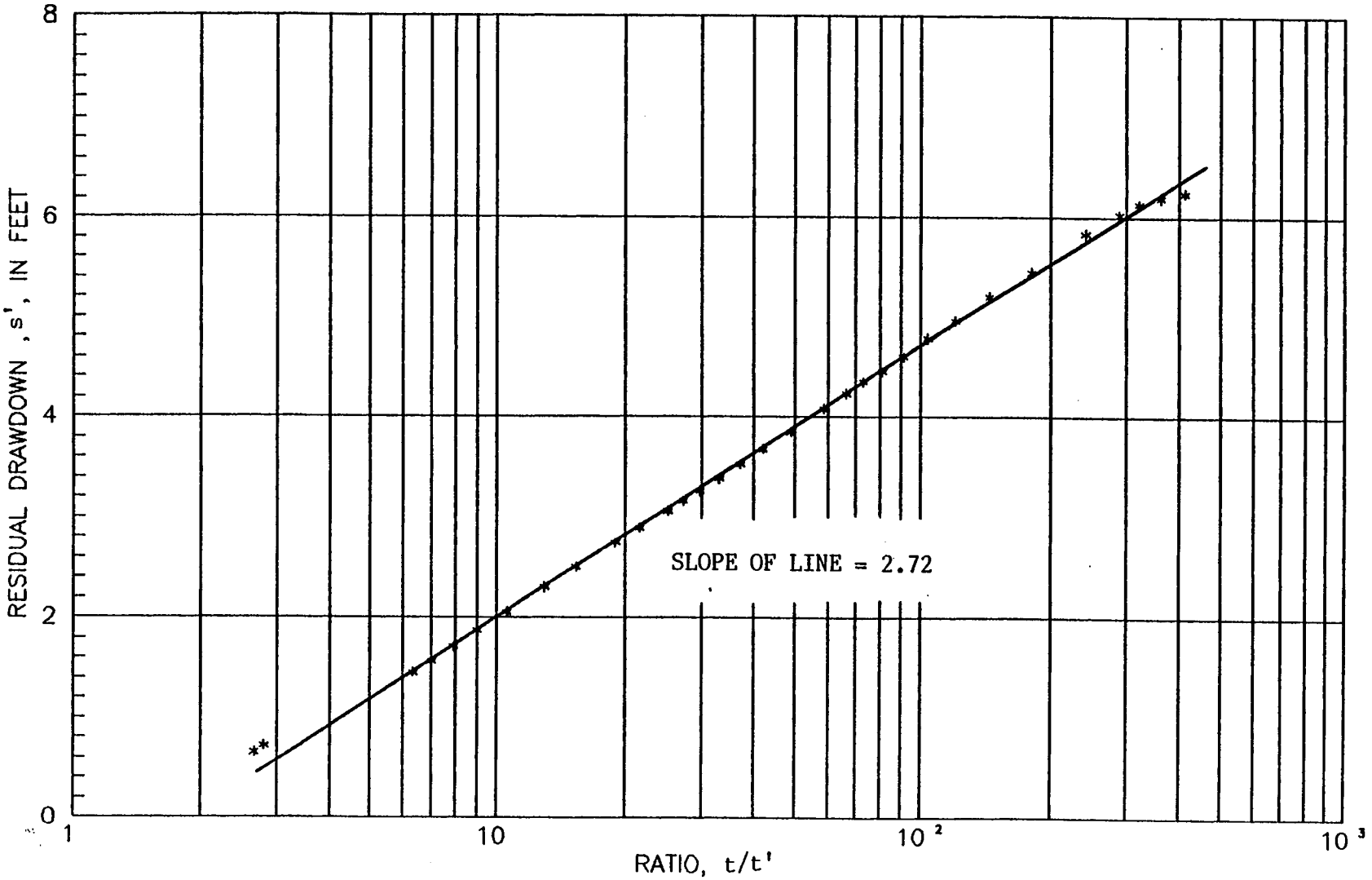


Figure A-6
DATA FOR NC-10

S8701

WELL NUMBER : NCWD #12 (OBSERVATION WELL) NON-PUMPING WATER LEVEL = 97.05 FT
TYPE AND DATE OF TEST : Drawdown Test, 3/10/87 PUMPING RATE = 364 GPM (NC#10)
CALCULATED TRANSMISSIVITY = 57,500 GPD/FT
CALCULATED STORATIVITY = 0.00087

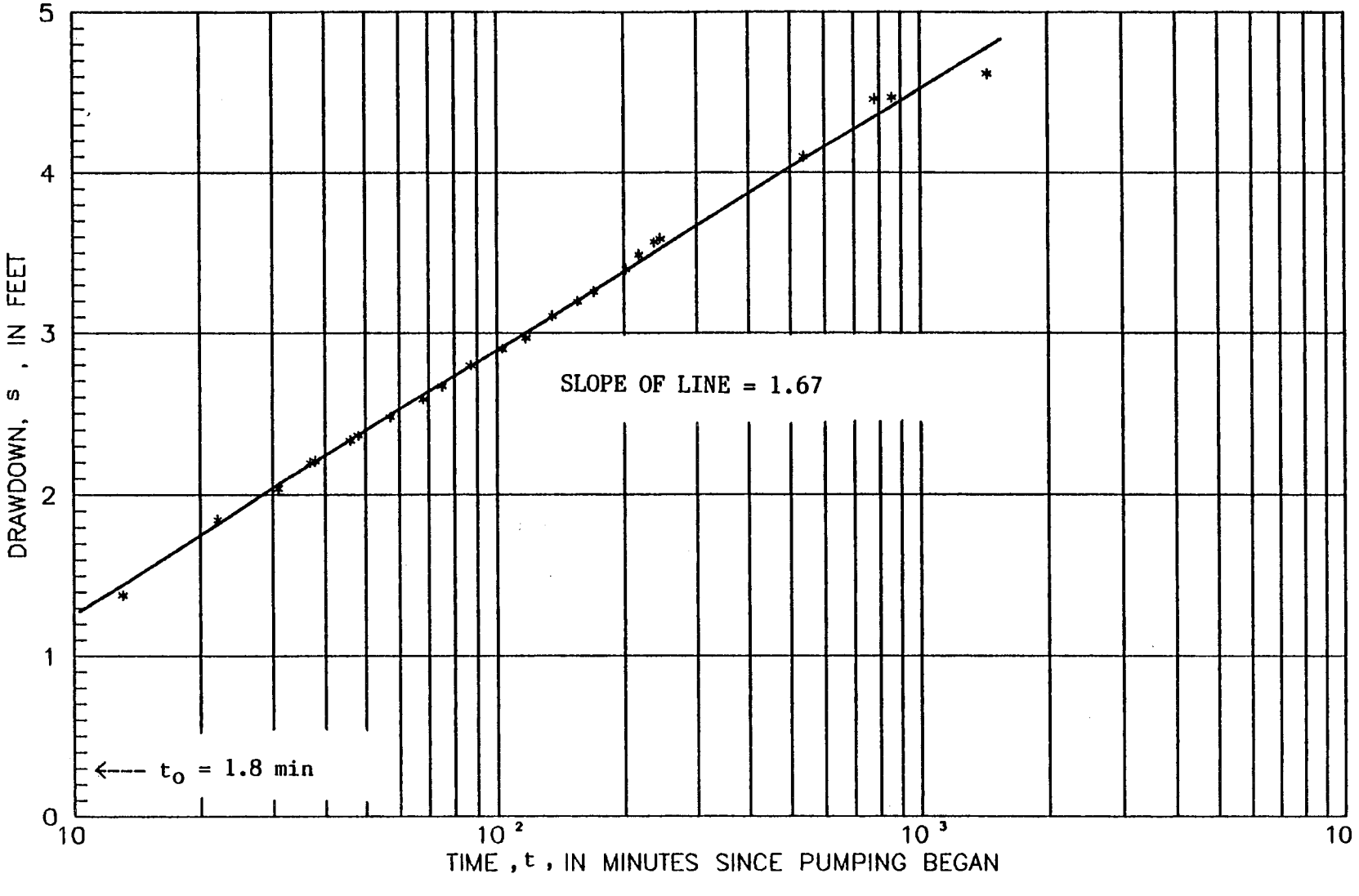


Figure A-7
DATA FOR NC-12

WELL NUMBER : NCWD #12 (OBSERVATION WELL) NON-PUMPING WATER LEVEL = 97.05 FT
TYPE AND DATE OF TEST : Residual Drawdown 3/11/87 PUMPING RATE = 364 GPM (NC#10)
CALCULATED TRANSMISSIVITY = 54,000 GPD/FT

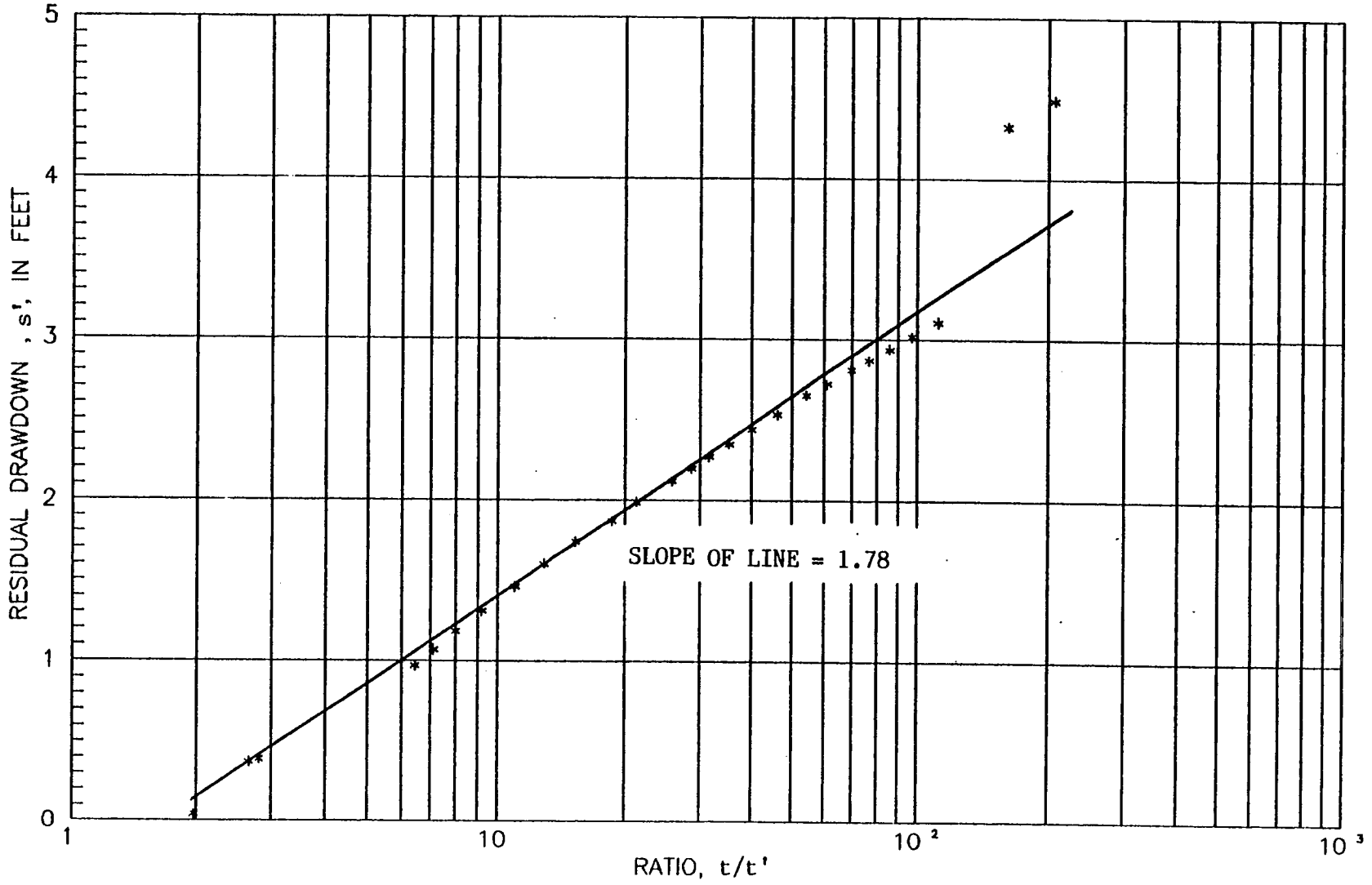


Figure A-8
DATA FOR NC-12

S8701

WELL NUMBER : NCWD #12 (OBSERVATION WELL) NON-PUMPING WATER LEVEL = 97.05 FT
TYPE AND DATE OF TEST : Recovery 3/11/87 PUMPING RATE = 364 GPM (NC#10)
CALCULATED TRANSMISSIVITY = 59,300 GPD/FT
CALCULATED STORATIVITY = 0.00080

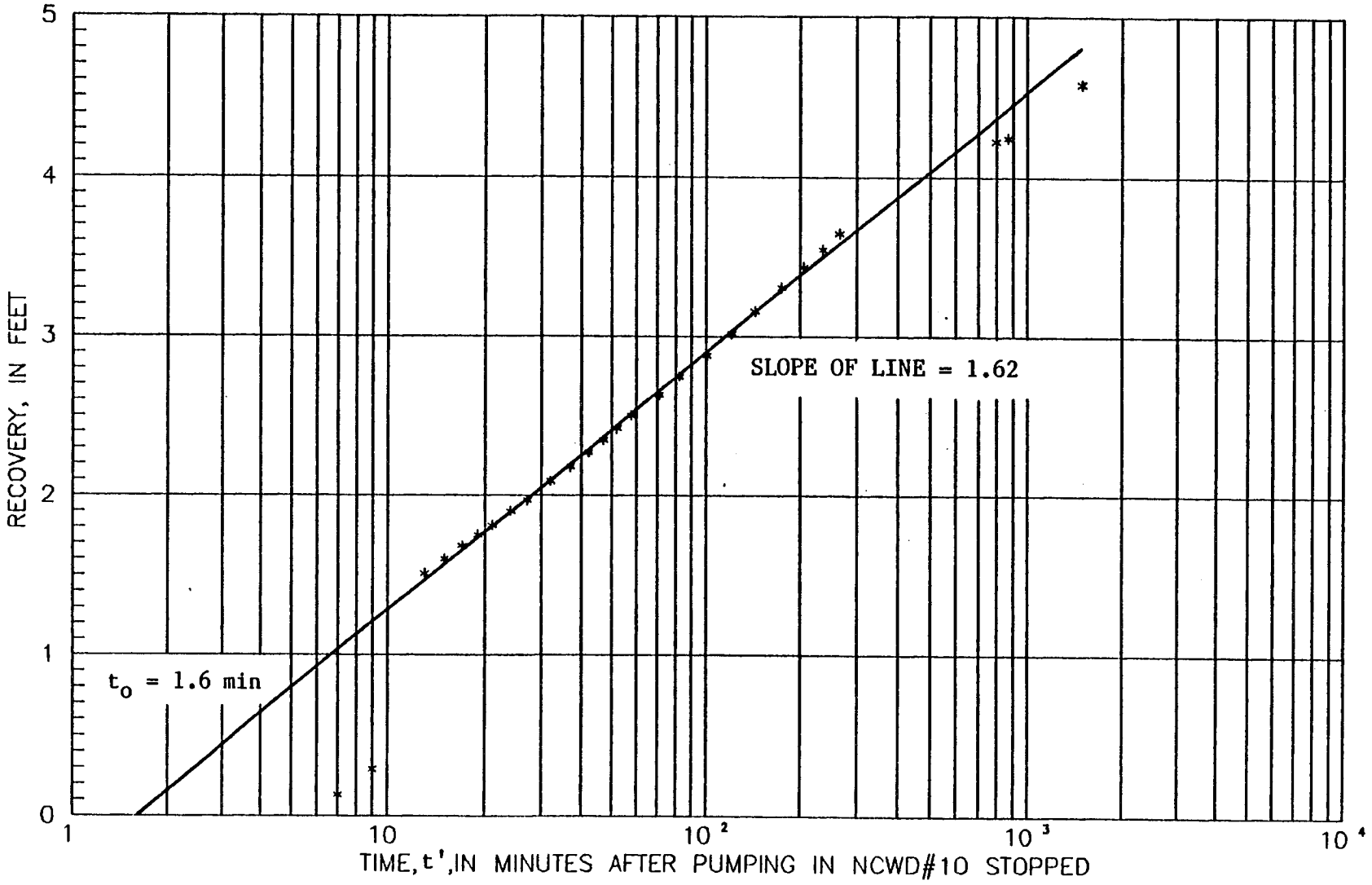


Figure A-9
DATA FOR NC-12

S8701

WELL NUMBER : VWC #157 NON--PUMPING WATER LEVEL = 70.52 FT
TYPE AND DATE OF TEST : Residual Drawdown 4/2/87 PUMPING RATE = 1347 GPM
CALCULATED TRANSMISSIVITY = 88,900 GPD/FT

