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CHINO BASIN WATERMASTER

SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SAN BERNARDINO

CHINO BASIN MUNICIPAL WATER DISTRICT,

Plaintiff,

v.

CITY OF CHINO, et al.,

Defendants.

Case No. RCVRS51010

[Assigned for All Purposes to the Honorable Carlos M. Cabrera]

DECLARATION OF BRADLEY J. HERREMA IN SUPPORT OF WATERMASTER'S MOTION FOR COURT TO RECEIVE AND FILE THE 2025/2026 ANNUAL REPORT OF THE GROUND-LEVEL MONITORING PROGRAM

Date: January 15, 2027
Time: 10:00 a.m.
Dept.: S24

[*Watermaster's Notice of Motion and Motion; and [Proposed] Order filed concurrently herewith*]

BROWNSTEIN HYATT FARBER SCHRECK, LLP
1020 State Street
Santa Barbara, CA 93101-2102

DECLARATION OF BRADLEY J. HERREMA

I, Bradley J. Herrema, declare as follows**:**

1. I am an attorney duly admitted to practice before all of the courts of this State, and am a shareholder in the law firm of Brownstein Hyatt Farber Schreck, LLP, counsel of record for Chino Basin Watermaster ("Watermaster"). I have personal knowledge of the facts stated in this declaration, except where stated on information and belief, and, if called as a witness, I could and would competently testify to them under oath. I make this declaration in support of the above-referenced request.

2. As legal counsel for Watermaster, I am familiar with Watermaster's practices and procedures, as well as actions taken by the Pool Committees, Advisory Committee, and Watermaster Board.

3. At their regularly scheduled meetings on November 12, 2026, the 2025/26 Annual Report for the Ground-Level Monitoring Program ("2025/26 GLMP Annual Report") was presented to the Overlying (Agricultural) Pool, Overlying (Non-Agricultural) Pool, and Appropriative Pool Committees for their review. Each of the Pool Committees unanimously recommended that the Advisory Committee recommend that the Watermaster Board approve the 2025/26 GLMP Annual Report and direct its filing with the Court.

4. At its meeting on November 19, 2026, the Advisory Committee unanimously recommended that the Watermaster Board approve the 2025/26 GLMP Annual Report and direct its filing with the Court.

5. At its meeting on November 19, 2026, the Watermaster Board unanimously approved the 2025/26 GLMP Annual Report, a true and correct copy of which is attached hereto as **Exhibit A**, and directed its filing with the Court.

6. I am unaware that any party has any objection to the Court's granting of Watermaster's Motion or any of the requests therein.

//

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BROWNSTEIN HYATT FARBER SCHRECK, LLP
1020 State Street
Santa Barbara, CA 93101-2102

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Dated this 23rd day of November, 2026, at Redondo Beach, California.

BRADLEY J. HERREMA

BROWNSTEIN HYATT FARBER SCHRECK, LLP
1020 State Street
Santa Barbara, CA 93101-2102

Exhibit A

FINAL REPORT | NOVEMBER 2026

2025/26 Annual Report for the Ground-Level Monitoring Program

PREPARED FOR

Ground-Level Monitoring Committee

PREPARED BY

WEST YOST
Water. Engineered.

2025/26 Annual Report for the Ground-Level Monitoring Program

Prepared for

Ground-Level Monitoring Committee

Project No. 941-80-26-22

Prepared By: Andrea Arevalo	November 4, 2026 Date
Prepared By: Clay Kelty	November 4, 2026 Date
QA/QC Review: Andy Malone, PG #8700	November 4, 2026 Date

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Appendix A. Recommended Scope of Work and Budget of the Ground-Level Monitoring Committee for Fiscal Year 2026/27
Appendix B. Response to GLMC Comments

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LIST OF ACRONYMS, ABBREVIATIONS, AND INITIALISMS

af	Acre-Feet
Ayala Park	Rubin S. Ayala Park
Ayala Park Extensometer	Extensometer at Ayala Park
BMA	Baseline Management Alternative
CCX	Chino Creek Extensometer Facility
DHX	Daniels Horizontal Extensometer
EDM	Electronic Distance Measurement
ft	Feet
ft-amsl	Feet Above Mean Sea Level
ft-btoc	Feet Below Top of Casing
ft-bgs	Feet Below Ground Surface
ft/yr	Feet Per Year
FY	Fiscal Year
GLMC	Ground-Level Monitoring Committee
GLMP	Ground-Level Monitoring Program
IMP	Management Zone 1 Interim Monitoring Program
InSAR	Interferometric Synthetic Aperture Radar
ISMA	Initial Subsidence Management Alternative
MVWD	Monte Vista Water District
MZ-1	Chino Basin Optimum Basin Management Plan Management Zone 1
MZ-1 Plan	Management Zone 1 Subsidence Management Plan
OBMP	Optimum Basin Management Plan
PA	Piezometer A (Ayala Park Extensometer Facility)
PC	Piezometer C (Ayala Park Extensometer Facility)
PFAS	Per – and Polyfluoroalkyl Substances
PX	Pomona Extensometer Facility
SAR	Synthetic Aperture Radar
SCADA	Supervisory Control and Data Acquisition
SMA-2	Second Subsidence-Management Alternative
Subsidence Management Plan	2015 Chino Basin Subsidence Management Plan
TCP	1,2,3-trichloropropane
USGS	United States Geological Survey
Watermaster	Chino Basin Watermaster
WEI	Wildermuth Environmental, Inc.
Work Plan	Work Plan to Develop a Subsidence Management Plan for the Northwest MZ-1

1.0 INTRODUCTION

This section describes:

- Background information on the history of land subsidence and ground fissuring in the Chino Basin.
- Information on the formation of the Ground-Level Monitoring Committee (GLMC) and its responsibilities.
- A description of the development and implementation of the Chino Basin Subsidence Management Plan (Subsidence Management Plan).
- The organization of this annual report.

1.1 Background

In general, land subsidence is the sinking or settlement of the Earth's surface due to the rearrangement of subsurface materials. In the United States, over 17,000 square miles in 45 states have experienced land subsidence (United States Geologic Survey [USGS], 1999). In many instances, land subsidence is accompanied by adverse impacts at the ground surface, such as sinkholes, earth fissures, encroachment of adjacent water bodies, modified drainage patterns, and others. In populated regions, these subsidence-related impacts can result in severe damage to man-made infrastructure and costly remediation measures. Over 80 percent of the documented cases of land subsidence in the United States have been caused by groundwater extractions from the underlying aquifer-system (USGS, 1999).

For purposes of clarification in this document, subsidence refers to the inelastic deformation (i.e., sinking) of the land surface. The term inelastic typically refers to the permanent, non-recoverable deformation of the land surface or the aquifer-system. The term elastic typically refers to fully reversible deformation of the land surface or the aquifer-system. A glossary of terms and definitions discussed in this report, as well as other terms related to basic hydrogeology and land subsidence is included in Section 5.0.

1.1.1 Subsidence and Fissuring in the Chino Basin

One of the earliest indications of land subsidence in the Chino Basin was the appearance of ground fissures within the City of Chino. These fissures appeared as early as 1973, but an accelerated occurrence of ground fissuring ensued after 1991 and resulted in damage to existing infrastructure. Figure 1-1 shows the locations of these fissures and the land subsidence that contemporaneously occurred in this area. Several scientific studies of the area attributed the fissuring phenomenon to differential land subsidence caused by pumping of the underlying aquifer-system and the consequent drainage and compaction of aquitard sediments (Fife et al., 1976; Kleinfelder, 1993, 1996; Geomatrix, 1994; GEOSCIENCE, 2002).

1.1.2 The Optimum Basin Management Program

In 1999, the Optimum Basin Management Program Phase I Report (OBMP Phase I Report) identified the pumping-induced decline of hydraulic heads and subsequent aquifer-system compaction as the most likely cause of the land subsidence and ground fissuring observed in the Chino Basin OBMP Management Zone 1 (MZ-1; Wildermuth Environmental Inc. [WEI], 1999). Program Element 4 of the OBMP

Implementation Plan, *Develop and Implement a Comprehensive Groundwater Management Plan for Management Zone 1*, called for the development and implementation of an interim management plan for MZ-1 that would:

- Minimize subsidence and fissuring in the short-term
- Collect the information necessary to understand the extent, rate, and mechanisms of subsidence and fissuring
- Abate future subsidence and fissuring or reduce it to tolerable levels

The OBMP called for an aquifer-system and land subsidence investigation in the southwestern region of MZ-1 to support the development of a management plan for MZ-1 (items 2 and 3 above). This investigation was titled the *MZ-1 Interim Monitoring Program* (WEI, 2003) and is described below.

The OBMP Phase I Report also identified that land subsidence was occurring in other parts of the basin besides in the City of Chino. Program Element 1 of the OBMP Implementation Plan, *Develop and Implement a Comprehensive Monitoring Program*, called for the collection of basin-wide data to characterize land subsidence, including ground-level surveys and remote-sensing (specifically, interferometric synthetic aperture radar [InSAR]), and for the development of an ongoing monitoring program based on the analysis of the collected data.

1.1.3 Interim Management Plan and the MZ-1 Summary Report

From 2001 to 2005, the Chino Basin Watermaster (Watermaster) developed, coordinated, and conducted the Interim Management Plan (IMP) under the guidance of the MZ-1 Technical Committee. The MZ-1 Technical Committee was comprised of representatives from all major MZ-1 producers and their technical consultants, including the Agricultural Pool; the Cities of Chino, Chino Hills, Ontario, Pomona, and Upland; the Monte Vista Water District (MVWD); the Golden State Water Company; and the California Institution for Men.

The IMP consisted of three main monitoring elements to analyze land subsidence: ground-level surveys, InSAR, and aquifer-system monitoring. The ground-level surveys and InSAR analyses were used to characterize vertical ground motion. Aquifer-system monitoring of hydraulic and mechanical changes within the aquifer-system was used to characterize the causes of the ground motion.

The monitoring program was implemented in two phases: the Reconnaissance Phase and the Comprehensive Phase. The Reconnaissance Phase consisted of constructing 11 piezometers screened at various depths at Rubin S. Ayala Park (Ayala Park) in the City of Chino and installing pressure-transducers with integrated data loggers (transducers) in nearby pumping and monitoring wells to measure hydraulic head. Following installation of the monitoring network, several months of aquifer-system monitoring and testing were conducted. Testing included aquifer-system stress tests conducted at pumping wells in the area.

The Comprehensive Phase consisted of constructing a dual-borehole pipe extensometer at Ayala Park (Ayala Park Extensometer) near the area of historical fissuring. Figure 1-2 shows the location of the Ayala Park Extensometer. Following installation of the Ayala Park Extensometer, two aquifer-system stress tests were conducted followed by passive aquifer-system monitoring.

During implementation of the IMP, Watermaster's Engineer made the data available to the MZ-1 Technical Committee and prepared quarterly progress reports for the MZ-1 Technical Committee, the Watermaster Pools and Board, and the Court.[1] The progress reports contained data and analyses from the IMP and summarized the MZ-1 Technical Committee meetings.

The main conclusions derived from the IMP were:

- Groundwater pumping from the deep and confined aquifer-system in the southwestern region of MZ-1 causes the greatest stress to the aquifer-system. In other words, pumping of the deep aquifer-system causes a hydraulic head decline that is much greater in magnitude and lateral extent than the hydraulic head decline caused by pumping of the shallow aquifer-system.
- Hydraulic head decline due to pumping from the deep aquifer-system can cause inelastic compaction of the aquifer-system sediments, which results in land subsidence. The initiation of inelastic compaction within the aquifer-system was identified during the investigation when hydraulic heads in the deep aquifer-system at the Ayala Park PA-7 piezometer fell below a depth of about 250 feet (ft).
- The state of aquifer-system deformation in southern MZ-1 was essentially elastic during the Reconnaissance Phase of the IMP. Very little inelastic compaction was occurring in this area, which contrasted with the recent past when about 2.2 ft of land subsidence occurred from about 1987 to 1995 and resulted in ground fissuring.
- During the development of the IMP, a previously unknown barrier to groundwater flow was identified, shown on Figure 1-1. The barrier was named the "Riley Barrier" after Francis S. Riley, a retired USGS geologist who first detected the barrier during the IMP. This barrier is located within the deep aquifer-system and is aligned with the historical zone of ground fissuring. Pumping from the deep aquifer-system was limited to the area west of the barrier, and the resulting hydraulic head decline did not propagate eastward across the barrier. Thus, compaction occurred within the deep aquifer-system on the west side of the barrier but not on the east side, which caused concentrated differential subsidence across the barrier and created the potential for ground fissuring.
- The InSAR and ground-level surveys indicated that subsidence in Central MZ-1 had occurred in the past and was continuing to occur. InSAR also suggested that the groundwater barrier (Riley Barrier) extends northward into Central MZ-1 as shown on Figure 1-1. These observations suggested that the conditions that very likely caused ground fissuring near Ayala Park in the 1990s were also present in Central MZ-1. However, there was not enough historical hydraulic head data in this area to confirm this relationship. The IMP recommended that, if subsidence continued or increased in Central MZ-1, the mechanisms causing land subsidence should be studied in more detail.

The IMP provided enough information for Watermaster to develop Guidance Criteria for the Parties that pump from the southwestern region of MZ-1, that if followed, would minimize the potential for subsidence and fissuring in the investigation area. The methods, results, and conclusions of the IMP, including the Guidance Criteria, were described in detail in the *MZ-1 Summary Report* (WEI, 2006).

[1] San Bernardino County Superior Court, which retains continuing jurisdiction over the Chino Basin Judgment.

The Guidance Criteria consisted of:

- A list of "Managed Wells" subject to the Guidance Criteria. Table 1-1 is a list of the Managed Wells that are subject to the Guidance Criteria. Figure 1-2 is a map that shows the locations of the Managed Wells. These wells have well screens that penetrate the deep aquifer-system.

Table 1-1. Managed Wells Screened in the Deep Aquifer and Subject to the Guidance Criteria[a]

Well Name	CBWM ID	Owner	2025 Status	Well Screen Depth Interval(s) ft-bgs
CIM-11A[b]	3602461	California Institution for Men	Active[c]	174-187; 240-283; 405-465
C-7	3600461	City of Chino	Abandoned[d]	180-780
C-15	600670		Abandoned	270-400; 626-820
CH-1B	600487	City of Chino Hills	Inactive[e]	440-470; 490-610; 720-900; 940-1,180
CH-7C	600687		Abandoned	550-950
CH-7D	600498		Destroyed	320-400; 410-450; 490-810; 850-930
CH-15B	600488		Active	360-440; 480-900
CH-16	600489		Inactive	430-940
CH-17	600499		Inactive	300-460; 500-680
CH-19	600500		Inactive	300-460; 460-760; 800-1,000

(a) The MZ-1 Subsidence Management Plan identified the Managed Wells that are subject to the Guidance Criteria for the Managed Area that, if followed, would minimize the potential for subsidence and fissuring.

(b) The original casing was perforated from 135-148, 174-187, 240-283, 405-465, 484-512, and 518-540 feet below ground surface (ft-bgs). This casing collapsed below 471 ft-bgs in 2011. A liner was installed to 470 ft-bgs with a screen interval from 155 to 470 ft-bgs.

(c) Active = Well is currently being used for water supply.

(d) Abandoned = Unable to pump the well without major modifications.

(e) Inactive = Well can pump groundwater with little or no modifications.

- The spatial extent of the "Managed Area." Figures 1-1 and 1-2 show the boundary of the Managed Area where the Guidance Criteria apply. Within the boundaries of the Managed Area, both existing (Table 1-1) and newly constructed wells are subject to being classified as Managed Wells. This area was delineated based on the observed and/or predicted effects of pumping on hydraulic heads and aquifer-system deformation. The Managed Well designations were based on the effects measured at the Ayala Park Extensometer during the IMP or well construction and borehole lithology.
- A piezometric "Guidance Level." The Guidance Level is a specified depth to water, as measured in feet below the top of casing (ft-btoc) at the Ayala Park PA-7 piezometer. The initial Guidance Level was established as 245 ft-btoc. It was defined as the threshold hydraulic head at the onset of inelastic compaction of the aquifer-system as recorded by the extensometer minus five feet. The five-foot reduction was meant to be a safety factor to ensure that inelastic compaction does not occur. The Guidance Level can be updated by Watermaster based on the periodic review of monitoring data.
- Criteria for recommending pumping curtailment. If the hydraulic head in PA-7 falls below the Guidance Level, Watermaster recommends that the MZ-1 Parties curtail their pumping from designated Managed Wells as required to maintain hydraulic heads above the Guidance Level.

- Monitoring/reporting of hydraulic heads at PA-7. Watermaster was to provide the MZ-1 Parties with real-time hydraulic head data from PA-7.
- Reporting of pumping operations at Managed Wells. The MZ-1 Parties were requested to maintain and provide Watermaster with accurate records of operations at the Managed Wells, including pumping rates and on-off dates and times. The MZ-1 Parties were requested to promptly notify Watermaster of all operational changes made to maintain the hydraulic head at PA-7 above the Guidance Level.
- Request for ongoing monitoring at other monitoring wells. Watermaster recommended that the MZ-1 Parties allow it to continue to monitor hydraulic heads at the Managed Wells.
- Process for adapting the Guidance Criteria. Watermaster and Watermaster's Engineer were to evaluate the data collected as part of the MZ-1 Monitoring Program (now called the Ground-Level Monitoring Program or GLMP) after each fiscal year and determine if modifications, additions, and/or deletions to the Guidance Criteria were necessary. Changes to the Guidance Criteria could include additions or deletions to the list of Managed Wells, re-delineation of the Managed Area, raising or lowering of the Guidance Level, or additions and/or deletions to the Guidance Criteria, including the need to have periods of hydraulic head recovery.
- Acknowledgement of uncertainty. Watermaster cautioned that some subsidence and fissuring could occur in the future, even if the Guidance Criteria were followed. Watermaster made no warranties that faithful adherence to the Guidance Criteria would eliminate subsidence or fissuring.

1.1.4 MZ-1 Subsidence Management Plan

The Guidance Criteria formed the basis for the *MZ-1 Subsidence Management Plan* ([MZ-1 Plan]; WEI, 2007), which was developed by the MZ-1 Technical Committee and approved by the Watermaster Board in October 2007. In November 2007, the Court approved the MZ-1 Plan and ordered its implementation.

To minimize the potential for future subsidence and fissuring in the Managed Area, the MZ-1 Plan codified the Guidance Level and recommended that the MZ-1 Parties manage their groundwater pumping such that the hydraulic heads at PA-7 remain above the Guidance Level.

The MZ-1 Plan called for ongoing monitoring, data analysis, annual reporting, and adjustments to the MZ-1 Plan as warranted by the data. Implementation of the MZ-1 Plan began in 2008. The MZ-1 Plan called for the continued scope and frequency of monitoring implemented during the IMP within the Managed Area and expanded monitoring of the aquifer-system and land subsidence in other areas of the Chino Basin where the IMP indicated concern for future subsidence and ground fissuring. Figure 1-1 shows the location of these so-called Areas of Subsidence Concern: Central MZ-1, Northwest MZ-1, Northeast Area, and Southeast Area. The expanded monitoring efforts outside the Managed Area are consistent with the requirements of the OBMP Program Element 1 and its implementation plan contained in the Peace Agreement.[2]

Potential future efforts listed in the MZ-1 Plan included: (i) more intensive monitoring of horizontal strain across the zone of historical ground fissuring to assist in developing management strategies related to fissuring, (ii) injection feasibility studies within the Managed Area, (iii) additional pumping tests to refine the Guidance Criteria, (iv) computer-simulation modeling of groundwater flow and subsidence, and (v) the development of alternative pumping plans for the MZ-1 Parties affected by the MZ-1 Plan. The MZ-1

[2] Source: http://www.cbwm.org/docs/legaldocs/Peace_Agreement.pdf.

Technical Committee (now called the Ground-Level Monitoring Committee or GLMC) discusses these potential future efforts, and if deemed prudent and necessary, they are recommended to Watermaster for implementation in future fiscal years.

In addition to the MZ-1 Plan, the Peace Agreement required the Watermaster to recharge a minimum of 6,500 afy of supplemental water in Management Zone 1. This requirement was continued under the Peace II Agreement as a long-term obligation to maintain hydrologic balance and control land subsidence in MZ1. The Watermaster is also required to evaluate this requirement and potentially increase the minimum recharge quantity above 6,500 afy after review of basin performance and subsidence studies. This evaluation will be performed in FY 2026/27 under a separate Watermaster task, Model Update and Required Demonstrations.

1.1.5 2015 Chino Basin Subsidence Management Plan

The MZ-1 Plan stated that if data from existing monitoring efforts in the Areas of Subsidence Concern indicate the potential for adverse impacts due to subsidence, Watermaster would revise it to avoid those adverse impacts. The 2014 Annual Report of the GLMC recommended that the MZ-1 Plan be updated to better describe Watermaster's land subsidence efforts and obligations, including areas outside of MZ-1. As such, the update included a name change to the 2015 Chino Basin Subsidence Management Plan ([Subsidence Management Plan]; WEI 2015a) and a recommendation to develop a subsidence management plan for Northwest MZ-1.

Watermaster had been monitoring vertical ground motion in Northwest MZ-1 via InSAR during the development of the MZ-1 Plan. Land subsidence in Northwest MZ-1 was first identified as a concern in 2006 in the MZ-1 Summary Report and again in 2007 in the MZ-1 Plan. Of particular concern was the occurrence of concentrated differential subsidence across the San Jose Fault in Northwest MZ-1—a similar spatial pattern of differential subsidence occurred in the Managed Area during the time of ground fissuring. Ground fissuring is the main subsidence-related threat to infrastructure. The issue of differential subsidence, and the potential for ground fissuring in Northwest MZ-1, has been discussed at prior GLMC meetings, and the subsidence has been documented and described as a concern in Watermaster's State of the Basin Reports, the annual reports of the GLMC, and in the *Initial Hydrologic Conceptual Model and Monitoring and Testing Program for the Northwest MZ-1 Area* (WEI, 2017a). Watermaster increased monitoring efforts in Northwest MZ-1 beginning in Fiscal Year (FY) 2012/13 to include ground elevation surveys and electronic distance measurements (EDM) to monitor ground motion and the potential for fissuring.

In 2015, Watermaster's Engineer developed the *Work Plan to Develop a Subsidence Management Plan for the Northwest MZ-1 Area* ([Work Plan]; WEI 2015b). The Work Plan is characterized as an ongoing Watermaster effort and includes a description of a multi-year scope-of-work, a cost estimate, and an implementation schedule. The Work Plan was included in the Subsidence Management Plan as Appendix B. Implementation of the Work Plan began in July 2015.

The updated Subsidence Management Plan also addressed the need for hydraulic head "recovery periods" in the Managed Area by recommending that all deep aquifer-system pumping cease for a continuous six-month period between October 1 and March 31 of each year within the Managed Area. And, the Subsidence Management Plan recommends that every fifth year, all deep aquifer-system pumping cease for a continuous period until the hydraulic head at PA-7 reaches "full recovery" of 90 ft-btoc. These periodic cessations of pumping are intended to allow for sufficient hydraulic head recovery at PA-7 to recognize inelastic compaction, if any, at the Ayala Park Extensometer.

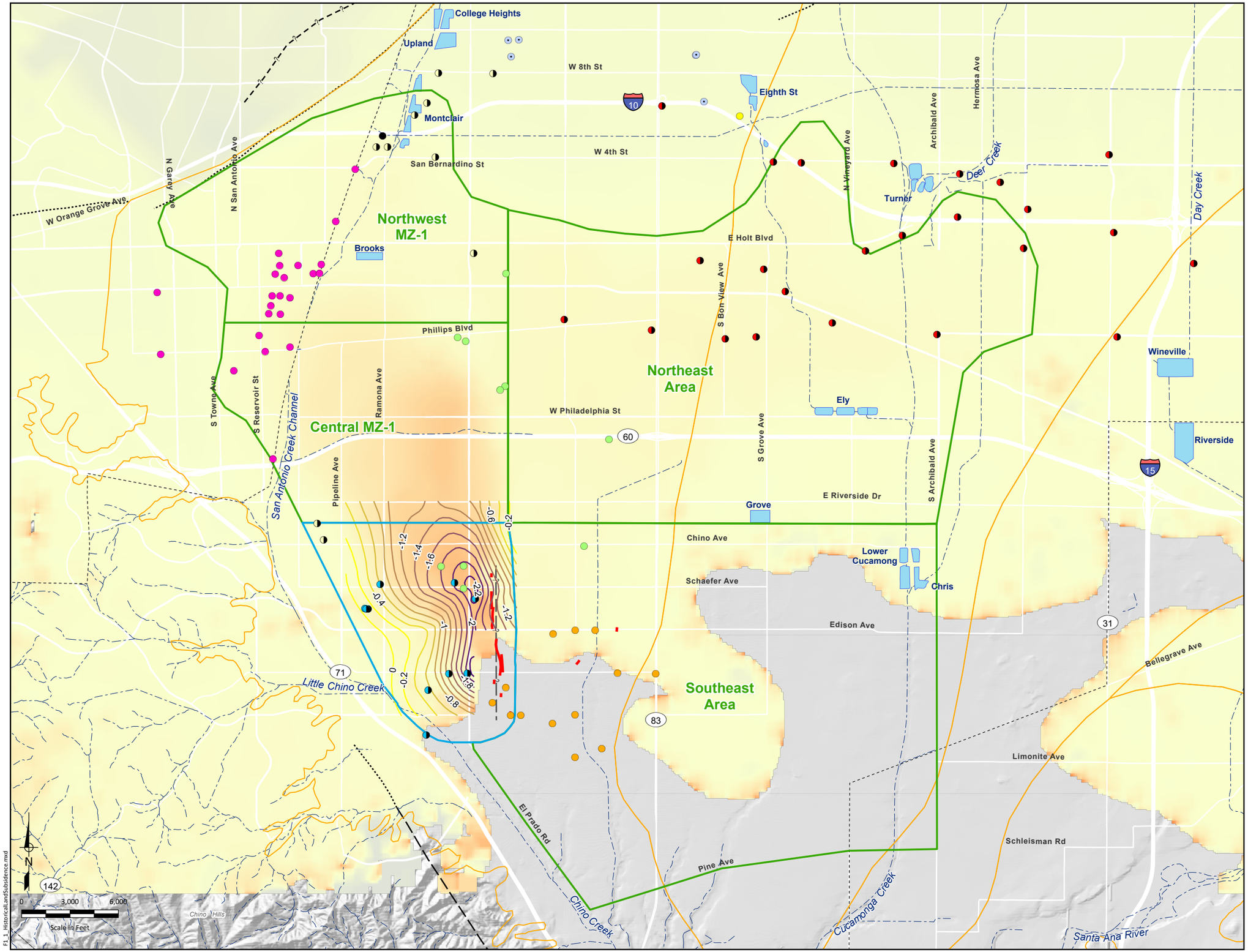
1.1.6 Annual Report for the Ground-Level Monitoring Program

Pursuant to the Subsidence Management Plan, Watermaster prepares an annual report containing the results of ongoing monitoring efforts, interpretations of the data, and recommended adjustments to the Subsidence Management Plan, if any. This Annual Report for the GLMP includes the results and interpretations for the data collected between March 2025 through March 2026, as well as recommendations for Watermaster's GLMP for FY 2026/27.

