Baldwin Hills CSD Inglewood

Surface Monitoring Program: Evaluation of 2022 Survey, 2021-2022 Production Year, Results

Sentinel Peak Resources

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REVISION HISTORY

Rev	Date	Reason for Issue	Originator	Checker	Approver
01	15-Dec-22	First submission	Val Larma, P.E. Jerry Nichols, Licensed P.G.	Tim Rathmann, Valeria Gonzalez	Val Larma, P.E.

REVISION DESCRIPTIONS

Rev	Section	Detail of Change
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Contents

1. Executive Summary

This report summarizes InterAct's analysis of ground survey data, satellite data, and oilfield activities such as liquid injection/production, individual oil producing zones, and pressure data as it pertains to vertical and horizontal elevation change measured during the production period from July 2021 through June 2022.

Analysis of ground movement as it relates to the Baldwin Hills Community Standards District (BHCSD) began in Year 2010 with a baseline study. Each year since, oilfield operations in the Inglewood Field are evaluated with regard to ground movement data.

The area of investigation for the surveying extends approximately one mile in all directions from the field boundary and includes 57 active monuments as shown in **Figure 1.1.** In addition, satellite data is acquired over a 25-square-mile area centering the Inglewood Oil Field (IOF), currently operated by Sentinel Peak Resources (SPR).

We specifically analyzed the ground survey data (acquired July 7 through July 21, 2022 by Psomas, with leveling runs done from July 28 through September 14, 2022), the Interferometric Synthetic Aperture Radar surveys (InSAR; cumulative July 1 2021 through June 30 2022 by CGG), the IOF production/injection data from the Vickers Rindge (V/R) oil sands (cumulative July 2021 through June 2022 by SPR), and the reservoir pressure in the V/R oil sands, estimated from static fluid levels taken in July, 2022 by SPR. The V/R reservoir sands are the focus of the study because they comprise about 94% of field liquids production and are also highly porous with shallow burial depths. A comparison of the survey data was done for the data acquired in 2021 to the data acquired in 2022. We find that:

1. There were no monument changes over the 12 month period; all monitoring control points remained intact in 2022.
2. Overall field fluid replacement ratio is 103.9% for the V/R reservoirs. This indicates that fluid injection and withdrawal are essentially balanced.
3. Average V/R reservoir pressure in 2022 is 1040 psi, 53 psi higher than the 987 psi pressure (corrected for casing pressure) recorded in 2021, further validating that subsurface pressure is being maintained by injection activities.
4. Three of the monument locations as recorded by the ground survey moved more than 0.6 inches vertically, the threshold as specified in the BHCSD ordinance. All movements exceeding this threshold were in the negative direction.
5. Max survey elevation decrease was -1.62” at monument 110, near the center of **Fig 1.1**.
6. Max survey elevation increase was +0.108” at monument 107, near the bottom of **Fig 1.1**.
7. Average elevation change for the 57 monuments was -0.139”.
8. There was a poor correlation between ground movement and operations at the fieldwide, local, and regional levels.
9. The ground movements observed in the current and past Annual Ground Movement Surveys (AGMS) are relatively small and, taken in context with overall Los Angeles Basin ground movement, are not considered unusual or excessive. Ground movements also show significant variations in displacement (both magnitude and direction) from year to year. Field operations alone cannot account for this variation as they are essentially stable, suggesting several independent factors are involved in observed ground motion.

10. Twin monuments show good correlation with original monuments and are considered superior locations for measuring ground movement.
11. InSAR data continues to correlate well with GPS data and are considered equal or superior to GPS data due to better ground coverage of data and significantly more data points at each location.

The geotechnical analysis can be found in Laguna Geoscience's report and the year 2022 survey data can be found in the report from Psomas; the results are incorporated in this report.

2. Introduction and Background

The BHCSD survey monitoring program began in 2010 and requires the operator to conduct ground movement surveys, including both vertical and horizontal surveys, once every 12 months. A variance was granted for the 12-month period to be extended to 18 months in 2020 due to the COVID-19 pandemic. The 2021 and 2022 periods are a 12 month period, but the time frame has shifted from a calendar year to the July 2020-June 2021 time period. This is because the 18 month period in 2020 ended in June 2020.

The survey results are analyzed in relation to oil field activities, taking into consideration individual oil producing zones, production and injection volumes, and reservoir pressure. The intent of this program is to monitor subsidence, and where subsidence damage is found to be caused by oil operations, to adjust operations accordingly.

InterAct's review by a Registered Professional Engineer and a Licensed Professional Geologist, Laguna Geosciences, Inc. review by a Registered Geotechnical Engineer and Certified Engineering Geologist, and the inclusion of surveys by Psomas' licensed surveyor constitute SPR's current AGMS of the IOF, as required under the guidelines established by the BHCSD Environmental Impact Report (EIR) (Marine Research Specialists, 2008).

3. Monuments

Reference locations used for the AGMS include 57 actively monitored monuments both within and outside of the field boundaries. (**See Figure 1.1.)** Five monuments are older historical monuments (the 50000 series monuments). Thirty-five of the monuments were established by Psomas in 2010 both in and around the BHCSD (the 100 series monuments). Five monuments were established by Psomas in 2010 as benchmarks outside the BHCSD (the 200 series monuments). The twelve monuments installed in 2014 (the 300 series monuments) were driven to refusal to serve as twin monuments to those that could be unduly influenced by surface features such as hill slopes, tree roots, or other factors unrelated to actual ground movement.

The movement of these twinned monuments is relatively consistent with the original monument movement except for 2018, when there was essentially no correlation (see **Figure 3.1**). The 2022 data shows very good agreement with an R2 correlation factor of 0.925. It is recommended that in future years, only the 300 series monuments be incorporated into the analysis, as those monuments are considered to provide more accurate data on ground movement than the 12 original monuments they replaced.

No monument changes have occurred during the 12 month interval of this study; the 57 monuments used this year are intact from last year. (If the destroyed monuments are counted, there are 60 monuments, all of which are shown in **Figure 1.1**.)

4. InSAR

InSAR satellite data has been reviewed annually since 2010 as a complement to the annual survey data, although the BHCSD AGMS guidelines do not require it. The InSAR data is provided in 30 foot grid nodes throughout the area. These grid nodes are then grouped in 200 foot circles around each surveyed monument to compare InSAR data to survey data. As shown in **Figure 4.1**, the data correlates well; the R^2 correlation coefficient is 0.7875. The size of the bubbles in the figure is proportional to the number of grid points in the 200 foot circle. The number of grid nodes around each monument ranges from 0-140, with the average being 112 grid nodes per monument. It is recommended that in future years, only the InSAR data be used to monitor ground movement, as it provides data for the entire BHCSD area rather than only at 57 discrete locations which survey data can provide. Also, InSAR data has an accuracy similar, in fact, slightly better this year, than that of GPS.

InSAR is also available to provide a regional view of ground movement in the Los Angeles Basin as shown in **Figure 4.2**. One section of the BHCSD area has a noticeable decrease in elevation this year but this same section had a noticeable increase in elevation last year. Oilfield operations have remained consistent, and subsurface pressures have increased in response to the positive net injection ratio of 103.9%, indicating other factors dominate ground movement in the study area.

For a 12-month period, the accuracy of the InSAR vertical displacement measurement is about +/- 0.24 inches. Details on the data acquisition, processing, and interpretation are given in CGG's 2022 report filed separately.

5. Oilfield Causes of Ground Movement

From the 1924 field discovery until the waterflood began in the 1950's, the Inglewood V/R interval was dominated by solution-gas drive (primary recovery), causing high reservoir pressure depletion and causally related ground subsidence. Once the waterflood began, ground movement due to oilfield causes declined accordingly. Relative to the five to ten feet of subsidence **recorded in the early years** of field development (and clearly attributed to oilfield operations), the cumulative ground movements observed in the 2010-2022 AGMS have been small, highly variable, and with a few exceptions, do not correlate well with field operational parameters. The relationship between the two has been examined at three different levels: local, regional, and fieldwide.

The production history from the V/R interval is shown in **Figure 5.1**, with the yearly production and waterflood injection volumes over the life of the field. The "net injection volume" is defined as the yearly waterflood *injection volume minus the liquid production volume* and has been positive for most of the last 25 years. The volume contribution of natural gas to this calculation is not considered to be significant. **Figure 5.2** provides a different perspective on the net injection volume by showing the *cumulative net fluid withdrawal* and the yearly *ratio of injection to production volume* over the life of the field for the V/R. The yearly injection volume first reached a balance with the yearly liquid production volume in 1972. Except for the value of 99.5% in 2010, the net injection ratio has been greater than 100% since 1995. It has been demonstrated in previous AGMS reports that this increase in net injection since the 1950's has reversed annual and cumulative subsidence caused by underbalanced production prior to that period. Since balance was permanently achieved in 1995, ground movement has been much smaller than in the early years of field development, and annual displacement has generally stabilized such that measurements tend to lie in a range comparable to the level of accuracy of the tools used to record them.

The 2017 engineering report (Minner Engineering, Inc., 2017) states that the original reservoir pressure gradient in the V/R was normal at 0.44 psi/foot subsea. When the large-scale installation of the waterflood was started in 1957, it was estimated that the pore pressure had dropped from the original 880 psi to 40-160 psi, a pressure gradient of 0.02-0.08 psi/foot (*Oefelein, 1963*) using a datum of 2000 feet below sea level (subsea). The fieldwide waterflood began in the Inglewood V/R interval to rebuild and stabilize reservoir pressure. The current average reservoir pressure is estimated to be 1040 psi at 2000 feet subsea, with a gradient of 0.49 psi/foot, higher than the original reservoir pressure conditions, validating that the reservoir pressure has been re-established through water injection as shown in **Figure 5.3**. Static fluid levels and casing pressures taken in 2022 in the V/R were used to generate this isobaric map.

6. Ground Movement and Comparison to Previous Years

<u>Survey Vertical Movement Results</u>

The AGMS surveys were taken between July 2022 and September 2022, using both leveling and GPS conventional surveying techniques. This year's ground survey was conducted by Psomas, the same surveyor that conducted the survey from 2010-2017, the 2020 and 2021 surveys. Survey accuracy depends on a number of factors; Psomas reports elevations within a 95% confidence interval, which is about +/- 0.29 inches. For reference, this compares to the +/- 0.24 inches reported above by CGG for InSAR. Additional technical detail can be found in the Psomas Survey Report.