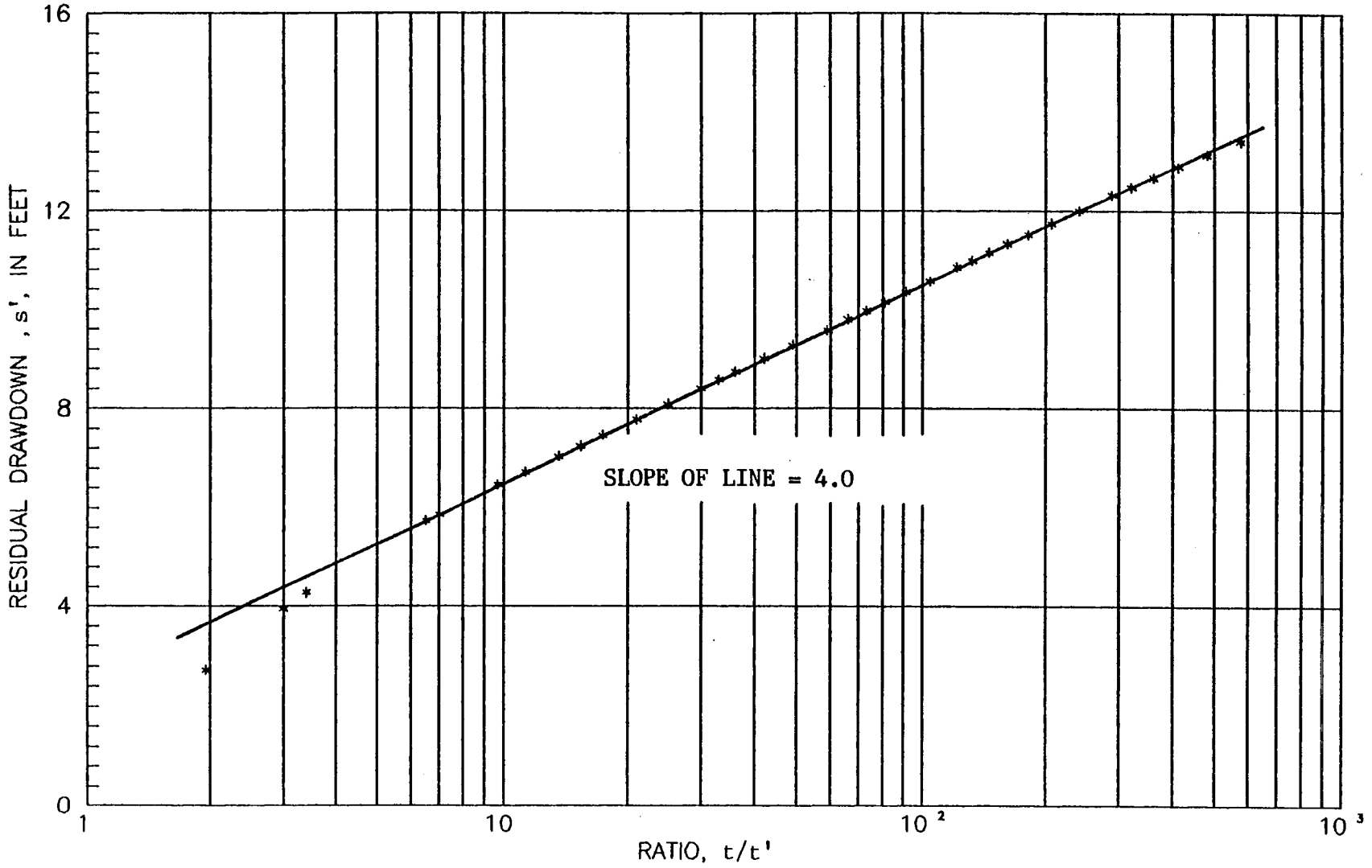


Figure A-10
DATA FOR V-157

S8701

WELL NUMBER : VWC #160 NON-PUMPING WATER LEVEL = 45.11 FT
TYPE AND DATE OF TEST : Drawdown Test, 3/24/87 PUMPING RATE = 2562 GPM
CALCULATED TRANSMISSIVITY = 169,100 GPD/FT

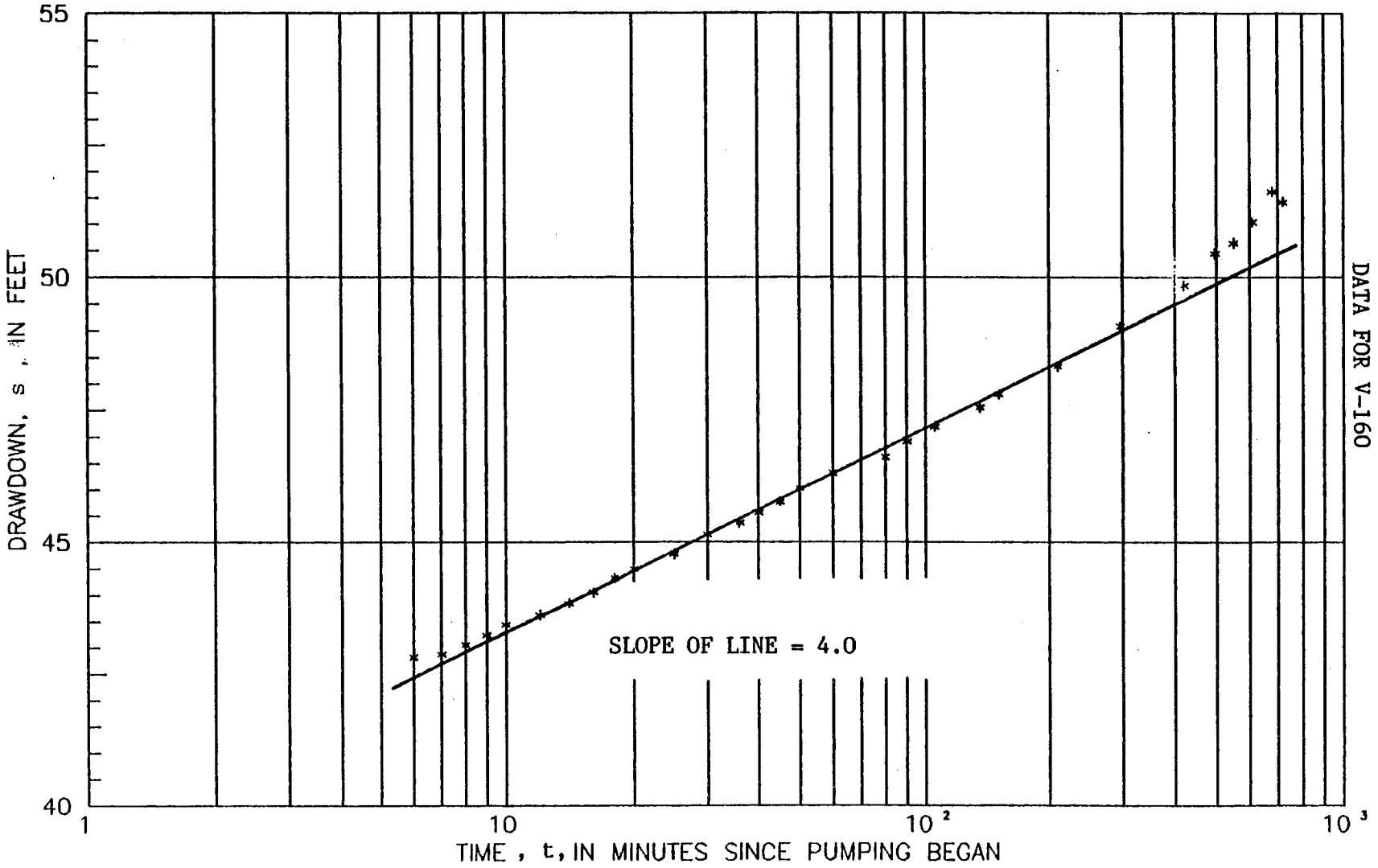


Figure A-11

S8701

WELL NUMBER : VWC #160 NON-PUMPING WATER LEVEL = 45.11 FT
TYPE AND DATE OF TEST : Residual Drawdown 3/24/87 PUMPING RATE = 2562 GPM
CALCULATED TRANSMISSIVITY = 157,000 GPD/FT

S8701

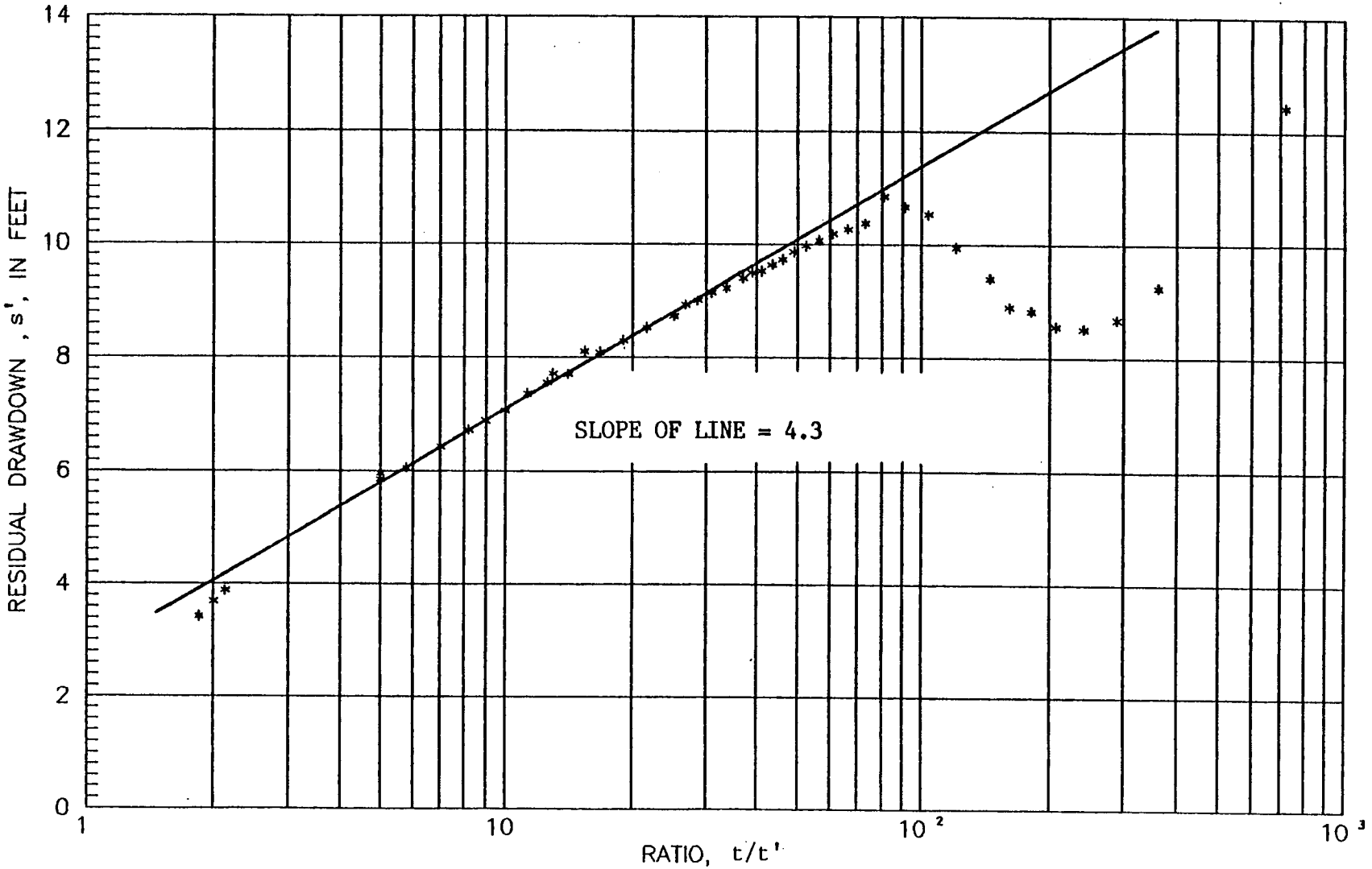


Figure A-12
DATA FOR V-160

RCS

SECTION 1

VOLUME II — REPORT PLATES

HYDROGEOLOGIC ASSESSMENT

OF THE

SAUGUS FORMATION

in the

SANTA CLARA VALLEY

of

LOS ANGELES COUNTY, CALIFORNIA

FOR

CASTAIC LAKE WATER AGENCY

LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 36 — VAL VERDE

NEWHALL COUNTY WATER DISTRICT

SANTA CLARITA WATER COMPANY

VALENCIA WATER COMPANY

FEBRUARY 1988

RICHARD C. SLADE

CONSULTING GROUNDWATER GEOLOGIST

SUPERIOR COURT OF THE STATE OF CALIFORNIA
COUNTY OF KERN

UNITED WATER CONSERVATION DISTRICT, Petitioner, v. COUNTY OF LOS ANGELES, *et al.*, Respondents.	**Case No. 239324 RDR** (Ventura County Superior Court No. CIV 188402) Assignment for all purposes: Honorable Roger D. Randall
MARIA VEGA, *et al.*, Petitioners, v. COUNTY OF LOS ANGELES, *et al.*, Respondents.	**Case No. 239325 RDR** (Ventura County Superior Court No. CIV 188434)
SIERRA CLUB, *et al.*, Petitioners, v. COUNTY OF LOS ANGELES, *et al.*, Respondents.	**Case No. 239326 RDR** (Ventura County Superior Court No. CIV 188430)
COUNTY OF VENTURA, *et al.*, Petitioners, v. COUNTY OF LOS ANGELES, *et al.*, Respondents.	**Case No. 239327 RDR** (Ventura County Superior Court No. CIV 188403) **NEWHALL RANCH** **ADMINISTRATIVE RECORD** **Volume 59** **Bates Pages 056719 - 056752**
THE NEWHALL LAND AND FARMING COMPANY, *et al.*, Real Parties in Interest.	

RCS

RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

4950 BELLAIRE AVENUE
NORTH HOLLYWOOD, CA 91607
(818) 506-0418

February 10, 1988

Mr. Robert Sagehorn, General Manager
Castaic Lake Water Agency
23560 Lyons Avenue, Suite 225
Newhall, California 91321

Job S8701

Dear Mr. Sagehorn:

This document represents Volume II - Report Plates - of the two volume set of reports prepared for our hydrogeologic assessment of the Saugus Formation in the Santa Clara Valley of Los Angeles County, California. Volume I of this investigation contains the entire text and is separately bound.

Volume II is presented in two sections. The following plates are contained in Section 1:

Plate 1	Water Well Location Map
Plate 2	Map of Groundwater Production for 1986
Plate 3	Hydrogeology Map
Plate 4	Hydrogeologic Sections A-A' through F-F'

The following plates are contained in Section 2:

Plate 5	Thickness of Fresh Water-Bearing Deposits
Plate 6	Potential Aquifers, Sand Thickness Map - Saugus Formation
Plate 7	Contour Map of Generalized Groundwater Elevations--Summer-Fall, 1967
Plate 8	Contour Map of Groundwater Elevations--March, 1987
Plate 9	Theoretical Water Quality - Saugus Formation
Plate 10	Recommended Drilling Areas

Very truly yours,

Richard C. Slade

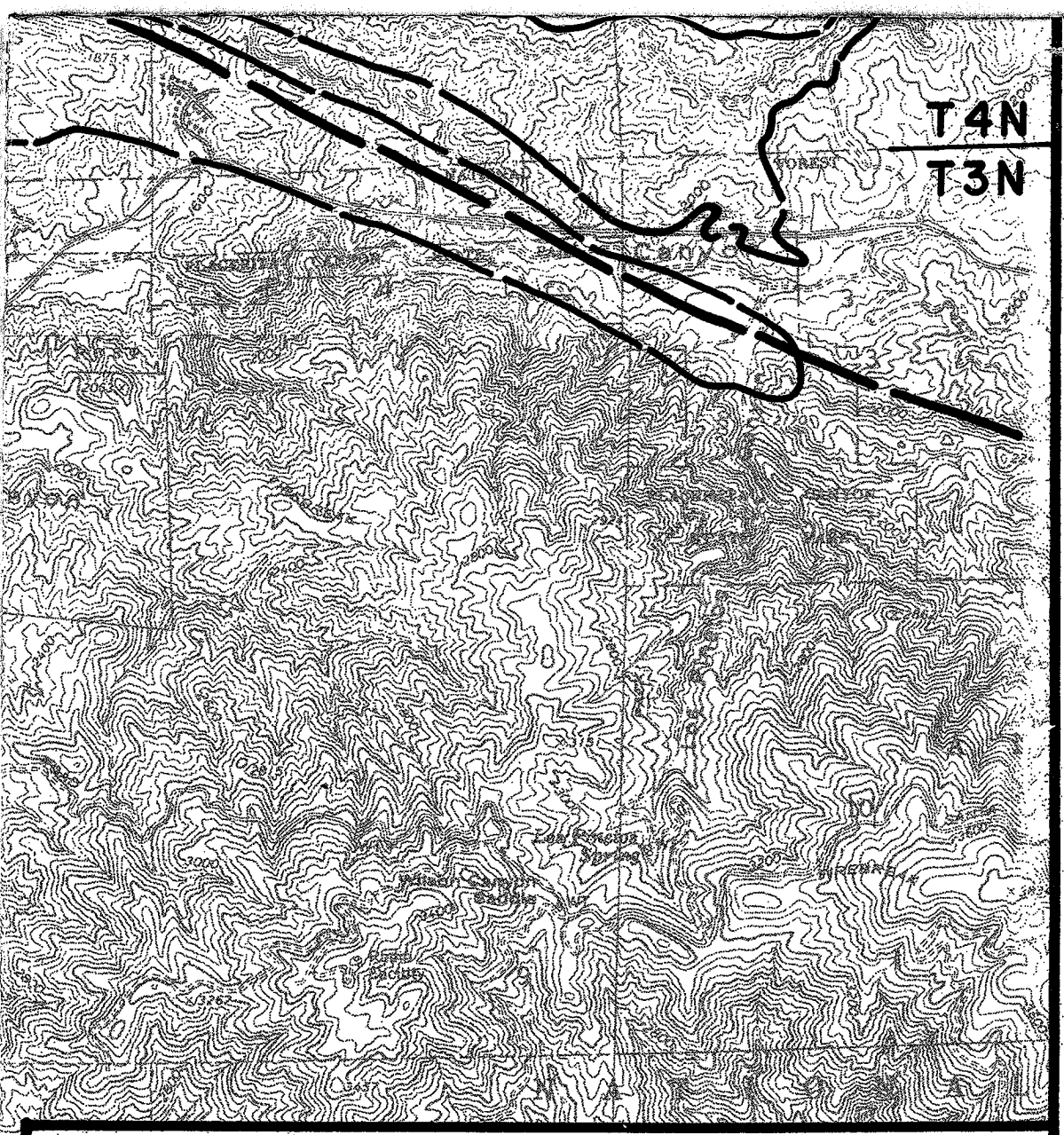
Richard C. Slade
Registered Professional Hydrogeologist