1.2 Report Organization

This report is organized into the following six sections:

- **Section 1.0 – Introduction**. This section provides background information on the history of land subsidence and ground fissuring in Chino Basin, information on the formation of the GLMC and its responsibilities, and a description of the development and implementation of the Subsidence Management Plan, which calls for annual reporting.
- **Section 2.0 – Ground-Level Monitoring Program.** This section describes the monitoring and testing activities performed by Watermaster for its GLMP between March 2025 and March 2026.
- **Section 3.0 – Results and Interpretations.** This section discusses and interprets the monitoring data collected between March 2025 and March 2026, including basin stresses (groundwater pumping and recharge) and responses (changes in hydraulic heads, aquifer-system deformation, and ground motion).
- **Section 4.0 – Conclusions and Recommendations.** This section summarizes the main conclusions derived from the monitoring program between March 2025 and March 2026 and describes recommended activities for the GLMP for FY 2026/27.
- **Section 5.0 – Glossary.** This section is a glossary of the terms and definitions utilized within this report and in discussions at GLMC meetings.
- **Section 6.0 – References.** This section lists the publications and reports cited in this report.



F1.1_HistoricalLandSubsidence.mxd

Contours of Relative Change
in Land Surface Elevation
as Estimated by Leveling Surveys
1987 to 1999

0.0 ft

-2.2 ft

Relative Change in Land Surface Elevation
as Measured by InSAR
Oct-1993 to Dec-1995

High : 1 ft

0 ft

Low : -1 ft

InSAR absent or incoherent

Active Pumping Wells by Owner: 1987 to 1999

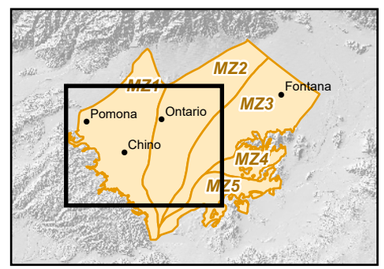
- CA Institution for Men
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Golden State WC
- Monte Vista WD
- San Antonia WC

Managed Areas

- Managed Area
- Areas of Subsidence Concern

Other Features

- Flood Control and Conservation Basins
- Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)



Chino Basin Watermaster

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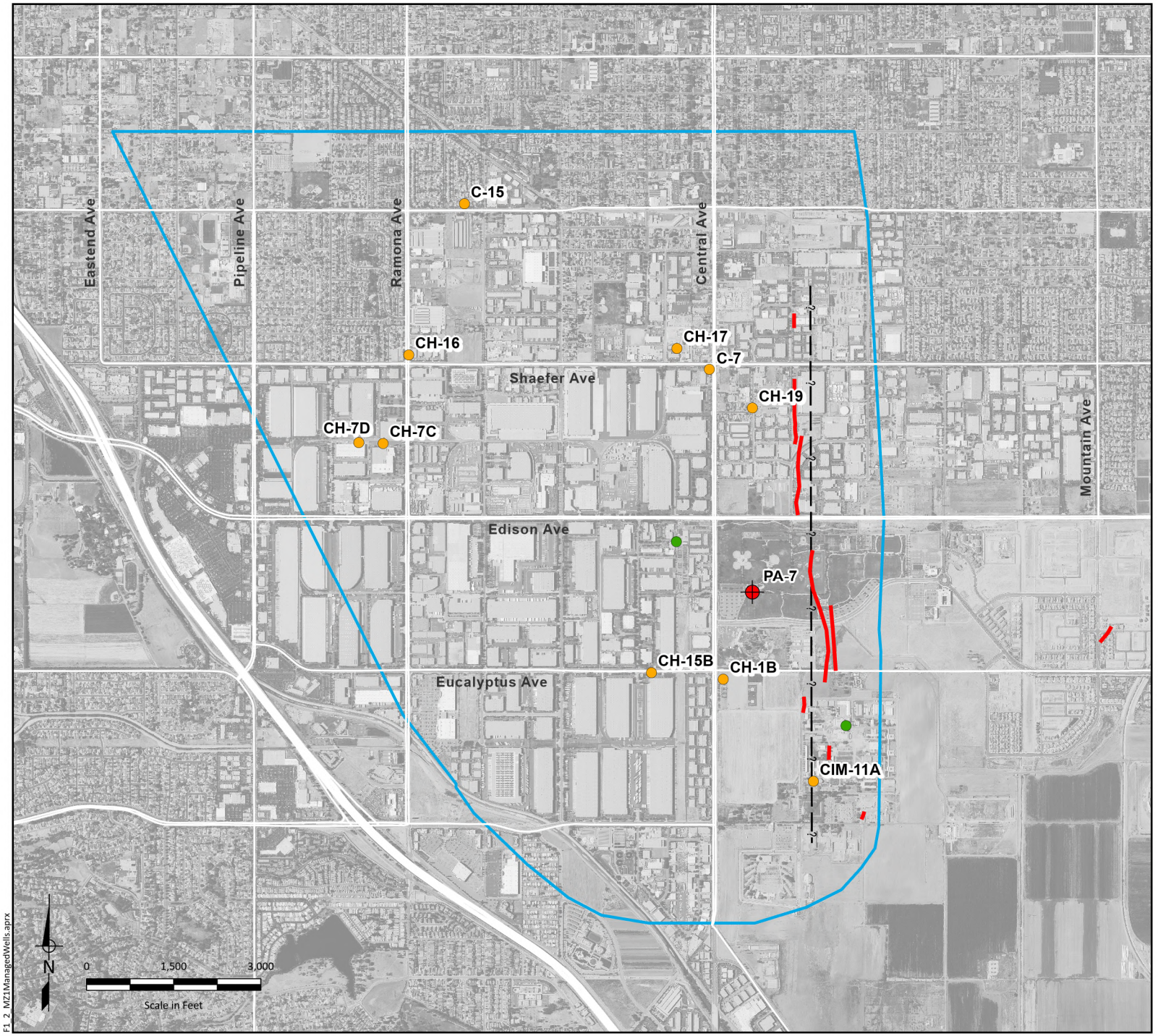
Figure 1-1

Historical Land Surface Deformation in Management Zone 1: 1987-1999



F1_2_MZ1ManagedWells.aprx

Chino Basin Watermaster
2025/26 Annual Report for the
Ground-Level Monitoring Program

Figure 1-2

MZ-1 Managed Area and the Managed Wells

2.0 GROUND-LEVEL MONITORING PROGRAM

This section describes the activities performed by Watermaster for the GLMP between March 2025 and March 2026.

Figure 2-1 shows the groundwater pumping and recharge facilities in the western Chino Basin that impart pumping and recharge stresses to the aquifer-system. Figure 2-2 shows the locations of the monitoring facilities in Watermaster's ground-level monitoring network, including: wells equipped with a transducer; extensometers that measure vertical aquifer-system deformation; benchmark monuments that are used to perform periodic ground elevation and EDM surveys to measure vertical and horizontal deformation of the ground surface; and four benchmark monuments that will serve as control points for annual GPS surveys beginning in FY 2026/27.

2.1 Ground-Level Monitoring Program

Watermaster conducts its GLMP in the Managed Area and other Areas of Subsidence Concern pursuant to the Subsidence Management Plan and the recommendations of the GLMC. The GLMP activities performed between March 2025 and March 2026 are described below.

2.1.1 Setup and Maintenance of the Monitoring Network

The Ayala Park, Chino Creek, and Pomona extensometer (PX) facilities are key monitoring facilities for the GLMP. They require monthly or as needed visits for maintenance and calibration to remain in good working order and to ensure the recording of accurate measurements.

2.1.1.1 Pomona Extensometer

During 2025/26, rehabilitation activities, equipment replacement, and calibration efforts were conducted at the PX facility to improve the accuracy and reliability of the extensometer measurements. The background, methods, results, and ongoing calibration efforts at PX are described herein.

The PX is a multi-purpose monitoring facility located within the City of Pomona. The PX facility was completed August 2019 and monitoring commenced in December 2020. It is designed to monitor depth-specific hydraulic heads and the vertical deformation of the aquifer-system sediments caused by head changes that can result in permanent land subsidence. The PX included:

- Four piezometers with well screens at progressively greater depths. Each piezometer is equipped with instrumentation to measure hydraulic head at 15-minute intervals within the aquifer-system. Originally, hydraulic heads were measured using pressure transducers installed on direct read cables.
- A cable extensometer is installed within each piezometer to measure the vertical deformation of the overlying sediments caused by the head changes. Each extensometer cable is attached to a steel anchor-weight that rests on the bottom of the piezometer. The cable is maintained under tension by a counterweight and pulley system at the well head to reduce friction between the cable extensometer and the piezometer casing. Vertical deformation of the aquifer-system is measured at 15-minute intervals using a linear potentiometer that records vertical displacement between the cable and the conductor casing, which is anchored to the ground surface. Figure 2-3 is a schematic diagram of a cable extensometer.

Typical data collected at a properly functioning extensometer facility display a correlated relationship between head changes and extensometer displacement. For example, as heads decrease, the aquifer-system skeleton (and pore spaces) will contract, causing the land surface (and conductor casing) to sink relative to the extensometer cable. Since installation in 2020, the PX recorded logical head changes that are consistent with measurements at nearby wells but did not record logically correlated extensometer displacement. This indicated that the extensometers, monitoring and recording equipment, or both were not functioning as intended.

During 2025/26, the Watermaster Engineer retained a well subcontractor to remove the existing downhole equipment and anchor-weights from each of the four piezometers. During removal, the pressure-transducer cables were found tangled around the steel extensometer cables. This entanglement could have interfered with the extensometer readings and may have contributed to the poor correlation between hydraulic head changes and extensometer displacements.

With the downhole equipment removed, video inspections were performed on all four piezometers to evaluate the condition of the casings and screen intervals. The video inspection of PX-1 identified buildup on portions of the well screen, and the well was subsequently brushed to remove the accumulated material. All four piezometers were also bailed to remove sediment accumulated at the bottom of the wells and provide a clean, stable surface for the extensometer anchor-weights.

Following well rehabilitation activities, the Watermaster Engineer replaced and upgraded several components of the monitoring equipment, including:

- New steel extensometer cables were installed to replace the existing cables.
- Four new linear potentiometers replaced the existing potentiometers, and the data acquisition software code was improved to support more accurate measurement and recording of extensometer displacement. The new potentiometers and updated software were calibrated and tested in the office and field.
- Four sonic water-level sensors were installed to eliminate the potential for the transducers to interfere with the extensometer cables. New enclosed well covers were fabricated to accommodate the sonic sensors.

Following reinstallation of the equipment, monitoring of hydraulic heads and extensometer displacement resumed.

Although rehabilitation of the PX facility and replacement of the monitoring equipment have been completed, the reliability of the extensometer measurements has not yet been confirmed. Calibration and evaluation of the PX extensometer measurements over time is ongoing in an attempt to improve the accuracy and reliability of the measurements. During FY 2026/27, the Watermaster Engineer will continue to collect and evaluate hydraulic head and extensometer data to determine whether the extensometers are producing reasonable responses to hydraulic head changes. Additional adjustments or modifications to the monitoring equipment will be made as warranted by the data, followed by periodic data collection and evaluation. The results of these evaluations, including the status of the extensometer calibration and any remaining data quality issues, will be documented in future GLMP reporting once sufficient data have been collected and evaluated.

2.1.2 Monitoring Activities

Changes in hydraulic heads are caused by the stresses of groundwater pumping and recharge. Changes in hydraulic head are the mechanism behind aquifer-system deformation, which in turn causes vertical and horizontal ground motion. Because of this cause-and-effect relationship, the Watermaster monitors groundwater pumping, recharge, hydraulic heads, aquifer-system deformation, and vertical and horizontal ground motion across the western portion of the Chino Basin. All data collected for the GLMP are compiled, checked, and stored in Watermaster databases.

This subsection describes Watermaster's monitoring activities, that are called for in the Subsidence Management Plan and informed by GLMC recommendations, between March 2025 and March 2026.

2.1.2.1 Monitoring of Pumping, Recharge, and Piezometric Levels

Watermaster staff collects and compiles groundwater pumping data on a quarterly basis from well owners in the Managed Area and Areas of Subsidence Concern. Figure 2-1 shows the well locations where groundwater was pumped between March 2025 and March 2026.

The Watermaster collects data from the Inland Empire Utilities Agency on the volumes of imported water, stormwater, and recycled water that are artificially recharged at spreading basins, and the volumes of recycled water for direct use within the Chino Basin.

Hydraulic heads were measured and recorded once every 15 minutes using transducers maintained by the Watermaster at 85 wells across the Managed Area and Areas of Subsidence Concern. Figure 2-2 shows the locations of these wells. Watermaster staff and well owners also measure hydraulic heads monthly at other wells in the western Chino Basin.

2.1.2.2 Monitoring Vertical Aquifer-System Deformation

The Watermaster measured and recorded the vertical component of aquifer-system deformation at the Ayala Park and Chino Creek Extensometer Facilities once every 15 minutes. Limited vertical displacement data were recorded at the Pomona Extensometer Facility during 2025/26 due to rehabilitation and calibration activities.

2.1.2.3 Monitoring Vertical Ground Motion

The Watermaster monitored vertical ground motion via InSAR and traditional ground-level surveys.

For InSAR, the Watermaster obtained six TerraSAR-X collections through Airbus DS Geo, Inc., covering the western half[3] of the Chino Basin from March 2025 to March 2026. The SAR image collection area is shown in Photo 2-1, with the area of interest highlighted in white with a red outline. While motion estimates are created over the entirety of the image area as a processing by-product, only the highlighted area of interest is analyzed and delivered by the Watermaster, shown in Photo 2-2.

[3] The SAR image footprint is fixed in longitude by the satellite orbit and sensor collection parameters. Coverage of the eastern Basin requires separate collection, processing, and analysis. InSAR from 1993 to 2010 indicates minimal vertical motion in the eastern Basin, the GLMC decided in 2012 to acquire and analyze InSAR only in the western Basin as a cost-saving strategy.

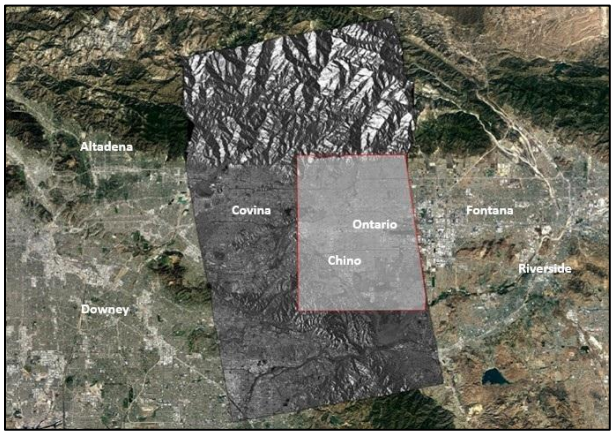


Photo 2-1: Full SAR Collection Area
Google Earth, Landsat/Copernicus 2020



Photo 2-2: Delivered Area of Interest
Google Earth, Airbus 2024

Including the final collection from the 2025-2026 monitoring period as a reference, six SAR images were processed to create 15 short- and long-term vertical ground motion estimates over the periods listed in Table 2-1.

Table 2-1. 2025 to 2026 Vertical Displacement Estimates

Short-Term (2025-2026) Vertical Ground Motion Estimates	
March 2025 to May 2025	March 2025 to July 2025
May 2025 to July 2025	March 2025 to September 2025
July 2025 to September 2025	March 2025 to November 2025
September 2025 to November 2025	March 2025 to January 2026
November 2025 to January 2026	March 2025 to March 2026
January 2026 to March 2026	-
Long-Term (5+ year) Vertical Ground Motion Estimates	
March 2011 to March 2016	June 2011 to March 2025
March 2016 to March 2021	February 2017 to March 2026
March 2021 to March 2026	March 2011 to March 2026

With a transition away from the previous processing arrangement with General Atomics (formerly Neva Ridge Technologies, Inc.), all interferometry beginning March 2011 was reprocessed in-house by the Watermaster,[4] creating a vertical motion estimate independent of previously delivered results.[5] The new estimate was compared frame-by-frame with historic deliveries through March 2026 to verify accuracy, and

[4] The basic SAR processing suite (GAMMA) and SAR collection footprint are identical to previous monitoring seasons.

[5] The past processing agreement with General Atomics (previously Neva Ridge Technologies, Inc.) allowed for transferal of the original Airbus data products, but not the scripts used to drive the GAMMA processing software. Since 2022, the Watermaster developed a new processing framework around the GAMMA software.

showed improvements in vertical fidelity in the primary subsidence feature in Northwest MZ-1,[6] decreased overall spatial noise, decreased time series noise at monitored points,[7] improved feature visibility near the Ontario and Chino airports,[8] and improvements in spatial quadratic phase trend correction.[9]

For the ground-level surveys, Watermaster retained Guida Surveying, Inc. to conduct traditional leveling surveys at selected benchmark monuments in the western part of the Chino Basin. In April 2026, benchmark monuments in the Northwest and San Jose Fault Zone Areas were surveyed. Watermaster also established a new benchmark monument in the Northeast Area near De Anza Park in the City of Ontario and well ONT-33 to serve as a control point for future GPS surveys. Table 2-2 below shows the date of the most recent benchmark monument survey by ground-level survey area. The locations of the ground-level survey areas are shown on Figure 2-2.

Table 2-2. Benchmark Monuments Surveyed in Ground-Level Survey Areas

Ground-Level Survey Area	Date of Most Recent Survey
Managed Area[(a)]	May 2024
Central Area[(a)]	January 2018
Northwest Area	April 2026
San Jose Fault Zone Area	April 2026
Southeast Area[(a)]	May 2022
Northeast Area[(a)]	April 2020

(a) The entire benchmark monument survey network for the ground-level survey area was not surveyed in 2025/26 based on the GLMC scope and budget recommendations for FY 2025/26.

[6] InSAR results are subject to the Coastline Paradox. Small spatial filters preserve vertical estimate magnitude and fine spatial detail but may generate artifacts over less-coherent areas. Broad spatial filters obscure displacement estimates and reduce spatial detail but must be used to provide temporal continuity over areas with intermittent and spatially variant data quality. The current processing method balances the accuracy of small spatial filters with the necessity of broad spatial filters.

[7] The residual noise level in previous deliveries forced an overly complex workflow when converting InSAR displacement rasters to ArcGIS contours. The new processing method reduces the standard deviation over small areas while maintaining depth estimates. Though more complex than a spatially variant smoothing operation, it may be described as such.

[8] This improvement, particularly south of ONT around the Whispering Lakes golf course and extending southward toward Ontario Ranch, was made possible by the improvements noted above.

[9] Satellite ephemeris inaccuracies create quadratic phase trends in the processed interferometry. These trends may be thought of as "tilts" or "bends" across the complex data and are a source of displacement error if left uncorrected. Inaccuracies in the underlying elevation model may also contribute to overall phase trends. Correction requires careful selection of high-quality control points via manual masking and automatic data quality estimation. The improvements were made possible by updates to the GAMMA software, improved computing resources within the Watermaster, detailed analysis of the processed interferometry and displacement results with respect to previous deliveries and ground truth, and substantial analyst time invested by the Watermaster.

2.1.2.4 Monitoring of Horizontal Ground Motion

Watermaster periodically measures horizontal ground motion between benchmarks across areas that are susceptible to ground fissuring via EDMs. The dates of the most recent horizontal benchmark survey within the ground-level survey area are shown in Table 2-3. Horizontal benchmark surveys were not performed in 2025/26 and are not planned for 2026/27.

Table 2-3. Horizontal Benchmark Survey

Ground-Level Survey Area	Date of Most Recent Survey
Fissure Zone Area[(a)]	February 2018
San Jose Fault Zone Area[(a)]	May 2021

(a) EDMs across the Fissure Zone Area and San Jose Fault Zone Area were not conducted in 2025/26 based on GLMC scope and budget recommendations for FY 2025/26.

2.2 Land-Subsidence Investigations

The Watermaster performs land subsidence investigations pursuant to the Subsidence Management Plan and/or recommendations from the GLMC that are approved in the annual Watermaster budget. The goals of these investigations are to refine the Guidance Criteria (described in Section 1.1.3) or assist in the development of subsidence management plans to minimize or abate land subsidence and maximize the prudent extraction of groundwater.

This section describes the land subsidence investigations conducted between March 2025 and March 2026.

2.2.1 Subsidence Management Plan for Northwest MZ-1

In 2015, the GLMC developed the final Work Plan to develop a subsidence-management plan for Northwest MZ-1, which describes a multi-year effort with cost estimates to execute the Work Plan. The Work Plan was included in the Subsidence Management Plan as Appendix B.[10] The background and objectives of the Work Plan are described in Section 1.1.5. The Watermaster began implementation of the Work Plan in July 2015. The Work Plan has evolved over time as new data and information has been collected and evaluated by the GLMC. The following describes the Work Plan tasks and status of each task:

- **Task 1. Describe Initial Hydrogeologic Conceptual Model and Monitoring and Testing Program** – A final report was submitted to the GLMC and Watermaster in December 2017 that summarized the current state of knowledge of the hydrogeology of Northwest MZ-1, the data gaps needed to be filled to fully describe the occurrence and mechanisms of aquifer-system deformation and the pre-consolidation stress, and a strategy to fill the data gaps.
- **Task 2. Implement the Initial Monitoring and Testing Program** – The Watermaster's Engineer worked with the Watermaster, MVWD, City of Pomona, and SCADA Integrations, Inc. to identify and equip a set of wells with supervisory control and data acquisition (SCADA) monitoring capabilities and/or transducers. Through several field visits and technical meetings with the well owners, a protocol was developed to install monitoring equipment and collect pumping and piezometric data. For the City of Pomona, nine wells were equipped with transducers. For MVWD, seven wells were equipped with transducers,

[10] Source: http://www.cbwm.org/pages/reports/engineering/

two wells with sonar units, and two wells with air-line units. Hydraulic heads are recorded once every 15 minutes. Nine of the 11 MVWD wells were connected to the MVWD's existing SCADA system. The hydraulic head data from these wells are currently being collected and analyzed as part of the Northwest MZ-1 monitoring and testing program. These data will be used in future efforts to recalibrate the Chino Valley Model (MODFLOW model of Chino Basin) and the 1D Models at PX and MVWD-28.

- **Task 3. Develop and Evaluate the Baseline Management Alternative (BMA) and Task 4.** Develop and Evaluate the Initial Subsidence-Management Alternative – A final technical memorandum was submitted to the GLMC and Watermaster in December 2017 that described the construction, calibration, and use of a numerical one-dimensional aquifer-system compaction model (1D compaction model) at MVWD-28. The objective of this memo was also to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater pumping and artificial recharge and to identify potential subsidence mitigation strategies.
- **Task 5. Design and Install the Pomona Extensometer (PX) Facility** – The Watermaster's Engineer completed construction of two dual-nested piezometers located in Montvue Park, Pomona, CA in August 2019. Each PX piezometer was equipped with transducers and cable extensometers in June and July 2020 and has been collecting preliminary depth-specific hydraulic head and aquifer-system deformation since December 2020.

  The piezometers at the PX facility provide accurate, depth-specific head data. These data will be used in future efforts to verify or recalibrate the 1D Models at PX. However, the extensometers have not recorded aquifer-system deformation that is logically correlated with hydraulic head changes. During 2025/26, Watermaster rehabilitated the four piezometers and replaced or upgraded the extensometer cables, linear potentiometers, data acquisition software, and water-level monitoring equipment. During removal of the existing equipment, pressure-transducer cables were found tangled around the extensometer cables, which may have contributed to the poor data quality. Pressure transducers were subsequently replaced with sonic water-level sensors to eliminate downhole cable interference.

  Following reinstallation, monitoring resumed and the Watermaster Engineer continues to make incremental adjustments to the extensometers and evaluate the resulting data. Calibration and evaluation remain ongoing to improve the accuracy and reliability of the aquifer-system deformation measurements (see Section 2.1.1.1).
- **Task 6. Design and Conduct Aquifer-System Stress Tests (if necessary)** – The objective of this task is to perform controlled aquifer-system stress tests at pumping wells in Northwest MZ-1 and to monitor the depth-specific hydraulic head and aquifer-system deformation response at PX. This information, along with hydraulic head data collected as part of Task 2 will be used to help identify the subsidence mechanisms and the pre-consolidation stress(es) in Northwest MZ-1. The Watermaster Engineer has not yet identified specific questions that need to be answered with the controlled aquifer-system stress tests. It is recommended that a period of "passive" data collection and assessment of the data over time to determine if a controlled aquifer-system stress test is recommended in the future.
- **Task 7/8. Update the Hydrogeologic Conceptual Model/Construct and Calibrate Subsidence Modeling Tools** – The objectives of these tasks are: (i) to update the hydrogeologic conceptual model of Northwest MZ-1 based on new lithologic information from PX and an improved understanding of hydraulic head data across Northwest MZ-1; (ii)

describe the subsidence mechanisms and the pre-consolidation head by aquifer-system layer in Northwest MZ-1; and (iii) develop modeling tools that can be used to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater production and artificial recharge and to identify potential subsidence mitigation strategies.

A new 1D compaction model was constructed and calibrated using the hydrogeologic information collected at the PX. The 1D model at MVWD-28 was also updated and recalibrated using current information. This work was reviewed by the GLMC, and additional 1D model calibration refinements and sensitivity analyses were performed based on GLMC recommendations. In December 2022, the Watermaster Engineer, with review and input from the GLMC, deemed 1D model calibrations sufficient for simulation of future land subsidence under prospective plans for pumping and recharge (see Task 9 below).

- **Task 9. Refine and Evaluate Subsidence-Management Alternatives** – This task began in FY 2023-24 and helps answer the question: *What are potential methods to manage the land subsidence in Northwest MZ-1?*

The 1D compaction models at MVWD-28 and PX were used to characterize the mechanical response of the aquifer-system to an initial Subsidence Management Alternative (SMA-1). In 2023, the Watermaster Engineer, with review and input from the GLMC, developed an SMA-1, which is equivalent to the planning scenario that was simulated with the 2020 Chino Valley Model (CVM) to support the 2020 Safe Yield Recalculation (2020 SYR). The 2020 SYR was intended to represent and simulate the Parties' projected pumping, recharge, and use of storage through 2050. The results of the 2020 SYR (*i.e.,* projected hydraulic heads by CVM layer) were used as input data for the 1D Model simulations to predict the potential future occurrence of subsidence through 2050. In February 2024, the Watermaster Engineer published a final TM titled *1D Model Simulation of Subsidence in Northwest MZ-1—Subsidence Management Alternative #1*. The Watermaster Engineer's recommendations from this work were the following:

- Establish a preliminary "Northwest MZ-1 Guidance Level" of 630 ft-amsl for hydraulic heads in Layers 3 and 5 at the PX location. The *preliminary* Guidance Level is an aspirational Watermaster recommendation that, if achieved, would likely slow or stop aquitard compaction and land subsidence in Northwest MZ-1.
- Compliance with the Guidance Level should be measured at the PX-2/3 piezometer, which is generally representative of heads in Layers 3 and 5.
- The methods to achieve the Guidance Level could include but are not limited to: voluntary modification of pumping patterns; in-lieu recharge; wet-water recharge via spreading and/or injection; or a combination of methods. These methods might necessitate voluntary modification of water-supply plans of the purveyors in the Chino Basin; modification of Watermaster practices for recharge and replenishment; and/or the implementation of regional-scale storage or conjunctive-use programs.
- Additional SMAs should be developed and evaluated with the 1D Models to generate the necessary information to finalize the Guidance Level and the *Subsidence Management Plan for Northwest MZ-1*. The additional SMAs could be developed during Watermaster's groundwater modeling efforts associated with the 2025 Safe Yield Reevaluation and the update to the Storage Management Plan. The GLMC should participate in the scenario building exercises associated with these Watermaster efforts to develop the SMAs, so that the scenarios include various methods to achieve the Guidance Level. Then, the 1D Models should be used to evaluate the potential future subsidence in Northwest MZ-1 under the

SMAs. These model results and evaluations will support the recommendation for a Guidance Level(s) in the *Subsidence Management Plan for Northwest MZ-1*. It should be noted that future monitoring and analyses always hold the potential for revisions to the Guidance Level, consistent with the adaptive management approach called for in the Chino Basin Subsidence Management Plan.