Vertical ground movement results for 2022 are tabulated in **Table 6.1**. These results are shown as a gridded surface in **Figure 6.2a.** The change in elevation scale ranges from +1.0 inches (blue) to -1.0 inches (red), and the color scheme is designed to show abrupt color changes at +/- 0.6 inches (the BHCSD action trigger for follow-up of property damage claims). Note that this data is based only on the 57 monuments shown in the Figure. Three of the monuments exceeded the 0.6 inch vertical movement in the negative direction (subsidence). None of the monuments exceeded the BHCSD 0.6 inch vertical movement threshold in the positive direction (uplift).

Figure 6.2b shows the same area using InSAR recorded ground movement. The correlation between the two figures is apparent. The InSAR data is based on information taken every 30 feet, with the exception of the white areas where data is not available due to vegetation (which does not reflect for satellite data). Five of the InSAR measurements at monument locations exceeded the 0.6 inch vertical movement in the negative direction (subsidence). None of the InSAR measurements exceeded the BHCSD 0.6 inch vertical movement threshold in the positive direction (uplift).

Figure 4.2 provides regional perspective on the movement in the Baldwin Hills area relative to the Los Angeles Basin, based on InSAR elevation changes. The same color scale is used, and oilfields are outlined in light green. The Newport Inglewood Fault trace is shown as blue dashed line in the figure; other prominent features are also labeled in the Figure.

Survey Horizontal Movement Results
Horizontal ground movement is also measured in the monument surveys. A full listing of the horizontal data for 2021-2022 is given in **Table 6.2.** The maximum annualized horizontal displacement was 1.256 inches for Monument 114. The average horizontal movement for all 57 monuments was 0.421 inches. The east-west displacement vectors recorded by InSAR are consistent with the established right-lateral slip along the Newport-Inglewood Fault zone.

As discussed in Section 7 below, the movement observed in the monument data does not appear to have any clearly defined correlation to oilfield operations.

7. Ground Movement and Oilfield Operations

The historical impact of oilfield operations on ground movement prior to the 1980's, before full volume balance was achieved, is well documented and is not the focus of this analysis. Overall vertical displacement after this point has been mostly stable (less than 0.6 inches per year). Much work has been done on causation in previous years: the focus here is on new observations and conclusions for the 2021-2022 production year. The study has historically included fieldwide, local, and regional perspectives. Each of these perspectives is discussed below to further investigate the potential relationship between oilfield operations and ground movement in the BHCSD.

Fieldwide Volume Balance
Table 7.1 shows that the fieldwide net injection ratio, as defined by the ratio of total fluids injected to fluids produced (in reservoir barrels), was 101.8% for the production year ending June 30, 2022. The cumulative fieldwide net injection ratio for the BHCSD program which began in 2010 is 102.4%. With the exception of 2010, the yearly field-wide net injection ratio has been greater than 100% since 1995 (27 years), as can be seen **in Figures 5.1** and **5.2**.

A cross-plot of fieldwide yearly net injection volume and average yearly infield monument movement over the period from 2010-2022 shows no correlation, as seen in **Figure 7.1**. An infield monument is defined as a monument that has had an active producer or injector within a 1000-foot radius in 2021.

The IOF remains in positive volume balance. Therefore, based on historical observations, significant displacement at a fieldwide level above the threshold, due directly to volume imbalance, is considered to be very unlikely.

Local Monument Balance

Table 7.2 shows the 'local' net injection volume for the cumulative time period 2021-2022 for *each* monument, which is defined as the total V/R waterflood injection volume *minus* the total V/R liquid production for wells with a bottom hole location within a 1000-foot radius of the monument. The list of monuments is ranked by the magnitude of survey vertical elevation change.

The table also shows the total number of V/R wells (waterflood injection or production) within the 1000 foot radius in the data set. There are 31 monuments with non-zero net injection volumes; the remainder were over 1000 feet from any active well.

Figure 7.2 presents a cross-plot of the annualized elevation change of the infield monuments versus their associated net injection volume for the corresponding time period. The data shows that there was essentially no correlation between these two measurements.

These figures suggest that ground movement cannot be explained solely by net injection, since other factors (either real or noise-related) must be present to explain the large amount of scatter observed. At the scale of ground movement observed at IOF, the local annual net injection volume is a poor predictor of local annual vertical displacement.

The relationship between surface displacement and net injection within 1000 feet of monuments observed this year is very similar to that seen in previous years since the beginning of the BHCSD program: there has been no discernable correlation between the two variables.

Regional Volume Balance

Finally, there are four different regions of the BHCSD, as shown in **Figure 7.3**, which are defined by internally consistent movement characteristics as recorded by InSAR over the 2021-2022 period. These regions exist at an intermediate or regional level, in between the fieldwide and local levels discussed above. Each region was analyzed, and their associated production and injection figures are shown in **Table 7.3.**

Only the north area had a negative net injection (94%), and this region had the lowest elevation change, just -0.011 inches. The remaining three areas all had positive net injection, ranging from 103.6% to 115.6% as shown in **Table 7.3**. In spite of this, all three regions had a decrease in ground elevation ranging from -0.049" to -0.826". **Figure 7.4** shows the poor correlation between regional ground movement and regional net injection in 2022. *Clearly, ground movement at the regional level is not simply a function of volume balance.*

We conclude that even at the regional level, other factors apart from field operations must be important contributors to ground movement based on the inconsistent correlation observed between average ground movement and net injection for each region.

Summary of Ground Movement and Oilfield Operations Analysis

Evaluation of surface survey results relative to the V/R net injection volume balance and reservoir pressure does not indicate a quantitative relationship exists between ground movement and oilfield operations at the fieldwide, local, or regional level. At the scale of ground movement observed in recent years, any relationship between field operations and subsidence, if it does exist, appears to be masked by other factors. Our conclusions are summarized below:

1. There is low confidence in using the monument displacement trends to provide clear guidance for fieldwide, local, or regional replacement ratio targets.
2. There are significant mechanisms not directly related to volume balance affecting ground movement at the scales analyzed.
3. There is no relationship discernable with survey measurements between the yearly fieldwide *net injection ratio* and the *number of monuments* that cross the 0.6 inches elevation change threshold and/or their *movement direction*.
4. Twin monuments provide good readings consistent with original monuments.
5. InSAR measurements provide good readings consistent with GPS measurements.

8. Summary and Recommendations

The amount of movement observed in the BHCSD is relatively small and not unique. It is recognized that significant ground movement occurred due to oilfield operations prior to the start of the waterflood in the 1950, but since the maintenance of net injection near or above 100% was established in 1995, the ground movement on average has been relatively stable (<0.6 inches/year) on a fieldwide basis.

There does not appear to be a consistent relationship between the yearly waterflood injection ratio and vertical displacement observed in monument leveling surveys. No statistically significant trends were identified in the annualized 2022 monument elevation changes plotted against the fieldwide, local (1000 foot radius), or regional net waterflood injection volumes. The lack of a simple connection between the net injection volume and surface monument movement is likely *due to more than one mechanism impacting the surface survey results* at the current scale of ground movement under volume balanced conditions. Other possible contributors to ground movement are discussed in the Laguna Geosciences report. Additionally, the amount of displacement at near volume balance conditions may be at the limit of tool resolution, and both random and systematic noise are probably also impacting the measurements.

It is recommended that SPR continue its practice of 100% net injection ratio and monitoring of the BHCSD as outlined in the EIR. It is also recommended that the twin monuments be incorporated in this report rather than the original monuments, and that only the twin monuments are used in the local movement analysis. Twin monuments are considered a more accurate data point due to the surface conditions of the original monuments identified as unstable. Finally, it is recommended that InSAR be considered for this annual survey instead of GPS data as it affords a similar level of accuracy but includes many more data points than the 57 monuments used for the GPS data. The 11 years of data gathered during the period of the AGMS (since 2010) has proven the good correlation between the twin monuments and the original monuments, as well as the good correlation between the InSAR data and the GPS data.

References

References used are the same as those listed in the 2018 report, updated as appropriate.

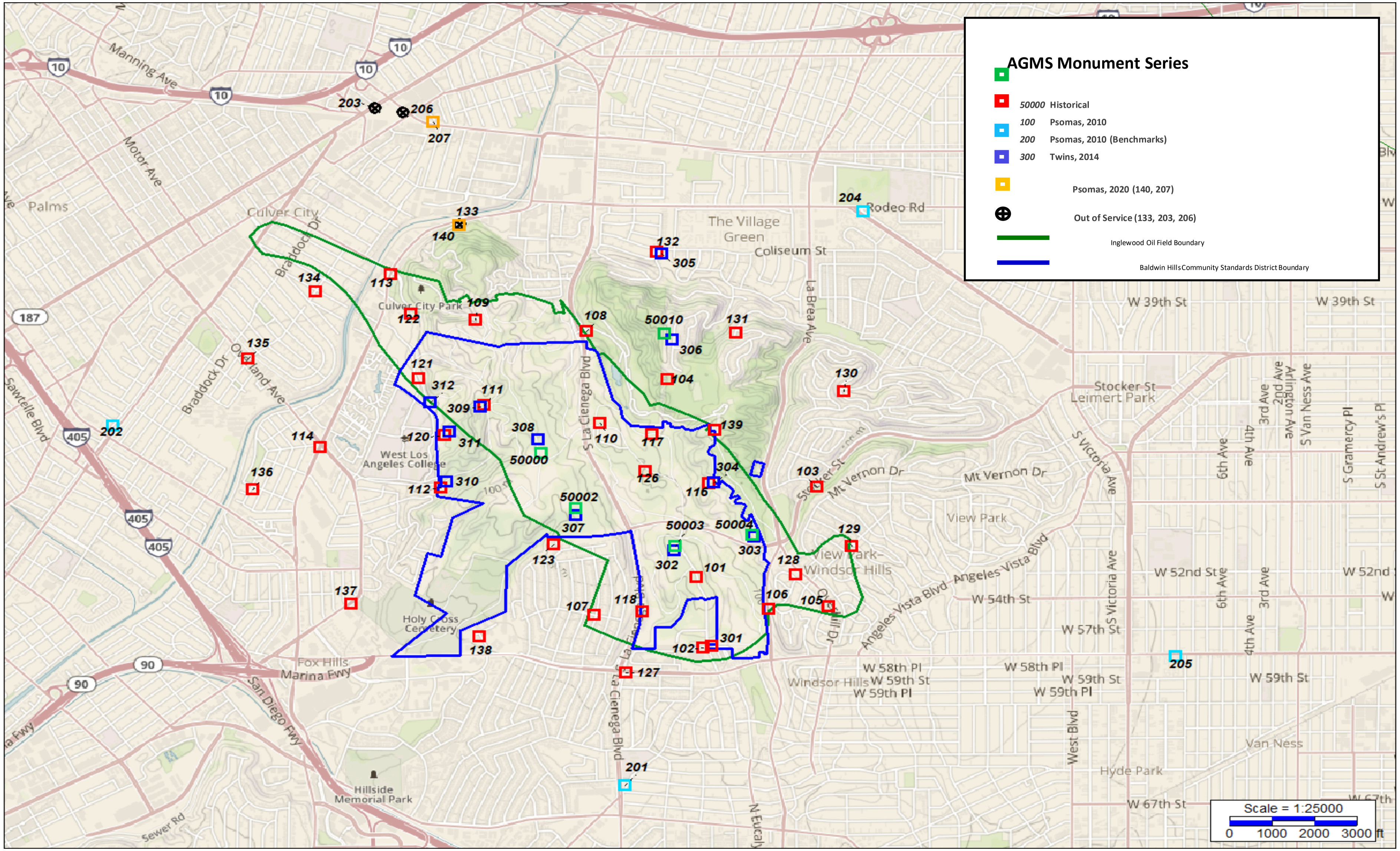


Figure 1.1. AGMS monument network.