Slade 1988

Vol. 2 / Section 1

Plates 1, 2, 3, 4

(Plate 4 = 6 maps)



RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

WELL LOCATION MAP

JOB S8701 FEBRUARY 1988 PLATE 1

R17W | R16W

R16W | R15W

SAN GABRIEL FAULT

HOLSER FAULT

T5N
T4N

T4N
T3N

36 | 31
1 | 6

QTs

Qal

NLF-156 (20)

V-158

V-160 (1157)

V-157 (760)

NLF-154

NC-11 (2237)

NLF-155

NC-12

NC-10 (754)

NC-8 (225)

NC-7 (276)

NLF-159

NLF-P3

SC-LOMBARDI

NC-6

NC-5 (116)

NC-4

NC-2

NC-3

NC-1

NC-3

LEGEND

NC-9 — LOCATION AND LOCAL NAME OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE WELL PRODUCTION IN 1 UNIT.

NLF-P2 — LOCATION AND LOCAL NAME OF DESTROYED SAUGUS FORMATION WATER WELL.

X or X — INDICATES WELL HAS AN ELECTRIC LOG.

WELL OWNERSHIPS

NC = NEWHALL COUNTY WATER DISTRICT
NLF = NEWHALL LAND & FARMING COMPANY
SC = SANTA CLARITA WATER COMPANY
V = VALENCIA WATER COMPANY
P = PRIVATELY-OWNED

Qal = ALLUVIUM IN STREAM CANYONS, HOLOCENE AGE.

Qt = TERRACE DEPOSITS, LATE PLEISTOCENE AGE.

QTs = SAUGUS FORMATION, PLIOCENE-PLEISTOCENE AGE.

GEOLOGIC CONTACT.

FAULT, SURFACE TRACE.

NC-9 (116) — ACTIVE SAUGUS WELL; RADIUS OF CIRCLE INDICATES 1986 GROUNDWATER PRODUCTION; NUMBER IN PARENTHESES IS 1986 WELL PRODUCTION IN ACRE-FEET.

0 500 1000 SCALE IN AC-FT

0 2000 4000 6000 SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF GROUNDWATER PRODUCTION FOR 1986

JOB 58701 FEBRUARY 1988 PLATE 2

R17W | R16W

R16W | R15W

T5N
T4N

T4N
T3N

36 | 31
1 | 6

Tp
Tc
QTs
Qal
Qt
Tmc
bc

SAN GABRIEL FAULT

HOLSER FAULT

FAULT

0 2000 4000 9000
SCALE IN FEET

LEGEND

WATER-BEARING SEDIMENTS
- Qal = UNDIFFERENTIATED ALLUVIUM, HOLOCENE AGE.
- Qt = TERRACE DEPOSITS, PLEISTOCENE AGE.
- QTs = SAND & GRAVEL FORMATION, UNDIFFERENTIATED, PLIO-PLEISTOCENE AGE.
- Tp = PICO FORMATION, UNDIFFERENTIATED, PLIOCENE AGE.
- Tc = CASTAIC FORMATION, MIOCENE AGE.
- Tt = TUNGLEY FORMATION, UNDIFFERENTIATED, MIOCENE AGE.
- Tmc = WEST CANYON FORMATION, MIOCENE AGE.

NON-WATER-BEARING ROCKS
- bc = UNDIFFERENTIATED BEDROCK, GNEISS AND SCHIST, PRE-TERTIARY AGE.

- APPROXIMATE GEOLOGIC CONTACT.
- SURFACE TRACE OF FAULT, DOTTED WHERE CONCEALED.
- STRIKE AND DIP OF BEDDING.
- MAJOR SYNCLINE IN QTs, SHOWING PLUNGE
- MAJOR ANTICLINE IN QTs, SHOWING PLUNGE.

Geology adapted from Dibblee (1958), Whitmore and Barbee (1962), Bellinger (1978), Stein (1980), Saul and Wootton (1965), Stein (1964).

NC-8 ● LOCATION AND LOCAL NAME OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE WELL STRUCTURE IS FOR.

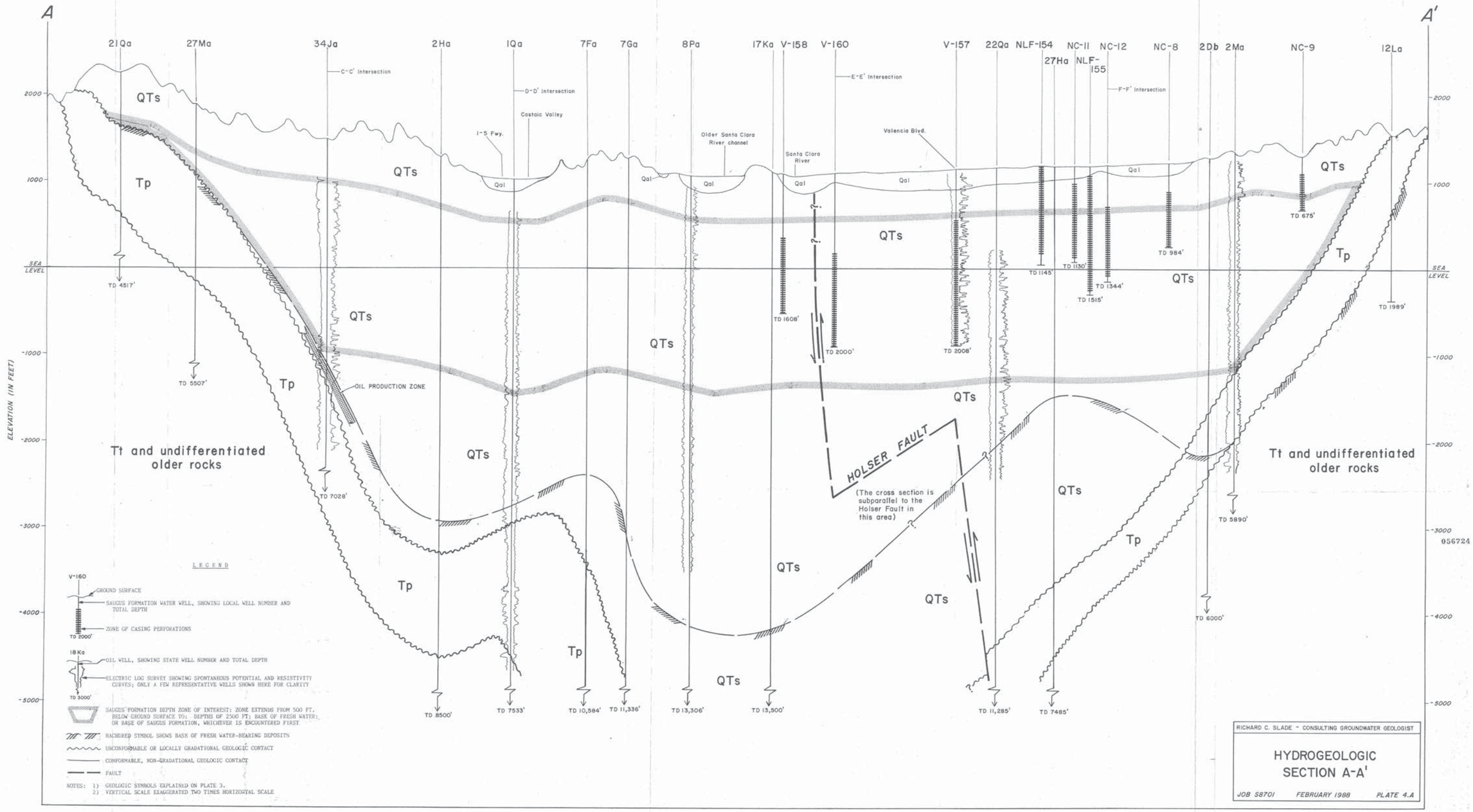
NLF-P8 ○ LOCATION AND LOCAL NAME OF DESTROYED SAUGUS FORMATION WATER WELL.

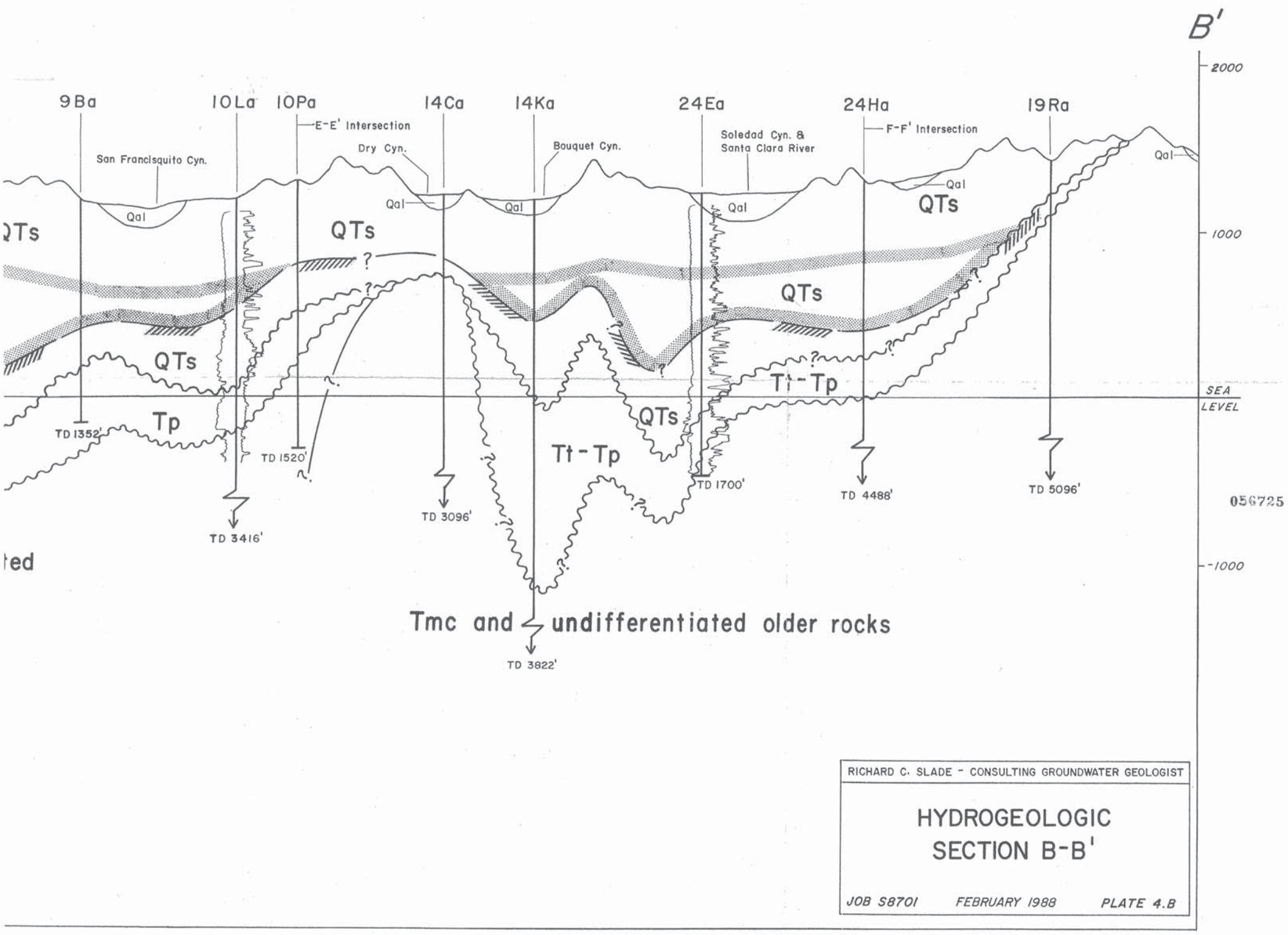
WELL OWNERSHIPS
- NC = NEWHALL COUNTY WATER DISTRICT
- NLF = NEWHALL LAND & FARMING COMPANY
- SC = SANTA CLARITA WATER COMPANY
- V = VALENCIA WATER COMPANY
- P = PRIVATELY-OWNED

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

HYDROGEOLOGY MAP

JOB S8701 FEBRUARY 1988 PLATE 3


A
A'
21Qa
27Ma
34Ja
2Ha
1Qa
7Fa
7Ga
8Pa
17Ka
V-158
V-160
V-157
22Qa
NLF-154
27Ha
NC-11
NC-12
NLF-155
NC-8
2Db
2Ma
NC-9
12La
C-C' Intersection
D-D' Intersection
E-E' Intersection
F-F' Intersection
Castaic Valley
I-5 Fwy.
Older Santa Clara River channel
Santa Clara River
Valencia Blvd.
QTs
Tp
Tt and undifferentiated older rocks
Qal
SEA LEVEL
ELEVATION (IN FEET)
2000
1000
-1000
-2000
-3000
-4000
-5000
TD 4517'
TD 5507'
TD 7028'
TD 8500'
TD 7533'
TD 10,584'
TD 11,336'
TD 13,306'
TD 13,500'
TD 1608'
TD 2000'
TD 2008'
TD 1145'
TD 1130'
TD 1515'
TD 1344'
TD 984'
TD 675'
TD 1989'
TD 5890'
TD 6000'
TD 11,285'
TD 7485'
OIL PRODUCTION ZONE
HOLSER FAULT
(The cross section is subparallel to the Holser Fault in this area)
LEGEND
V-160
GROUND SURFACE
SAUGUS FORMATION WATER WELL, SHOWING LOCAL WELL NUMBER AND TOTAL DEPTH
ZONE OF CASING PERFORATIONS
TD 2000'
18Ka
OIL WELL, SHOWING STATE WELL NUMBER AND TOTAL DEPTH
ELECTRIC LOG SURVEY SHOWING SPONTANEOUS POTENTIAL AND RESISTIVITY CURVES; ONLY A FEW REPRESENTATIVE WELLS SHOWN HERE FOR CLARITY
TD 3000'
SAUGUS FORMATION DEPTH ZONE OF INTEREST: ZONE EXTENDS FROM 500 FT. BELOW GROUND SURFACE TO: DEPTHS OF 2500 FT; BASE OF FRESH WATER; OR BASE OF SAUGUS FORMATION, WHICHEVER IS ENCOUNTERED FIRST
HACHURED SYMBOL SHOWS BASE OF FRESH WATER-BEARING DEPOSITS
UNCONFORMABLE OR LOCALLY GRADATIONAL GEOLOGIC CONTACT
CONFORMABLE, NON-GRADATIONAL GEOLOGIC CONTACT
FAULT
NOTES: 1) GEOLOGIC SYMBOLS EXPLAINED ON PLATE 3.
2) VERTICAL SCALE EXAGGERATED TWO TIMES HORIZONTAL SCALE
RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST
HYDROGEOLOGIC SECTION A-A'
JOB S8701 FEBRUARY 1988 PLATE 4.A
056724