During FY 2025/26, the Watermaster Engineer advanced this recommendation by simulating subsidence at the PX using the results from the 2025 Safe Yield Reevaluation and the 1D compaction model; developing zone-budget projections with the CVM to evaluate future recharge and pumping in Northwest MZ-1 to achieve the Guidance Level(s); and developing preliminary subsidence-management guidance criteria based on the modeling results. The methods, results, and findings from this work will be documented in a separate technical memorandum in FY 2026/27.

Task 10. Update the Chino Basin Subsidence Management Plan – The objective of this task is to incorporate the recommended Guidance Criteria for Northwest MZ-1 into the Chino Basin Subsidence Management Plan.

During FY 2026/27, the Watermaster Engineer plans to complete Task 9 and use the results to support the update of the Chino Basin Subsidence Management Plan. The updated Subsidence Management Plan will require review and input by the GLMC and the Watermaster Pools, Advisory Committee, and Board. The Watermaster will apprise the Court of revisions to the Subsidence Management Plan as part of its OBMP implementation status reporting. The updated Chino Basin Subsidence Management Plan is anticipated to be completed by the end of FY 2026/27.

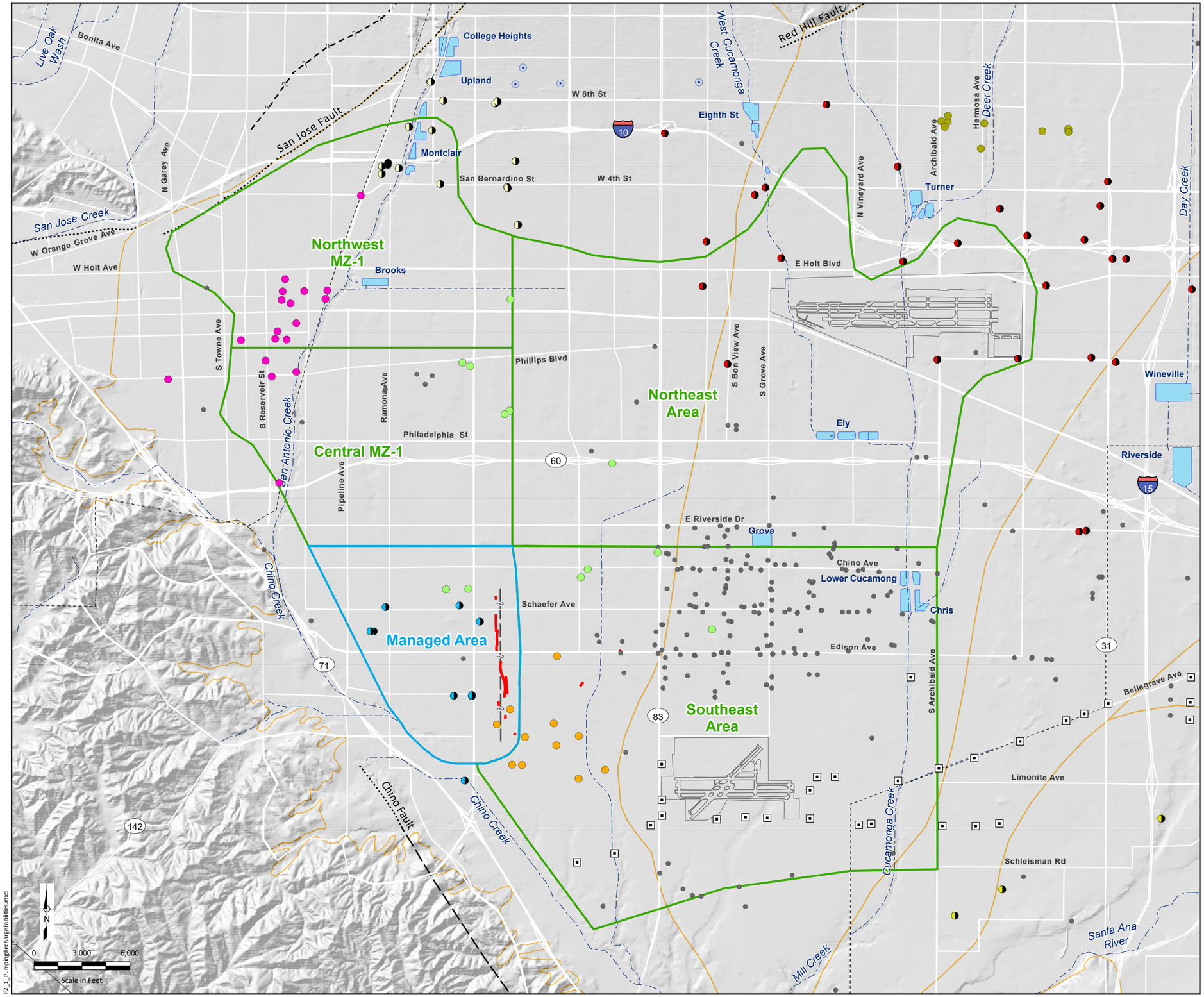
It should be noted that future monitoring and analyses always hold the potential for revisions to the Guidance Criteria, consistent with the adaptive management approach called for in the Chino Basin Subsidence Management Plan.

2.2.2 Northeast Area Subsidence Investigation

In the Northeast Area, the long- and short-term InSAR estimates indicate that persistent downward ground motion has occurred in a concentrated area in the vicinity of Whispering Lakes Golf Course, south of the Ontario Airport between Vineyard Avenue and Archibald Avenue. The western and eastern edges of this subsiding area exhibit steep subsidence gradients (i.e., differential subsidence).

In FY 2021/22, the Watermaster conducted a reconnaissance-level subsidence investigation of the Northeast Area focusing on the Whispering Lakes Subsidence Feature. This investigation included collection, review, and analysis of available borehole and lithologic data, pumping and recharge data, hydraulic head measurements, and InSAR estimates of vertical ground motion. Figures and charts were prepared for the *2021-22 Annual Report of the GLMC* to support the data analysis, interpretations, and recommendations for future investigations and monitoring.

For this annual report, additional monitoring and analysis of groundwater pumping, land use, and land subsidence as measured by InSAR were conducted for the period 2025-26. The results, conclusions, and recommendations of the analysis are reported in Section 3.5.



Active Groundwater Pumping Wells
April 1, 2025 to March 31, 2026

- Private
- California Institution for Men
- Chino Basin Desalter Authority
- City of Chino
- City of Chino Hills
- City of Ontario
- City of Pomona
- City of Upland
- Cucamonga Valley Water District
- Golden State Water Company
- Jurupa Community Services District
- Monte Vista Water District

Other Features

- Managed Area
- Areas of Subsidence Concern
- Flood Control and Conservation Basins

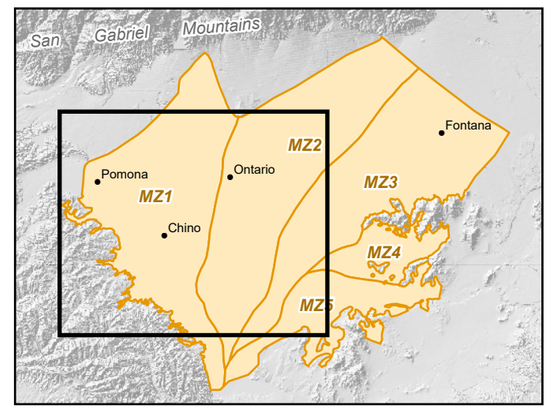


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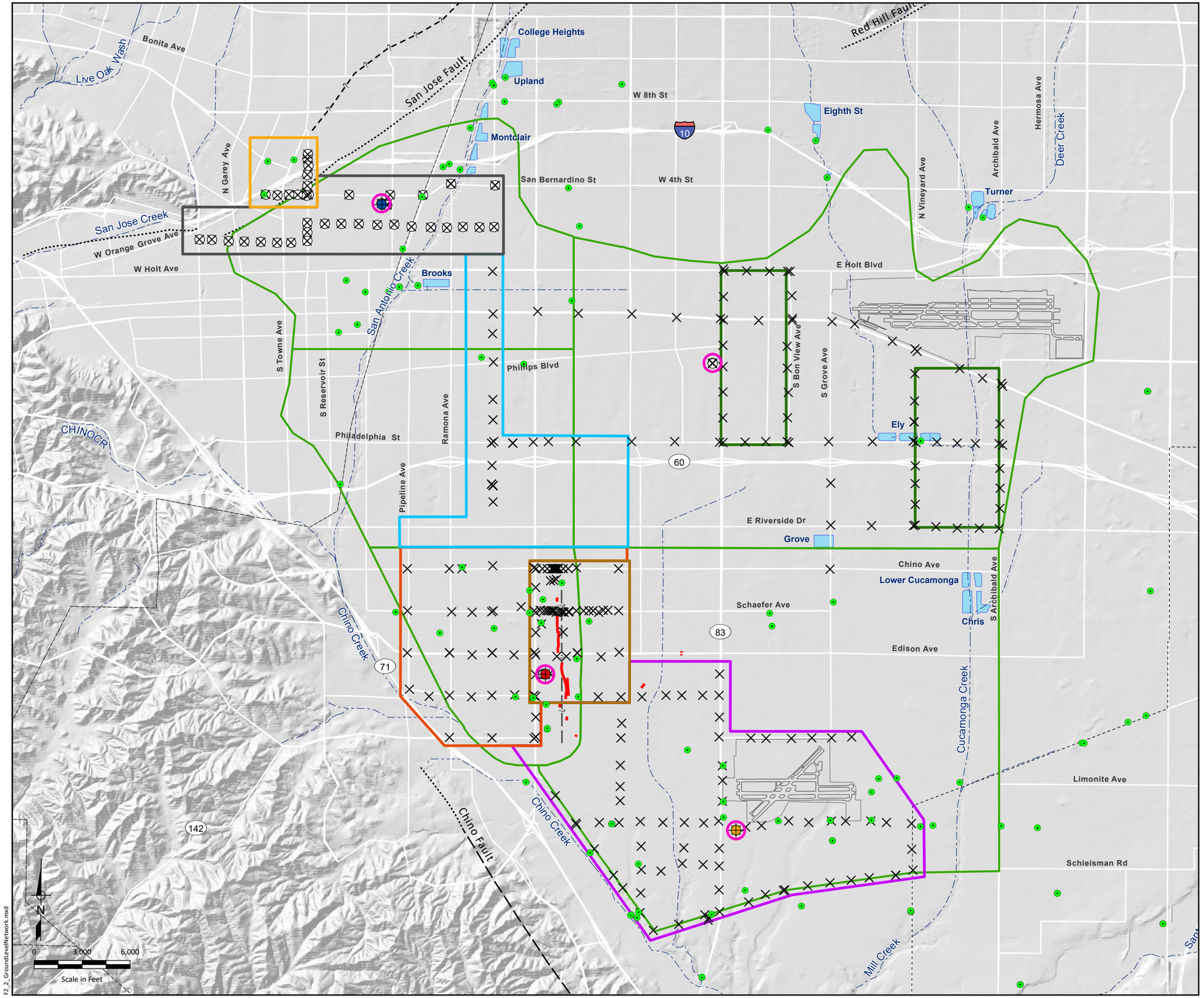
Figure 2-1

Pumping and Recharge Facilities
Western Chino Basin: 2025/26



Ground-Level Monitoring Network Facilities

- Pomona Extensometer
- Ayala Park Extensometer
- Chino Creek Extensometer
- All Program Transducer Wells
- GPS Control Points
- Ground-Level Survey Benchmark
- Ground-Level Benchmark (Measured April 15, 2026)

Ground-Level Survey Areas

- Managed Area
- Fissure Zone Area
- Central Area
- Northwest Area
- San Jose Fault Zone Area
- Northeast Area
- Southeast Area

Other Features

- Areas of Subsidence Concern
- Flood Control and Conservation Basins

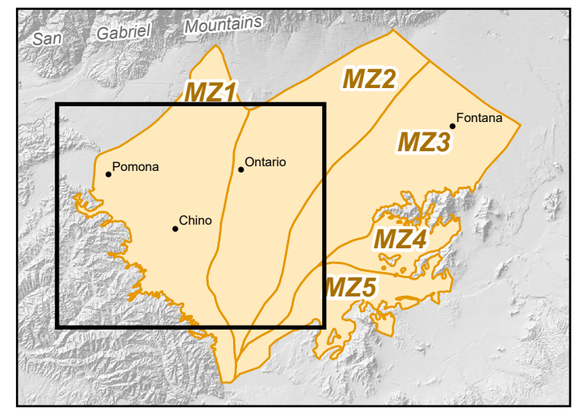


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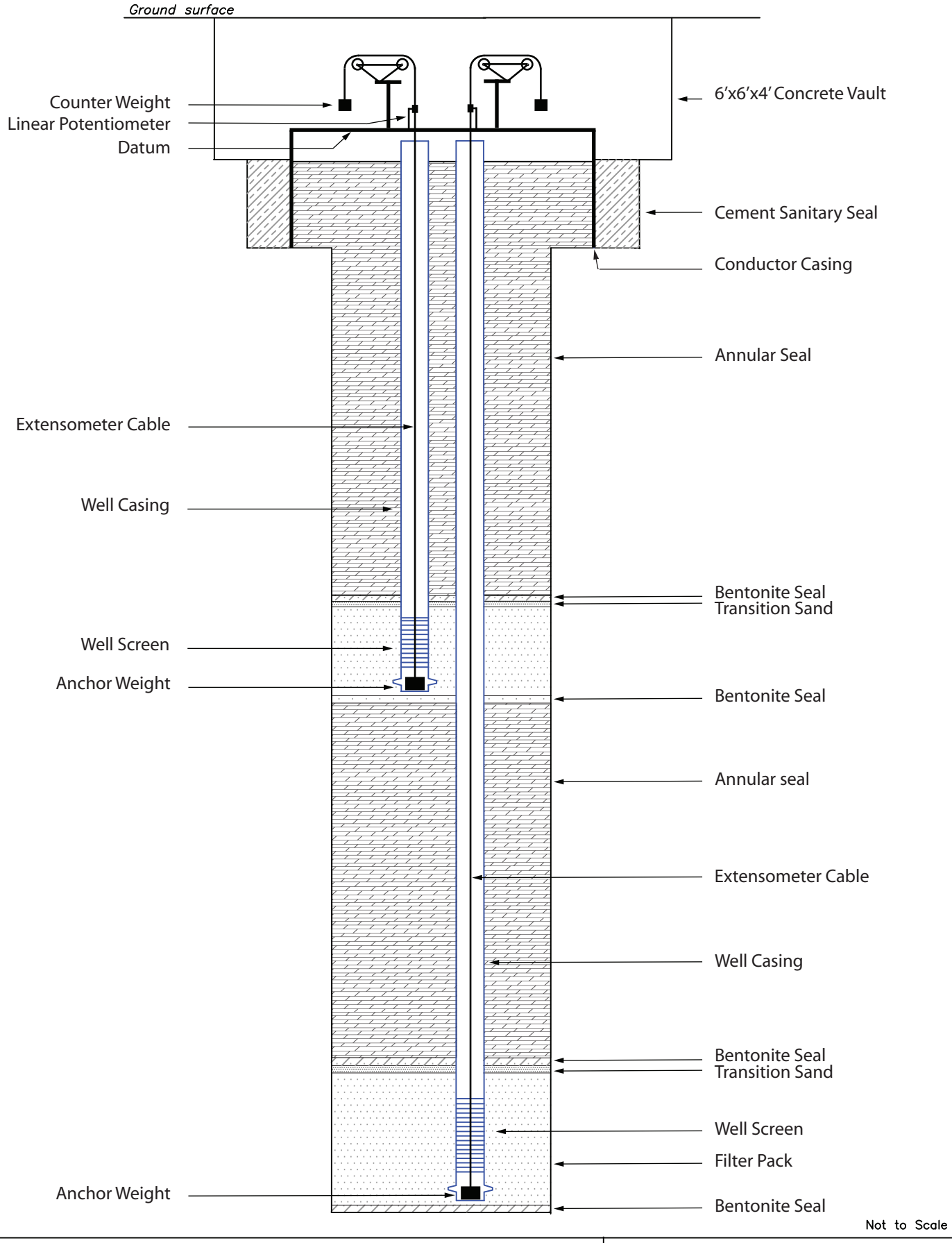
Figure 2-2

Ground-Level Monitoring Network Western Chino Basin



Prepared by:

WEST YOST

Prepared for:

Chino Basin Watermaster
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Dual-Nested Cable Extensometer
Conceptual Schematic

Figure 2-3

3.0 RESULTS AND INTERPRETATIONS

This section describes the results and interpretations derived from the GLMP for the Managed Area and Areas of Subsidence Concern in the Chino Basin for the March 2025 to March 2026 reporting period. Figures 3-1a, 3-1b, 3-1c, 3-1d, and 3-1e are maps that display vertical ground motion as measured by InSAR across the western portion of the Chino Basin between the periods of March 2011 and March 2026, March 2025 and March 2026, March 2011 and March 2016, March 2016 and March 2021, and March 2021 and March 2026, respectively. The maps also show the locations and magnitude of pumping and artificial recharge, which represent the stresses to the aquifer-system that can cause ground motion. Data shown on these and other figures are described and interpreted in this section to describe the historical and current state of land subsidence across the five Areas of Subsidence Concern in the Chino Basin. In general, the rates of subsidence have been slowing and there have been no documented reports of ground fissuring or damage to overlying infrastructure during the reporting period.

3.1 Managed Area

The Managed Area is the primary focus of the Subsidence Management Plan. The discussion below describes the results and interpretations of the monitoring program in the Managed Area and, where appropriate, relative to the Guidance Criteria in the Subsidence Management Plan.

3.1.1 History of Stress and Strain in the Aquifer-System

Figure 3-2 illustrates the long-term history of groundwater pumping, hydraulic heads, and vertical ground motion in the Managed Area. Also shown is the volume of the direct use of recycled water in the Managed Area, which is an alternative water supply that can result in decreased groundwater pumping from the area. Recycled water is often used for irrigation purposes and can contribute to groundwater recharge to the shallow aquifer-system as well. General observations and interpretations from this chart are:

- Pumping from the shallow aquifer-system between the 1930s and about 1977 caused hydraulic heads to decline by about 150 ft. From 1978 to 1990, hydraulic heads recovered by about 50 ft.
- Pumping from the confined, deep aquifer-system during the 1990s caused hydraulic heads to decline, coinciding with high rates of land subsidence. About 2.5 ft of subsidence occurred from 1987 to 1999, and ground fissures opened within the City of Chino in the early 1990s.
- Since the early 2000s, groundwater pumping decreased, hydraulic heads in the deep aquifer-system recovered, and the rate of land subsidence declined significantly across the Managed Area.
- The direct use of recycled water, which began in 1997, may have contributed to decreased groundwater pumping from the area, which in turn, may have contributed to the observed increases in hydraulic heads in the Managed Area.
- Since 2005, hydraulic heads at PA-7 have not declined below the Guidance Level, and very little inelastic compaction was recorded in the Managed Area. These observations demonstrate the effectiveness of the Subsidence Management Plan in the management of land subsidence in the Managed Area.

3.1.2 Recent Stress and Strain in the Aquifer-System

This subsection discusses the last 15 years of groundwater pumping, changes in hydraulic heads, and vertical ground motion in the Managed Area under the Subsidence Management Plan.

3.1.2.1 Groundwater Pumping and Hydraulic Heads

Table 3-1 summarizes groundwater pumping by well within the Managed Area for Fiscal Year 2012 through March 2026. Groundwater pumping in the Managed Area has declined from about 5,772 acre-feet (af) in 2012 to almost negligible volumes since 2019 through 2026. A total of about 205 af of groundwater pumping occurred in the Managed Area from April 1, 2025, to March 31, 2026, and 100 percent of the groundwater pumping was from wells screened across the shallow aquifer-system.

Figure 3-3 displays the hydraulic stresses and mechanical strains that have occurred within the shallow and deep aquifer-systems in the Managed Area over the period January 2011 through March 2026. The figure includes three time-series charts: quarterly groundwater pumping (hydraulic stress to the aquifer-systems); the resultant head changes (hydraulic responses to pumping); and aquifer-system deformation as measured at the Ayala Park Extensometers (mechanical strain that occurred within the aquifer-system sediments in response to the head changes). The following are observations and interpretations regarding pumping and head changes:

- From 2011 to 2018, there was a seasonal pattern of pumping in the Managed Area – increased pumping during the spring to fall and decreased pumping during the winter. Since 2018, very little pumping has occurred in the Managed Area.
- Hydraulic heads respond differently to the pumping stresses in the shallow and deep aquifer-systems. Pumping from the deep confined aquifer-system causes a hydraulic head decline that is much greater in magnitude than the hydraulic head decline caused by pumping from the shallow aquifer-system despite that more groundwater pumping has occurred from the shallow aquifer-system.
- The hydraulic head at PA-7 (deep aquifer-system) has fluctuated from a low of approximately 190 ft-btoc in August 2013 to a high of about 48 ft-btoc in April 2026 and has not declined below the Guidance Level of 245 ft-btoc.
- The recovery of hydraulic heads in the deep aquifer-system to above 90 ft-btoc in May 2025 represented “full recovery” of hydraulic head at PA-7 as defined in the Subsidence Management Plan.
- Since the first instance of full recovery in 2012, the hydraulic head at PA-7 recovered to 90 ft-btoc or greater in 2016, 2018, 2019, 2022, 2023, and 2025 which complies with the recommendation in the Subsidence Management Plan for full recovery within the deep aquifer-system at least once every five years.[11]

[11] Page 2-2 in the Subsidence Management Plan, Section 2.1.1.3—Recovery Periods: “Every fifth year, Watermaster recommends that all deep aquifer-system pumping cease for a continuous period until water-level recovery reaches 90 ft-btoc at PA-7. The cessation of pumping is intended to allow for sufficient water-level recovery at PA-7 to recognize inelastic compaction, if any, at the Ayala Park Extensometer and at other locations where groundwater-level and ground-level data are being collected.”

- Since 2018, hydraulic heads at PA-10 and PA-7 have increased to relatively high levels because of very little pumping from the shallow and deep aquifer-systems in the Managed Area. On April 1, 2026, heads were at or near their highest recorded levels, at about 48 ft-btoc in both PA-10 and PA-7.

3.1.2.2 Aquifer-System Deformation

Figure 3-3 also includes a time-series chart of vertical deformation of the aquifer-system as measured at the Ayala Park Extensometers for the period January 2011 through March 2026. The following are observations and interpretations regarding aquifer-system deformation in response to the pumping and head changes:

- There has been seasonal compression and expansion of the aquifer-system in response to the seasonal decline and recovery of hydraulic heads, which indicates that the vertical deformation of the aquifer-system was mainly elastic during this period.
- However, between April 6, 2011 and May 3, 2018 (dates of full recovery at PA-7 to 90 ft-btoc), the Ayala Park Deep Extensometer recorded about 0.03 ft of aquifer-system compression, which indicates that this compression was permanent compaction that occurred within the depth interval of 30-1,400 ft-bgs.[12]
- From May 3, 2018 to May 22, 2025 (dates of full recovery at PA-7), the Deep Extensometer recorded multiple cycles of aquifer-system compression and expansion in response to multiple cycles of decline and recovery of hydraulic heads at PA-7. For much of this period, hydraulic heads at PA-7 remained above 90 ft-btoc (i.e., the full recovery threshold) and the Deep Extensometer recorded about 0.05 ft of expansion, indicating that the vertical deformation of the aquifer-system was mainly elastic.
- Since May 2025, hydraulic heads at PA 7 have remained above the full recovery threshold and increased to their highest recorded levels, and concurrently, the Deep Extensometer recorded its highest level of expansion. These trends indicate that vertical deformation of the deep aquifer-system sediments was mainly elastic from May 2025 to April 2026.

Figure 3-4 is a stress-strain diagram of hydraulic heads measured at PA-7 (stress) versus vertical deformation of the aquifer-system sediments as measured at the Deep Extensometer (strain). This diagram provides additional information on the nature of the aquifer-system deformation (i.e., elastic versus inelastic deformation). The hysteresis loops on this figure represent cycles of hydraulic head decline-recovery and the resultant compression-expansion of the aquifer-system sediments. The diagram can be interpreted to understand the timing and magnitude of the occurrence of inelastic compaction within the depth interval of the aquifer-system that is penetrated by the Deep Extensometer. Hydraulic head decline (drawdown) is shown as increasing from bottom to top on the y-axis, and aquifer-system compression (compaction) is shown as increasing from left to right on the x-axis. The following are observations and interpretations regarding aquifer-system deformation in response to the head changes:

- From May 2006 to May 2018, the hysteresis loops progressively shifted to the right on this chart, indicating that about 0.065 ft of inelastic compaction occurred during this time-period. However, the rate of inelastic compaction appeared to gradually decline over this 12-year period.

[12] The analysis of full recovery and inelastic compaction at Ayala Park was included in the 2016 Annual Report (WEI, 2016).

- From May 2018 to May 2025, the hydraulic heads at PA-7 fluctuated between about 60-120 ft-btoc, with hydraulic heads remaining about 90 ft-btoc (i.e., the full recovery threshold) for much of this time. During this period, the hysteresis loops started to overlap one another and then shifted to the left, indicating that the vertical deformation of the aquifer-system was mainly elastic expansion of the aquifer-system sediments.
- Since May 2025, hydraulic heads at PA-7 have increased and returned to about 48 ft-btoc. The hysteresis loops continued to overlap loops from prior time periods—indicating that the vertical deformation of the aquifer-system has remained elastic.

3.1.2.3 Vertical Ground Motion

Vertical ground motion is measured across the Managed Area via InSAR, traditional ground-level surveys, and the Deep Extensometer. Figures 3-1a, 3-1b, 3-1c, 3-1d, and 3-1e illustrate vertical ground motion[13] as estimated by InSAR for the periods of March 2011 and March 2026, March 2025 and March 2026, March 2011 and March 2016, March 2016 and March 2021, and March 2021 and March 2026, respectively.

Where coherent, the InSAR estimates of vertical ground motion from 2011 to 2026 shown on Figure 3-1a range from about +0.12 ft to -0.08 ft across the Managed Area. The greatest downward ground motion occurred in the southeastern portion of the Managed Area. The InSAR estimates of vertical ground motion from 2025 to 2026 shown on Figures 3-1b indicate minor upward vertical ground motion across the Managed Area.