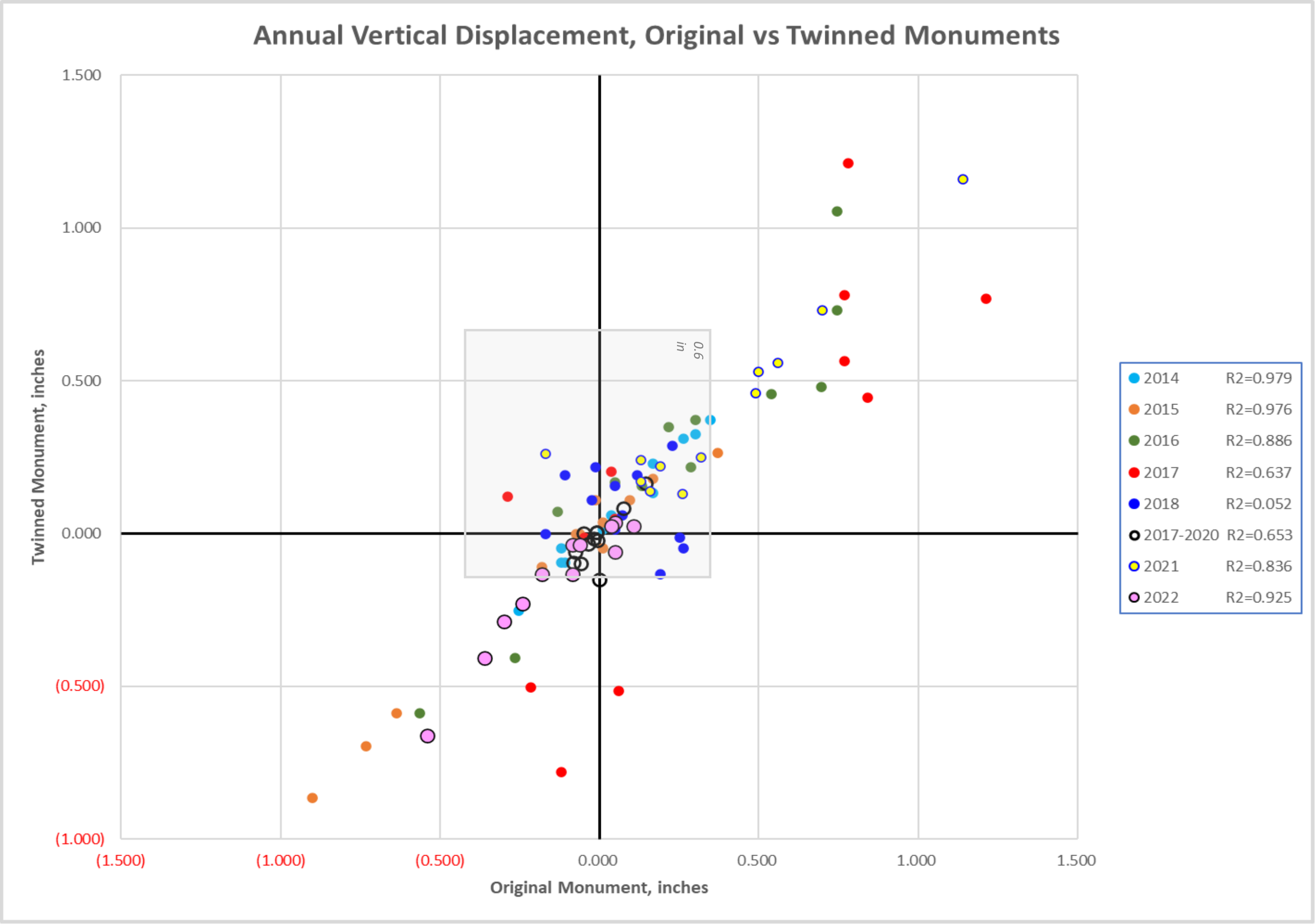


Figure 3.1. Annual vertical displacement for original monuments versus twinned monuments, 2014 through 2022. The 2018 data exhibits an anomalously high degree of scatter most likely due to a change in survey methodology. Data for the period 2017-2020 was annualized to compare with other years. The correlation is generally good, except for the 2018 surveys, where the R^2 correlation factor dipped below 0.60. Correlation for 2022 was very good, with an R^2 of 0.925

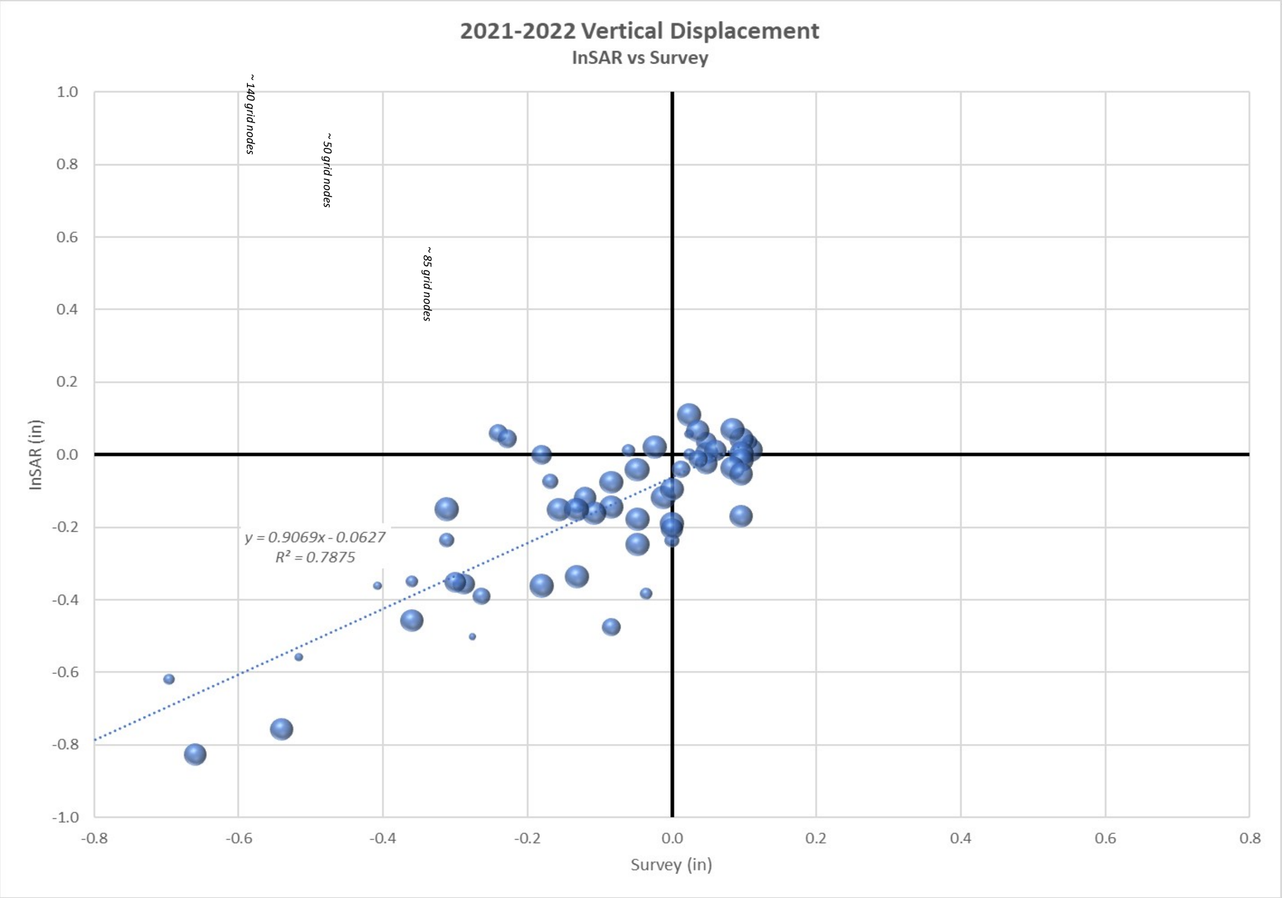
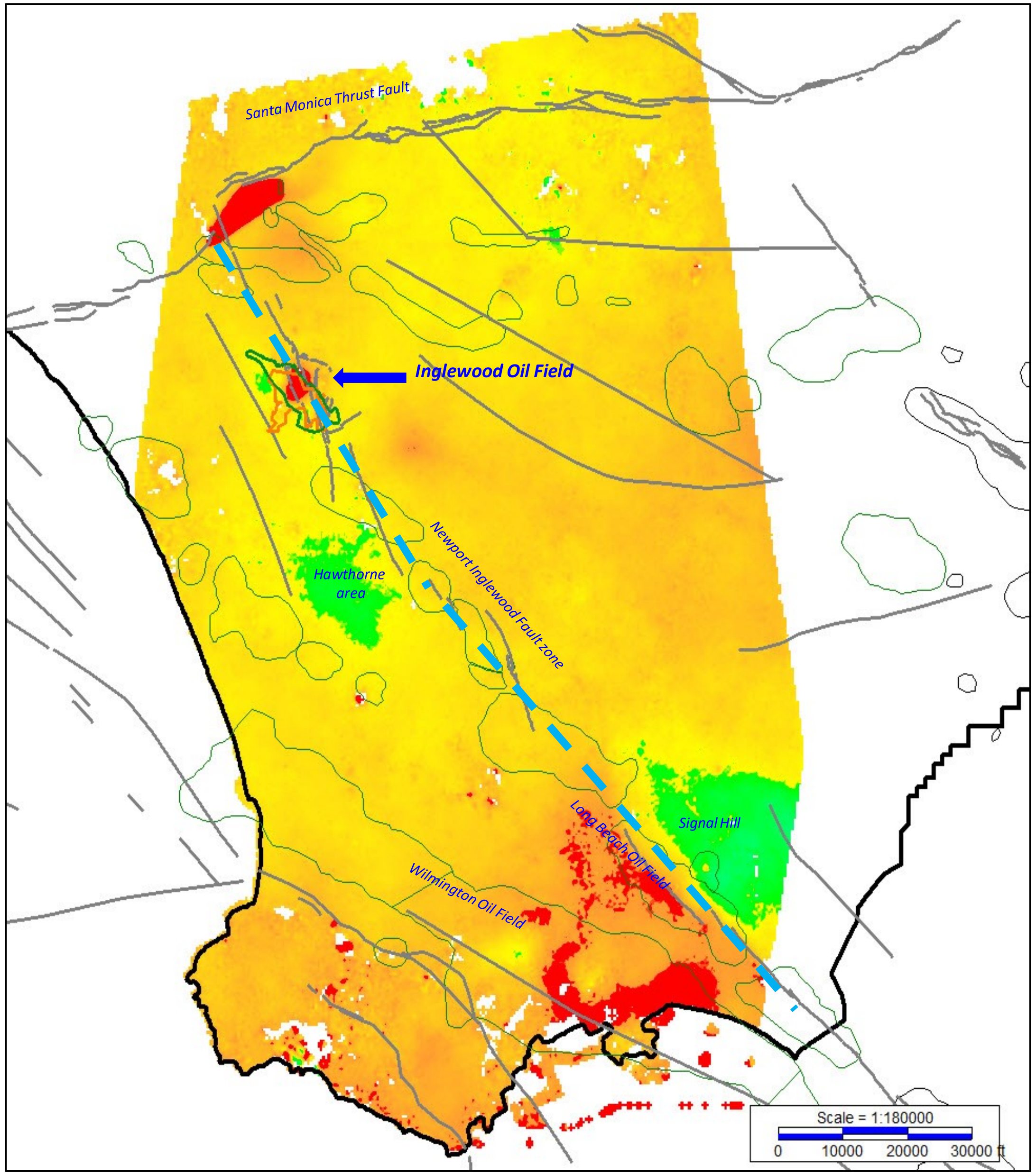