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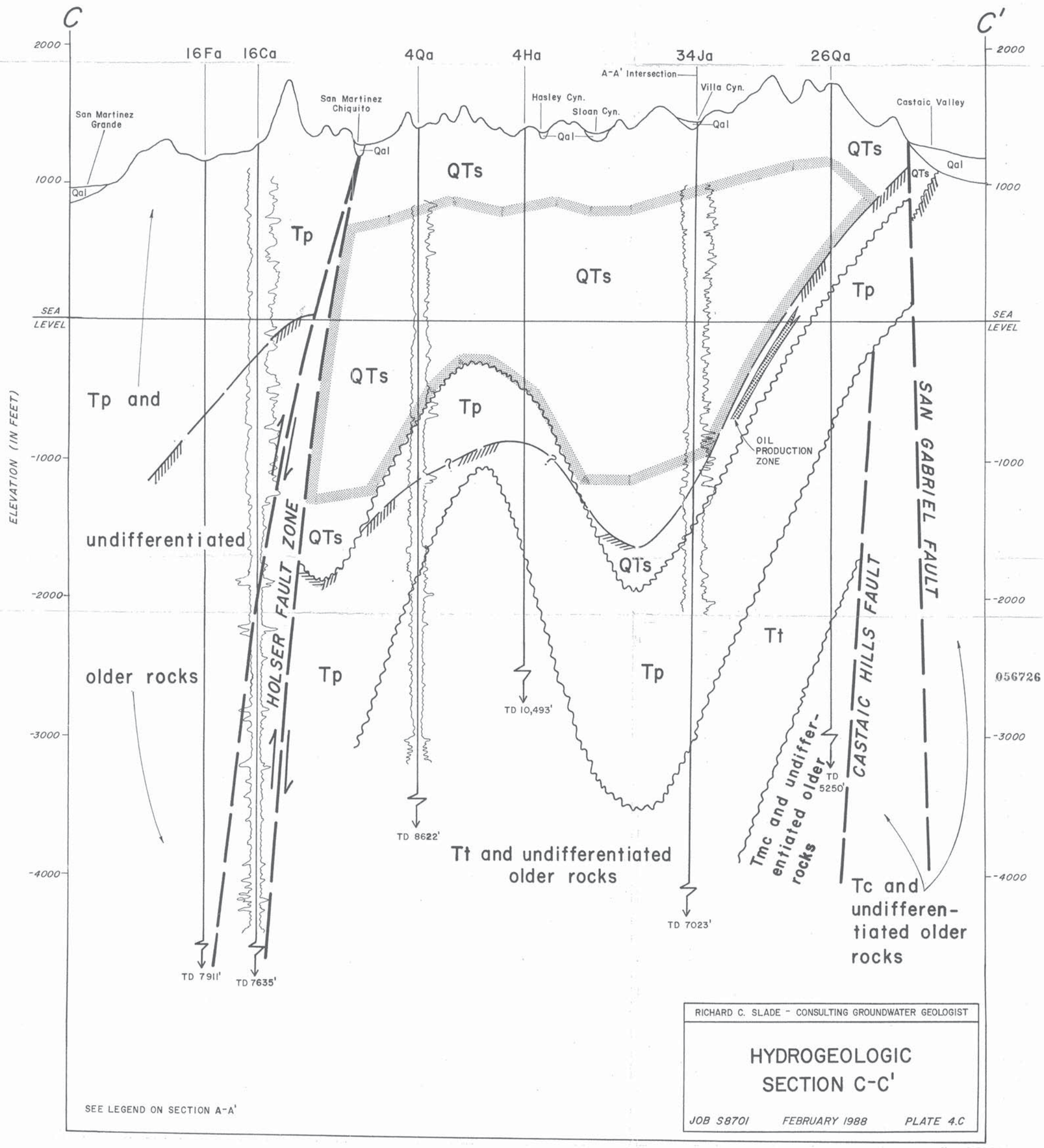
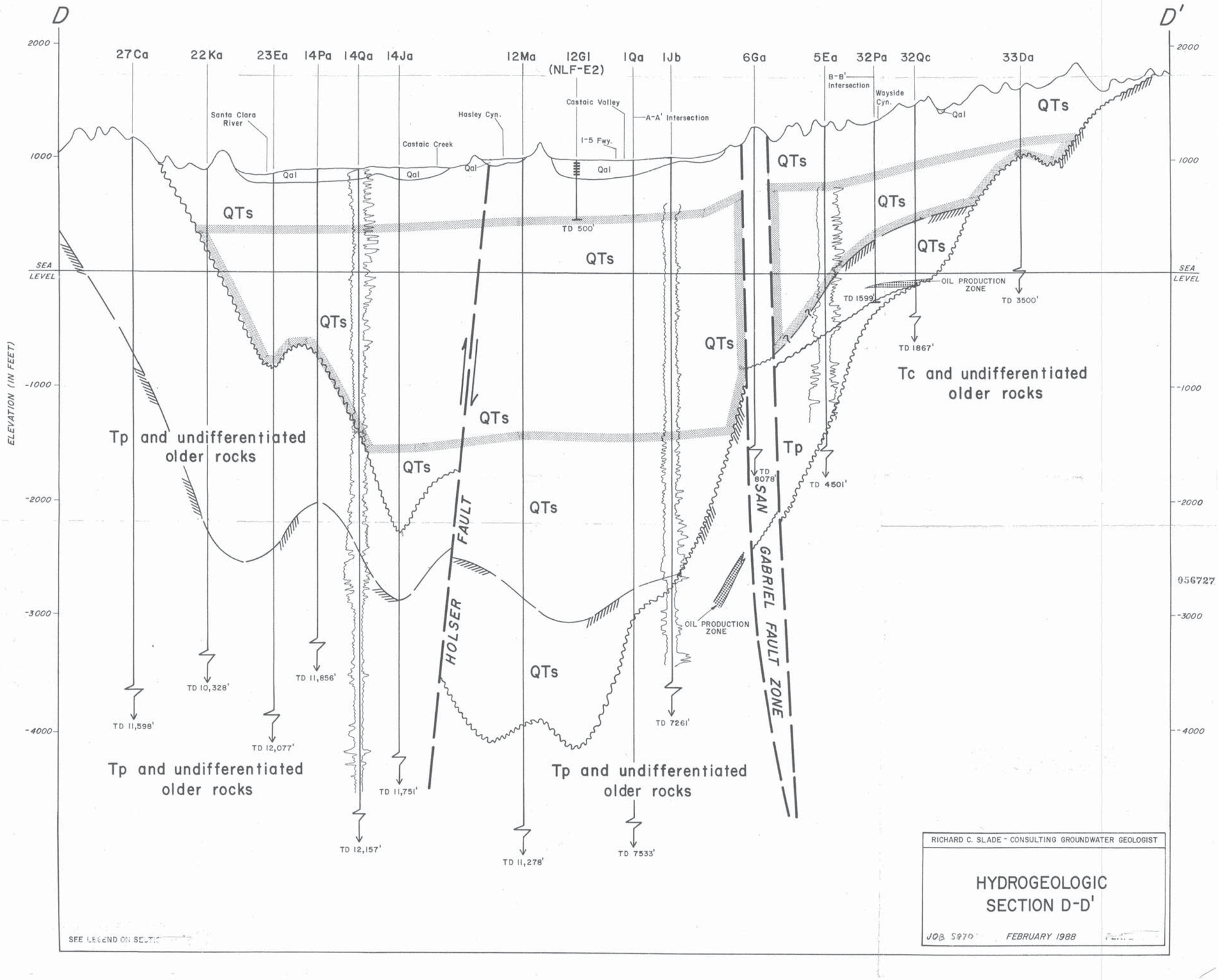
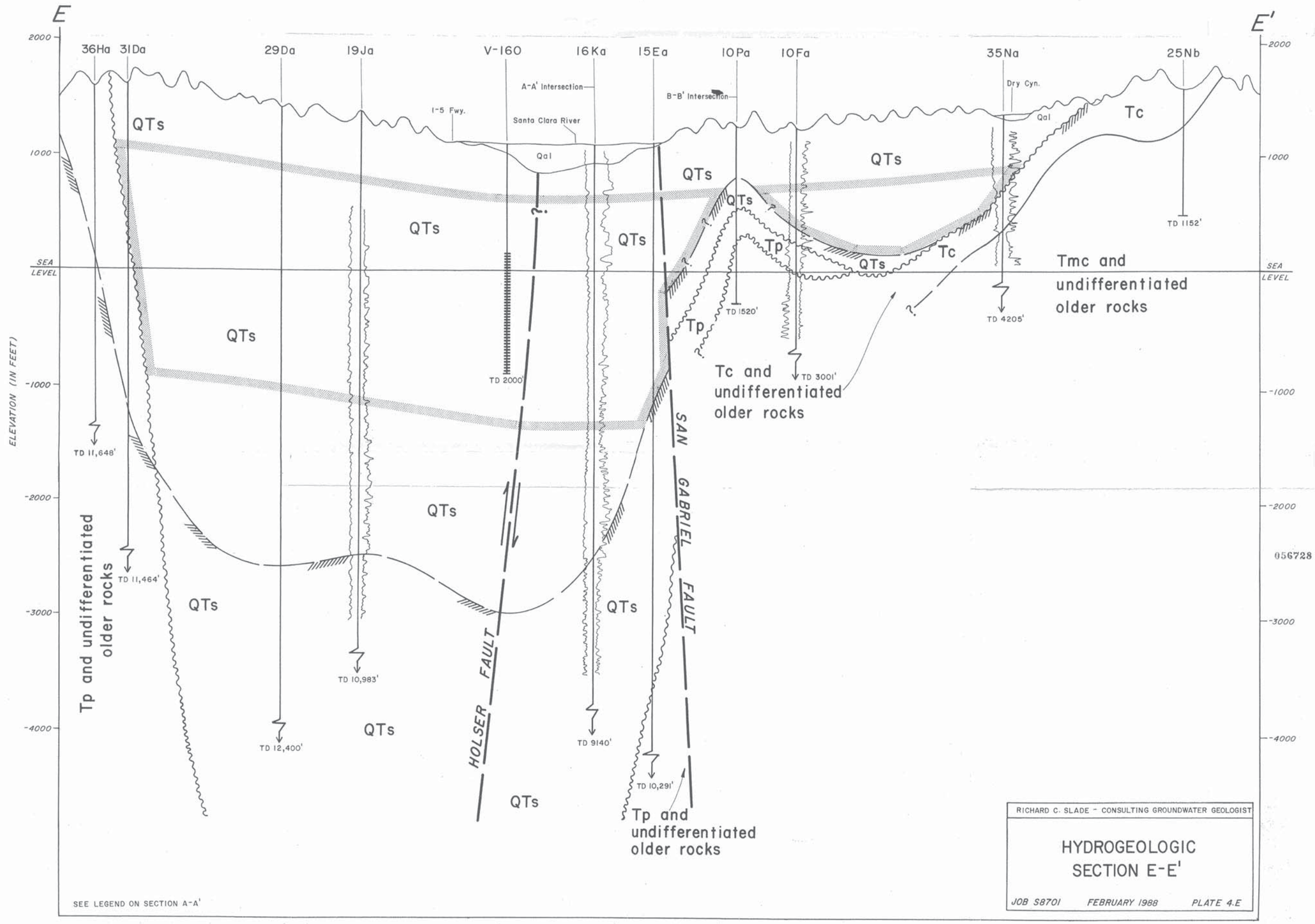
HYDROGEOLOGIC SECTION B-B'

JOB 8701 FEBRUARY 1988 PLATE 4.B


C
C'
16Fa
16Ca
4Qa
4Ha
34Ja
26Qa
A-A' Intersection
San Martinez Grande
San Martinez Chiquito
Hasley Cyn.
Sloan Cyn.
Villa Cyn.
Castaic Valley
Qal
QTs
Tp
SEA LEVEL
ELEVATION (IN FEET)
2000
1000
-1000
-2000
-3000
-4000
Tp and undifferentiated older rocks
HOLSER FAULT ZONE
OIL PRODUCTION ZONE
SAN GABRIEL FAULT
CASTAIC HILLS FAULT
Tt
Tt and undifferentiated older rocks
Tmc and undifferentiated older rocks
Tc and undifferentiated older rocks
TD 7911'
TD 7635'
TD 8622'
TD 10,493'
TD 7023'
TD 5250'
056726
RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST
HYDROGEOLOGIC SECTION C-C'
JOB S8701 FEBRUARY 1988 PLATE 4.C
SEE LEGEND ON SECTION A-A'


D
D'
2000
1000
SEA LEVEL
-1000
-2000
-3000
-4000
ELEVATION (IN FEET)
27Ca
22Ka
23Ea
14Pa
14Qa
14Ja
12Ma
12GI (NLF-E2)
1Qa
1Jb
6Ga
5Ea
32Pa
32Qc
33Da
B-B' Intersection
Wayside Cyn.
Santa Clara River
Castaic Creek
Hasley Cyn.
Castaic Valley
A-A' Intersection
I-5 Fwy.
Qal
QTs
Tp and undifferentiated older rocks
Tc and undifferentiated older rocks
HOLSER FAULT
SAN GABRIEL FAULT ZONE
OIL PRODUCTION ZONE
TD 500'
TD 1599'
TD 3500'
TD 1867'
TD 8078'
TD 4501'
TD 11,598'
TD 10,328'
TD 11,856'
TD 12,077'
TD 11,751'
TD 12,157'
TD 11,278'
TD 7261'
TD 7533'
SEE LEGEND ON SECTION
RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST
HYDROGEOLOGIC SECTION D-D'
JOB 5970
FEBRUARY 1988
056727



SEE LEGEND ON SECTION A-A'

RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST

HYDROGEOLOGIC SECTION E-E'

JOB S8701 FEBRUARY 1988 PLATE 4.E

056728

F

F'

ELEVATION (IN FEET)

2000

1000

SEA LEVEL

-1000

-2000

-3000

-4000

9Ka

3Na

NLF-P2

34La

NC-12

26Qa

26Ha

24Ha

18Ka

7Fa

6Ga

So. Fk. S.C. River

I-5 Fwy

So. Fk. S.C. River

Santa Clarita Valley

A-A' Intersection

So. Fk. S.C. River

B-B' Intersection

Soledad Cyn. Blvd.

Santa Clara River

Bouquet Cyn.

Qal

QTs

Tp

Tc

Tt-Tp

Tmc and undifferentiated older rocks

Tt and undifferentiated older rocks

Tp and undifferentiated older rocks

SAN GABRIEL FAULT ZONE

HOLSER FAULT ZONE

TD 8014'

TD 1300'

TD 1344'

TD 4488'

TD 3000'

TD 6912'

TD 3370'

TD 6007'

TD 3796'

TD 5950'

TD 9099'

SEE LEGEND ON SECTION A-A'

RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST

HYDROGEOLOGIC SECTION F-F'

JOB 8870I FEBRUARY 1988 PLATE 4.F

056729

SECTION 2

VOLUME II — REPORT PLATES

HYDROGEOLOGIC ASSESSMENT

OF THE

SAUGUS FORMATION
in the
SANTA CLARA VALLEY
of
LOS ANGELES COUNTY, CALIFORNIA

FOR

CASTAIC LAKE WATER AGENCY

LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 36 — VAL VERDE

NEWHALL COUNTY WATER DISTRICT

SANTA CLARITA WATER COMPANY

VALENCIA WATER COMPANY

FEBRUARY 1988

RICHARD C. SLADE

CONSULTING GROUNDWATER GEOLOGIST

RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

4950 BELLAIRE AVENUE
NORTH HOLLYWOOD, CA 91607
(818) 506-0418

February 10, 1988

Mr. Robert Sagehorn, General Manager
Castaic Lake Water Agency
23560 Lyons Avenue, Suite 225
Newhall, California 91321

Job S8701

Dear Mr. Sagehorn:

This document represents Volume II - Report Plates - of the two volume set of reports prepared for our hydrogeologic assessment of the Saugus Formation in the Santa Clara Valley of Los Angeles County, California. Volume I of this investigation contains the entire text and is separately bound.

Volume II is presented in two sections. The following plates are contained in Section 1:

Plate 1	Water Well Location Map
Plate 2	Map of Groundwater Production for 1986
Plate 3	Hydrogeology Map
Plate 4	Hydrogeologic Sections A-A' through F-F'

The following plates are contained in Section 2:

Plate 5	Thickness of Fresh Water-Bearing Deposits
Plate 6	Potential Aquifers, Sand Thickness Map - Saugus Formation
Plate 7	Contour Map of Generalized Groundwater Elevations--Summer-Fall, 1967
Plate 8	Contour Map of Groundwater Elevations--March, 1987
Plate 9	Theoretical Water Quality - Saugus Formation
Plate 10	Recommended Drilling Areas

Very truly yours,

Richard C. Slade

Richard C. Slade
Registered Professional Hydrogeologist

Slade 1988

Vol. 2 / Section 2

Plates 5, 6, 7, 8, 9, 10

R17W | R16W

R16W | R15W

T5N
T4N

T4N
T3N

T3N

SAN GABRIEL FAULT

HOLSER FAULT

SURFACE EXPOSURE OF BASE OF SAUGUS FORMATION

SURFACE EXPOSURE OF BASE OF SAUGUS FORMATION

NOTE: Data indicates fresh groundwater in the Pico Formation in this area

SC LOMBARDI

NC-1 NC-2 NC-3 NC-4 NC-5 NC-6 NC-7 NC-8 NC-9 NC-10 NC-11 NC-12

NLF-153 NLF-154 NLF-156 NLF-159

V-157 V-158 V-160

36 | 31
1 | 6

LEGEND

NC-8 ● LOCATION AND LOCAL BASE OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE ... OPERATION IN 1987.