The City of Chino Well 15 (C-15) is in the northern portion of the Managed Area, is screened across both the shallow and deep aquifers, and has been equipped with a transducer that measures and records hydraulic heads once every 15 minutes. These InSAR and hydraulic head data at the C-15 location provide information on the nature of the aquifer-system deformation that occurred in this area (i.e. elastic versus inelastic deformation). Figure 3-5 is a time-series chart that compares the hydraulic heads at C-15 to vertical ground motion as measured by InSAR at the same location between 2005 and 2026. The main observations from this chart are:

1. The InSAR record at C-15 is measuring seasonal elastic vertical ground motion which is caused by seasonal fluctuations in hydraulic head and the resultant seasonal elastic deformation in the aquifer-system(s). The seasonal fluctuations of hydraulic head at C-15 are coincident with the seasonal fluctuations of vertical ground motion measured by InSAR at the same location.
2. From 2007 to 2018, InSAR indicates a long-term trend of downward ground motion at C-15. However, hydraulic heads at C-15 during this same time-period increased, indicating that at least 0.28 ft of subsidence was caused by inelastic compaction of the aquifer-system. The inelastic compaction that occurred during this period of increasing hydraulic head most likely represents the delayed drainage and compaction of aquitards due to historical head declines that occurred prior to 2007.

[13] Upward vertical ground motion is indicated by positive values; downward vertical ground motion is indicated by negative values.

3. Since 2018, the long-term subsidence trend appears to have stopped, indicating that inelastic compaction of the aquitards has also stopped. This observation is supported by the Deep Extensometer record, which indicates mostly elastic deformation of the aquifer-system since 2018 (see Figure 3-4). The recent cessation of subsidence observed at C-15 is likely a result of increasing hydraulic heads in the aquifers, which has led to equilibration with hydraulic heads in the aquitards and the cessation of aquitard drainage and compaction.
4. The California Department of Water Resources (DWR) has recently provided guidance for using monitoring data (i.e., ground motion and head data) to estimate critical head "thresholds" as management criteria to protect against the future occurrence of land subsidence.[14] Using the DWR's "Empirical Analysis" method, when groundwater elevations at C-15 remain above about 588 ft-above mean sea level (ft-amsl), no permanent land subsidence occurs at this location.

3.2 Southeast Area

Vertical ground motion is measured across the Southeast Area via InSAR, traditional ground-level surveys, and the Chino Creek Extensometer Facility (CCX). The InSAR results (Figures 3-1a through 3-1e) are somewhat incoherent across much of this area because the overlying agricultural land uses are not hard, consistent reflectors of radar waves. In addition, recent construction activities have altered land cover and surface reflectivity, further reducing InSAR reliability in some locations. Where InSAR results are incoherent, the history of subsidence is best characterized by ground-level surveys and the CCX.

Figure 3-6 is a time-series chart that displays and describes the history of groundwater pumping, the direct reuse of recycled water, hydraulic heads, and vertical ground motion in the Southeast Area from 1930 to 2026. Vertical ground motion is estimated by InSAR, extensometer data, and ground-level surveys across the Southeast Area from 1987 to 2026; however, ground-level survey data were not acquired in this area since 2024. The main observations and interpretations from Figure 3-6 are:

- From the 1940s to about 1968, hydraulic heads declined by up to about 75 ft. There is a data gap from about 1968 to 1988; however, it is likely that hydraulic heads continued to decline from 1968 to 1978, as was the case in most portions of the Chino Basin during this period. In the western portion of the Southeast Area, hydraulic heads remained relatively stable from 1988 to 2010 and then gradually increased by about 10 to 30 ft from 2010 to 2026 (see wells CH-18A, C-13, CCPA-1, and CCPA-2). In the eastern portion of the Southeast Area, hydraulic heads have been gradually declining by about 5 to 15 ft between 2005 and March 2026 (see wells HCMP-1/1 and HCMP-1/2) likely in response to pumping at the Chino Basin Desalter Authority (CDA) wells.
- Figure 3-6 also displays vertical ground motion as estimated by InSAR, periodic ground-level surveys, and deep aquifer extensometer data located at CCX-2. All three methods indicate relatively minor ground motion over the period and similar, but not exact, spatial patterns and magnitudes of ground motion across the Southeast Area. These differences are likely related to the relative incoherence of the InSAR results, differences in the timing of the ground-level surveys and the SAR acquisition, and/or the relative errors associated with each monitoring technique. From 1987-2024, maximum downward ground motion of about 0.6 ft was

[14] https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents

estimated by ground-level surveys in the northwestern portion of the area (BM-137/61). From 2011-2026, maximum downward ground motion of about 0.36 ft was estimated by InSAR in the northeastern portion of the area (north of Chino Avenue). From 2012-2026, about 0.02 ft of upward ground motion was estimated by the deep aquifer extensometer data recorded at CCX-2. This gradual downward ground motion measured by the ground-level surveys and InSAR most likely represents the delayed drainage and compaction of aquitards due to the historical head declines that occurred prior to the Judgment.

- For the current period March 2025 and March 2026, hydraulic heads remained relatively stable or increased across most of the area, and Figures 3-1b and 3-6 indicate minor ground motion across most of the Southeast Area.

Figure 3-7 displays the time series of hydraulic heads and vertical aquifer-system deformation recorded at the CCX, which began collecting data in July 2012. In general, hydraulic heads at the CCX vary seasonally and remained relatively stable or increased since 2012, and a small amount of elastic expansion of the aquifer-system has been measured by the CCX extensometers. Groundwater pumping began at the Chino Creek Well Field in 2014, but appears to have had little, if any, effect on hydraulic heads or aquifer-system deformation at the CCX through March 2026. However, pumping from the deep aquifer-system at CDA Wells 1 through 4 restarted in 2023 and caused about 10 ft of decline in hydraulic heads at the CCPA-2 well and about 0.024 ft of compression of the aquifer-system as recorded at the CCX-2 extensometer. In general, the aquifer-system deformation recorded at the CCX is minor and likely elastic, which is consistent with the estimates of vertical ground motion as measured by InSAR and ground-level surveys (as shown on Figures 3-1a through 3-1e and 3-6).

3.3 Central MZ-1

Vertical ground motion is measured across Central MZ-1 via InSAR and traditional ground-level surveys. Figures 3-1a through 3-1e are maps that display vertical ground motion as measured by InSAR across Central MZ-1 over various periods during March 2011 to March 2026. The InSAR results are generally coherent across this area because the overlying land uses are urban and serve as hard and consistent reflectors of radar waves. Ground-level surveys are performed periodically along the eastern portion of the area. Figure 3-8 is a time-series chart that displays and describes the long-term history of pumping, recharge, hydraulic heads, and vertical ground motion in Central MZ-1. The following observations and interpretations are derived from these figures:

- Hydraulic head data are absent in the southern portion of Central MZ-1. In the northern portion of Central MZ-1, hydraulic heads declined by about 200 ft from 1930 to about 1978. From 1978 to 1986, hydraulic heads increased by about 80 ft and remained relatively stable or slightly increased from 1986 to 2026. Recent hydraulic heads (1986 to 2026) in the northern portion of Central MZ-1 are about 120 ft lower than the hydraulic heads in the 1930s.
- About 1.8 ft of subsidence occurred near Walnut and Monte Vista Avenue from 1988 to 2000, as measured by ground-level surveys at BM 125/49. Since 2000, the rate of subsidence has slowed significantly, with about 0.34 ft of additional subsidence occurring at a declining rate from 2000 to 2021, the most recent year this benchmark was surveyed. The timing and magnitude of vertical ground motion along the eastern side of Central MZ 1 are similar to those observed in the Managed Area, suggesting that similar aquifer mechanics may be contributing to land subsidence in both areas. However, there is insufficient historical head data in this area to confirm this relationship.

- Figure 3-1a shows that the areas that experienced the greatest magnitude of subsidence from March 2011 to March 2026 are in the eastern portion of Central MZ-1, where up to about 0.32 ft of downward ground motion has occurred—an average rate of about 0.02 ft/yr. Hydraulic heads remained relatively stable in this area from 2011 to 2026, which indicates that the downward vertical ground motion was, at least in part, permanent subsidence due to delayed aquitard drainage in response to the historical declines in hydraulic heads that occurred from 1930 to 1978.
- The ground motion measured by InSAR on Figure 3-1a also shows that the groundwater barrier (Riley Barrier) in the Managed Area may extend northward into Central MZ-1 to at least Mission Boulevard. This observation is evidenced by a steep subsidence gradient located just east of Central Avenue.
- Figure 3-1b shows that between March 2025 and March 2026 minor upward vertical ground motion occurred across most of Central MZ-1 while heads remained relatively stable or increased—indicating that delayed aquitard drainage has ceased in this area.

3.4 Northwest MZ-1

Vertical ground motion is measured across Northwest MZ-1 via InSAR and ground-level surveys. The InSAR results are generally coherent across this area because the overlying land uses are urban and serve as hard, consistent reflectors of radar waves. Ground-level surveys have been performed annually in the early spring across the area to supplement and check the InSAR estimates of vertical ground motion.

Figures 3-1a through 3-1e are maps that display vertical ground motion as measured by InSAR across Northwest MZ-1 over various periods during March 2011 to March 2026. Figure 3-9a is a time series chart that displays the long-term history of pumping, recharge, hydraulic heads, and vertical ground motion in Northwest MZ-1. Figure 3-9b displays the most recent estimates of vertical ground motion from InSAR and ground-level surveys across Northwest MZ-1 from March 2017 to April 2026. The following observations and interpretations are derived from these figures:

- From about 1930 to 1978, hydraulic heads in Northwest MZ-1 declined by about 200 ft. From 1978 to 1985, hydraulic heads increased by about 100 ft. From 1985 to 2026 hydraulic heads fluctuated but remained relatively stable at elevations well below the levels of 1930.
- A maximum of about 1.46 ft of subsidence occurred in this area from 1992 through March 2026—an average rate of about 0.04 ft/yr—while hydraulic heads remained relatively stable. The persistent subsidence that occurred from 1992 to 2026 cannot be entirely explained by the concurrent changes in hydraulic heads. A plausible explanation for this subsidence is that thick, slow-draining aquitards have been permanently compacting in response to the historical declines in hydraulic heads that occurred between 1930 and 1978.
- From March 2011 to March 2026, the InSAR results indicate that the maximum rate of downward ground motion in Northwest MZ-1 slowed to about 0.033 ft/yr. This resulted in a maximum of about 0.48 ft of downward ground motion near the intersection of Indian Hill Boulevard and San Bernardino Street.

- Figure 3-9b shows that the ground-level survey results from 2017 to 2026 indicate a similar spatial pattern of downward ground motion as estimated by InSAR, although the InSAR results generally indicate greater magnitudes of downward ground motion near the PX facility. These differences may be related to the different timing of the ground-level surveys and the SAR acquisition, differences in reference elevations, and/or relative errors associated with each monitoring technique.
- Figure 3-1b shows that InSAR data from March 2025 to March 2026 indicate minor downward ground motion of approximately 0.02 feet in the Northwest MZ-1 Area. In contrast, ground-level survey results (Figure 3-9a) show downward ground motion of about 0.05 ft during the same period. These differences are most likely related to the different timing of the ground-level surveys and the SAR acquisition and/or relative errors associated with each monitoring technique.
- Figures 3-1c through 3-1e are InSAR maps that illustrate the slowing rate of subsidence in Northwest MZ-1 from 2011-2026: about 0.28 ft of subsidence from 2011 to 2016; 0.12 ft of subsidence from 2016 to 2021; and 0.08 ft of subsidence from 2021 to 2026. This slowing rate of subsidence is likely due to a combination of increasing heads associated with reduced groundwater pumping and increased recharge, as shown on Figure 3-9a, and the gradual equilibration of hydraulic heads between aquifers and aquitards, which reduces the rate of delayed aquitard drainage and compaction associated with the historical groundwater level declines.

As described above, Figure 3-1a shows that maximum downward ground motion during 2011-2026 occurred near the intersection of Indian Hill Boulevard and San Bernardino Street. City of Pomona Well 30 (P-30) is a non-pumping well located just south of this area and is screened across the shallow aquifer and upper portion of the deep aquifer. P-30 was equipped with a transducer that measured and recorded hydraulic heads at 15-minute intervals from September 2006 to September 2024. The transducer was temporarily removed to accommodate ongoing well improvements and will be reinstalled upon completion of the work. In the meantime, water levels are being measured manually on a monthly basis. These data can provide information on the nature of the aquifer-system deformation that occurred in this area (i.e., elastic versus inelastic deformation). Figure 3-10 is a time-series chart that compares the hydraulic heads at P-30 to vertical ground motion as estimated by InSAR between 2006 and 2026. The main observations from this chart are:

- The InSAR record at P-30 shows seasonal elastic vertical ground motion that generally coincides with fluctuations in hydraulic head, indicating elastic deformation of the aquifer-system. However, the long-term trend of subsidence persisted at a decreasing rate between 2005 and 2026 despite periods of hydraulic head recovery.
- InSAR indicates a long-term trend of downward ground motion at P-30 from 2005 to 2017. However, hydraulic heads at P-30 during this same period increased, indicating that at least about 0.37 ft of subsidence was caused by inelastic compaction of the aquifer-system. The inelastic compaction that occurred during this period of increasing hydraulic heads most likely represents the delayed drainage and compaction of aquitards due to historical head declines.
- Between 2018 and 2026, the long-term subsidence trend appeared to have slowed, indicating that inelastic compaction of the aquitards had also slowed. The recent slowing of subsidence observed at P-30 was likely a result of increasing hydraulic heads in the aquifers, which has led to equilibration with hydraulic heads in the aquitards and the slowing of aquitard drainage and compaction.

- Between 2018 and early 2026, the hydraulic head at P-30 experienced seven cycles of head decline and recovery. The head decline and recovery at P-30 appears to be contemporaneous with the downward and upward vertical ground motion measured by InSAR at P-30 during this same period. These observations suggest that in Northwest MZ-1 changes in hydraulic heads, which are controlled by the pumping and recharge stresses in the area, control the pattern and rate of subsidence.
- The DWR has recently provided guidance for using monitoring data (i.e., ground motion and head data) to estimate critical head "thresholds" as management criteria to protect against the future occurrence of land subsidence.[14] Using the DWR's "Empirical Analysis" method, which is based on its Subsidence Best Management Practices, when groundwater elevations at P-30 remain above about 568 ft-amsl, very little permanent land subsidence occurs at this location.

3.5 Northeast Area

Vertical ground motion is measured across the Northeast Area via InSAR and ground-level surveys. In December 2017, a new network of benchmarks was installed across the Northeast Area (see Figure 2-2) and surveyed for initial elevations in January 2018. The Northeast Area benchmark network was last surveyed April 2020. In April 2026, Watermaster established a new benchmark monument in the Northeast Area near well ONT-33 and De Anza Park in the City of Ontario to serve as a control point for future GPS surveys. Beginning in 2026/27, the Watermaster Engineer recommends using this control point for annual GPS surveys of vertical ground motion in the Northeast Area.

Figures 3-1a through 3-1e are maps that display vertical ground motion as measured by InSAR across Northeast Area over various periods during March 2011 to March 2026. Figure 3-11 is a time-series chart that displays and describes the long-term history of pumping, recharge, hydraulic heads, and vertical ground motion in the Northeast Area. The following observations and interpretations are derived from these figures:

- From 1930 to 1978, hydraulic heads in the Northeast Area declined by about 125 ft. From 1978 to 1985, hydraulic heads increased by about 25 ft. From 1985 to 2026, hydraulic heads fluctuated but have generally remained relatively stable.
- From 1992 to 2026, about 1.18 ft of subsidence occurred in the Northeast Area near the intersection of Euclid Avenue and Phillips Street (Point D on the inset map on Figure 3-11). From 1992 to 2011, the subsidence occurred at a gradual and persistent rate of about 0.04 ft/yr. From 2011 to 2026, the subsidence rate declined to about 0.02 ft/yr. Hydraulic heads have remained relatively stable in this area from 1992-2026, which indicates that the downward ground motion was, at least in part, permanent subsidence due to delayed aquitard drainage in response to the historical declines in hydraulic heads that occurred from 1930 to 1978. The recent slowing of subsidence rates are likely due to decreases in pumping, increases in recharge, and equilibration of heads within the aquifers and aquitards.

3.5.1 Whispering Lakes Subsidence Feature

Figures 3-1a through 3-1e also show that downward ground motion has occurred in a concentrated area between Vineyard Avenue and Archibald Avenue, south of the Ontario International Airport in the vicinity of Whispering Lakes Golf Course in the City of Ontario (referred to herein as the Whispering Lakes Subsidence Feature). The Whispering Lakes Subsidence Feature was identified through enhanced processing and interpolation techniques used by General Atomics in post-processing the InSAR data and

preparing interferograms (see Section 2). Figure 3-1a indicates that a maximum of about 0.64 ft of downward ground motion occurred in this area from March 2011 to March 2026.

At the time of the recognition of the Whispering Lakes Subsidence Feature, there was not enough information to describe the history of the subsidence feature or its causes. As an initial step, the Watermaster Engineer performed a desktop investigation utilizing readily available data and information (the "Whispering Lakes Subsidence Investigation"). The specific objectives of the desktop investigation were to:

- Describe the history of the Whispering Lakes Subsidence Feature, including the extent and rate of subsidence.
- Attempt to identify the most plausible mechanism(s) causing the differential subsidence.
- Identify data gaps, if any, that need to be filled to characterize the extent, rate, and mechanisms of the differential subsidence.

The main potential mechanisms for the Whispering Lakes Subsidence Feature that were investigated included:

- Aquitard drainage and compaction
- Shallow soil consolidation due to historical land use and/or land use changes
- Differential tectonic movements

The results, conclusions, and recommendations of the Whispering Lakes Subsidence Investigation were published in the 2021/22 Annual Report of the GLMC.[15]

Since 2022, additional monitoring was conducted. Figure 3-12 is a series of air photo maps overlain with the annual subsidence contours from 2022-26 and cumulative subsidence contours from 2011-2026. Figure 3-12 demonstrates that: (i) land subsidence has continued to occur in this area at rates between 0.04 - 0.06 ft/yr during 2022-25, although the most recent InSAR data in 2026 indicate a decrease in the rate of subsidence; and (ii) the subsidence is spatially coincident with the Whispering Lakes Golf Course.

The Whispering Lakes Subsidence Investigation documented the history of overlying land uses in the vicinity of the Whispering Lakes Subsidence Feature, which included: agricultural, sewage disposal, and recreational (golf courses and parks). These overlying land uses could have involved disturbance, modifications, and additions to the shallow soils, which could have resulted in gradual consolidation of the shallow soils and the downward ground motion. These observations strongly suggest that the golf course and/or its prior land uses are related to the subsidence feature, and that shallow soil consolidation is responsible for the land subsidence. If true, groundwater management will have no effect on the Whispering Lakes Subsidence Feature.

Figure 3-13 is a map that displays the location and magnitude of earthquake epicenters relative to vertical ground motion as estimated by InSAR from March 2011 to March 2026 (see Section 3.6 below). A concentrated occurrence of earthquake epicenters is located just east of the Whispering Lakes Subsidence Feature, which may indicate an alternative mechanism for the subsidence.

[15] 2021/22 Annual Report of the GLMC

Based on the relatively minor subsidence observed since 2022 and lack of additional groundwater level data, the Watermaster Engineer does not recommend continuing the limited monitoring program in FY 2026/27. Vertical ground motion at the Whispering Lakes Subsidence Feature will continue to be monitored and evaluated using the high-resolution InSAR analyses prepared for the GLMC Annual Report.

The limited monitoring program should be reconsidered in future years if InSAR patterns change substantially at the Whispering Lakes Subsidence Feature or if Watermaster obtains access to nearby wells for groundwater level monitoring. Such monitoring could help determine whether aquitard drainage and groundwater utilization are contributing to the observed subsidence.

3.6 Seismicity

Tectonic displacement of the land surface on either side of geologic faults can be horizontal, vertical, or a combination of both. During a large earthquake, the land surface can deform suddenly (Weischet, 1963; Myers and Hamilton, 1964; Plafker, 1965). Aseismic creep is a process where smaller, more frequent earthquakes cause the land surface to deform more gradually (Harris, 2017).

Figure 3-13 is a map that displays the location and magnitude of earthquake epicenters relative to vertical ground motion as estimated by InSAR from March 2011 to March 2026. The main observations and interpretations derived from this figure are:

- The earthquake epicenters on Figure 3-13 do not show a spatial relationship to the differential subsidence that has occurred in Northwest MZ-1. Therefore, tectonic movement along the San Jose Fault Zone, including aseismic creep, is not the likely mechanism for the differential land subsidence that has occurred in Northwest MZ-1.
- Very little seismicity has occurred across the Areas of Subsidence Concern between March 2011 and March 2026. This observation indicates that the vertical ground motion that occurred in these areas is not related to tectonics (with the possible exception being the Whispering Lakes Subsidence Feature [see Section 3.5.1 above]).
- Most of the seismicity observed between March 2011 and March 2026 occurred in the eastern portion of the Chino Basin. The observed seismicity may reflect deep-seated convergence between the Perris Block that underlies the Chino Basin and the San Gabriel Mountains south of the Cucamonga Fault Zone (Morton and Yerkes, 1974; Morton et al., 1982; Morton and Matti, 1987).

3.7 Evaluation of Sentinel-1A and TerraSAR-X InSAR Data

As part of the approved FY 2025/26 scope and budget of the GLMC, the Watermaster Engineer evaluated Sentinel-1A InSAR data published by the DWR and compared the results with the TerraSAR-X InSAR data currently used for the GLMP. The purpose of this evaluation was to: (i) assess vertical ground motion across the eastern portion of the Chino Basin, where TerraSAR-X data are not currently purchased and used in the GLMP; and (ii) compare the Sentinel-1A and TerraSAR-X estimates across the western portion of the Basin where the datasets overlap. Figures 3-14 through 3-18 present the results of this comparison for June 2015 through March 2025.

Figures 3-14 and 3-15 compare cumulative vertical ground motion estimated by Sentinel-1A and TerraSAR-X across the western Chino Basin. The two datasets show generally similar spatial patterns of uplift and subsidence; however, there are significant differences in the magnitude and spatial detail of the vertical ground motion. TerraSAR-X is a higher-resolution dataset and more clearly delineates localized

areas of differential subsidence and their known boundaries. The TerraSAR-X results are averaged to approximately 15-meter grid cells, compared to approximately 100-meter grid cells for the DWR-provided Sentinel-1A data. The coarser spatial resolution of the Sentinel-1A data tends to smooth localized ground motion features and reduce the apparent magnitude of differential subsidence. This is particularly evident in Northwest MZ-1 along the San Jose Fault and in the Northeast Area at the Whispering Lakes Subsidence Feature. In these areas, the TerraSAR-X contours more closely align with the known boundaries of the subsidence features and show sharper subsidence gradients, whereas the Sentinel-1A contours extend beyond these boundaries and depict the subsidence as more regional in extent. TerraSAR-X also generally estimates greater magnitudes of downward ground motion.

An advantage of the Sentinel-1A dataset is its spatial coverage. Figure 3-16 indicates that relatively little vertical ground motion occurred across much of the eastern portion of Chino Basin from June 2015 through March 2025. The more pronounced areas of vertical ground motion remain concentrated primarily in the western portion of the Basin, where Watermaster currently conducts focused subsidence monitoring.

Figures 3-17 and 3-18 compare cumulative vertical ground motion estimated by Sentinel-1A and TerraSAR-X with groundwater elevations at wells C-15 and P-30, respectively. Both datasets show similar long-term patterns of vertical ground motion; however, from 2015 through 2024, the TerraSAR-X estimates generally show a closer correspondence with fluctuations in heads than Sentinel-1A. This relationship is particularly evident at C-15, where the timing and direction of TerraSAR-X ground motion more closely follow changes in hydraulic head. The final TerraSAR-X measurements in 2025 are an exception to this general relationship and may have been influenced by atmospheric effects associated with the final acquisition.

Based on these results and observations, Watermaster recommends continued use of TerraSAR-X InSAR data as the primary dataset for ongoing subsidence monitoring under the GLMP. TerraSAR-X provides higher spatial resolution, better delineates localized areas of differential subsidence and their boundaries, and generally shows a stronger correlation with measured hydraulic head changes.

Sentinel-1A provides a useful supplemental dataset because of its broader spatial coverage and public availability. The Sentinel-1A data indicate that little to no subsidence is currently occurring across most of the eastern Chino Basin; therefore, the Watermaster Engineer does not recommend expanding TerraSAR-X monitoring to this area. Instead, the Watermaster Engineer recommends reviewing the publicly available Sentinel-1A data approximately every five years to evaluate vertical ground motion in eastern Chino Basin.