Figure 4.1. InSAR vs survey ground movement comparisons for the period July 2021 through June 2022. Note that, as expected, the slope is very close to 1 and the y-intercept close to 0. The InSAR value is the average of all grid nodes (30 ft spacing) within 200 feet of each monument. The diameter of the datapoint is proportional to the number of grid nodes within the 200 ft radius of each monument. The number of grid nodes around each monument ranges from 0-140, with the average being 112 for the 57 monuments.



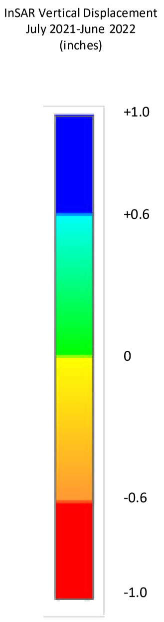


Figure 4.2. Gridded InSAR survey vertical displacement for July 2021-June 2022, LA Basin. Oil fields are indicated by green outlines, and faults are shown as thick gray lines. Almost all of the LA Basin experienced subsidence (warm colors) during this period, and subsidence locally exceeded 0.6" in the Inglewood, Wilmington, and Long Beach Oil Fields, as well as in the footwall of the Santa Monica Thrust Fault.

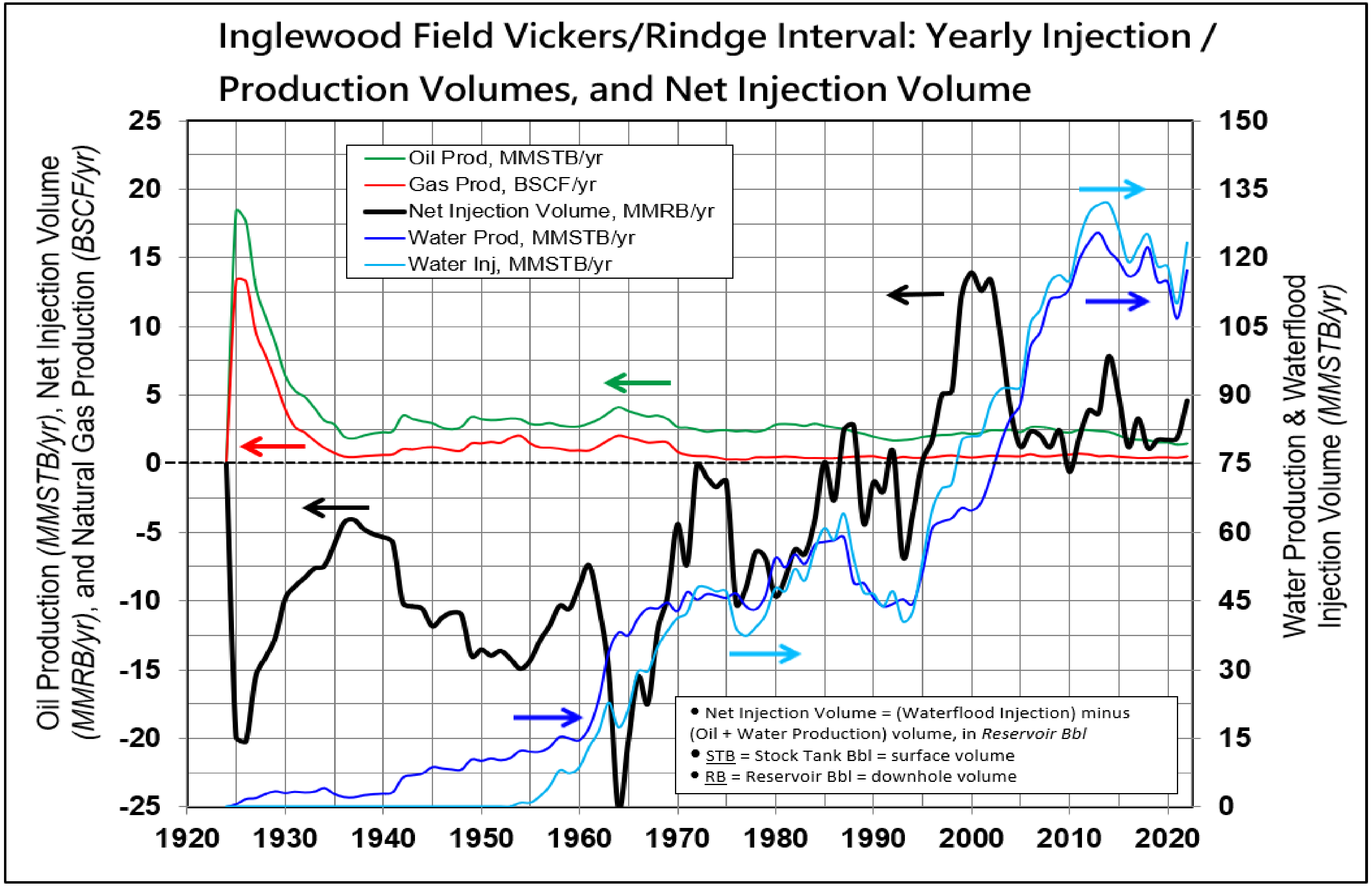


Figure 5.1. The Inglewood Vickers/Rindge cumulative net fluid withdrawal volume (total liquid production minus waterflood injection) and yearly ratio of waterflood injection to liquid production are shown over the life of the field, through June 2022. The net withdrawal stabilized in the early 1980's at about 600 MMBLS, and started on a downward trend in the mid-1990's. [Castle, 1976 (1924-1963); SPR, 2022 (1964 on)]. Arrows indicate which axis the color-coded curves apply to.