NLF-P2 ○ LOCATION AND LOCAL BASE OF DESTROYED SAUGUS FORMATION WATER WELL.

✱ or ⌘ INDICATES WELL HAS AN ELECTRIC LOG.

WELL OWNERSHIPS

NC = NEWHALL COUNTY WATER DISTRICT
NLF = NEWHALL LAND & FARMING COMPANY
SC = SANTA CLARITA WATER COMPANY
V = VALENCIA WATER COMPANY
P = PRIVATELY-OWNED

Qal = ALLUVIUM IN STREAM CANYONS, HOLOCENE AGE.

Qt = TERRACE DEPOSITS, LATE PLEISTOCENE AGE.

QTs = SAUGUS FORMATION, PLIOCENE-PLEISTOCENE AGE.

GEOLOGIC CONTACT.

FAULT, SUBSURFACE TRACE where different from Plate 1.

3Le ● (2545) LOCATION AND STATE WELL NUMBER OF OIL WELL. NUMBER IN PARENTHESES IS THICKNESS OF FRESH WATER-BEARING DEPOSITS IN FEET, FROM GROUND SURFACE TO BASE OF FRESH WATER REGARDLESS OF GEOLOGIC FORMATION, AS INTERPRETED FROM ELECTRIC LOG DATA.

1000 CONTOUR OF EQUAL THICKNESS OF FRESH WATER-BEARING DEPOSITS, IN FEET.

0 2000 4000 6000
SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

THICKNESS OF FRESH WATER-BEARING DEPOSITS

JOB 58701 FEBRUARY 1988 PLATE 5

R17W R16W

R16W R15W

T5N
T4N

T4N
T3N

R17W R16W

R16W R15W

STORAGE UNIT NO. 2

STORAGE UNIT NO. 1

STORAGE UNIT NO. 3

SAN GABRIEL FAULT

HOLSER FAULT

SURFACE EXPOSURE OF BASE OF SAUGUS FORMATION

SURFACE EXPOSURE OF BASE OF SAUGUS FORMATION

LEGEND

NC-8 ● LOCATION AND LOCAL NAME OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE WELL PRODUCTION IN 1967

NLF-P2 ○ LOCATION AND LOCAL NAME OF DESTROYED SAUGUS FORMATION WATER WELL.

⊗ or ⊠ INDICATES WELL HAS AN ELECTRIC LOG.

WELL OWNERSHIPS

NC = NEWHALL COUNTY WATER DISTRICT
NLF = NEWHALL LAND & FARMING COMPANY
SC = SANTA CLARITA WATER COMPANY
V = VALENCIA WATER COMPANY
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Qal = ALLUVIUM IN STREAM CANYONS, HOLOCENE AGE.

Qt = TERRACE DEPOSITS, LATE PLEISTOCENE AGE.

QTs = SAUGUS FORMATION, PLIOCENE-PLEISTOCENE AGE.

GEOLOGIC CONTACT.

FAULT, SUBSURFACE TRACE where different from Plate 1.

22Qa ● (1155) LOCATION AND STATE WELL NUMBER OF OIL WELL. NUMBER IN PARENTHESES IS CUMULATIVE THICKNESS OF POTENTIALLY USABLE SAND LAYERS, IN FEET, AS INTERPRETED FROM ELECTRIC LOG DATA FOR THE DEPTH ZONE BETWEEN 500 FT AND± 2500 FT. THE BASE OF SAUGUS FORMATION; OR THE BASE OF FRESH WATER, WHICHEVER IS SHALLOWER.

400 CONTOUR OF EQUAL SAND THICKNESS, IN FEET.

0 2000 4000 6000
SCALE IN FEET

RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST

POTENTIAL AQUIFERS, SAND THICKNESS MAP -SAUGUS FORMATION

JOB S8701 FEBRUARY 1988 PLATE 6

R17W | R16W

R16W | R15W

T5N
T4N

T4N
T3N

SAN GABRIEL FAULT

HOLSER FAULT

QTs

Qal

1000

1050

1100

V-158 (1008)

V-160 (997)

V-157 (1058)

NLF-156 (967)

NLF-154 (1058)

NLF-155 (1059)

NLF-159 (1033)

NC-11

NC-10 (1015)

NC-8 (1034)

NC-9 (1010)

NC-5

NC-6

NC-7

NC-1

NC-4

NC-2

NC-3

SC-LOMBARDI

36 | 31
1 | 6

LEGEND

NC-8 ● LOCATION AND LOCAL NAME OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE WELL PRODUCTION IN 1967.

NLF-P2 ○ LOCATION AND LOCAL NAME OF DESTROYED SAUGUS FORMATION WATER WELL.

⊠ or ⊠ INDICATES WELL HAS AN ELECTRIC LOG.

WELL OWNERSHIPS

NC = NEWHALL COUNTY WATER DISTRICT
NLF = NEWHALL LAND & FARMING COMPANY
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P = PRIVATELY-OWNED

Qal = ALLUVIUM IN STREAM CANYONS, HOLOCENE AGE.

Qt = TERRACE DEPOSITS, LATE PLEISTOCENE AGE.

QTs = SAUGUS FORMATION, PLIOCENE-PLEISTOCENE AGE.

GEOLOGIC CONTACT.

FAULT, SURFACE TRACE.

V-157 ● (1058) LOCATION OF SAUGUS FORMATION WATER WELL, WITH DATA IN PARENTHESES FOR NON-PUMPING ELEVATION OF GROUNDWATER, IN FEET, FOR SUMMER-FALL, 1967.

—1000— APPROXIMATE CONTOUR FOR NON-PUMPING WATER LEVEL ELEVATION, IN FEET, FOR SUMMER-FALL, 1967.

APPROXIMATE DIRECTION OF GROUNDWATER FLOW, SUMMER-FALL, 1967.

SCALE IN FEET
0 2000 4000 6000

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

CONTOUR MAP OF GENERALIZED GROUNDWATER ELEVATIONS SUMMER-FALL 1967

JOB S8701 FEBRUARY 1988 PLATE 7

R17W | R16W

R16W | R15W

SAN GABRIEL FAULT

HOLSER FAULT

T5N / T4N

T4N / T3N

36 | 31 / 1 | 6

QTs

Qal

1050

1100

1150

1200

1250

1300

NLF-156

V-158

V-160 (1055)

V-157 (1080)

NLF-154

NC-11 (1090)

NLF-155

NC-12 (1113)

NC-10 (1118)

NC-8 (1150)

NC-9 (1135)

NLF-159 (1133)

NLF-152

SC-LOMBARDI

NC-5

NC-6

NC-7 (1293)

NC-4

NC-2

NC-3

0 2000 4000 6000

SCALE IN FEET

LEGEND

NC-8 — LOCATION AND LOCAL NAME OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE WELL PRODUCTION IN 1987.

NLF-152 — LOCATION AND LOCAL NAME OF DESTROYED SAUGUS FORMATION WATER WELL.

or — INDICATES WELL HAS AN ELECTRIC LOG.

WELL OWNERSHIPS

NC = NEWHALL COUNTY WATER DISTRICT
NLF = NEWHALL LAND & FARMING COMPANY
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Qt = TERRACE DEPOSITS, LATE PLEISTOCENE AGE.

QTs = SAUGUS FORMATION, PLIOCENE-PLEISTOCENE AGE.

GEOLOGIC CONTACT.

FAULT, SURFACE TRACE

V-157 (1080) — LOCATION OF SAUGUS FORMATION WATER WELL, WITH DATA IN PARENTHESES FOR NON-PUMPING ELEVATION OF GROUNDWATER, IN FEET, FOR MARCH 1987.

1300 — APPROXIMATE CONTOUR FOR NON-PUMPING WATER LEVEL ELEVATION, IN FEET, FOR MARCH 1987.

APPROXIMATE DIRECTION OF GROUNDWATER FLOW, MARCH 1987.

RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST

CONTOUR MAP OF GROUNDWATER ELEVATIONS MARCH 1987

JOB 58701 FEBRUARY 1988 PLATE 8

R17W | R16W

R16W | R15W

T5N / T4N

T4N / T3N

36 | 31 / 1 | 6

QTs

Qal

SAN GABRIEL FAULT

HOLSER FAULT

NLF-158

V-159

V-160

V-157

NLF-154

NC-11

NLF-155

NC-12

NC-10

NC-8

NC-7

NC-5

NLF-159

NLF-P8

SC-LOMBARDI

NC-6

NC-9

NC-1

NC-4

NC-2

NC-3

NLF-P2

0 2000 4000 6000

SCALE IN FEET

LEGEND

NC-8 ● LOCATION AND LOCAL NAME OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE WELL PRODUCTION IN 1987.

NLF-P2 ○ LOCATION AND LOCAL NAME OF DESTROYED SAUGUS FORMATION WATER WELL.

⊠ INDICATED WELL HAS AN ELECTRIC LOG.

WELL OWNERSHIPS

NC = NEWHALL COUNTY WATER DISTRICT
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V = VALENCIA WATER COMPANY
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Qal = ALLUVIUM IN STREAM CANYONS, HOLOCENE AGE.

Qt = TERRACE DEPOSITS, LATE PLEISTOCENE AGE.

QTs = SAUGUS FORMATION, PLIOCENE-PLEISTOCENE AGE.

GEOLOGIC CONTACT.

FAULT, SUBSURFACE TRACE where different from Plate 1.

22Qa LOCATION AND STATE WELL NUMBER OF OIL WELL WITH ELECTRIC LOG DATA USED IN THEORETICAL QUALITY CALCULATIONS.

REGION WHERE SHALLOW DEPTH ZONE (500 to 1000 FT) HAS THEORETICAL SALINITY (see TD6) <800 ppm.

REGION WHERE DEEP DEPTH ZONE (2000 to 2500 FT) HAS THEORETICAL SALINITY (see TD6) <800 ppm.

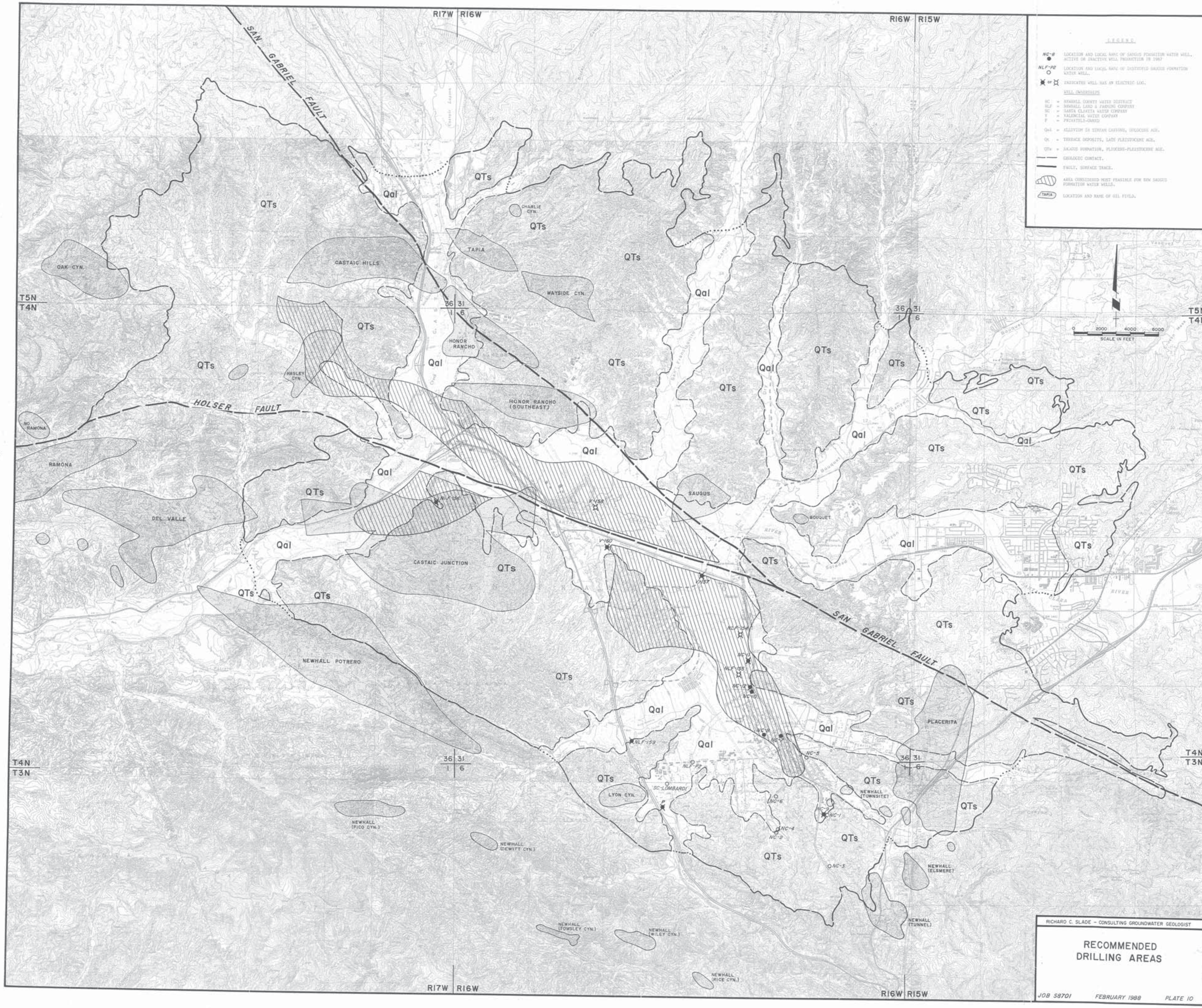
REGION WHERE BOTH SHALLOW AND DEEP DEPTH ZONES HAVE THEORETICAL SALINITY (see TD6) <800 ppm.

REGION WITHIN THE SAUGUS FORMATION OUTCROP AREA WHERE NO DATA EXIST ON WATER THEORETICAL SALINITY (see TD6) IN EITHER THE SHALLOW OR DEEP ZONES, OR BOTH, IS >800 ppm.

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

THEORETICAL WATER QUALITY —SAUGUS FORMATION

JOB 8870I FEBRUARY 1988 PLATE 9


LEGEND
NC-8 LOCATION AND LOCAL NAME OF SAUGUS FORMATION WATER WELL, ACTIVE OR INACTIVE WELL PRODUCTION IN 1987
NLF-P2 LOCATION AND LOCAL NAME OF DESTROYED SAUGUS FORMATION WATER WELL.
INDICATES WELL HAS AN ELECTRIC LOG.
WELL OWNERSHIPS
NC = NEWHALL COUNTY WATER DISTRICT
NLF = NEWHALL LAND & FARMING COMPANY
SC = SANTA CLARITA WATER COMPANY
V = VALENCIA WATER COMPANY
P = PRIVATELY-OWNED
Qal = ALLUVIUM IN STREAM CANYONS, HOLOCENE AGE.
Qt = TERRACE DEPOSITS, LATE PLEISTOCENE AGE.
QTs = SAUGUS FORMATION, PLIOCENE-PLEISTOCENE AGE.
GEOLOGIC CONTACT.
FAULT, SURFACE TRACE.
AREA CONSIDERED MOST FEASIBLE FOR NEW SAUGUS FORMATION WATER WELLS.
TAPIA LOCATION AND NAME OF OIL FIELD.
SCALE IN FEET
0 2000 4000 6000
R17W R16W
R16W R15W
T5N T4N
T4N T3N
SAN GABRIEL FAULT
HOLSER FAULT
OAK CYN.
CASTAIC HILLS
TAPIA
CHARLIE CYN.
WAYSIDE CYN.
HONOR RANCHO
HASLEY CYN.
HONOR RANCHO (SOUTHEAST)
NO. RAMONA
RAMONA
DEL VALLE
CASTAIC JUNCTION
SAUGUS
BOUQUET
NEWHALL POTRERO
PLACERITA
LYON CYN.
SC-LOMBARDI
NEWHALL (TOWNSITE)
NEWHALL (ELSMERE)
NEWHALL (TUNNEL)
NEWHALL (PICO CYN.)
NEWHALL (DEWITT CYN.)
NEWHALL (TOWSLEY CYN.)
NEWHALL (WILEY CYN.)
NEWHALL (RICE CYN.)
QTs
Qal
RIVER
RICHARD C. SLADE - CONSULTING GROUNDWATER GEOLOGIST
RECOMMENDED DRILLING AREAS
JOB 58701 FEBRUARY 1988 PLATE 10

SECTION 1

VOLUME II — REPORT PLATES

HYDROGEOLOGIC INVESTIGATION

PERENNIAL YIELD

and

ARTIFICIAL RECHARGE POTENTIAL

of the

ALLUVIAL SEDIMENTS

in the

SANTA CLARITA RIVER VALLEY

of

LOS ANGELES COUNTY, CALIFORNIA

FOR

UPPER SANTA CLARA WATER COMMITTEE

MEMBERS: LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 36 — VAL VERDE
NEWHALL COUNTY WATER DISTRICT
SANTA CLARITA WATER COMPANY
VALENCIA WATER COMPANY

AFFILIATE: CASTAIC LAKE WATER AGENCY

DECEMBER 1986

RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

4950 BELLAIRE AVENUE
NORTH HOLLYWOOD, CA 91607
(818) 506-0418

December 16, 1986

Mr. Kenneth R. Putnam, Chairman
Upper Santa Clara Water Committee
Post Office Box 779
Newhall, California 91322

S8605

Dear Mr. Putnam:

This document represents Volume II - Report Plates - of the two volume set of documents prepared for my hydrogeologic investigation of the perennial yield and artificial recharge potential of the alluvial sediments within the Santa Clarita Valley of Los Angeles County, California. Volume I of this investigation contains the entire text and is separately bound.