Table 3-1. Groundwater Pumping in the Managed Area -- *2012 through 2026*

Well Name	Aquifer Layer	Annual Pumping, af														2026 Pumping, af [a]					
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2025 Qtr 4	2026 Qtr 1	2026 Qtr 2	2026 Qtr 3	2026 Qtr 4	By Layer
C-4	Shallow	752	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	
C-6		1018	961	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	
CH-1A		1194	872	679	873	770	607	584	0	0	0	0	0	0	0	0	0	0	0	-	
CH-7A		531	375	166	315	258	58	8	0	0	0	0	0	0	0	0	0	0	0	-	
CH-7B		690	410	22	643	435	84	498	0	0	0	0	0	0	0	0	0	0	0	-	
CIM-1		463	1,106	1,088	994	890	853	847	0	0	0	0	0	2	189	37	103	41	34	-	
XRef 8730[b]		1	5	5	5	3	3	55	29	29	30	17	29	22	29	7.35	7.35	9.80	9.80	-	
Sub-Totals		**4,649**	**3,728**	**1,960**	**2,830**	**2,355**	**1,604**	**1,993**	**29**	**29**	**30**	**17**	**29**	**24**	**218**	**44**	**110**	**51**	**44**	**-**	**205**
CH-17	Deep[c]	894	1,304	900	1,159	968	285	911	0	0	0	0	0	0	0	0	0	0	0	-	
CH-15B		0	0	133	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	-	
CIM-11A		229	441	140	150	81	220	27	0	1	5	41	2	1	0	0	0	0	0	-	
Sub-Totals		**1,123**	**1,745**	**1,173**	**1,308**	**1,049**	**505**	**938**	**0**	**1**	**5**	**41**	**27**	**1**	**0**	**0**	**0**	**0**	**0**	**-**	**0**
Totals		**5,772**	**5,473**	**3,133**	**4,138**	**3,404**	**2,110**	**2,930**	**29**	**31**	**34**	**58**	**55**	**24**	**218**	**44**	**110**	**51**	**44**	**-**	**205**

"C" = City of Chino

"CH" = City of Chino Hills

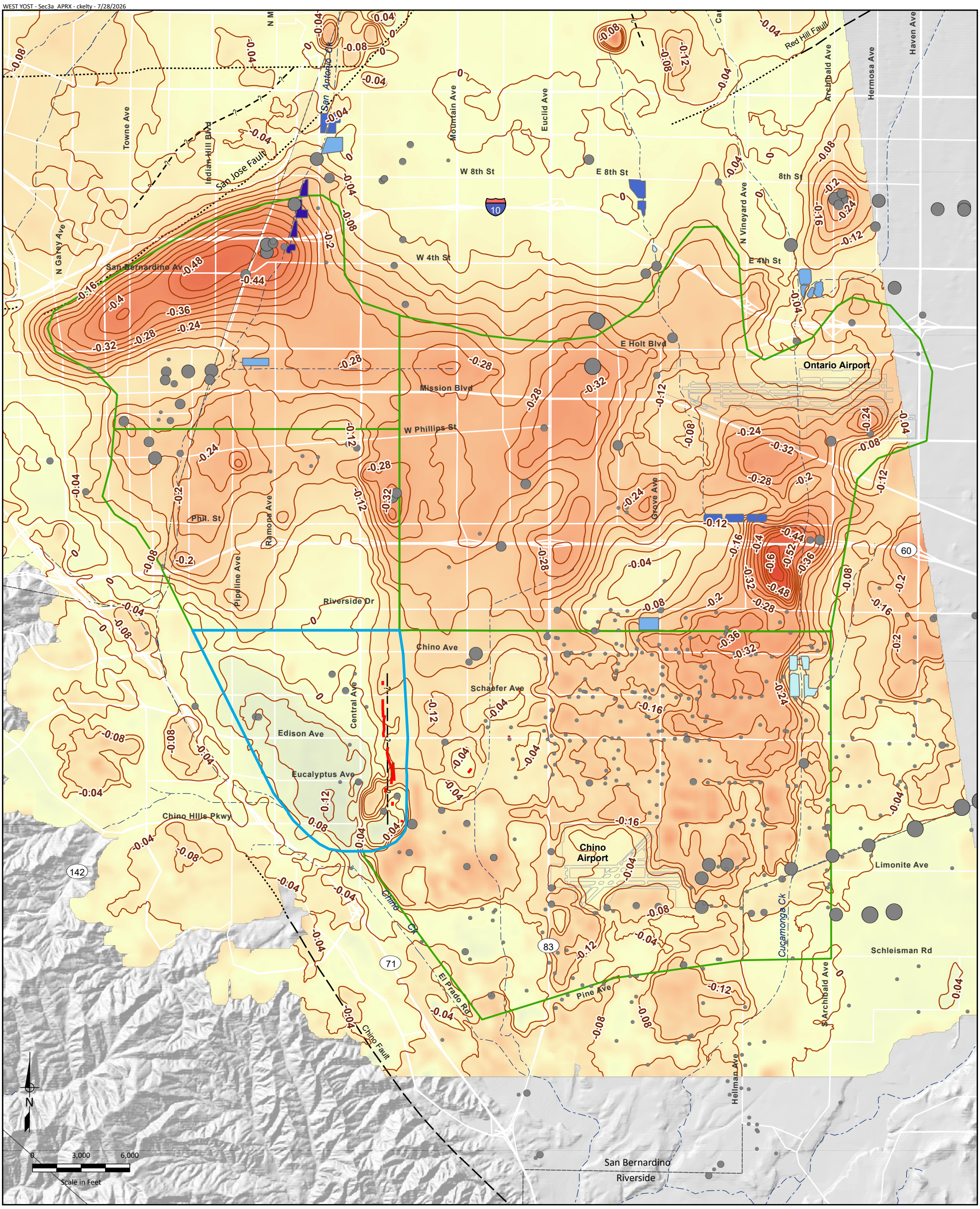
"CIM" = California Institution for Men

"XRef" = Private

(a) Annual pumping is reported on an April–March basis. Therefore, 2026 annual pumping consists of FY 2025 Q4 and FY 2026 Q1 through Q3. FY 2026 Q4 will be included in the 2027 annual pumping total.

(b) Well screen interval is unknown but assumed to be shallow based on typical well construction for other private wells in the vicinity.

(c) These wells have screen intervals that extend into the shallow-aquifer system, so a portion of the production comes from the shallow aquifer-system.



Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2026)

High : 0.65 ft

0 ft

Low : -0.65 ft

InSAR absent or incoherent

Managed Area

Areas of Subsidence Concern

Average Annual Groundwater Pumping
April 1, 2011 to March 31, 2026
(afy)

0 - 100

101 - 500

501 - 1,000

1,001 - 2,000

> 2,000

Historical Ground Fissures

Approximate Location of the Riley Barrier

Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)

Average Annual Basin Recharge
April 1, 2011 to March 31, 2026
(afy)

0

1- 1500

1500 - 2500

>2500

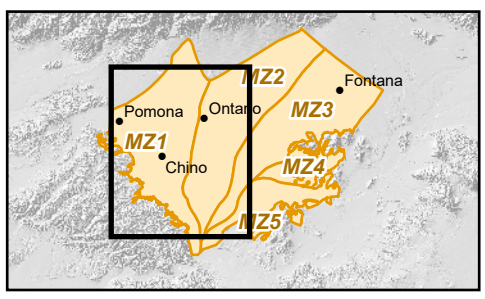


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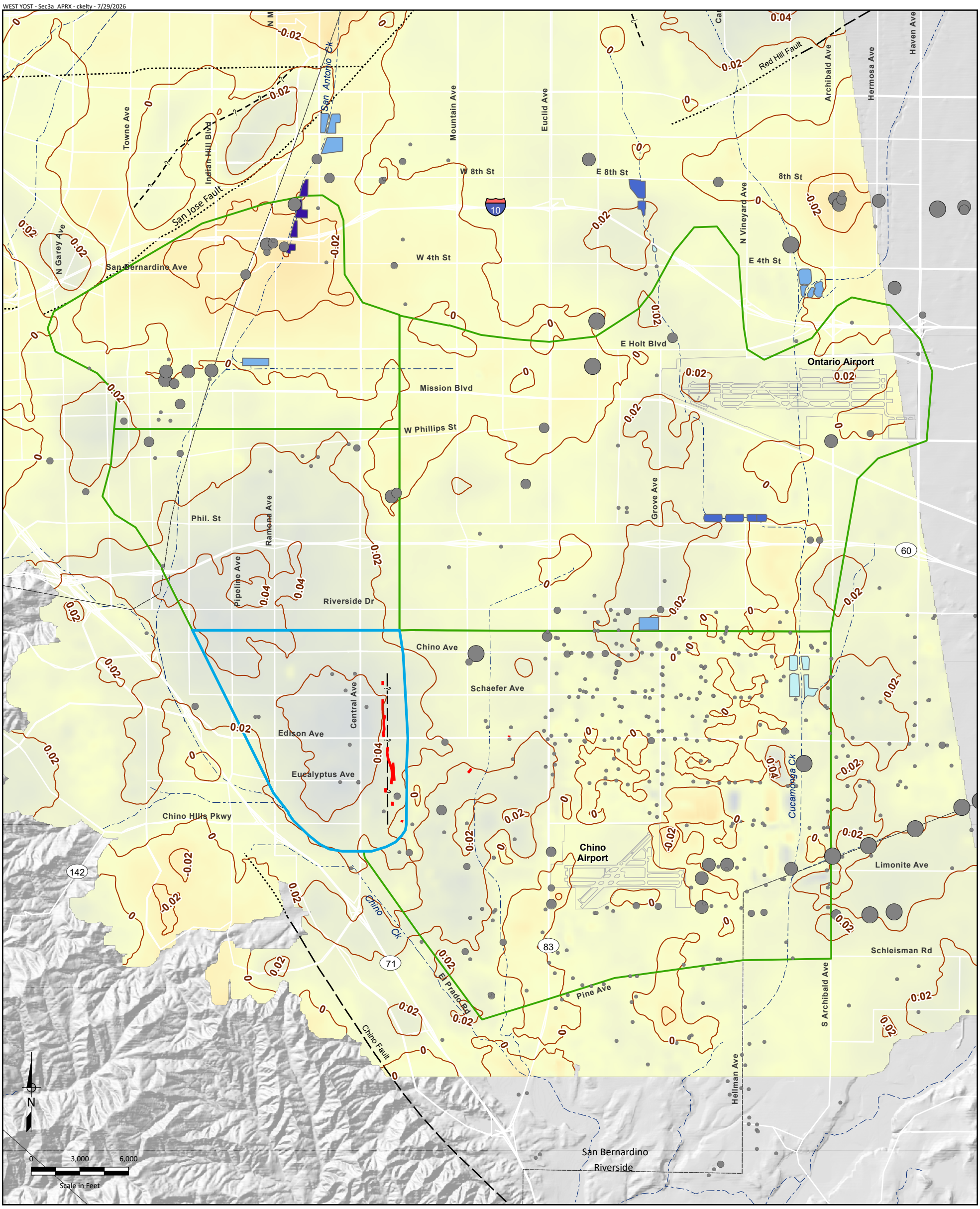
Figure 3-1a

Vertical Ground Motion across the Western Chino Basin: 2011-2026

WEST YOST - Sec3a_APRX - ckelty - 7/29/2026



Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2025 to March 2026)

High : 0.2 ft

0 ft

Low : -0.2 ft

InSAR absent or incoherent

Managed Area

Areas of Subsidence Concern

Average Annual Groundwater Pumping
April 1, 2025 to March 31, 2026
(afy)

0 - 100

101 - 500

501 - 1,000

1,001 - 2,000

> 2,000

Historical Ground Fissures

Approximate Location of the Riley Barrier

Fault (solid where accurately located;
dashed where approximately located
or inferred; dotted where concealed)

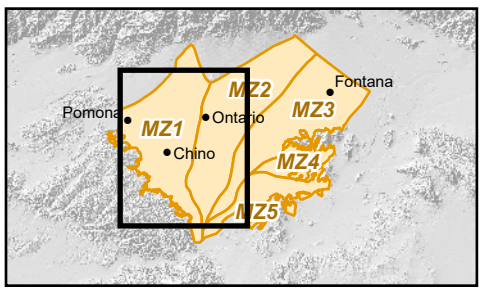
Average Annual Basin Recharge
April 1, 2025 to March 31, 2026
(afy)

0

1- 1500

1500 - 2500

>2500



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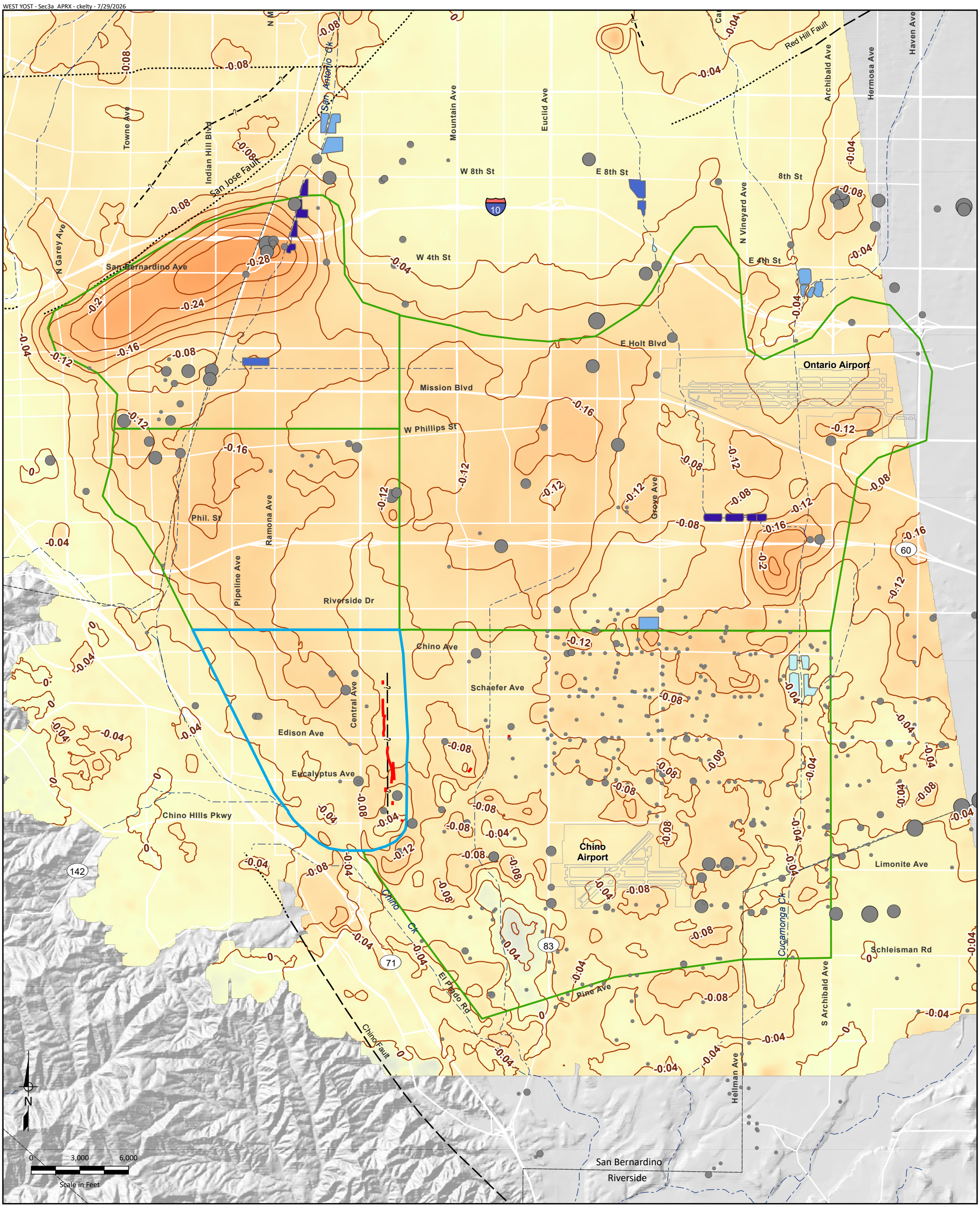
WEST YOST

Figure 3-1b

Vertical Ground Motion across the Western Chino Basin: 2025-2026

WEST YOST - Sec3a_APRX - ckelty - 7/29/2026



Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2016)

High : 0.4 ft

0 ft

Low : -0.4 ft

InSAR absent or incoherent

Managed Area

Areas of Subsidence Concern

Average Annual Groundwater Pumping
April 1, 2011 to March 31, 2016
(afy)

0 - 100

101 - 500

501 - 1,000

1,001 - 2,000

> 2,000

Historical Ground Fissures

Approximate Location of the Riley Barrier

Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)

Average Annual Basin Recharge
April 1, 2011 to March 31, 2016
(afy)

0

1- 1500

1500 - 2500

>2500

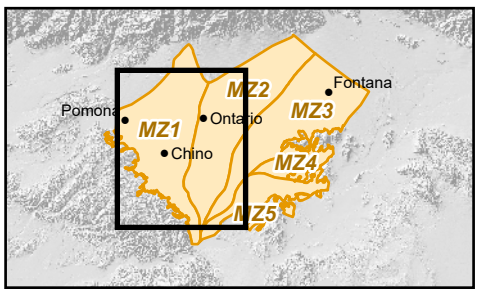


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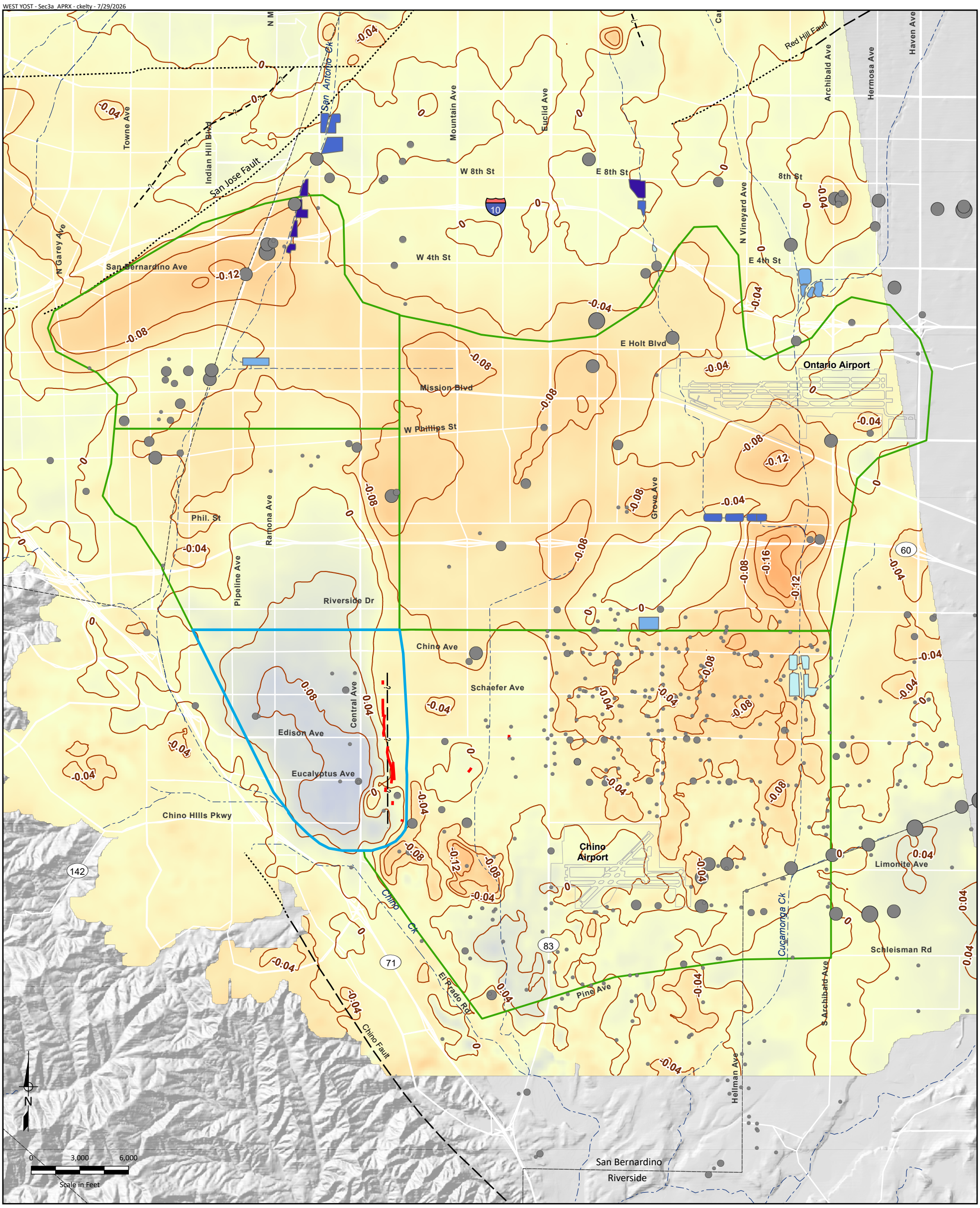
Figure 3-1c

Vertical Ground Motion across the Western Chino Basin: 2011-2016



Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2016 to March 2021)

- High : 0.3 ft
- 0 ft
- Low : -0.3 ft
- InSAR absent or incoherent

- Managed Area
- Areas of Subsidence Concern

Average Annual Groundwater Pumping
April 1, 2016 to March 31, 2021
(afy)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 1,001 - 2,000
- > 2,000

- Historical Ground Fissures
- Approximate Location of the Riley Barrier
- Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)

Average Annual Basin Recharge
April 1, 2016 to March 31, 2021
(afy)

- 0
- 1- 1500
- 1500 - 2500
- >2500

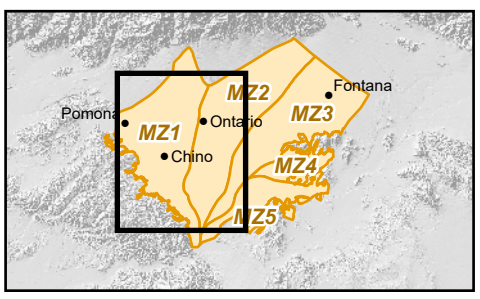


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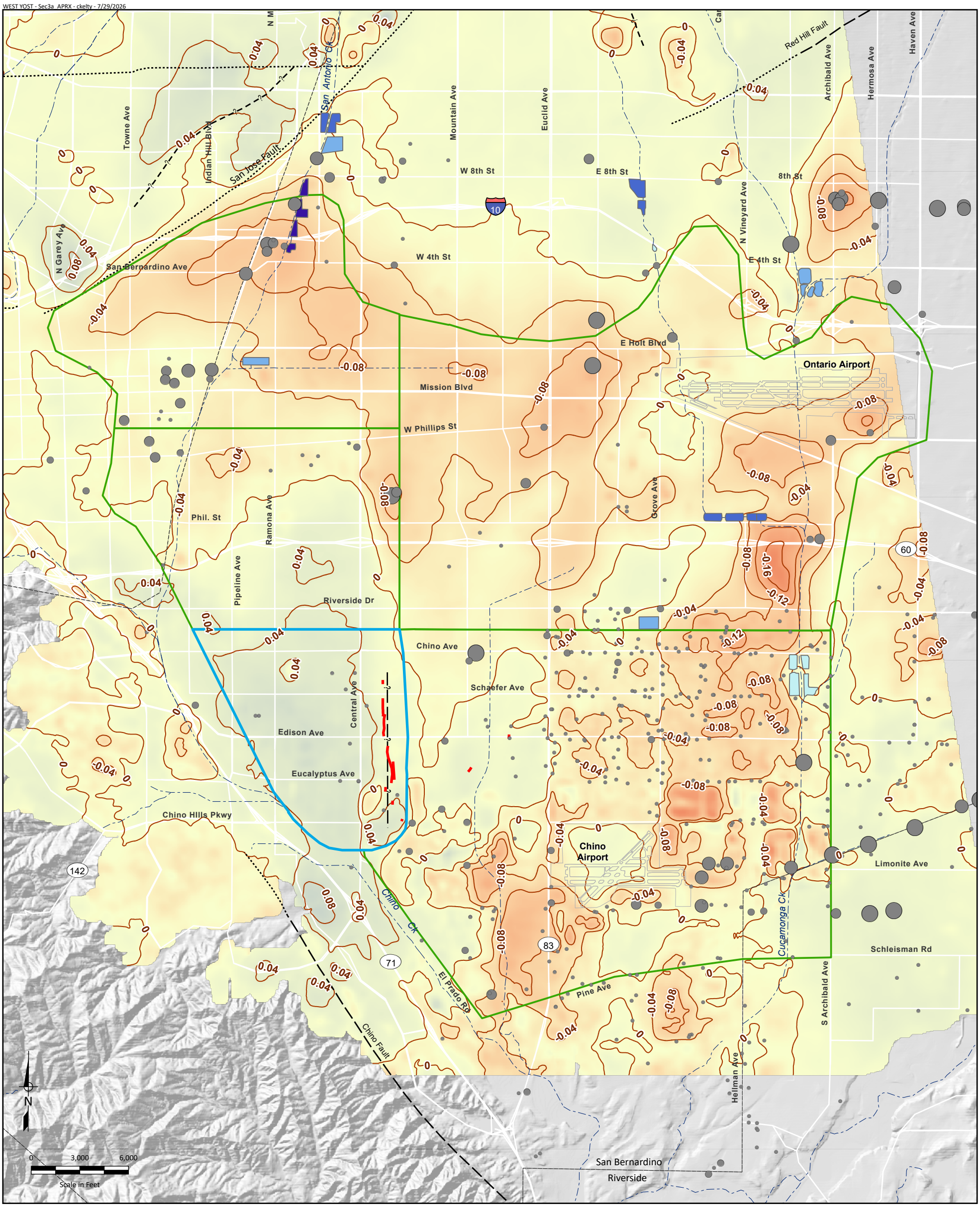
Figure 3-1d

Vertical Ground Motion across the Western Chino Basin: 2016-2021

WEST YOST - Sec3a_APRX - ckelty - 7/29/2026



Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2021 to March 2026)

- High : 0.3 ft
- 0 ft
- Low : -0.3 ft
- InSAR absent or incoherent

Average Annual Groundwater Pumping
April 1, 2021 to March 31, 2026
(afy)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 1,001 - 2,000
- > 2,000

Average Annual Basin Recharge
April 1, 2021 to March 31, 2026
(afy)

- 0
- 1- 1500
- 1500 - 2500
- >2500

- Managed Area
- Areas of Subsidence Concern
- Historical Ground Fissures
- Approximate Location of the Riley Barrier
- Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)

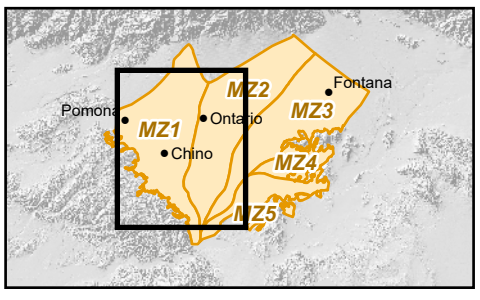


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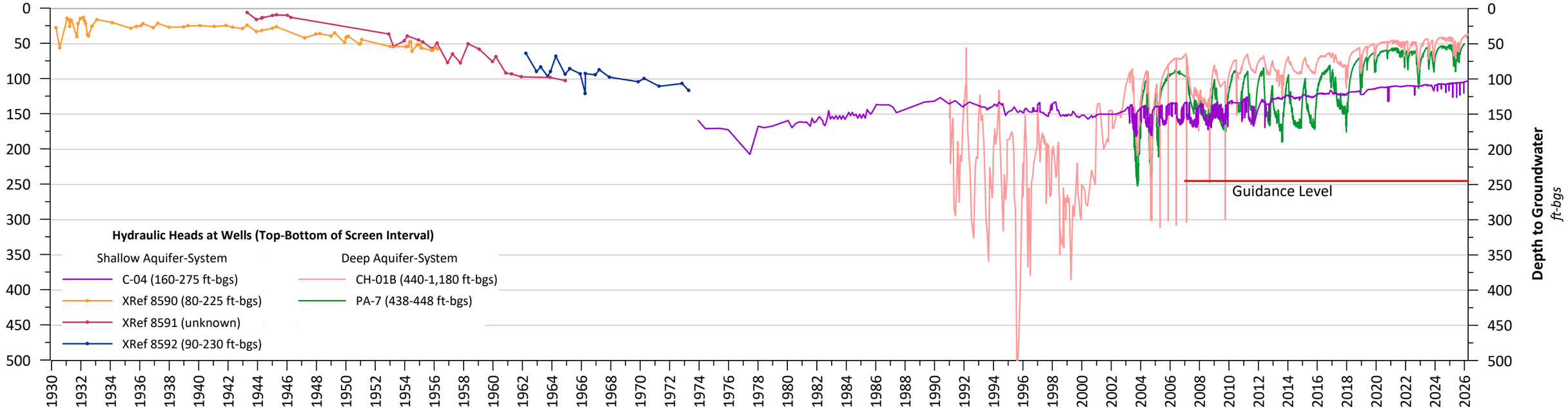
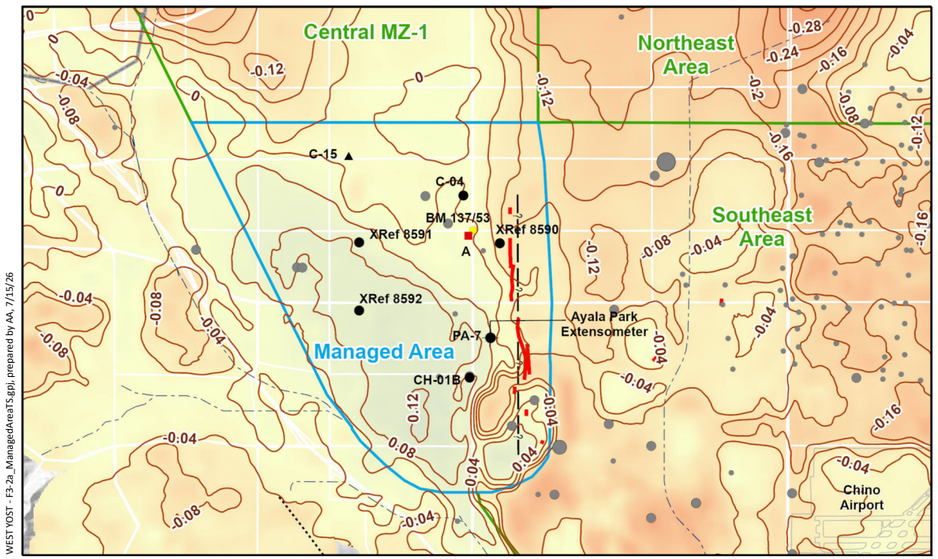
Figure 3-1e