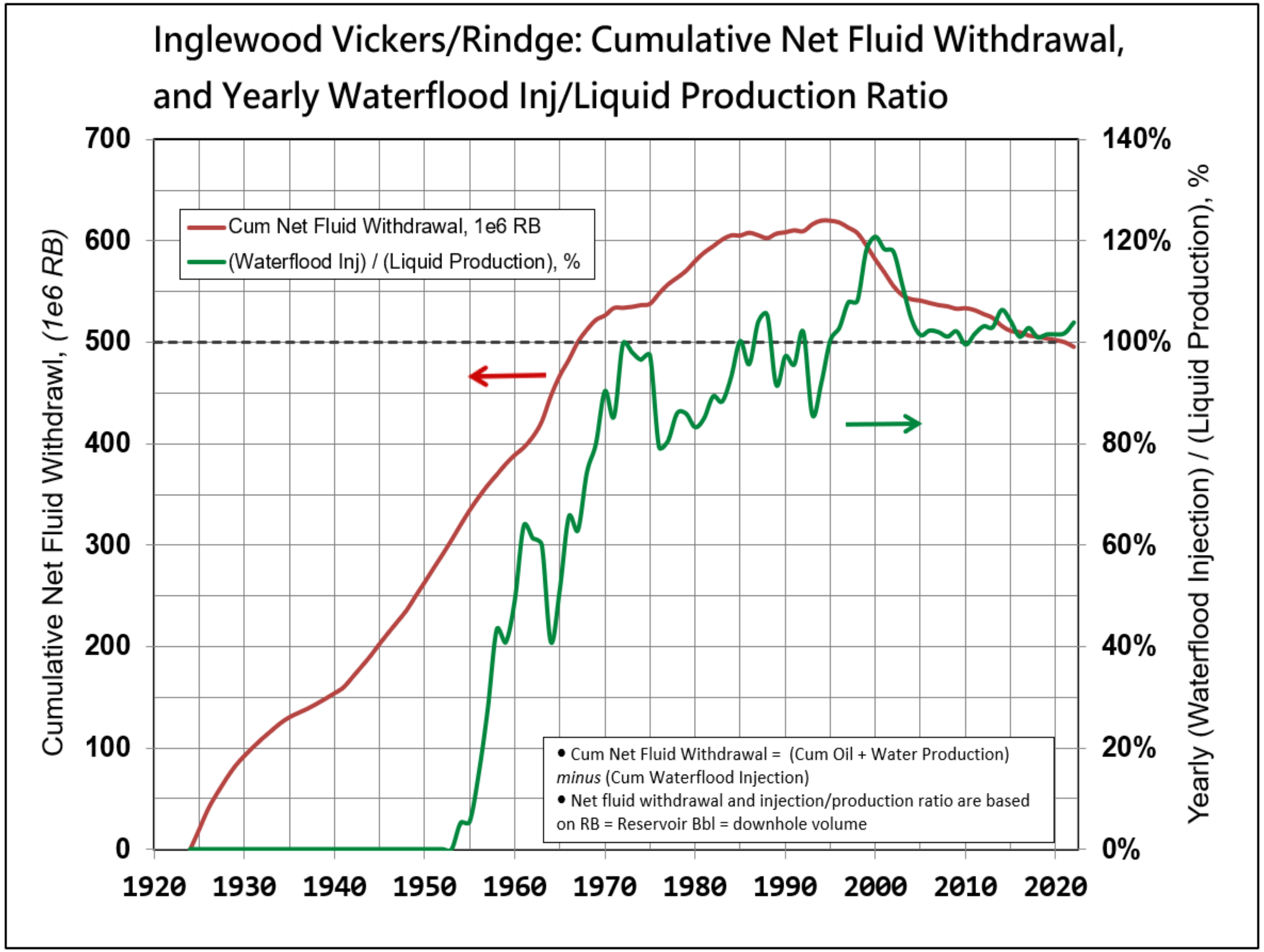
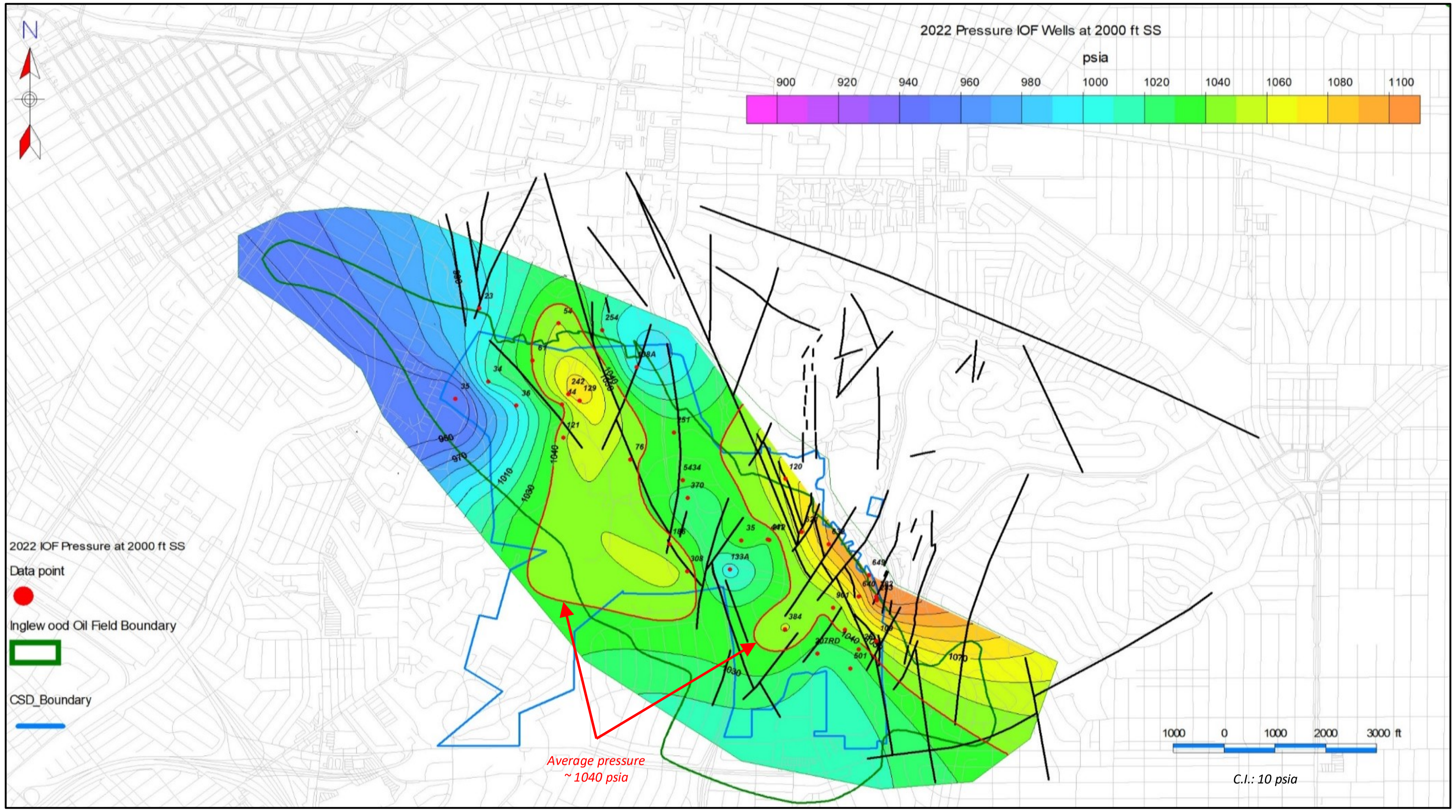


Figure 5.2. The Inglewood Vickers/Rindge cumulative net fluid withdrawal volume (total liquid production minus waterflood injection) and yearly ratio of waterflood injection to liquid production are shown over the life of the field, through June 2022. The net withdrawal stabilized in the early 1980's at about 600 MMBLS, and started on a downward trend in the mid-1990's. [Castle, 1976 (1924-1963); SPR, 2022 (1964 on)]. Arrows indicate which axis the color-coded curves apply to.



Idle Well Location, Symbol Plotted at 2000 ft TVDSS

Vickers-Rindge Formation Pressure
Corrected to 2000 ft TVDSS Datum

Figure 5.3. Pressure data normalized to 2000 feet True Vertical Depth Subsea (TVDSS). Fluid levels taken from idle wells only, shown in red with well symbol plotted at 2000 feet SS (or total depth if well TD is above 2000 feet TVDSS). Average pressure is ~ 1040 psia.

2022 Inglewood BHCSD Monitoring Program Survey Results

- *Data sources: Psomas Survey 2021, 2022*
- *For period 7/1/2021 through 6/30/2022 inclusive*

Sorted By…

Site Count	Monument Number	InSAR 2022-2021 Elevation Change, in.	Ground Survey 2022-2022Elevation Change, in.
1	110	-1.553	-1.620
2	117	-0.619	-0.696
3	308	-0.828	-0.660
4	50000	-0.758	-0.540
5	108	-0.558	-0.516
6	304	-0.362	-0.408
7	126	-0.349	-0.360
8	116	-0.457	-0.360
9	205	-0.151	-0.312
10	50004	-0.352	-0.300
11	303	-0.357	-0.288
12	104	-0.502	-0.276
13	139	-0.390	-0.264
14	111	0.059	-0.240
15	309	0.044	-0.228
16	50010	-0.001	-0.180
17	101	-0.362	-0.180
18	140	-0.074	-0.168
19	109	-0.236	-0.168
20	128	-0.152	-0.156
21	306	-0.141	-0.132
22	305	-0.151	-0.132
23	103	-0.336	-0.132
24	204	-0.120	-0.120
25	207	-0.162	-0.108
26	129	-0.076	-0.084
27	50002	-0.476	-0.084
28	120	-	-0.060
29	312	0.011	-0.060
30	132	-0.041	-0.048
31	131	-0.178	-0.048
32	105	-0.247	-0.048
33	106	-0.144	-0.048
34	311	-0.384	-0.036
35	307	0.039	-0.036
36	201	0.021	-0.024
37	130	-0.118	-0.012
38	202	-0.096	0.000
39	113	-0.040	0.012
40	122	0.000	0.024
41	310	0.109	0.024
42	302	0.056	0.024
43	301	-0.013	0.036
44	50003	0.066	0.036
45	137	0.003	0.048
46	121	0.036	0.048
47	102	-0.026	0.048
48	127	0.012	0.060
49	136	0.068	0.084
50	118	-0.037	0.084
51	114	0.042	0.096
52	135	-0.169	0.096
53	134	0.003	0.096
54	138	-0.015	0.096
55	123	-0.053	0.096
56	112	0.012	0.108
57	107	0.036	0.108

- *0.6" threshold (negative) subsidence*
- *InSAR and / or GS*

Table 6.1. BHCSD 2022 survey results for all monuments, sorted by elevation change. Three (110, 117, 308) of the monuments recorded vertical displacements exceeding the BHCSD threshold of 0.6 inches/year, all in the negative (subsidence) direction.

NOTES

- Monument 120 does not have any InSAR data within a 200' radius.
- InSAR data for five monuments (108, 110, 117, 308, 5000) measurements exceeded the threshold of 0.6" (negative) subsidence.