Volume II is presented in two sections. The following plates are contained in Section 1:

Plate 1	Basin Boundaries and Well Location Map
Plate 2	Land Use Map
Plate 3	Map of Groundwater Extractions for 1985
Plate 4	Hydrogeology Map
Plate 5	Contour Map of Groundwater Elevations, Fall 1985
Plates 6.1 - 6.4	Hydrographs and TDS Graphs
Plate 6.5	Location Map of Data Graphs

The following plates are contained in Section 2:

Plate 7	Map of Aquifer Characteristics
Plate 8	Map of Stiff Water Quality Diagrams - Groundwater
Plate 9	Map of Watersheds and Drainage
Plate 10	Map of Flood Hazards
Plate 11	Map of Surface Water Sampling Sites and Stiff Water Quality Diagrams
Plate 12	Map of Groundwater Storage Units
Plate 13	Map of Soil Infiltration Rates
Plate 14	Percent Clay Map
Plate 15	Map of Preliminary Surface Spreading Areas

Very truly yours,

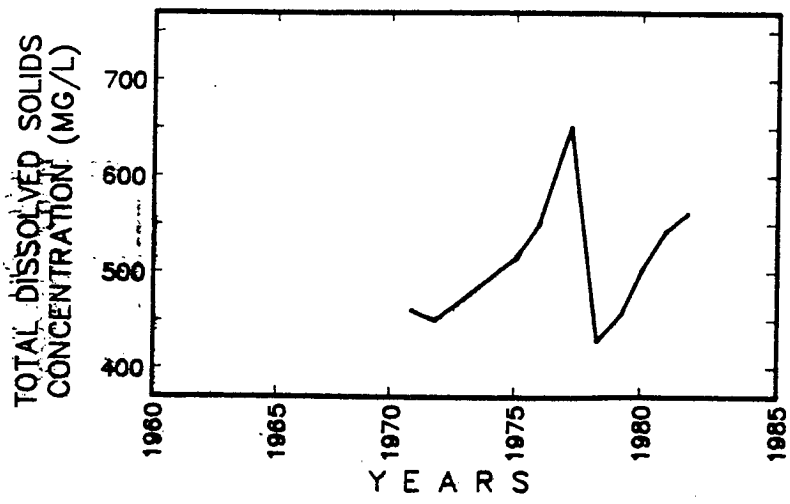
Richard C. Slade
Registered Professional Hydrogeologist

Slade 1986

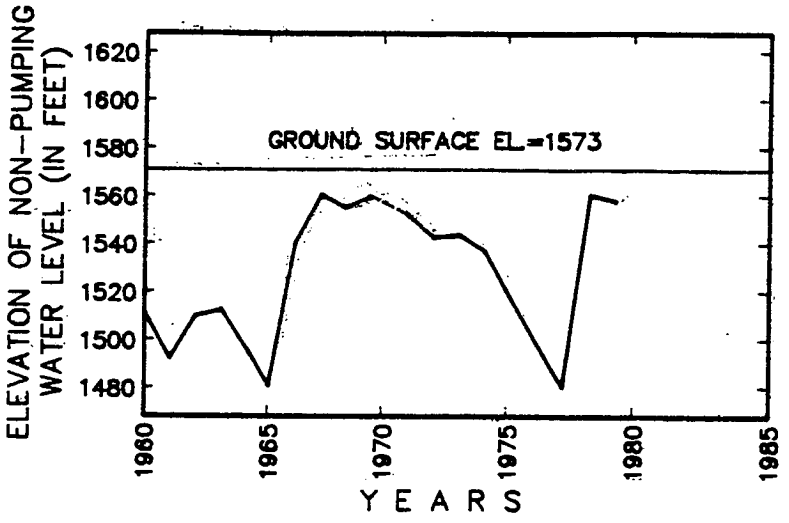
Vol. 2 / Section 1

Plates 1, 2, 3, 4, 5

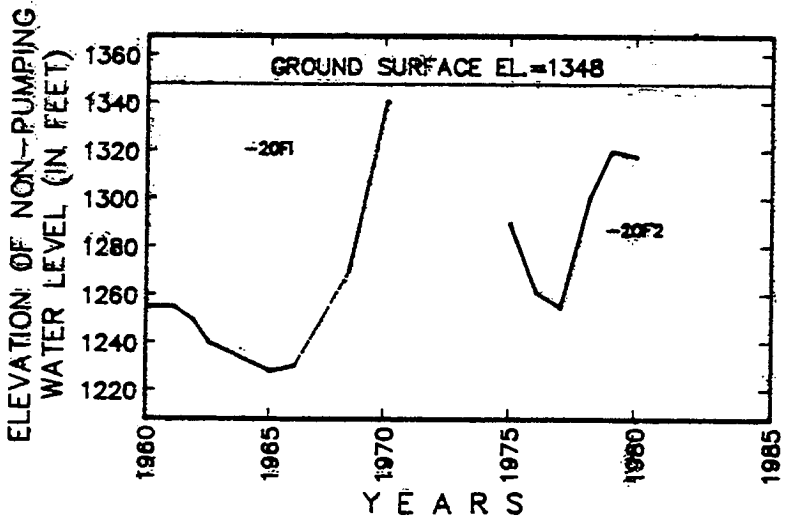
LOCATION: UPPER REACH, SANTA CLARA RIVER



WELL NO. 4N/15W-14J1 (ALLUVIUM)
DEPTH = 117 FT.
PERFORATIONS = UNKNOWN



WELL NO. 4N/15W-13P1 (ALLUVIUM)
DEPTH = 150 FT.
PERFORATIONS = UNKNOWN



WELL NOS. 4N/20F1, -20F2 (ALLUVIUM)
DEPTH = 175 FT.
PERFORATIONS = 160-170(?) FT.

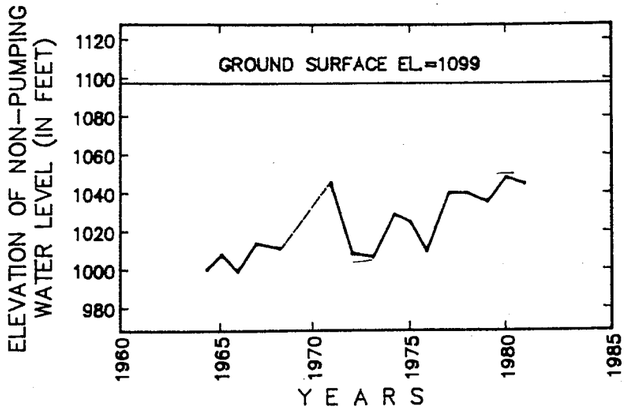
RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

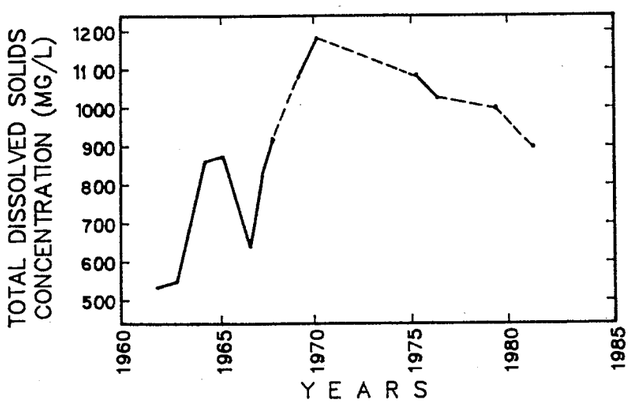
HYDROGRAPHS AND TDS GRAPHS

JOB NO. 58605 JULY 1988 PLATE 6.1

LOCATION: MIDDLE REACH, SANTA CLARA RIVER

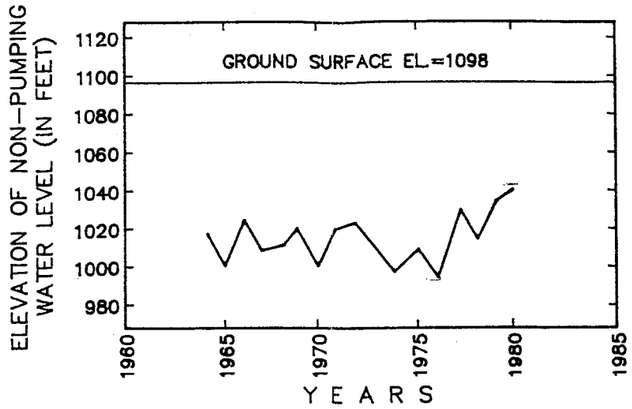
VALENCIA WATER CO.
WELL NO. 158 (SAUGUS FM)
4N/16W-17J1
DEPTH = 1608 FT.
PERFORATION = 740-1600 FT.

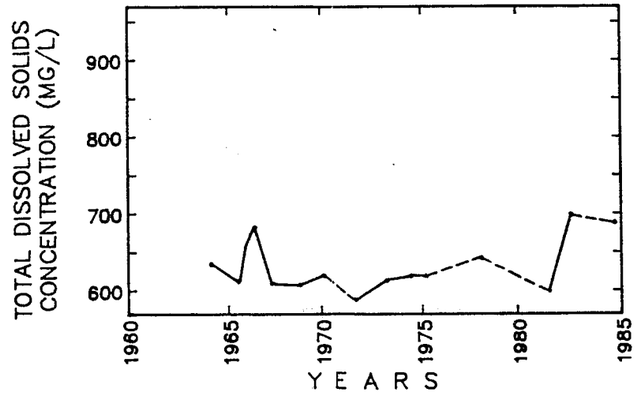




LOCATION: MIDDLE REACH, SANTA CLARA RIVER

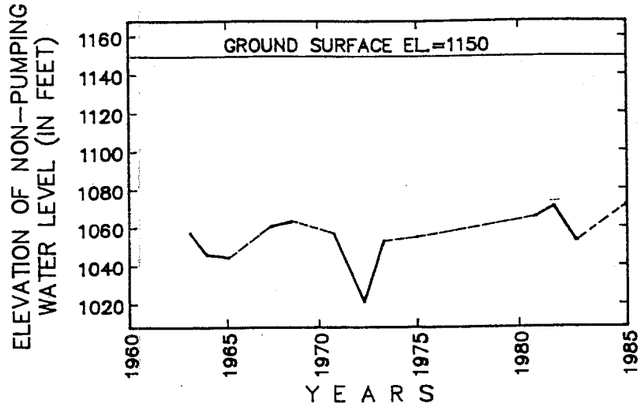
VALENCIA WATER CO.
WELL NO. 160 (SAUGUS FM)
4N/16W-21D1
DEPTH = 2000 FT.
PERFORATION = 950-2000 FT.

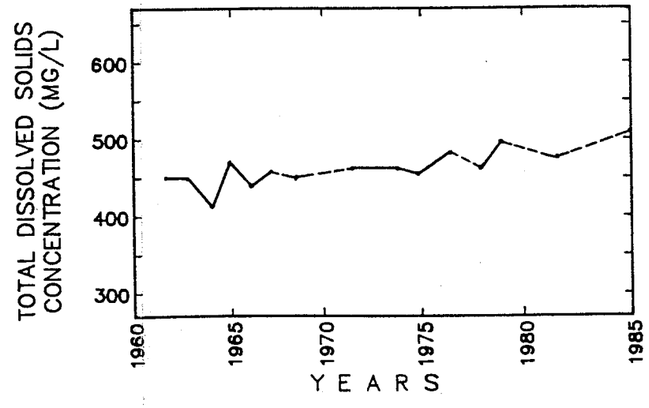




LOCATION: MIDDLE REACH, SANTA CLARA RIVER

VALENCIA WATER CO.
WELL NO. 157 (SAUGUS FM)
4N/16W-22M1
DEPTH = 2014 FT.
PERFORATION = 593-2014 FT.





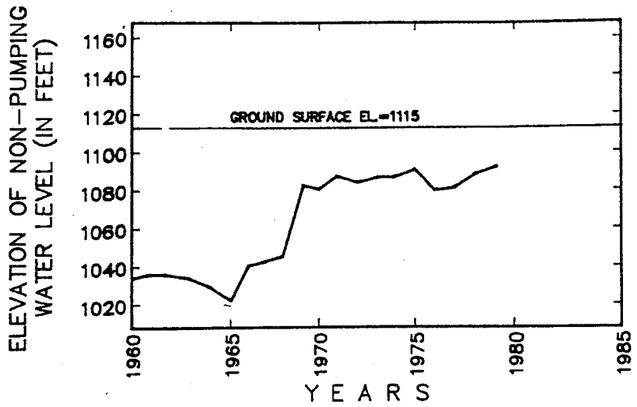
RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

HYDROGRAPHS AND TDS GRAPHS

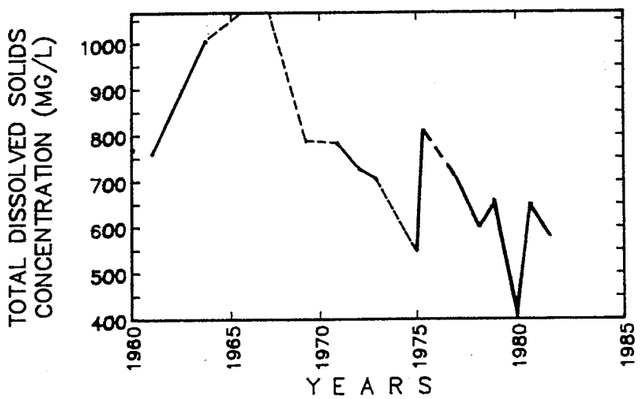
JOB NO. S8605 JULY 1986 PLATE 6.2

1

LOCATION: MIDDLE REACH, SANTA CLARA RIVER

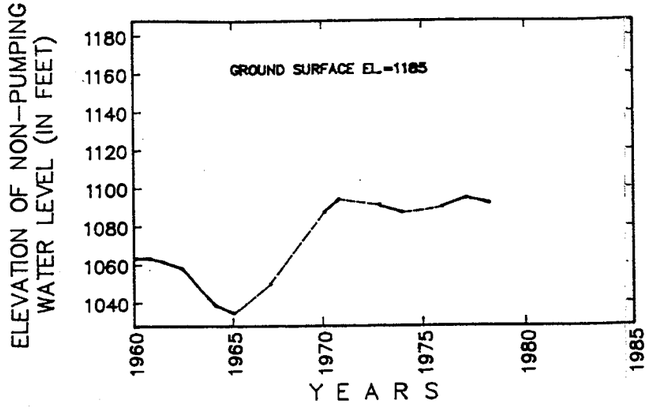


NL&F CO.
WELL NO. S & S-2 (ALLUVIUM)
4N/16W-16Q1 AND -16Q3
DEPTH = 230 AND 212 FT.
PERFORMATIONS = 60-220 FT. & 50-202 FT.

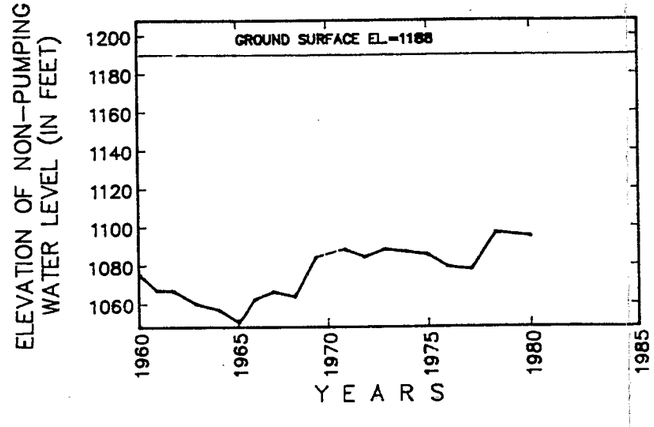


NL&F CO.
WELL NO. R2-94 (ALLUVIUM)
4N/16W-14E2
DEPTH = 130 FT.
PERFORATION = 40-128 FT.

LOCATION: SOUTH FORK, SANTA CLARA RIVER



NL&F CO.
WELL NO. 154 (ALLUVIUM & SAUGUS FM)
4N/16W-27H5
DEPTH = 1137 FT.
PERFORATIONS = 45-1016 FT.