Vertical Ground Motion across the Western Chino Basin: 2021-2026





InSAR from March 2011 to March 2026 (see Figure 3-1a)

Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2026)

High : 0.65 ft

0 ft

Low : -0.65 ft

InSAR absent or incoherent

Average Annual Groundwater Pumping
April 1, 2011 to March 31, 2026
(afy)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 1,001 - 2,000
- >2,000

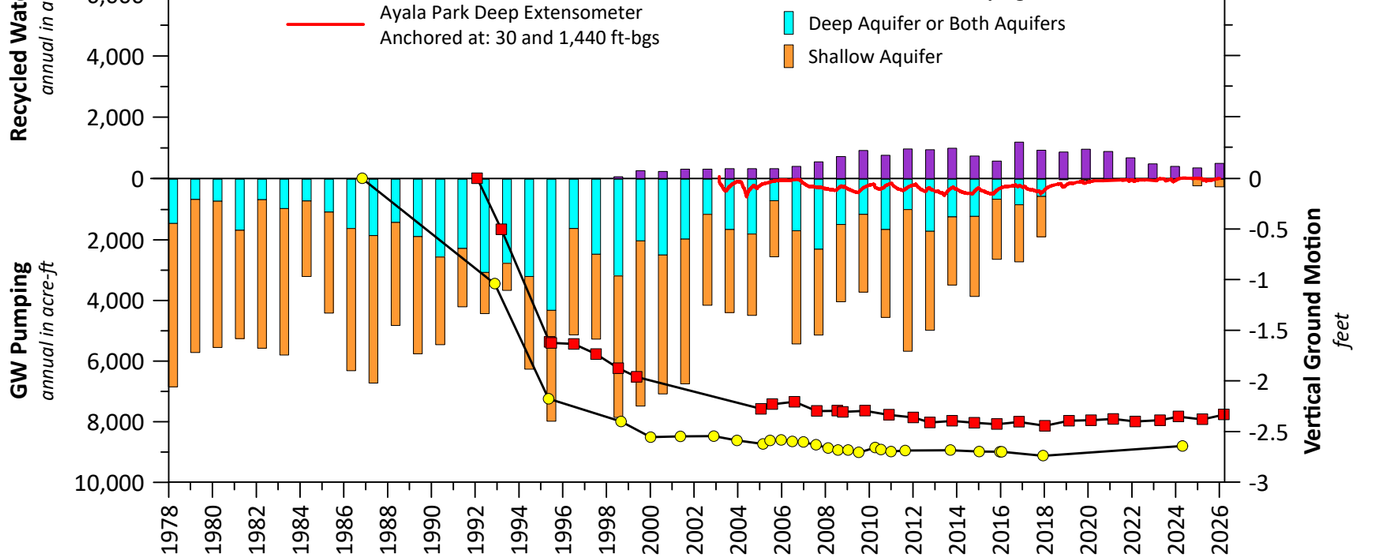


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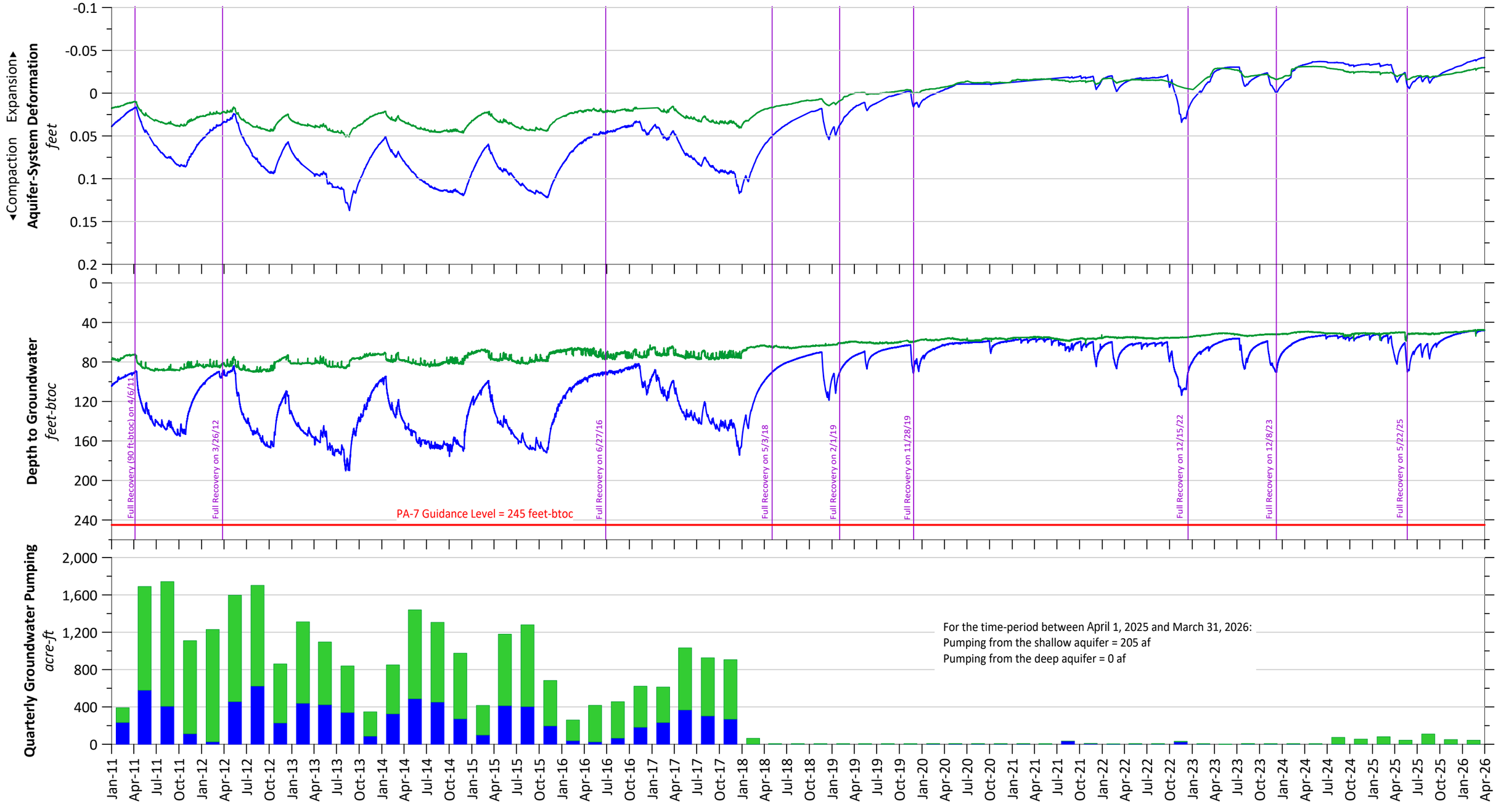
Figure 3-2

History of Land Subsidence in the Managed Area



Aquifer-System Deformation at Ayala Park (Extensometer Depth Interval)

- Shallow Extensometer (30-550 ft-bgs)
- Deep Extensometer

Hydraulic Heads at Ayala Park (Screened Interval)

- Shallow Piezometer PA-10 (213-233 ft-bgs)
- Deep Piezometer PA-7 (438-448 ft-bgs)

Quarterly Groundwater Pumping (see Table 3-1 for groundwater pumping by well)

- Shallow Aquifer
- Deep Aquifer

F3-3_ManagedAreaStnStrn.gpj

WEST YOST

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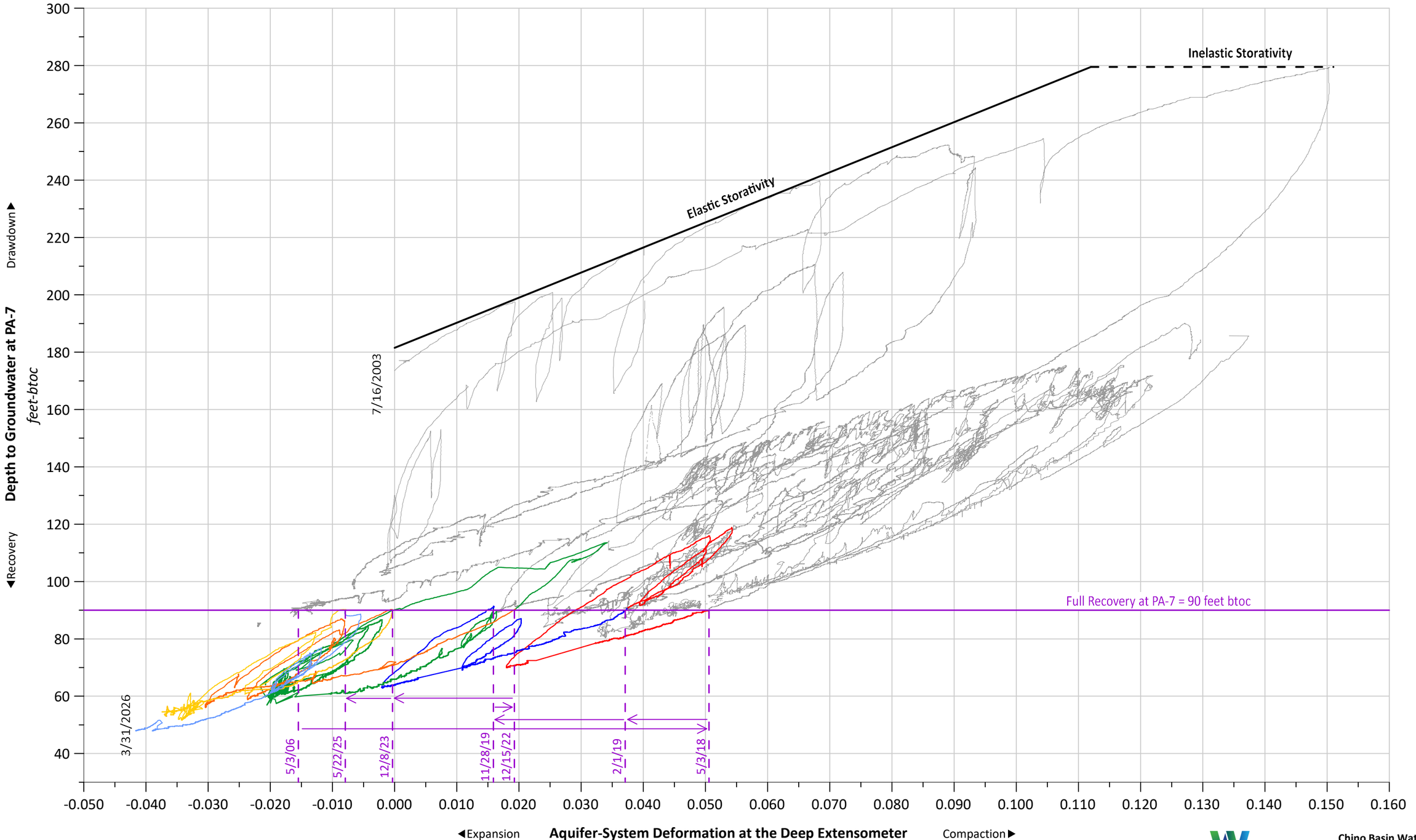
Figure 3-3

Stress and Strain within the Managed Area



Stress - Strain Hysteresis Loops of Drawdown

- Drawdown and recovery between 7/16/03 and 5/3/18
- Drawdown and recovery between 5/3/18 to 2/1/19
- Drawdown and recovery between 2/1/19 and 11/28/19
- Drawdown and recovery between 11/28/19 and 12/15/22
- Drawdown and recovery between 12/15/22 and 12/8/23
- Drawdown and recovery between 12/8/23 and 5/22/25
- Drawdown and recovery between 5/22/25 to 3/31/26

*PA-7 well-screen interval: 438-448 ft-bgs
Depth interval of the Deep Extensometer: 30-1,400 feet-bgs

WEST YOST

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Figure 3-4

Stress-Strain Diagram
Ayala Park Extensometer

WEST YOST - F3-4_ManagedAreaHysteresis.gpj

Quarterly Groundwater Pumping
acre-ft

0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200

For the time-period between April 1, 2025 and March 31, 2026:
Pumping from the shallow aquifer = 205 af
Pumping from the deep aquifer = 0 af

When groundwater elevations remain above 588 ft-amsl, InSAR indicates no permanent land subsidence. Therefore, 588 ft-amsl is the current estimate of the pre-consolidation stress threshold.

588 ft-amsl

Groundwater Elevation
ft-amsl

640
620
600
580
560
540
520
500

Vertical Ground Motion
feet

0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25

2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

Quarterly Groundwater Pumping
Managed Area
- Shallow Aquifer
- Deep Aquifer

Groundwater Elevation at Wells (Screen Interval)
- C-15 (270 - 820 ft-bgs)

Vertical Ground Motion
- Cumulative Displacement (C-15)

WEST YOST

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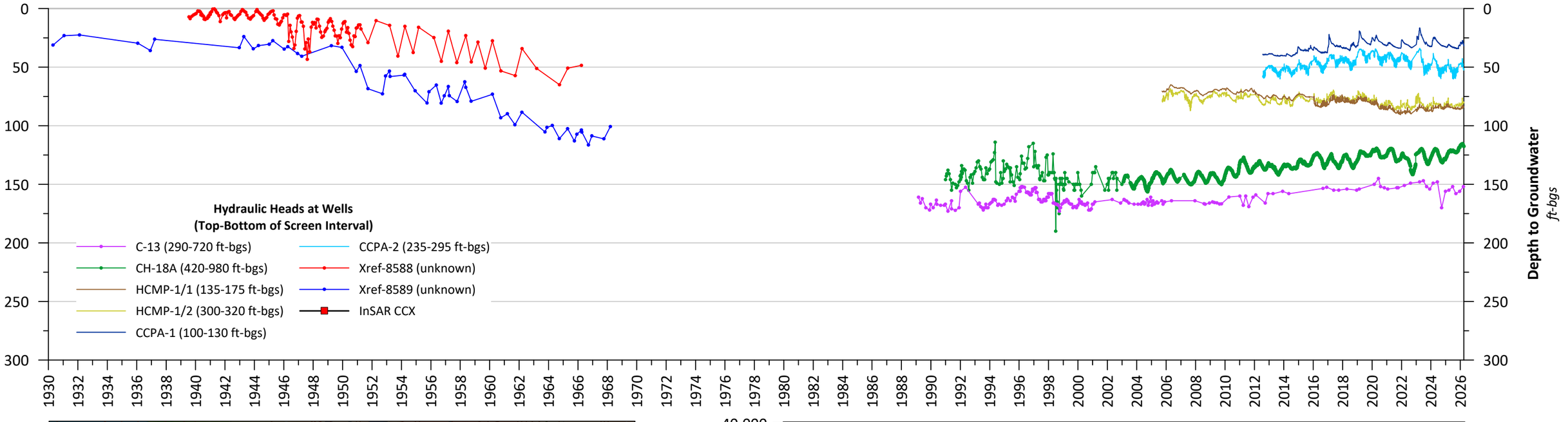
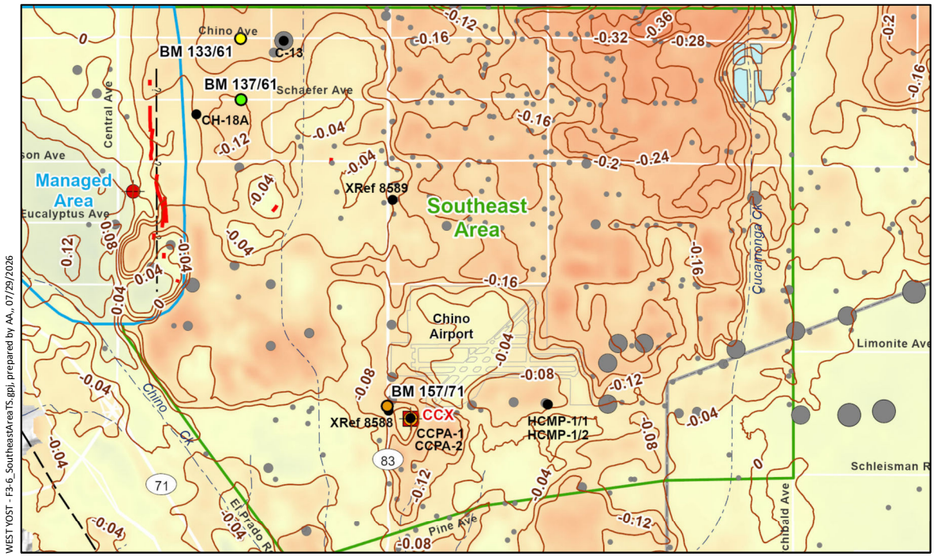
Figure 3-5

Hydraulic Heads at C-15 Versus Groundwater Pumping and Vertical Ground Motion

WEST YOST - F3-5C15_InSAR_PumpRecharge.gpj





InSAR from March 2011 to March 2026 (see Figure 3-1a)

Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2026)

High : 0.65 ft

0 ft

Low : -0.65 ft

InSAR absent or incoherent

Average Annual Groundwater Pumping
April 1, 2011 to March 31, 2026
(afy)

0 - 100
101 - 500
501 - 1,000
1,001 - 2,000
>2,000

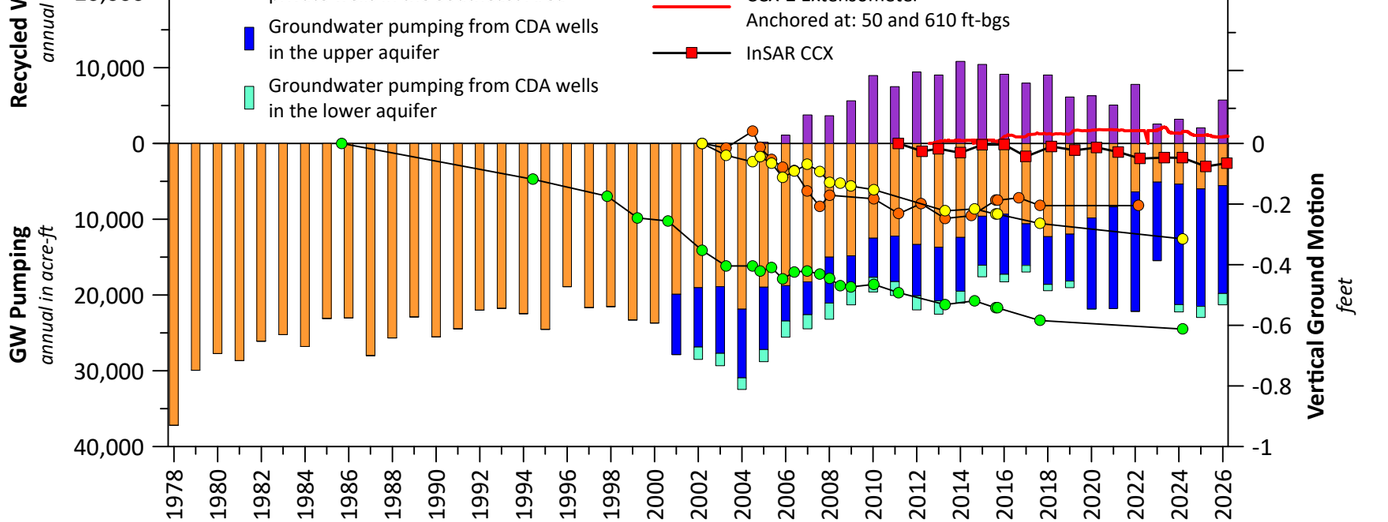


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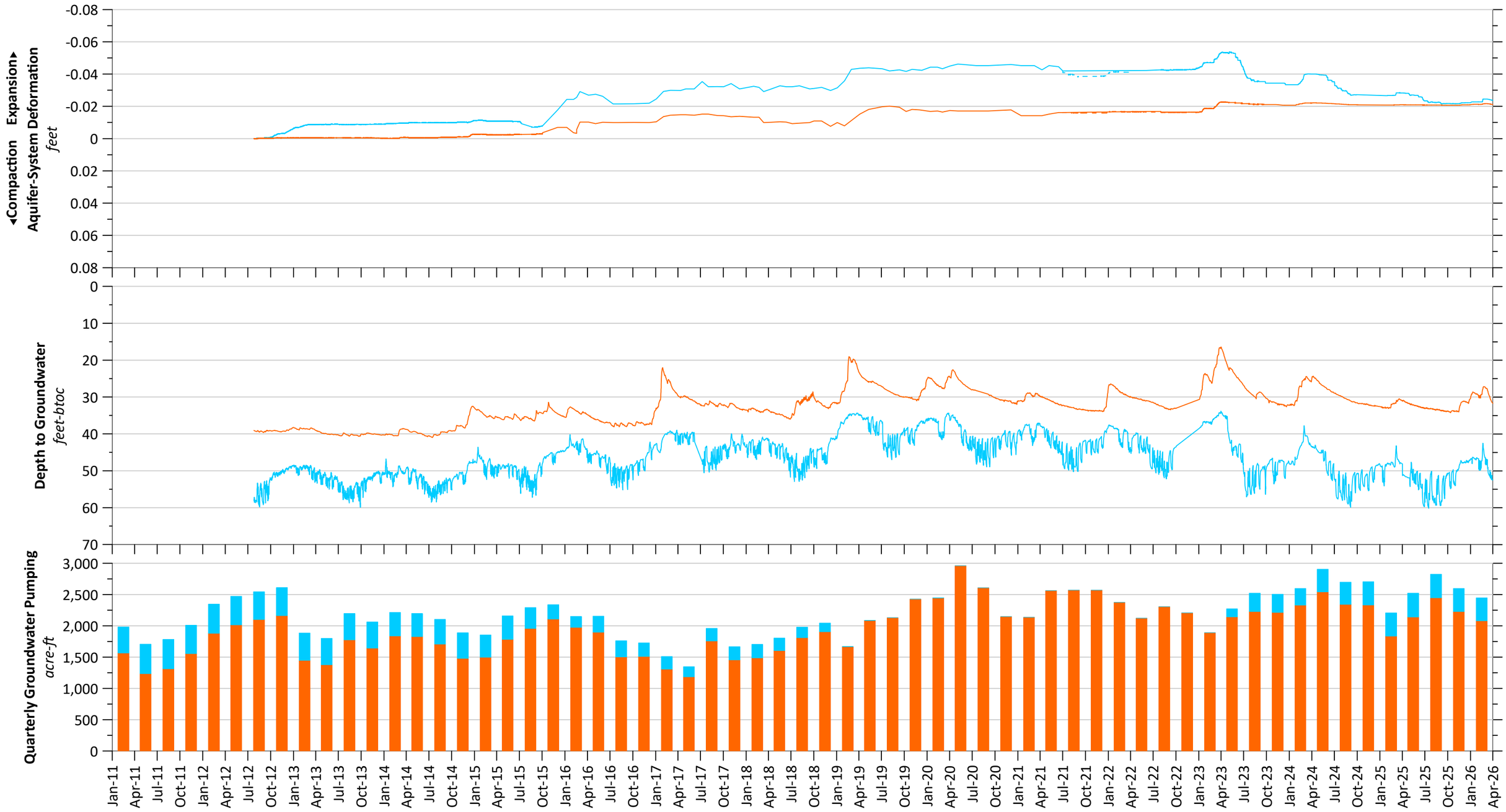
Figure 3-6

History of Land Subsidence in the Southeast Area



Aquifer-System Deformation (Extensometer Depth Interval)

- CCX-1 (0-140 ft-bgs)
- CCX-2 (50-610 ft-bgs)

Hydraulic Heads (Screened Interval)

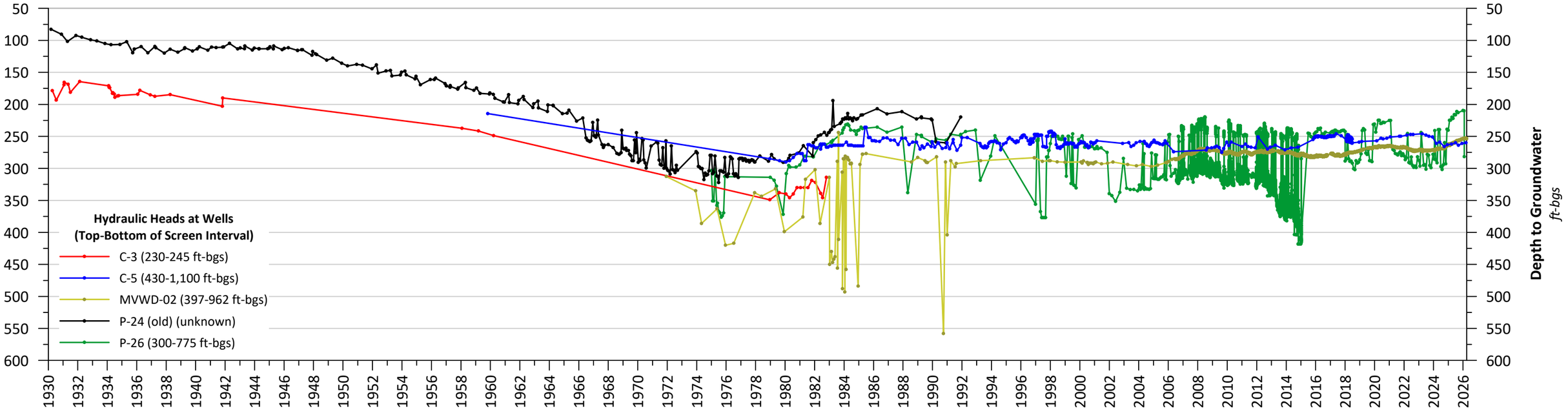
- CCPA-1 (100-130 ft-bgs)
- CCPA-2 (235-295 ft-bgs)

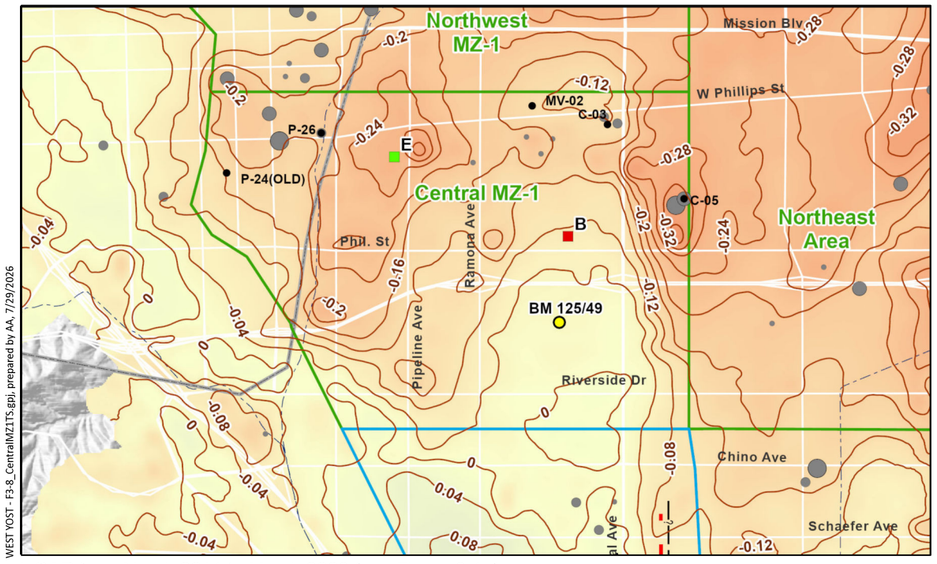
Quarterly Groundwater Pumping

- Shallow Aquifer (CDA-5 to 11; 16, 17, 20 and 21)
- Deep Aquifer (CDA-1 to 4)