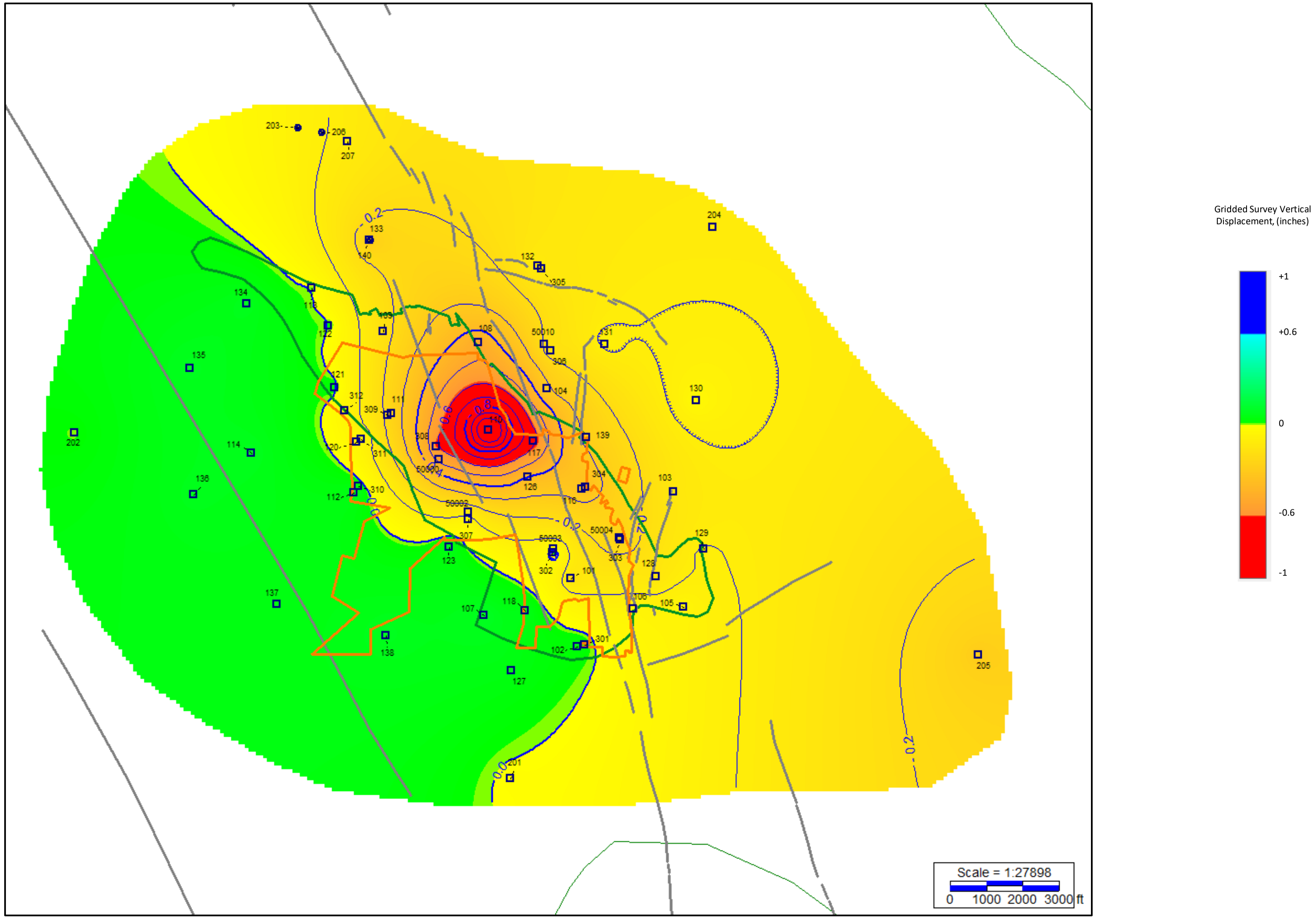


Figure 6.2a. Gridded survey vertical displacement for July 2021 - June 2022. Subsidence in excess of the BHCSD threshold of 0.6” was recorded in 3 (110, 117 & 308) of 57 monuments having recorded data. Uplift in excess of the 0.6” threshold was not recorded in any of the monuments.

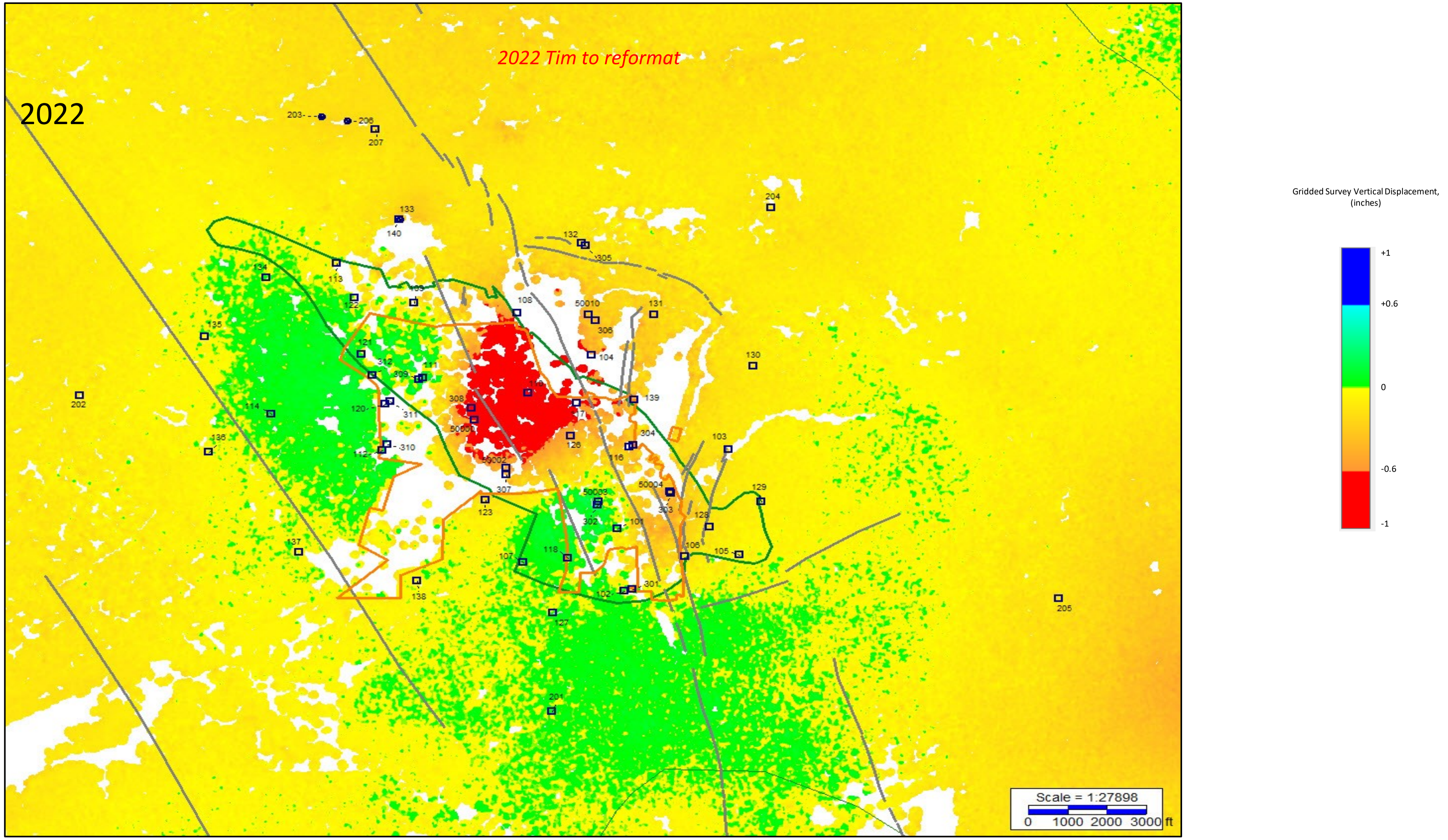


Figure 6.2b. InSAR vertical displacement for July 2021-June 2022. The grid cell size in this image is 30 feet, but no signal was recorded in the white areas. Subsidence in excess of the BHCSD threshold of 0.6" was recorded in five of the central part of the IOF area, but no uplift in excess of the threshold was observed. Vertical displacement from July 2021 to June 2022 shows mostly subsidence within the Community Standards District (CSD), reaching an InSAR maximum of approximately -1.8 inches. *Source report: SPR, Baldwin Hills & LA Basin, InSAR Monitoring Analysis 2010-2022*

2022-2021 Inglewood BHCSD Monitoring

- *Data sources: Psomas Survey 2021 and 2022*
- *For period July 2021 through June 2022*

Sorted By...

Site Count	Monument Number	2021-2022 Delta X, in.	Delta Y, in.	Horizontal Vector, in
1	114	-1.128	0.552	1.256
2	120	0.072	0.912	0.915
3	110	-0.468	0.732	0.869
4	117	-0.804	0.324	0.867
5	139	-0.456	0.720	0.852
6	306	-0.720	0.444	0.846
7	104	-0.792	0.192	0.815
8	109	0.708	0.396	0.811
9	50002	-0.276	0.696	0.749
10	50004	-0.708	0.132	0.720
11	116	-0.300	0.564	0.639
12	310	0.288	0.552	0.623
13	130	-0.264	0.552	0.612
14	50000	0.396	0.456	0.604
15	307	-0.168	0.540	0.566
16	50010	-0.312	0.468	0.562
17	111	0.372	0.408	0.552
18	128	-0.204	0.492	0.533
19	308	0.420	0.288	0.509
20	204	-0.168	0.468	0.497
21	309	0.360	0.324	0.484
22	103	-0.456	0.156	0.482
23	129	-0.060	0.444	0.448
24	312	0.372	0.228	0.436
25	304	-0.036	0.408	0.410
26	50003	0.072	0.372	0.379
27	302	0.144	0.348	0.377
28	101	0.204	0.312	0.373
29	126	-0.192	0.312	0.366
30	207	-0.300	0.180	0.350
31	303	0.072	-0.336	0.344
32	301	0.156	0.300	0.338
33	106	-0.024	0.336	0.337
34	122	0.084	0.324	0.335
35	132	-0.228	0.240	0.331
36	305	0.048	0.324	0.328
37	311	0.036	0.312	0.314
38	205	-0.228	0.216	0.314
39	121	0.180	0.192	0.263
40	131	-0.216	0.144	0.260
41	112	-0.120	0.216	0.247
42	123	-0.036	0.240	0.243
43	136	-0.060	-0.216	0.224
44	113	-0.048	0.216	0.221
45	108	-0.204	0.024	0.205
46	138	-0.096	0.180	0.204
47	137	-0.072	0.180	0.194
48	105	0.000	0.144	0.144
49	134	-0.096	0.060	0.113
50	135	-0.084	0.072	0.111
51	118	0.048	-0.084	0.097
52	140	0.036	0.084	0.091
53	202	-0.060	0.036	0.070
54	102	-0.036	0.036	0.051
55	127	0.012	0.048	0.049
56	107	-0.048	0.000	0.048
57	201	0.000	0.000	0.000

Table 6.2. BHCSD 2022 survey results listing horizontal displacement for all monuments, sorted by resultant vector length.

NOTES

- Monument 201 was the reference point for the 2022 survey.

Inglewood Waterflood Volume Balance

Field Wide Yearly Totals: Vickers/Rindge Reservoirs

Year	2021	2022	Cumulative 2010-2022
Oil Production, STB	1,406,010	1,476,023	24,474,340
Water Production, STB	106,745,498	117,236,535	1,473,870,809
Gas Production, Mscf	449,779	551,204	6,891,537
Waterflood Injection, STB	110,121,658	123,372,670	1,412,771,155
Total Liquid Production, RB	108,218,996	118,783,407	1,499,519,917
Waterflood Injection, RB	110,121,658	123,372,670	1,536,143,825
Net Waterflood Injection*, RB	1,902,662	4,589,263	36,623,908
Water Inject/Liquids Production, %	101.8%	103.9%	102.4%

Table 7.1 Total field liquids production and injection, 2021 through June 2022 inclusive. The net injection ratio for this year was 103.9%. Cumulative net injection ratio during the AGMS study period (2010-2022) is 102.4%..