WELL NO. 4N/16W-27J1
(ALLUVIUM & POSSIBLE SAUGUS FM)
DEPTH = 380 FT.
PERFORATION = UNKNOWN

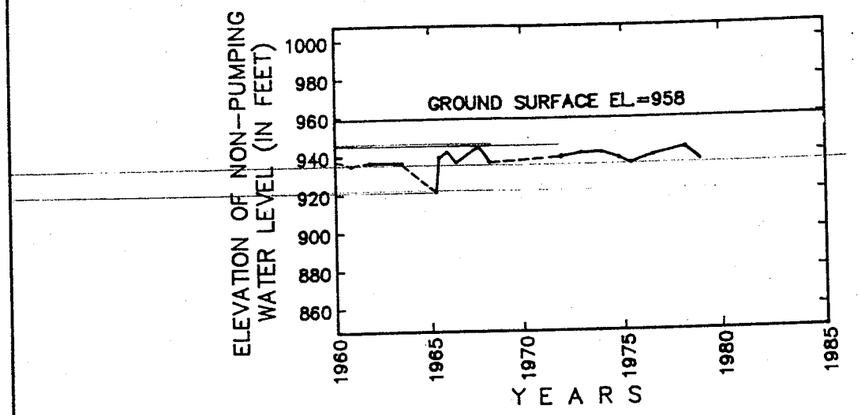
RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

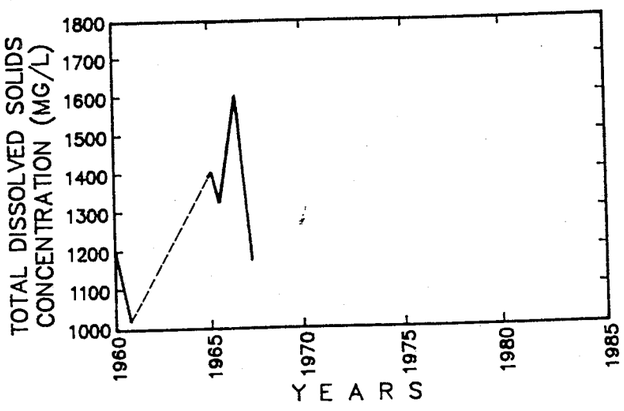
HYDROGRAPHS AND TDS GRAPHS

JOB NO. S8605 JULY 1986 PLATE 6.3

LOCATION: LOWER REACH, SANTA CLARA RIVER

NL&F CO.
WELL NO. C (ALLUVIUM)
4N/17W-14Q2
DEPTH = 140 FT.
PERFORATION = 80-135 FT.

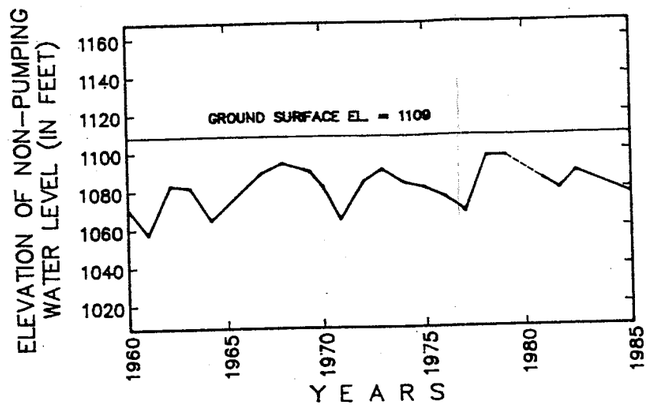


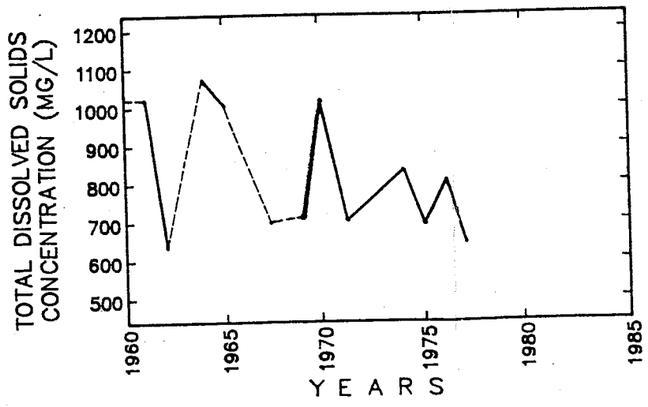


ALLUVIAL WELL
NL&F CO. WELL C-2
4N/17W-14Q1
DEPTH=135 FT.
PERFORATION = ?

LOCATION: CASTAIC CREEK

WAYSIDE HONOR RANCHO
WELL NO. 14 (ALLUVIUM), 5N/17W-36A3
DEPTH = 126 FT.
PERFORATION = 66-106 FT.





ALLUVIAL WELL
4N/17W-1J1
WAYSIDE NO. 11
DEPTH=100 FT.
PERFORATION = 50-100 FT.

RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

HYDROGRAPHS AND TDS GRAPHS

JOB NO. 58605 JULY 1986 PLATE 6.4

Slade 1986

Vol. 2/Section 1

Plate 6.5

LEGEND
APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.
APPROXIMATE LOCATION OF AGENCY-OWNED WATER WELLS, ACTIVE IN 1985, SHOWING STATE NUMBER (IF KNOWN) AND LOCAL DESIGNATION.
AGENCIES AS FOLLOWS:
NC NEWHALL COUNTY WATER DISTRICT
SC SANTA CLARITA WATER COMPANY
V VALENCIA WATER COMPANY
W WAYSIDE (PITCHESS) HONOR RANCHO; INCLUDES OTHER L.A. COUNTY WATER WORKS DISTRICT NO. 36 WELLS.
APPROXIMATE LOCATION OF NEWHALL LAND AND FARMING COMPANY WELL, ACTIVE IN 1985, SHOWING STATE NUMBER AND LOCAL DESIGNATION.
APPROXIMATE LOCATIONS OF INACTIVE AGENCY-OWNED WELLS AND OF OTHER KNOWN HISTORICALLY DRILLED WATER WELLS, SHOWING STATE NUMBER (ACTIVITY OF THESE WELLS IS NOT KNOWN).
R17W
R16W
R15W
R14W
T5N
T4N
T3N
EASTERN GROUNDWATER BASIN
BASIN BOUNDARY
PIRU BASIN PORTION OF VENTURA CENTRAL BASIN
TO ACTION BASIN
QTs
SCALE IN FEET
0 2000 4000 6000
RICHARD C. SLADE — CONSULTING GROUNDWATER GEOLOGIST
BASIN BOUNDARIES AND WELL LOCATION MAP
JOB 58605
DEC, 1986
PLATE 1

LAND USE MAP

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

JOB 88605 DEC, 1986 PLATE 2

LEGEND

- APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.
- APPROXIMATE LOCATION OF VARIOUS INDUSTRIES, STABLES, TRAILER PARKS, ETC., WHICH COULD POSSIBLY IMPACT WATER QUALITY.
- SAUGUS OIL FIELD — APPROXIMATE SURFACE PROJECTION AND NAME OF THE PRODUCTION LIMITS OF THE OIL FIELD; FIELD IS ACTIVE UNLESS INDICATED OTHERWISE.
- APPROXIMATE LOCATION OF NATURAL OIL SEEP.
- APPROXIMATE LOCATION OF LANDFILL, MUD SUMP DISPOSAL AREA, AS ADAPTED FROM L.A. COUNTY HEALTH DEPARTMENT – SOLID WASTE SECTION.

SCALE IN FEET: 0 2000 4000 6000

R17W R16W R15W R14W

T5N T4N T3N

SEWERED UNSEWERED AGRICULTURE

OAK CYN. OIL FIELD
MUD SUMP INACTIVE CLASS II
CASTAIC HILLS OIL FIELD
CHARLIE CYN. OIL FIELD (ABANDONED)
LA CO. INDUSTRIAL SITE
TAPIA OIL FIELD
OIL STORAGE
LA CO. BRINE EVAP. POND
HONOR RANCHO OIL FIELD (MAIN AREA)
LA CO. ACTIVE CLASS II
DAIRY
OIL STORAGE
LOCKHEED FACILITIES
HASLEY CYN. OIL FIELD
LA CO CLOSED CLASS III
HONOR RANCHO OIL FIELD (SOUTHEAST AREA)
BORROW AREA
VALENCIA INDUSTRIAL PARK
WWTP NO. 32
QTs
N. RAMONA OIL FIELD
RAMONA OIL FIELD
DEL VALLE OIL FIELD
CHIQUITA CANYON DISPOSAL SITE ACTIVE
MAGIC MOUNTAIN FACILITIES
CASTAIC JUNCTION OIL FIELD
NEWHALL-POTRERO OIL FIELD
SANTA SUSANA OIL FIELD
S. TAPIA CYN. OIL FIELD
SAUGUS OIL FIELD
BOUQUET OIL FIELD (ABAND.)
EDISON SUBSTATION
WWTP NO. 26
RACEWAY
INDUSTRIAL
WHITTAKER-BERMITE CO.
FORMER THATCHER GLASS CO.
MUD SUMP INACTIVE CLASS II
TRAILER PARK
BORROW AREA
LUBRICATION CO. OF AMERICA
SPACE ORDINANCE 975
MICRONICS INT'L.
PLACERITA OIL FIELD
LYON CYN. OIL FIELD
STABLES
CEMETERY
MUD SUMP
ABANDONED REFINERY
NEWHALL OIL FIELD (TOWNSITE AREA)
NEWHALL OIL FIELD (DEWITT CYN. AREA)
NEWHALL OIL FIELD (ELSMERE AREA)
NEWHALL OIL FIELD (TUNNEL AREA)
NEWHALL OIL FIELD (RICE CYN. AREA – ABAND.)
NEWHALL OIL FIELD (WESTTOWN AREA)
NEWHALL OIL FIELD (POWELL CYN. AREA)

SANTA SUSANA MOUNTAINS
ANGELES NATIONAL FOREST
SAN FERNANDO VALLEY
SANTA CLARA RIVER

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.

NLF-161 — ACTIVE AGENCY-OWNED WELL PRODUCING FROM ALLUVIAL AQUIFERS, SHOWING LOCAL DESIGNATION; RADIUS OF CIRCLE INDICATES 1985 PRODUCTION, IN AC-FT.

V-157 — WELLS WITH 1985 PRODUCTION LESS THAN 150 AC-FT. SHOW PRODUCTION IN PARENTHESES.

AS ABOVE, BUT PRODUCING FROM SAUGUS FORMATION.

AGENCY DESIGNATIONS AS FOLLOWS:

NC = NEWHALL COUNTY WATER DISTRICT
SC = SANTA CLARITA WATER COMPANY
V = VALENCIA WATER COMPANY
W = WATERSIDE (PITCHESS) HONOR RANCHO, INCLUDING L.A. COUNTY WATER WORKS DISTRICT NO. 36
NLF = THE NEWHALL LAND & FARMING COMPANY

0 500 1000 SCALE IN AC-FT.

0 2000 4000 6000 SCALE IN FEET

MAP OF GROUNDWATER EXTRACTIONS FOR 1985

RICHARD C. SLADE — CONSULTING GROUNDWATER GEOLOGIST

JOB 88605 DEC, 1986 PLATE 3

HYDROGEOLOGY MAP

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

JOB 86605 DEC, 1986 PLATE 4

LEGEND

WATER-BEARING SEDIMENTS

- Qal — UNDIFFERENTIATED ALLUVIUM, HOLOCENE
- Qt — TERRACE DEPOSITS, PLEISTOCENE AGE.
- QTs — SAUGUS FORMATION, UNDIFFERENTIATED, PLIO-PLEISTOCENE AGE.
- Tp — PICO FORMATION, UNDIFFERENTIATED, MIOCENE AGE.
- Tc — CASTAIC FORMATION, MIOCENE AGE.
- Tt — TOWSLEY FORMATION, UNDIFFERENTIATED, MIOCENE AGE.
- Tvb — VIOLIN BRECCIA, MIOCENE AGE.
- Tmc — MINT CANYON FORMATION, MIOCENE AGE.
- Tms — MODELO FORMATION, UNDIFFERENTIATED, MIOCENE AGE.
- Ttc — TICK CANYON FORMATION, MIOCENE AGE.
- Tv — VASQUEZ FORMATION, OLIGOCENE
- bc — UNDIFFERENTIATED BEDROCK, GNEISS AND SCHIST, PRE-TERTIARY AGE.

NON-WATER BEARING ROCKS

- APPROXIMATE GEOLOGIC CONTACT.
- FAULT, DOTTED WHERE CONCEALED.
- STRIKE AND DIP OF BEDDING.
- SURFACE TRACE OF SYNCLINE.
- SURFACE TRACE OF ANTICLINE.

GEOLOGY ADAPTED PRINCIPALLY FROM STITT (1980), OAKESOTT (1958), WINTERER & DURHAM (1958)

SCALE IN FEET 0 2000 4000 6000

RI7W RI6W RI5W RI4W

T5N T4N T3N

SAN GABRIEL FAULT

HOLSER FAULT

PICO ANTICLINE

MOUNTAIN SYNCLINE

WHITNEY CANYON FAULT

SANTA CLARA RIVER

ANGELES NATIONAL FOREST

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.

G1 (750) — WATER WELL APPROXIMATELY LOCATED, SHOWING STATE NUMBER; NUMBER IN PARENTHESES IS ELEVATION OF NON-PUMPING GROUNDWATER SURFACE, IN FEET ABOVE SEA LEVEL, FOR FALL (OCT-NOV) 1985.

1700 — APPROXIMATE NON-PUMPING GROUNDWATER ELEVATION CONTOUR, IN FEET, FOR FALL 1985.

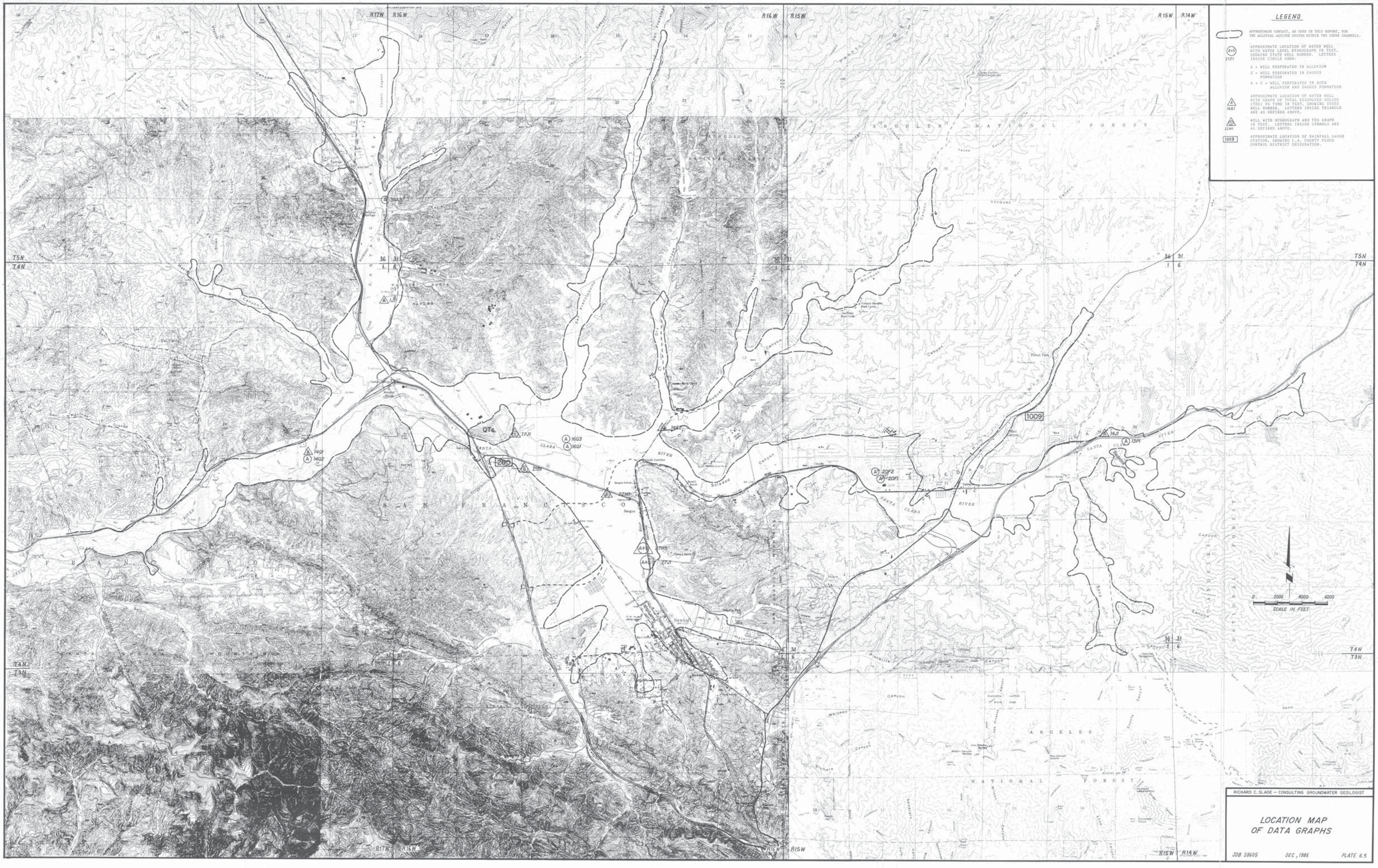
APPROXIMATE DIRECTION OF GROUNDWATER FLOW.