Figure 3-7

Stress and Strain within the Southeast Area





InSAR from March 2011 to March 2026 (see Figure 3-1a)

Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2026)

High : 0.65 ft

0 ft

Low : -0.65 ft

InSAR absent or incoherent

Average Annual Groundwater Pumping
April 1, 2011 to March 31, 2026
(afy)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 1,001 - 2,000
- >2,000

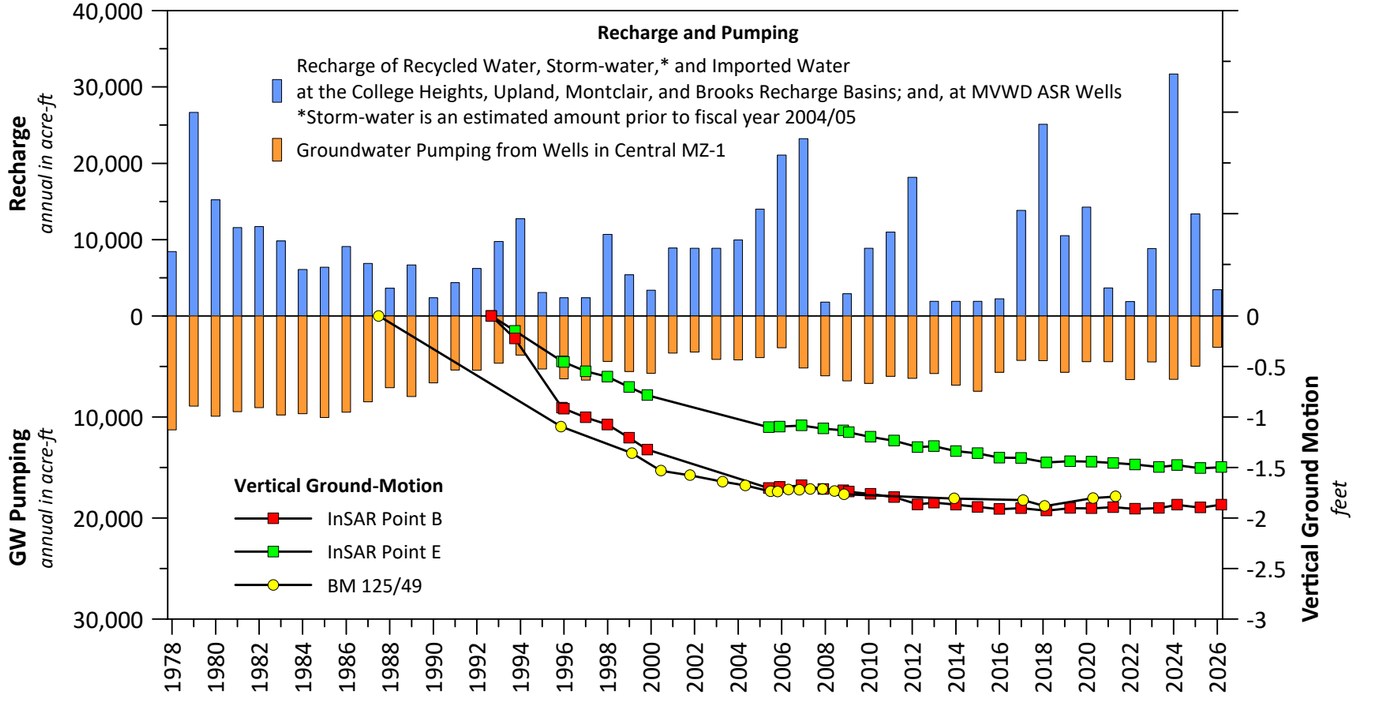


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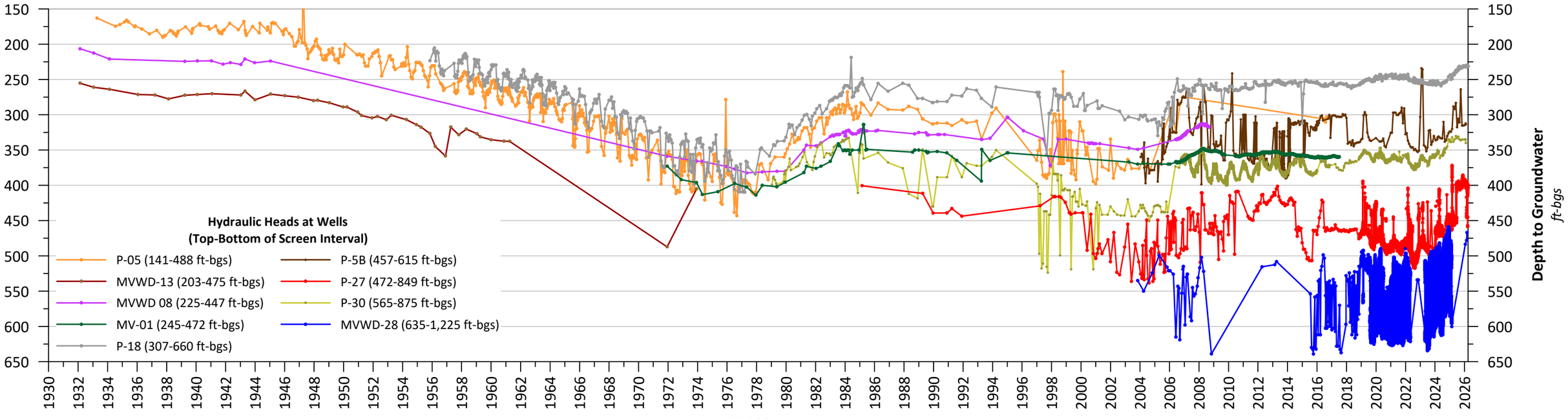
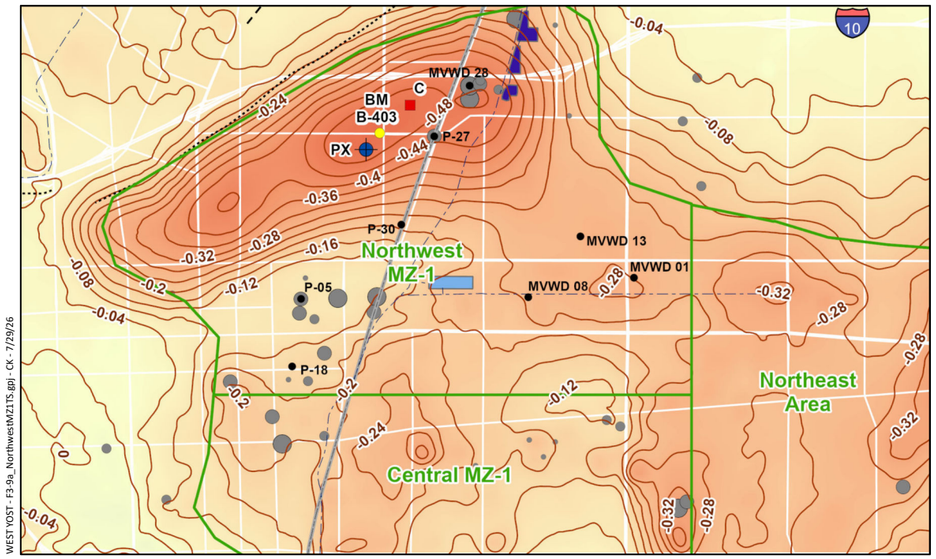
Figure 3-8
History of Land Subsidence in Central MZ-1





InSAR from March 2011 to March 2026 (see Figure 3-1a)

Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2026)

High : 0.65 ft

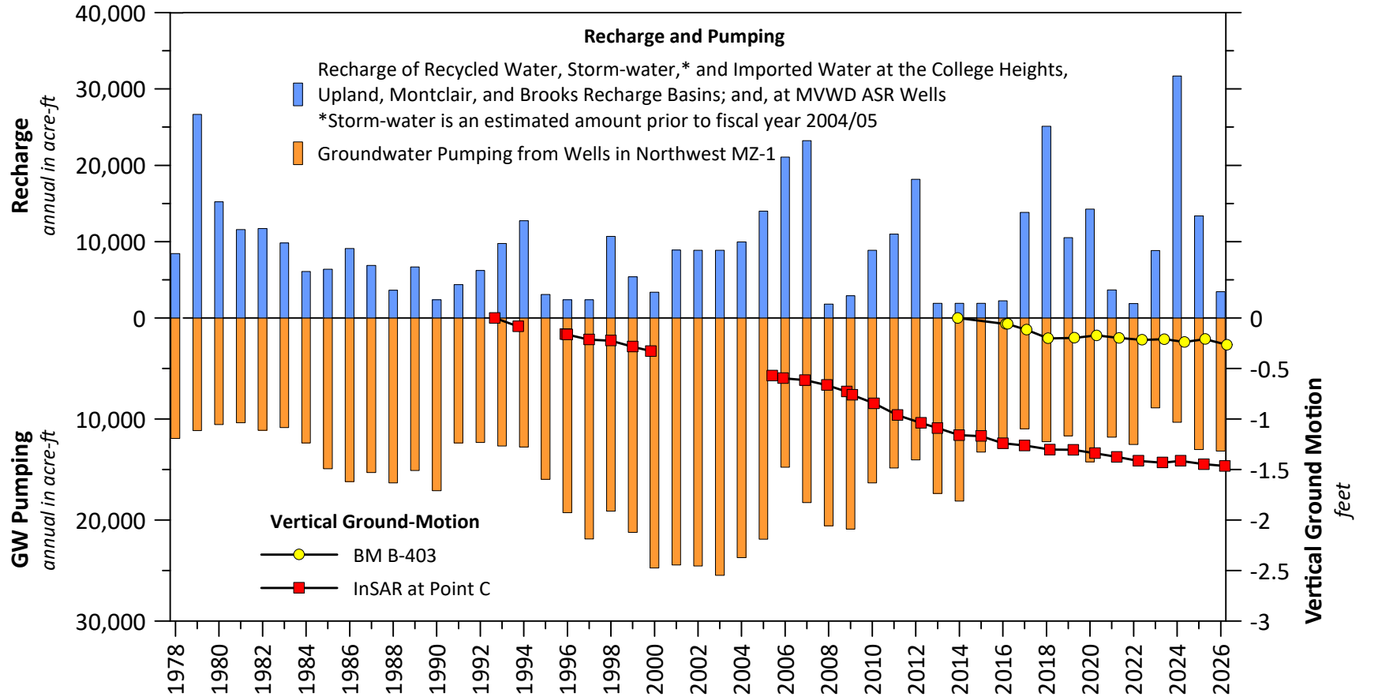
0 ft

Low : -0.65 ft

InSAR absent or incoherent

Average Annual Groundwater Pumping
April 1, 2011 to March 31, 2026
(afy)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 1,001 - 2,000
- >2,000



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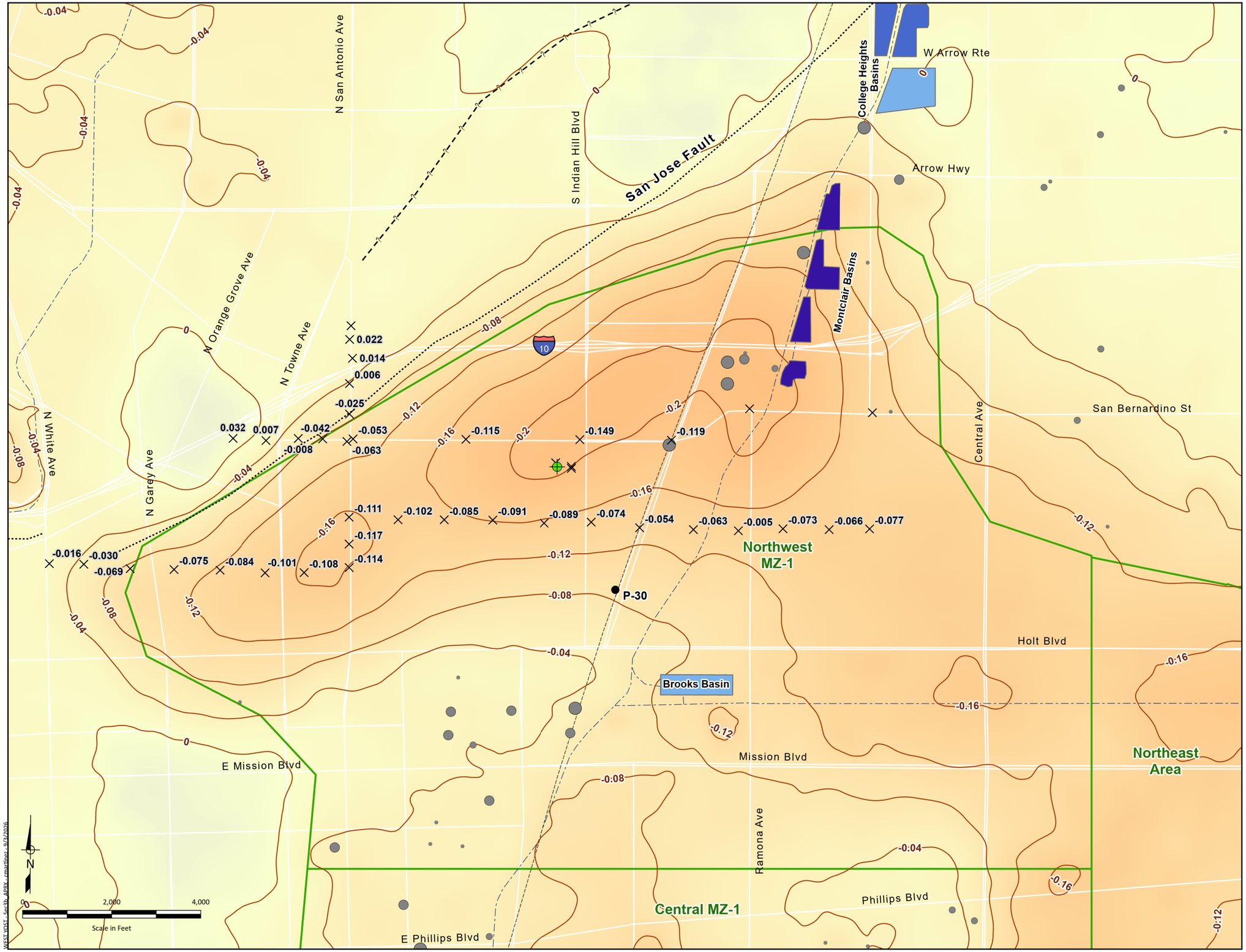
Ground-Level Monitoring Program

Figure 3-9a
History of Land Subsidence in Northwest MZ-1



Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2017 to March 2026)

High : 0.4 ft

0 ft

Low : -0.4 ft

InSAR absent or incoherent

Ground-Level Survey Benchmark
(Measured April 15, 2026) Labeled by Vertical Ground Motion (in feet from February 2017 to April 2026)

Average Annual Groundwater Pumping
April 1, 2017 to March 31, 2026
(afy)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 1,000 - 2,000
- > 2,000

Average Annual Basin Recharge
April 1, 2017 to March 31, 2026
(afy)

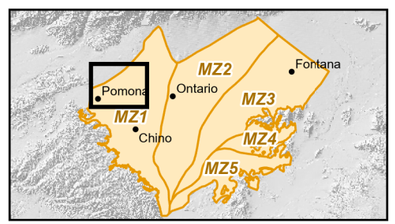
- 0 - 500
- 500 - 1,000
- 1,000 - 1,500
- 1,500 - 2,000
- 2,000 - 2,500
- > 2,500

Pomona Extensometer Facility

Groundwater Well (P-30)

Areas of Subsidence Concern

Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)



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WEST YOST

Figure 3-9b

Vertical Ground Motion across Northwest MZ-1: 2017-2026

WEST YOST_Sep3b_APRX - cmartinez - 9/3/2026

Groundwater Recharge
acre-ft per Quarter

Groundwater Pumping
acre-ft per Quarter

When groundwater elevations remain above 568 ft-amsl, InSAR indicates no permanent land subsidence. Therefore, 568 ft-amsl is the current estimate of the pre-consolidation stress threshold.

568 ft-amsl

Groundwater Elevation
ft-amsl

Vertical Ground Motion
feet

Quarterly Groundwater Pumping from Northwest MZ-1
- Aquifer Layer 1
- Aquifer Layer 3
- Aquifer Layer 5
- Unknown Aquifer(s)

Quarterly Recharge Northwest MZ-1*
**Brooks Basin*
Upland Basin
Montclair Basins 1-4
College Heights Basins 1-2
MVWD Injection Wells

Groundwater Elevation at Wells (Screen Interval)
- P-30 (565-875 ft-bgs)
  Well screen across aquifer (model) layers 1 and 3

Vertical Ground Motion
- Cumulative Displacement (at the P-30 location)

WEST YOST - F3-10_P30_InSAR_PumpRecharge.gpj - CK - 20250630

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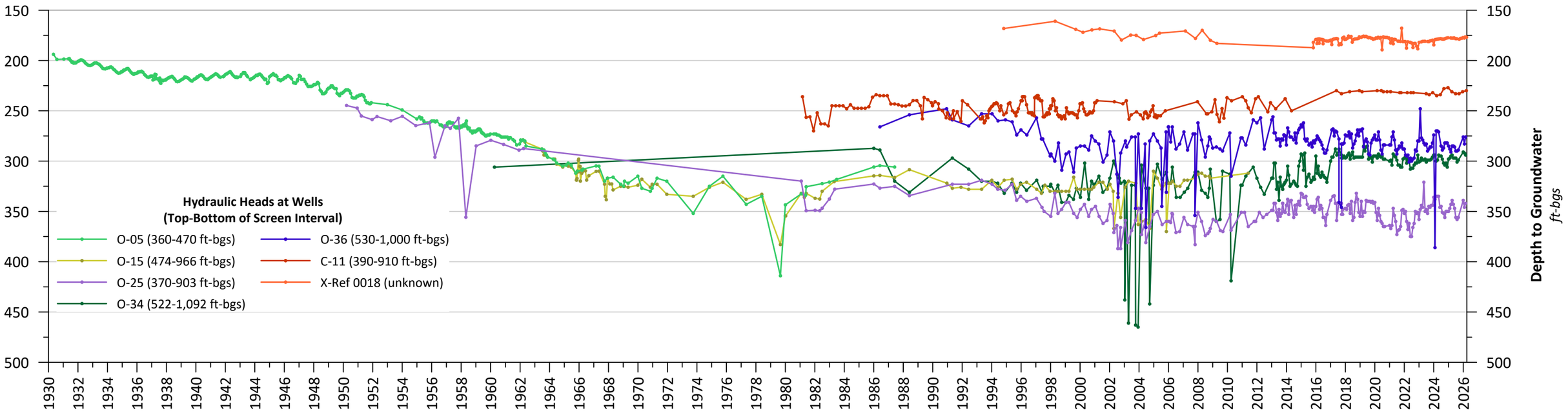
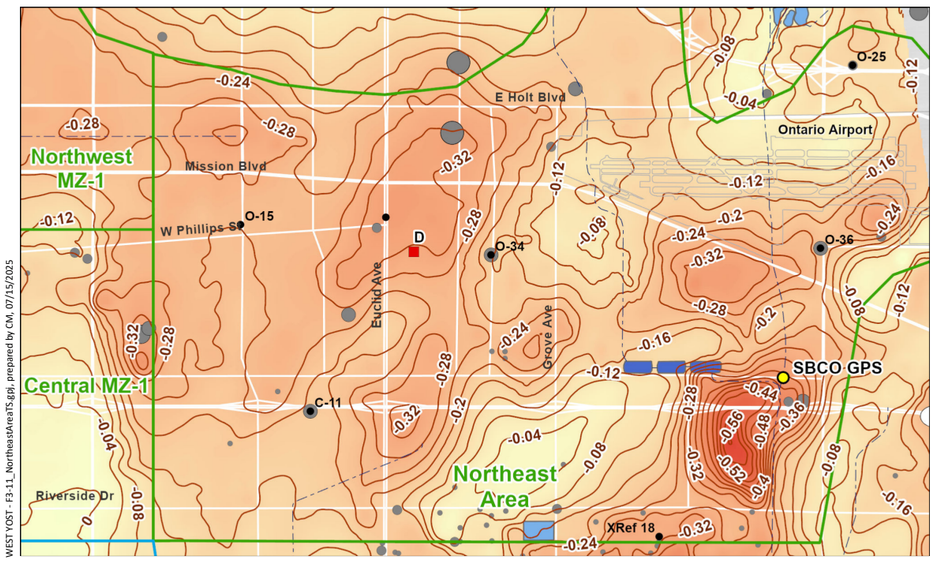
Figure 3-10

Hydraulic Heads at P-30 Versus Groundwater Pumping and Vertical Ground Motion





InSAR from March 2011 to March 2026 (see Figure 3-1a)

Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2026)

High : 0.65 ft

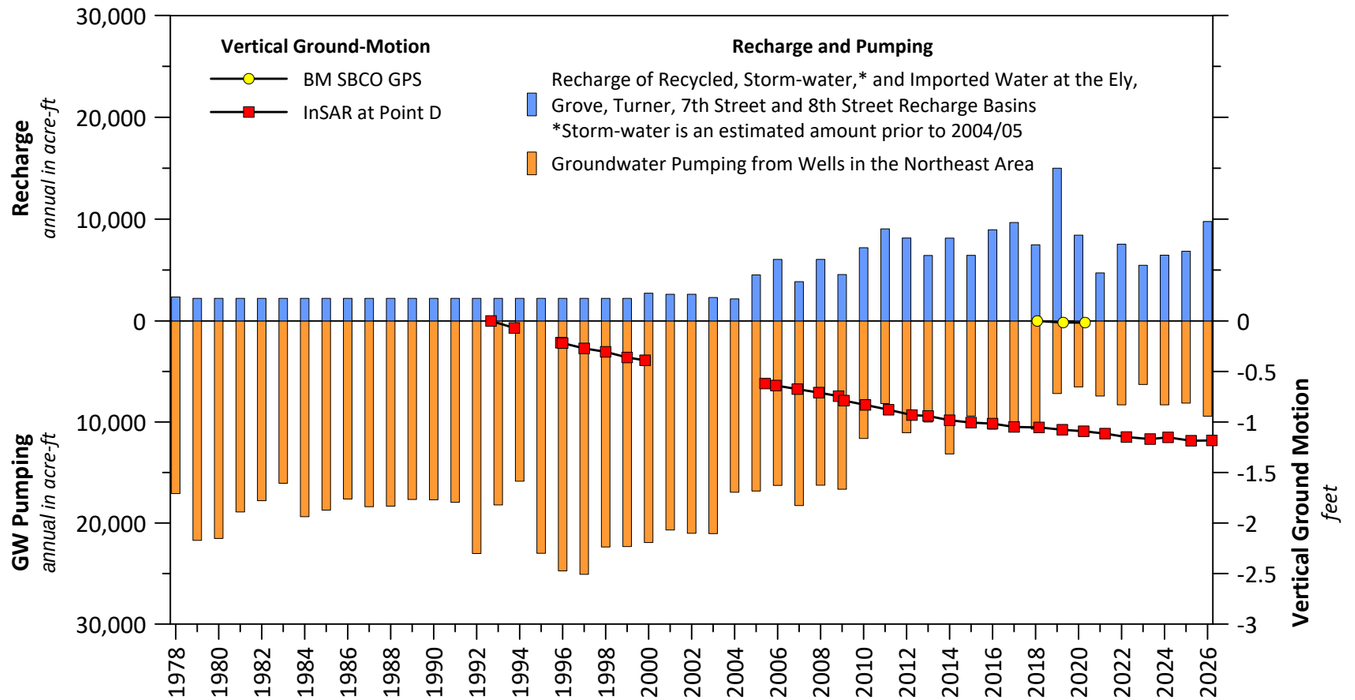
0 ft

Low : -0.65 ft

InSAR absent or incoherent

Average Annual Groundwater Pumping
April 1, 2011 to March 31, 2026
(afy)