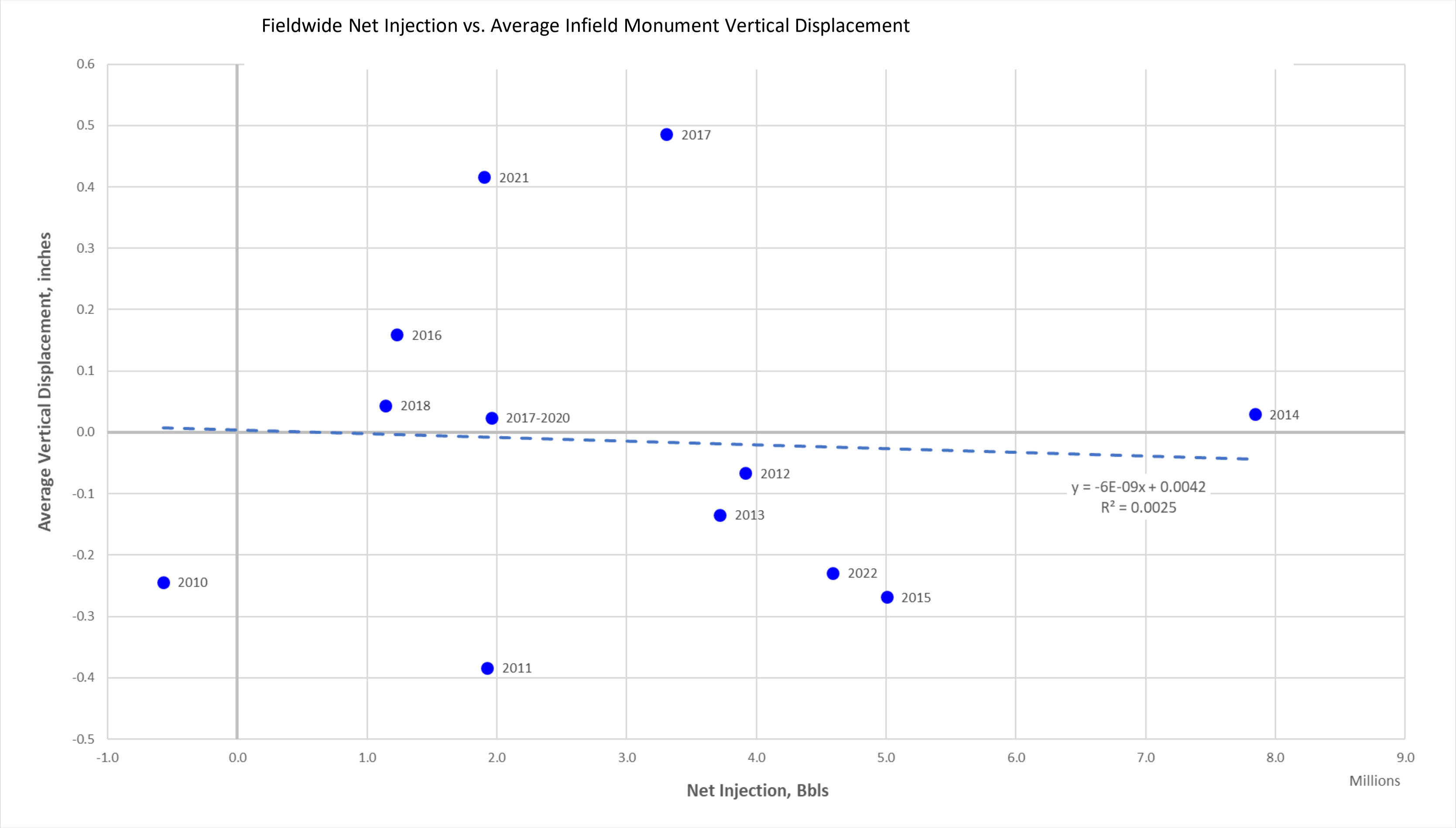


Figure 7.1. Infield monument average vertical displacement versus fieldwide net injection for the period 2010 through 2022. Net injection equals total injection less fluid production within 1000 feet of each monument. An infield monument is a monument located within 1000 feet of an active producer or injector. There is essentially no correlation.

2022 Inglewood BHCSD Monitoring Program Survey Results

- *Data sources: Psomas Survey 2021, 2022; SPR internal production database, 2022*
- *For period July 2021 through June 2022 inclusive*

Sorted By...

		July 2021 - June 2022		InSAR	Ground Survey
Site Count	Monument Number	V/R Wells within 1000 ft Radius (2020	V/R Net Injection Volume in 1000' Radius, 1000 RB	Elevation Change, in.	Elevation Change, in.
1	110	73	-241	-1.553	-1.620
2	117	38	1128	-0.619	-0.696
3	308	61	-3,264	-0.828	-0.660
4	50000	52	-1105	-0.758	-0.540
5	108	4	1778	-0.558	-0.516
6	304	32	546	-0.362	-0.408
8	116	36	-671	-0.349	-0.360
7	126	64	1901	-0.457	-0.360
9	205	0	0	-0.151	-0.312
10	50004	28	1191	-0.352	-0.300
11	303	29	698	-0.357	-0.288
12	104	0	0	-0.502	-0.276
13	139	5	695	-0.390	-0.264
14	111	42	1608	0.059	-0.240
15	309	36	4,590	0.044	-0.228
17	101	46	1093	-0.001	-0.180
16	50010	0	0	-0.362	-0.180
19	109	28	-4152	-0.074	-0.168
18	140	0	0	-0.236	-0.168
20	128	15	923	-0.152	-0.156
23	103	0	0	-0.141	-0.132
22	305	0	0	-0.151	-0.132
21	306	0	0	-0.336	-0.132
24	204	0	0	-0.120	-0.120
25	207	0	0	-0.162	-0.108
26	129	1	-17	-0.076	-0.084
27	50002	26	2384	-0.476	-0.084
28	120	2	1880	-	-0.060
29	312	5	1,649	0.011	-0.060
32	105	1	-88	-0.041	-0.048
33	106	29	156	-0.178	-0.048
31	131	0	0	-0.247	-0.048
30	132	0	0	-0.144	-0.048
35	307	18	3,388	-0.384	-0.036
34	311	4	3,421	0.039	-0.036
36	201	0	0	0.021	-0.024
37	130	0	0	-0.118	-0.012
38	202	0	0	-0.096	0.000
39	113	0	0	-0.040	0.012
40	122	12	-1959	0.000	0.024
42	302	48	1,639	0.109	0.024
41	310	0	0	0.056	0.024
43	301	2	936	-0.013	0.036
44	50003	54	2384	0.066	0.036
47	102	0	0	0.003	0.048
46	121	10	-440	0.036	0.048
45	137	0	0	-0.026	0.048
48	127	0	0	0.012	0.060
50	118	1	-206	0.068	0.084
49	136	0	0	-0.037	0.084
51	114	0	0	0.042	0.096
55	123	1	383	-0.169	0.096
53	134	0	0	0.003	0.096
52	135	0	0	-0.015	0.096
54	138	0	0	-0.053	0.096
57	107	0	0	0.012	0.108
56	112	0	0	0.036	0.108

Table 7.2. BHCSD 2021-2022 survey results for all monuments, sorted by cumulative elevation change. The results include the local net waterflood injection volume and total producer plus injector well count within a 1000' radius for each monument.

NOTES
- V/R = Vickers/Rindge reservoirs; RB = in situ reservoir barrel
- The number of "Wells within 1000' Radius" for each monument includes both producers and injectors.
- "Net Injection Volume in 1000' Radius" = (waterflood inj. Reservoir bbls) minus (liquids production, reservoir bbls)
- Monument 201 was the reference point for the 2022 survey. The North Park station was the reference point for InSAR.

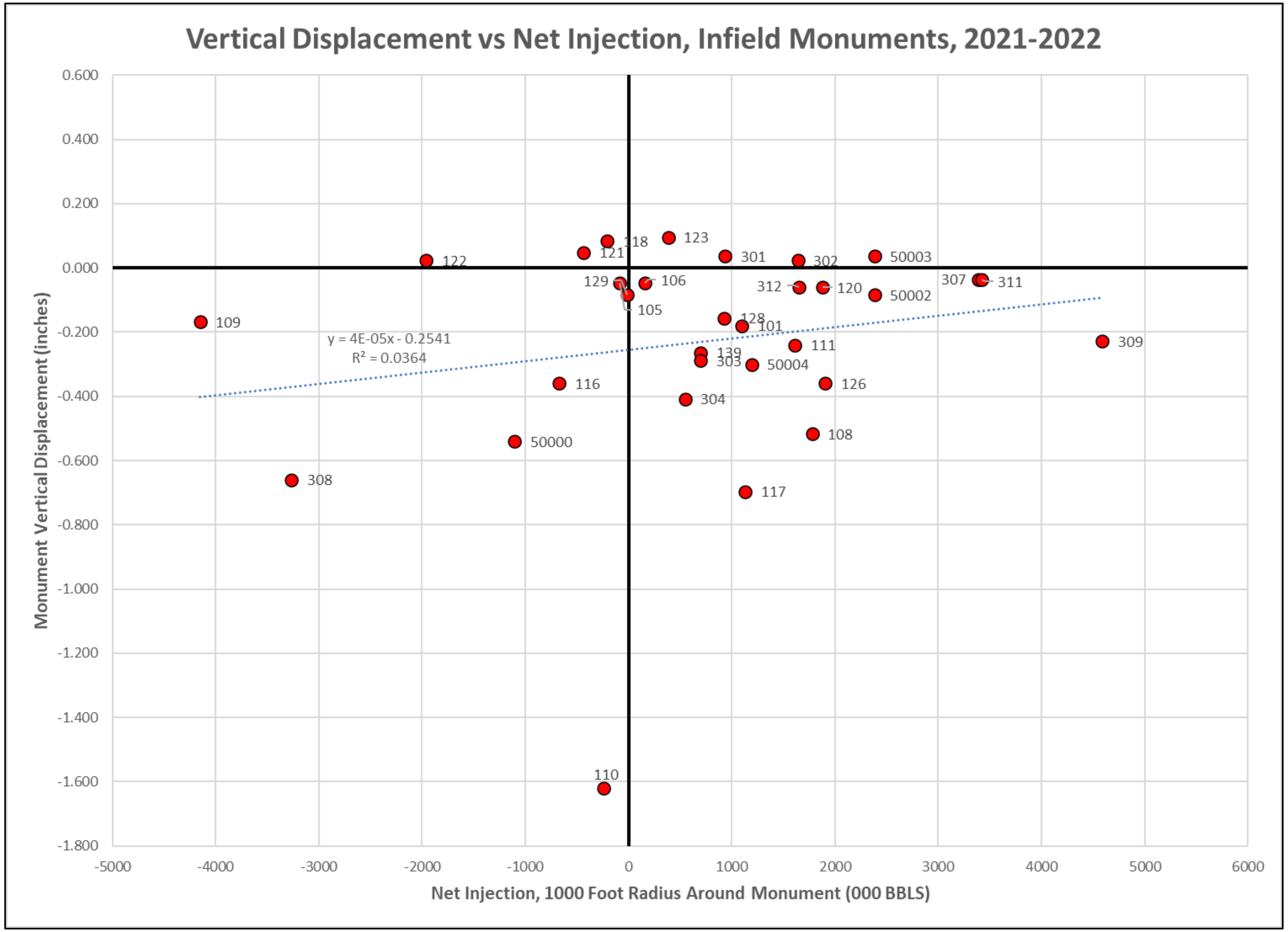


Figure 7.2. Vertical displacement vs net Injection for infield monuments for the period July 2021 through June 2022. Net injection equals total injection less fluid production within 1000 feet of each monument. There is essentially no correlation.