0 2000 4000 6000
SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

CONTOUR MAP OF GROUNDWATER ELEVATIONS FALL 1985

JOB 58605 DEC, 1986 PLATE 5


R17W
R16W
R15W
R14W
T5N
T4N
T3N
CASTAIC
SAN FRANCISQUITO
ANGELES NATIONAL FOREST
SANTA CLARA RIVER
Castaic Creek
Castaic Lagoon
San Francisquito Canyon
Bouquet Canyon
Solemint Canyon
Soledad Canyon
Vasquez Canyon
Whitney Canyon
Placerita Canyon
Pyramid Reservoir
Castaic Junction
Saugus
Newhall
Pinetree
Pilot Pipe
Vasquez Rocks County Park
Placerita Canyon Nature Center
Los Pinetos Forest Camp
Live Oak Springs Forest Camp
Mt. Gleason
Mt. Lukens
Sawmill Mtn.
Whitney Canyon Reservoir
Los Pinetos Reservoir
Wiley Canyon Reservoir
Live Oak Reservoir
1009
200
QTs
LEGEND
APPROXIMATE CONTACT, AS USED IN THIS REPORT, TOP THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.
APPROXIMATE LOCATION OF WATER WELL WITH WATER LEVEL HYDROGRAPH IN TEXT, SHOWING STATE WELL NUMBER. LETTERS INSIDE CIRCLE SHOW:
A = WELL PERFORATED IN ALLUVIUM
S = WELL PERFORATED IN SAUGUS FORMATION
A + S = WELL PERFORATED IN BOTH ALLUVIUM AND SAUGUS FORMATION
APPROXIMATE LOCATION OF WATER WELL WITH GRAPH OF TOTAL DISSOLVED SOLIDS (TDS) VS TIME IN TEXT, SHOWING STATE WELL NUMBER. LETTERS INSIDE TRIANGLE ARE AS DEFINED ABOVE.
WELL WITH HYDROGRAPH AND TDS GRAPH IN TEXT. LETTERS INSIDE SYMBOLS ARE AS DEFINED ABOVE.
APPROXIMATE LOCATION OF RAINFALL GAUGE STATION, SHOWING L.A. COUNTY FLOOD CONTROL DISTRICT DESIGNATION.
0 2000 4000 6000
SCALE IN FEET
RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST
LOCATION MAP OF DATA GRAPHS
JOB 58605
DEC., 1986
PLATE 6.5

SECTION 2

VOLUME II — REPORT PLATES

HYDROGEOLOGIC INVESTIGATION

PERENNIAL YIELD
and
ARTIFICIAL RECHARGE POTENTIAL
of the
ALLUVIAL SEDIMENTS
in the
SANTA CLARITA RIVER VALLEY
of
LOS ANGELES COUNTY, CALIFORNIA

FOR
UPPER SANTA CLARA WATER COMMITTEE
MEMBERS: LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 36 — VAL VERDE
NEWHALL COUNTY WATER DISTRICT
SANTA CLARITA WATER COMPANY
VALENCIA WATER COMPANY

AFFILIATE: CASTAIC LAKE WATER AGENCY

DECEMBER 1986

RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

RCS

RICHARD C. SLADE
CONSULTING GROUNDWATER GEOLOGIST

4950 BELLAIRE AVENUE
NORTH HOLLYWOOD, CA 91607
(818) 506-0418

December 16, 1986

Mr. Kenneth R. Putnam, Chairman
Upper Santa Clara Water Committee
Post Office Box 779
Newhall, California 91322

S8605

Dear Mr. Putnam:

This document represents Volume II - Report Plates - of the two volume set of documents prepared for my hydrogeologic investigation of the perennial yield and artificial recharge potential of the alluvial sediments within the Santa Clarita Valley of Los Angeles County, California. Volume I of this investigation contains the entire text and is separately bound.

Volume II is presented in two sections. The following plates are contained in Section 1:

Plate 1	Basin Boundaries and Well Location Map
Plate 2	Land Use Map
Plate 3	Map of Groundwater Extractions for 1985
Plate 4	Hydrogeology Map
Plate 5	Contour Map of Groundwater Elevations, Fall 1985
Plates 6.1 - 6.4	Hydrographs and TDS Graphs
Plate 6.5	Location Map of Data Graphs

The following plates are contained in Section 2:

Plate 7	Map of Aquifer Characteristics
Plate 8	Map of Stiff Water Quality Diagrams - Groundwater
Plate 9	Map of Watersheds and Drainage
Plate 10	Map of Flood Hazards
Plate 11	Map of Surface Water Sampling Sites and Stiff Water Quality Diagrams
Plate 12	Map of Groundwater Storage Units
Plate 13	Map of Soil Infiltration Rates
Plate 14	Percent Clay Map
Plate 15	Map of Preliminary Surface Spreading Areas

Very truly yours,

Richard C. Slade
Registered Professional Hydrogeologist

Slade 1986

Vol. 2/Section 2

Plates 7, 8, 9, 10, 11, 12, 13, 14, 15

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF AQUIFER CHARACTERISTICS

JOB 58605 DEC, 1986 PLATE 7

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.

SC-SIERRA — APPROXIMATE LOCATION OF WATER WELL PRODUCING FROM THE ALLUVIUM, SHOWING STATE NUMBER, OR LOCAL OWNER AND DESIGNATION.

AGENCIES ARE AS FOLLOWS:
- NC = NEWHALL COUNTY WATER DISTRICT
- SC = SANTA CLARITA WATER COMPANY
- V = VALENCIA WATER COMPANY
- W = WAYSIDE (PITCHESS) HONOR RANCHO
- NLF = NEWHALL LAND & FARMING COMPANY

NC-11 — APPROXIMATE LOCATION OF WATER WELL PRODUCING FROM THE SAUGUS FORMATION.

NOTE: NLF-134 PRODUCES FROM BOTH THE ALLUVIUM AND THE SAUGUS FORMATION.

STIFF WATER QUALITY PATTERN DIAGRAM, UNITS ARE EQUIVALENTS PER MILLION (EPM).

261 / 6 — TDS, IN MG/L; NITRATE AS NO_3, IN MG/L

ALL DATA DATE FROM 1980-85, EXCEPT WAYSIDE WELLS (1974 DATA); 3S1 (1973), 22R2(1979)

SCALE IN FEET: 0, 2000, 4000, 6000

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF STIFF WATER QUALITY DIAGRAMS – GROUNDWATER

JOB 86605 DEC., 1986 PLATE 8

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.

TRIBUTARY WATERSHED DIVIDE. ARROW SHOWS DIRECTION OF SURFACE RUNOFF.

(6) CANYON WATERSHED, TRIBUTARY TO SANTA CLARA RIVER, FOR WHICH RECOVERABLE WATER HAS BEEN DETERMINED FOR THIS STUDY. NUMBER REFERS TO DESIGNATION OF THIS CANYON IN TEXT.

16 ISOMETRIC CONTOUR, IN INCHES PER YEAR, AS ADAPTED FROM LACFD.

NOTE: DRAINAGE DIVIDES NOT SHOWN HEREON FOR ALL OR PORTIONS OF USGS QUADRANGLE SHEETS: LAKE HUGHES, SLEEPY VALLEY, DEL SUR, AGUA DULCE, GREEN VALLEY, WARM SPRINGS, WHITAKER PEAK, SUNLAND, DAY MOUNTAIN.

SCALE IN FEET
0 2000 4000 6000

DRAINAGE TO SAN FERNANDO VALLEY

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF WATERSHEDS AND DRAINAGES

JOB 58605 DEC., 1986 PLATE 9

R17W R16W R15W R14W

T5N
T4N
T3N

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CHEEK-CHANNELS.

AREA ENCLOSING APPROXIMATE 100-YEAR FLOOD HAZARD BOUNDARIES.

NOTE: DATA ADAPTED FROM USGS 7½ MAPS (1980)

0 2000 4000 6000
SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF FLOOD HAZARDS

JOB 58605 DEC, 1986 PLATE 10

R17W R16W R16W R15W R15W R14W

T5N T4N

T4N T3N

T4N T3N

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, TOP THE ALLUVIAL AQUIFER WITHIN THE CREEK CHANNELS.

SURFACE WATER FIELD TESTING SITE; ELECTRICAL CONDUCTIVITY, TEMPERATURE, AND APPROXIMATE FLOW RATE MEASURED MARCH 26-28, 1986. DESIGNATION (SW-13) REFERS TO DATA TABLE IN TEXT.

SURFACE FLOW OBSERVATION SITE; ESTIMATED FLOW, IF ANY, IS NOTED FOR MARCH 26-28, 1986.

SURFACE WATER SAMPLING SITE, JANUARY 1969, FROM USGS/DWR STUDY, SHOWING STIFF PATTERN DIAGRAM; NUMBER SHOWS NITRATE AS NO_3, IN mg/L, IN JANUARY 1969.

ION UNITS ARE EQUIVALENTS PER MILLION.

STIFF PATTERN DIAGRAM

0 2000 4000 6000
SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF SURFACE WATER SAMPLING SITES AND STIFF WATER QUALITY DIAGRAMS

JOB 8605 DEC, 1986 PLATE 11

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CHINO CHANNELS.

ARBITRARY BOUNDARY USED BETWEEN GROUNDWATER STORAGE UNITS.

ARBITRARY BOUNDARY USED BETWEEN GROUNDWATER STORAGE SUBUNITS.

A, B, C1a, D1a — LETTER DESIGNATIONS USED IN THIS REPORT FOR THE VARIOUS GROUNDWATER STORAGE UNITS AND SUBUNITS.

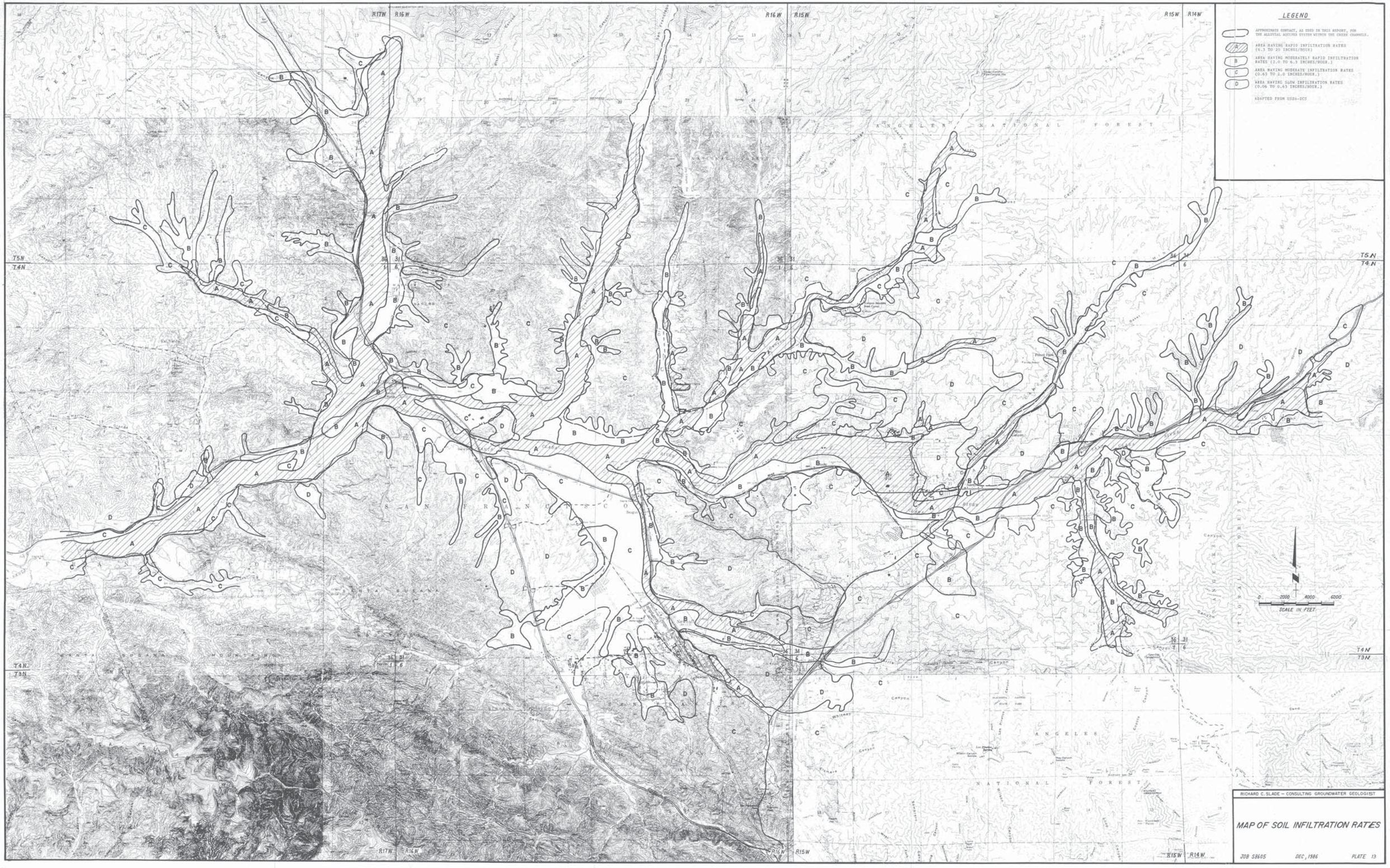
C2a
C2b
C3
C1a
C1b
C1c
B4a
B4b
B4c
B3
B2a
B2b
B2c
B1b
QTs
B1a
A4a
A4b
A1d
A1e
A1a
A1b
A2
A1c
A3b
A3a
D1b
D1a

0 2000 4000 6000
SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF GROUNDWATER STORAGE UNITS

JOB 58605 DEC, 1986 PLATE 12


R17W
R16W
R15W
R14W
T5N
T4N
T4N
T3N
LEGEND
APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.
A
AREA HAVING RAPID INFILTRATION RATES (6.3 TO 20 INCHES/HOUR)
B
AREA HAVING MODERATELY RAPID INFILTRATION RATES (2.0 TO 6.3 INCHES/HOUR.)
C
AREA HAVING MODERATE INFILTRATION RATES (0.63 TO 2.0 INCHES/HOUR.)
D
AREA HAVING SLOW INFILTRATION RATES (0.06 TO 0.63 INCHES/HOUR.)
ADAPTED FROM USDA-SCS
0 2000 4000 6000
SCALE IN FEET
RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST
MAP OF SOIL INFILTRATION RATES
JOB 58605
DEC, 1986
PLATE 13

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CREEK CHANNELS.

APPROXIMATE LOCATION OF WATER WELL, WITH DRILLER'S LOG ON FILE WITH DWR:

UPPER NUMBER = PERCENTAGE OF CLAY IN 0-25 FOOT DEPTH ZONE OF SEDIMENTS AS LOGGED BY DRILLER.

LOWER NUMBER = PERCENTAGE OF CLAY IN 25-50 FOOT DEPTH ZONE OF SEDIMENTS AS LOGGED BY DRILLER.

CONTOUR OF EQUAL CLAY PERCENTAGE IN THE 0 TO 25 FOOT DEPTH ZONE.

R17W R16W R15W R14W

T5N T4N T3N

QTs

ANGELES NATIONAL FOREST

SAN FRANCISQUITO CANYON

SANTA SUSANA MOUNTAINS

SAN FERNANDO VALLEY

SAN GABRIEL MOUNTAINS

SAN GABRIEL RIVER

SANTA CLARA RIVER

0 2000 4000 6000

SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

PERCENT CLAY MAP

JOB 8605 DEC, 1986 PLATE 14

LEGEND

APPROXIMATE CONTACT, AS USED IN THIS REPORT, FOR THE ALLUVIAL AQUIFER SYSTEM WITHIN THE CHIEF CHANNELS.

ZONE ENCLOSING ALLUVIAL AREA CONSIDERED TO BE POTENTIALLY AMENABLE TO SURFACE SPREADING; THESE ZONES HAVE:

1) OF CLAY FROM 0 TO 25 FEET ON DRILLER'S LOG.
2) SOIL INFILTRATION RATES $\geq$ 0.3 INCHES/HOUR, BASED USDA-SCS DATA.

NOTE: ALLUVIAL AREAS NOT SPECIALLY DENOTED DO NOT HAVE BOTH CHARACTERISTICS OR DRILLER'S LOG DATA ARE NOT AVAILABLE.

R17W R16W R15W R14W

T5N T4N

T4N T3N

QTs

SAN FRANCISQUITO MOUNTAINS

SANTA SUSANA MOUNTAINS

ANGELES NATIONAL FOREST

0 2000 4000 6000
SCALE IN FEET

RICHARD C. SLADE – CONSULTING GROUNDWATER GEOLOGIST

MAP OF PRELIMINARY SURFACE SPREADING AREAS

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