InSAR Vertical Displacement 2022

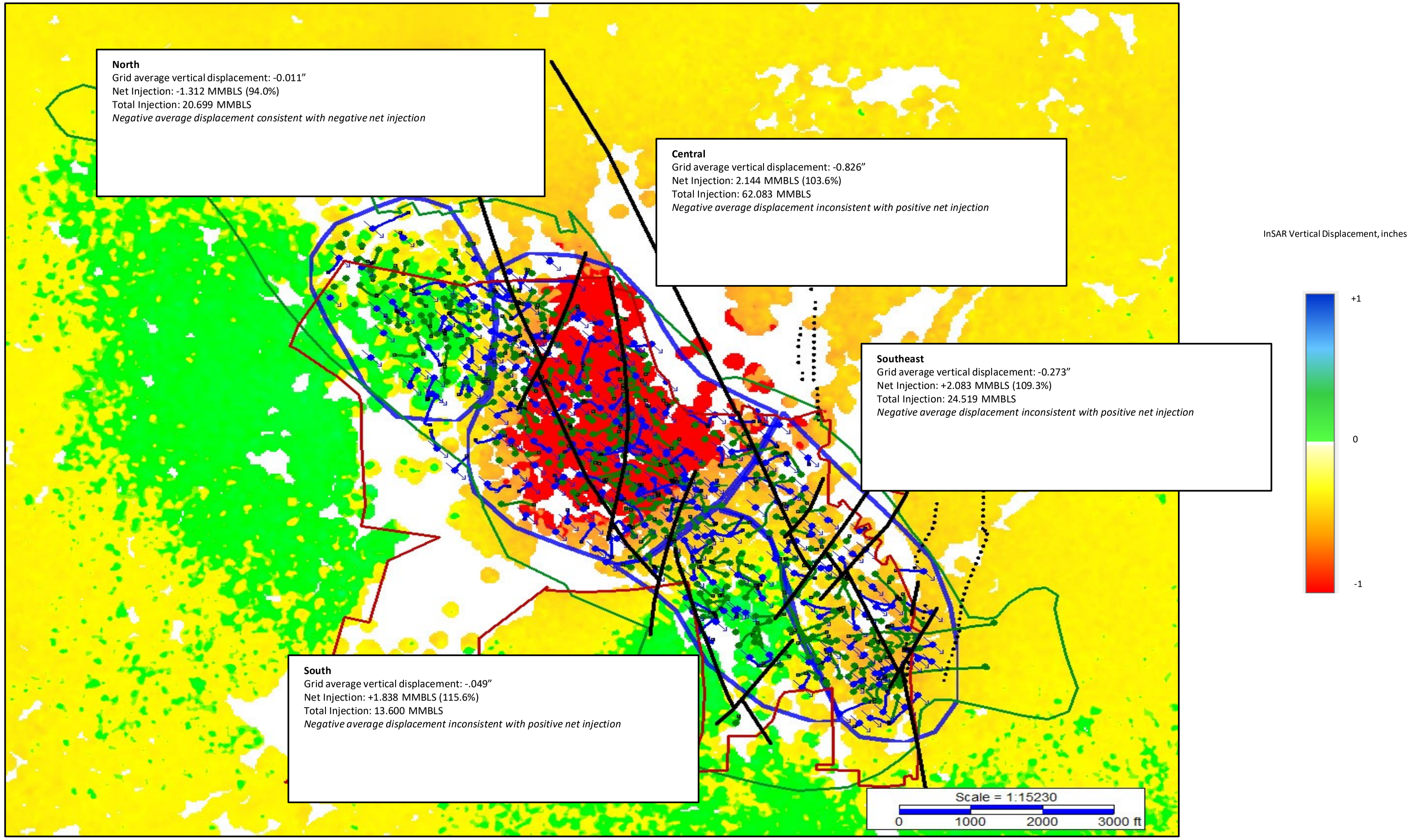


Figure 7.3. The four regions analyzed for volume balance are shown in blue. The polygons were selected to encompass areas of similar vertical ground movement behavior. All active Vickers-Rindge wells for the period July 2021 through June 2022 inclusive are plotted, with subtotal average vertical displacement, net injection, total injection, and net injection ratios for the period shown for each of the four regions.

Inglewood Waterflood Volume Balance by Region

Vickers/Rindge Reservoir: July 2021 through June 2022

Well Count	86	260	134	69
2021-2022	**North**	**Central**	**Southeast**	**South**
Oil Production, STB	257,418	683,178	352,405	142,764
Water Production, STB	21,741,425	59,222,256	22,066,618	11,613,051
Gas Production, Mscf	51,905	303,408	138,164	43,783
Waterflood Injection, STB	20,698,820	62,082,578	24,518,845	13,600,400
Total Liquid Production, RB	22,011,199	59,938,227	22,435,938	11,762,668
Waterflood Injection, RB	20,698,820	62,082,578	24,518,845	13,600,400
Net Waterflood Injection*, RB	-1,312,379	2,144,351	2,082,907	1,837,732
Water Inject/Liquids Production, %	94.0%	103.6%	109.3%	115.6%
Average Vertical Displacement, inches	-0.011	-0.826	-0.273	-0.049

**Net waterflood injection volume = [waterflood injection, resv Bbl] minus [oil + water production volume, resv Bbl]*

Table 7.3. Vickers-Rindge production and injection by field region, July 2021 through June 2022.

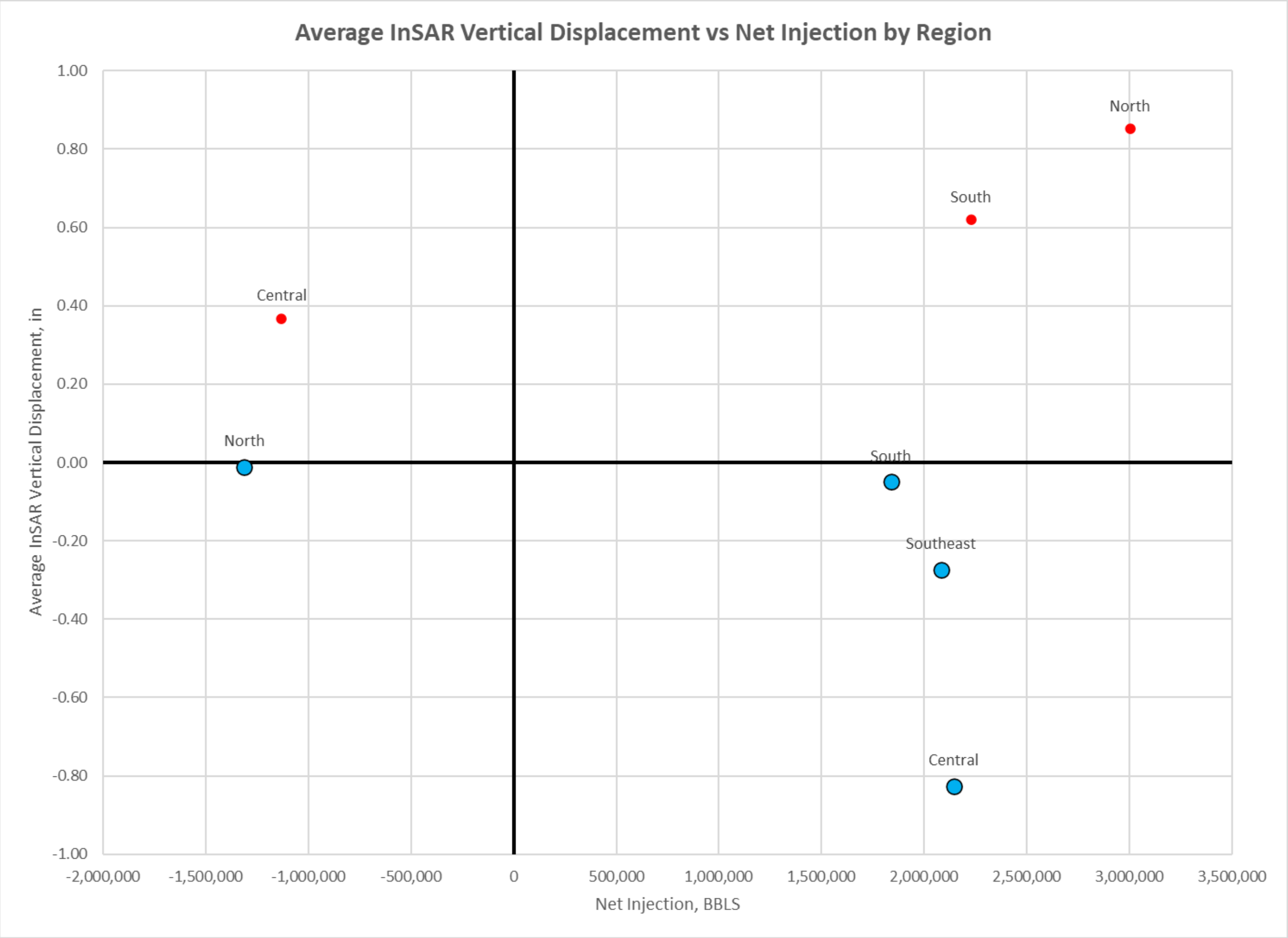


Figure 7.4. Average vertical displacement for the four regions (blue dots) versus their net injection for the 2022 year. Data points for the three 2021 regions are shown in red. Clearly the relationship is poor. Note that the regions used in 2022 were not the same as those used in 2021.