- 0 - 100
- 101 - 500
- 501 - 1,000
- 1,001 - 2,000
- >2,000



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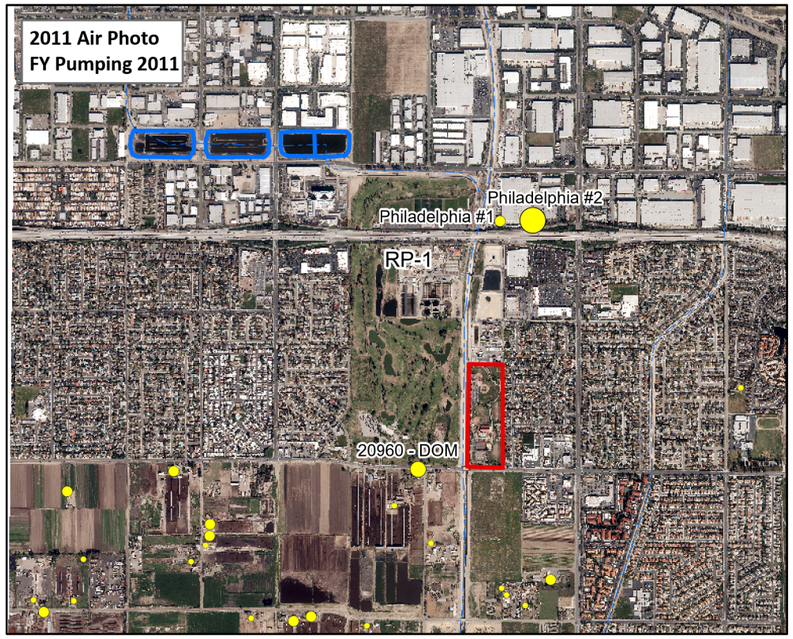
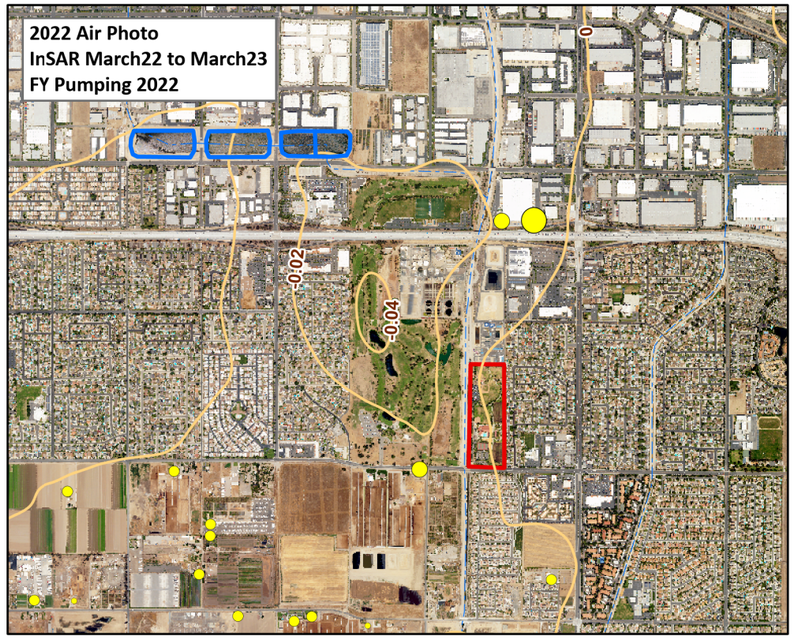
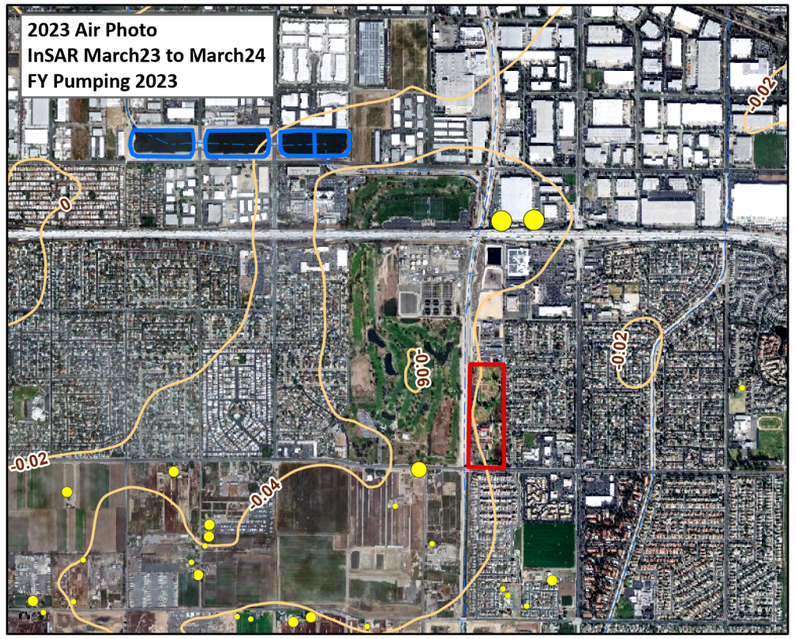
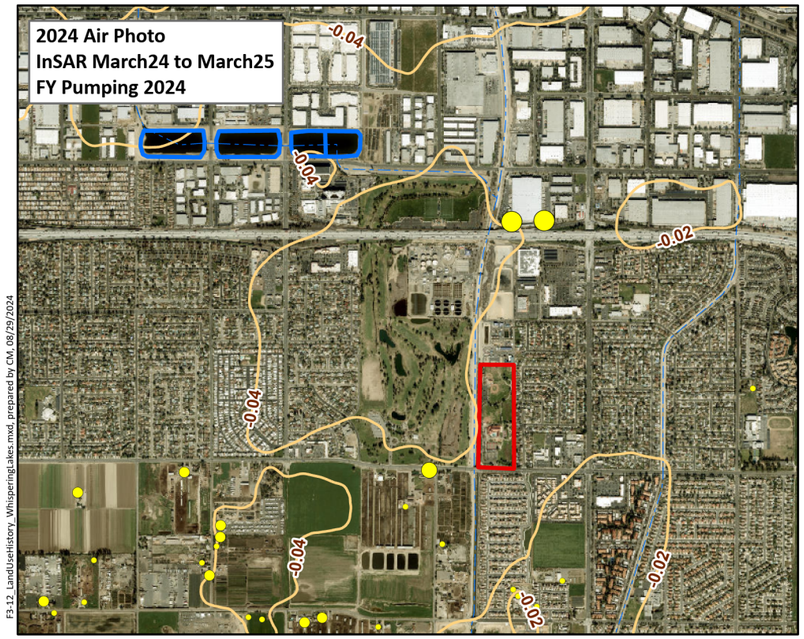
Ground-Level Monitoring Program

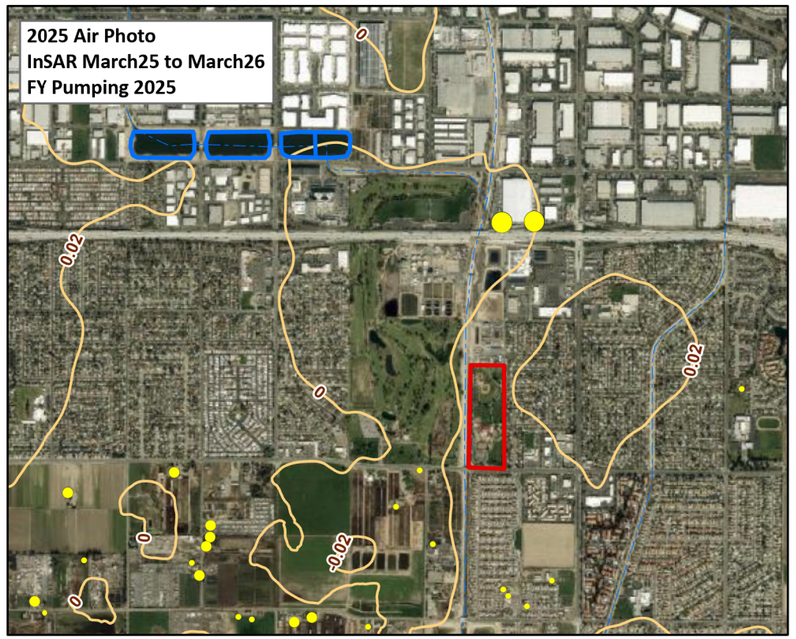
Figure 3-11
History of Land Subsidence in the Northeast Area

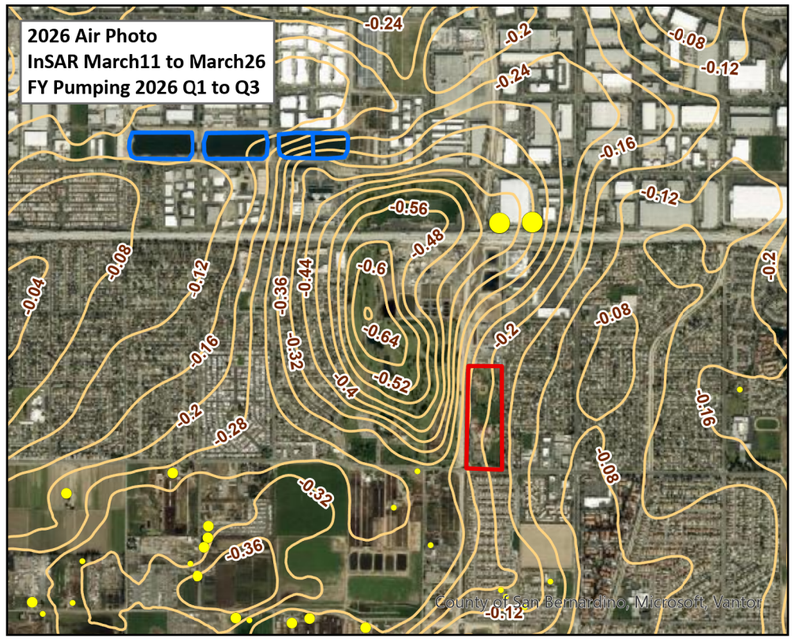












F3-12_LandUseHistory_WhisperingLakes.mxd, prepared by CM, 08/29/2024



Annual Groundwater Production (af)

(reported by fiscal year)

- < 10
- 10 - 100
- 101 - 250
- 250 - 500
- 500 - 730

0 0.5 1

Miles

Contours of the Relative Change in Land Surface Elevation as Estimated by InSAR (ft)

N

Location of Historic Sewage Disposal Ponds

Ely Recharge Basins

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Figure 3-12

Land Use, Pumping, and Vertical Ground Motion at the Whispering Lakes Subsidence Feature

Seismicity in the Chino Basin
March 1, 2011 to March 31, 2026
(Magnitude)

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6

Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2026)

- High : 0.65 ft
- 0 ft
- Low : -0.65 ft
- InSAR absent or incoherent

- Pomona Extensometer
- Ayala Park Extensometer
- Chino Creek Extensometer
- Managed Area
- Areas of Subsidence Concern
- Recharge Conservation Basins
- Historical Ground Fissures
- Approximate Location of the Riley Barrier
- Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)



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Figure 3-13

Seismicity across the Chino Basin: 2011-2026

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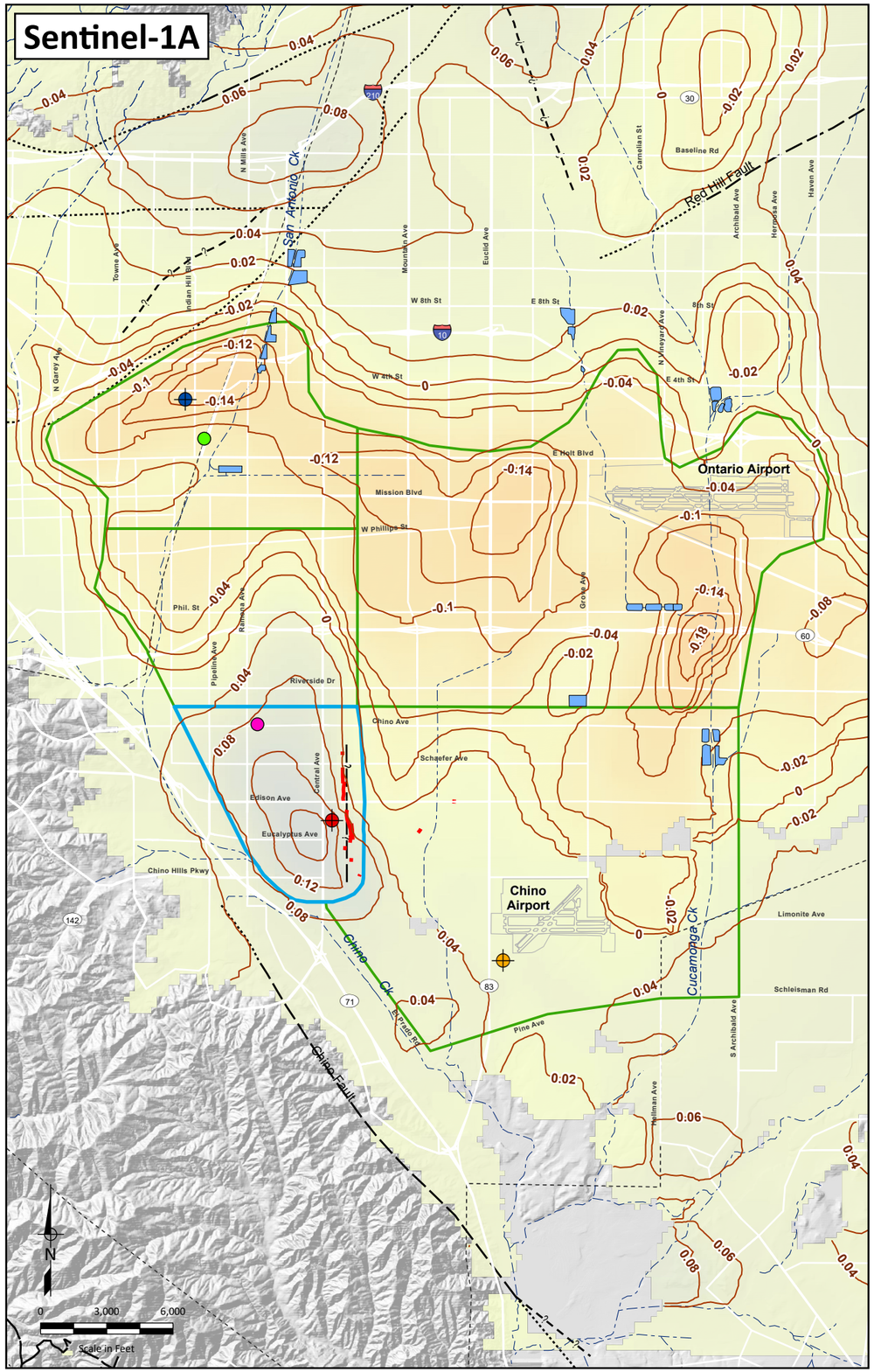

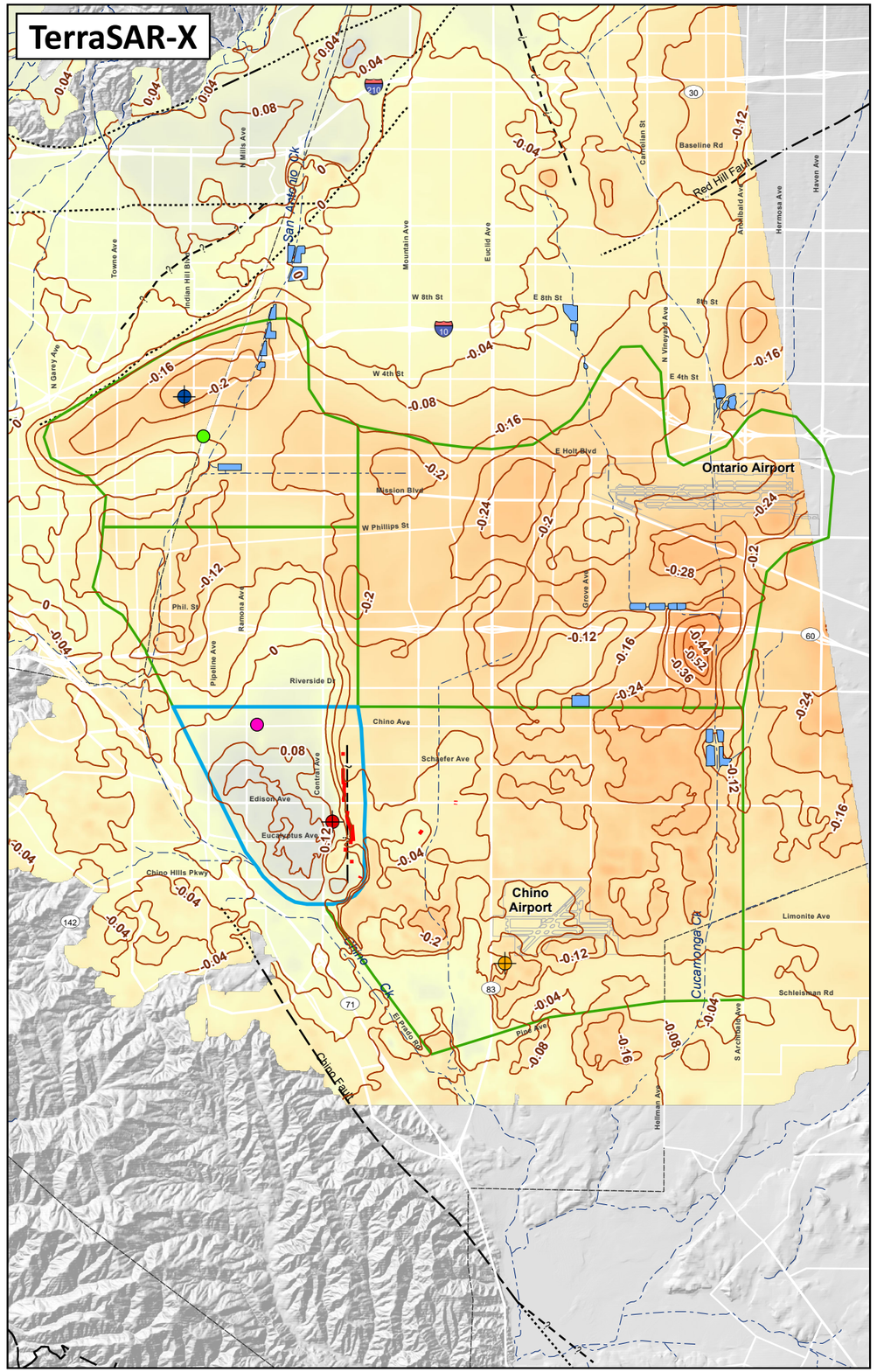

Relative Change in Land Surface Elevation
as Estimated by InSAR
(June 2015 to March 2025)

- High : 0.6 ft
- 0 ft
- Low : -0.6 ft
- InSAR absent or incoherent

- Managed Area
- Areas of Subsidence Concern
- Historical Ground Fissures
- Approximate Location of the Riley Barrier
- Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)
- Flood Control and Conservation Basins
- Pomona Extensometer
- Ayala Park Extensometer
- Chino Creek Extensometer
- City of Pomona Production Well (P-30)
- City of Chino Production Well (C-15)

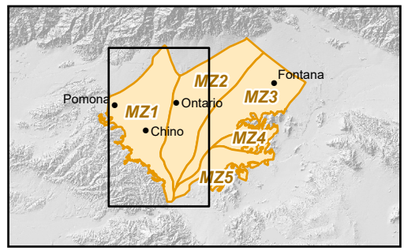

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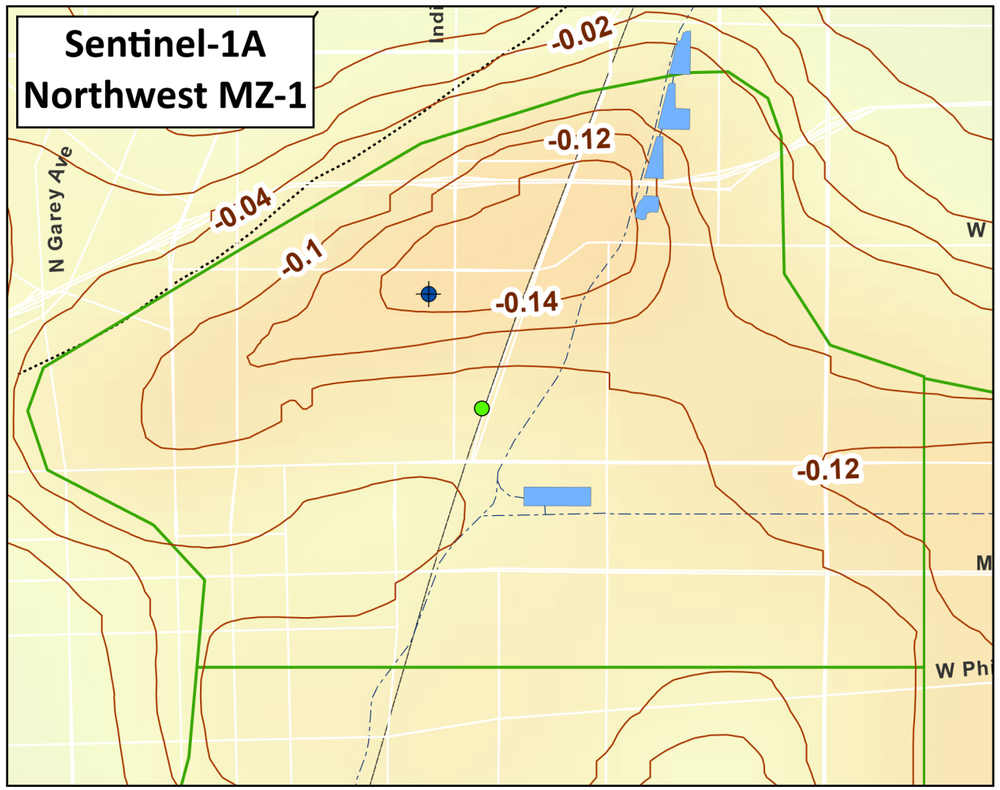
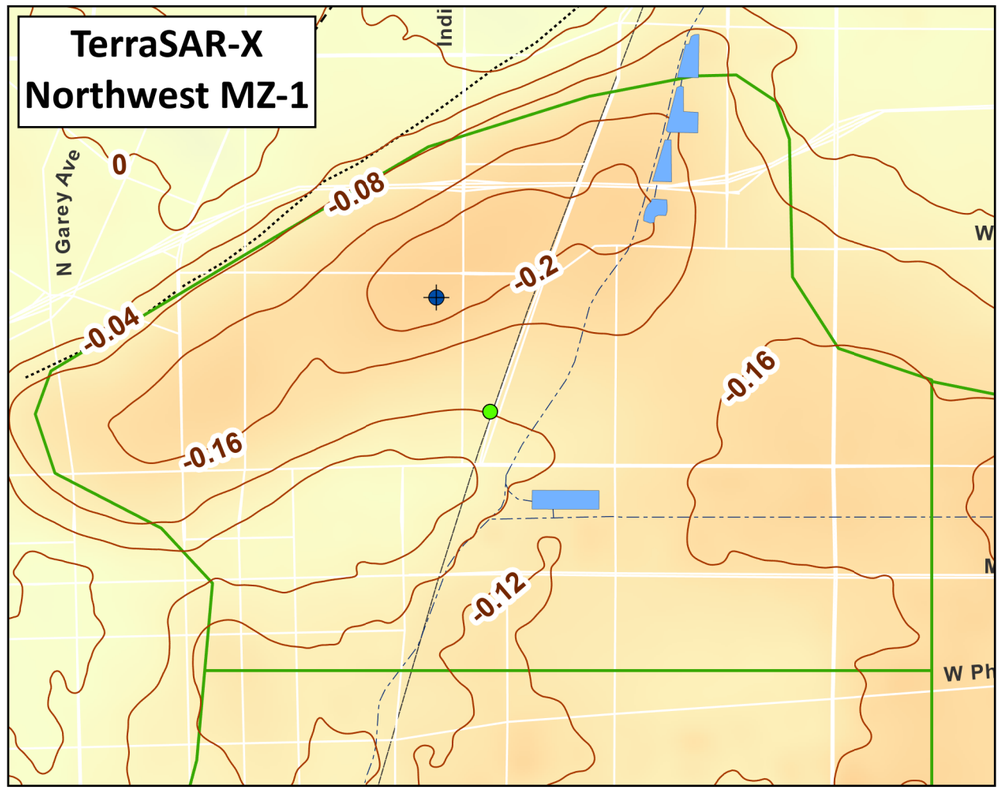
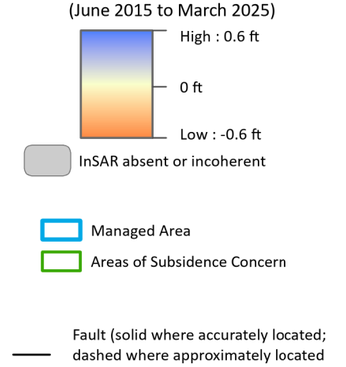
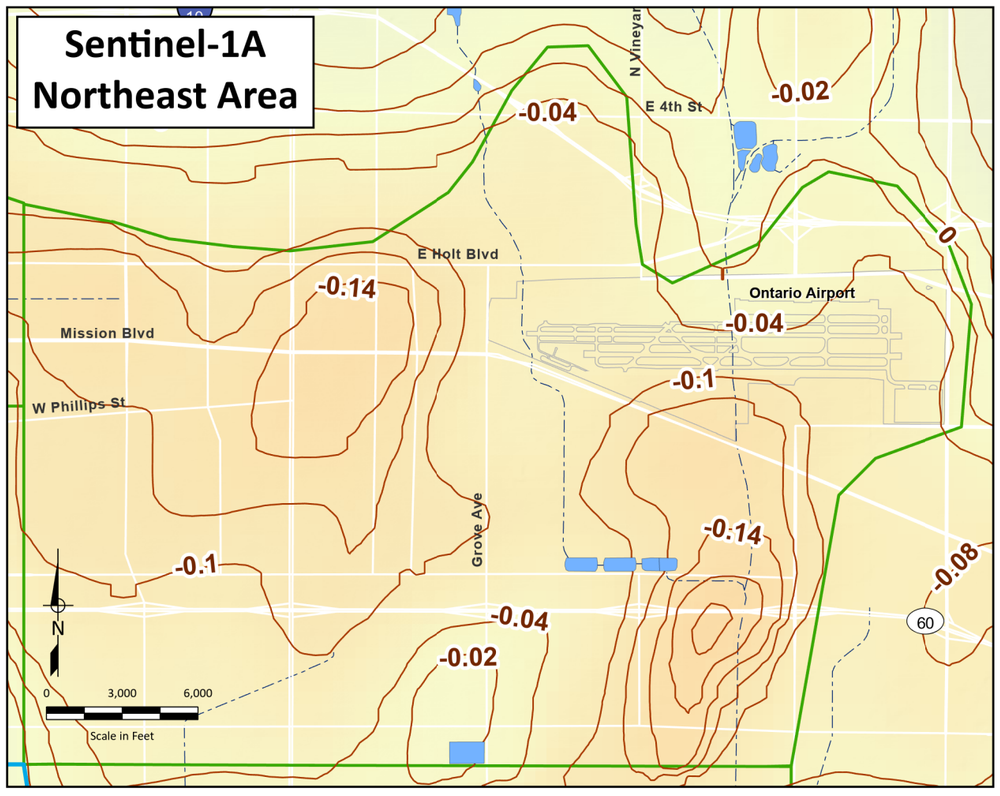
Figure 3-14

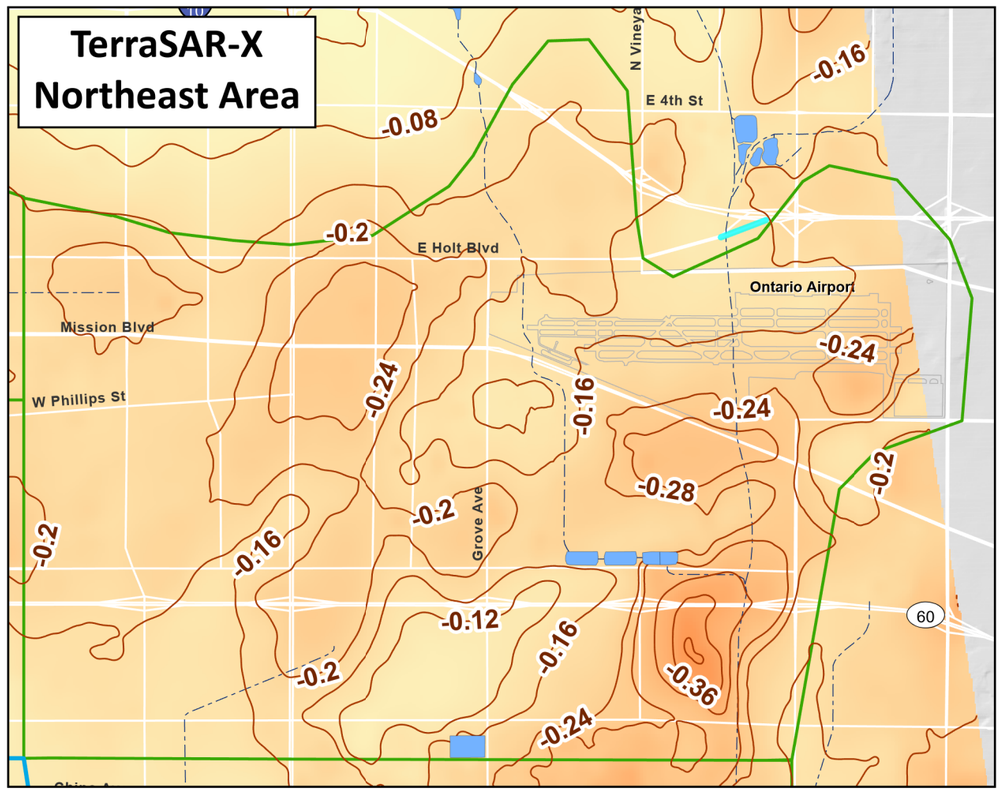
Sentinel-1A and TerraSAR-X
Estimates of Vertical Ground Motion
Across the Western Chino Basin
June 2015 - March 2025











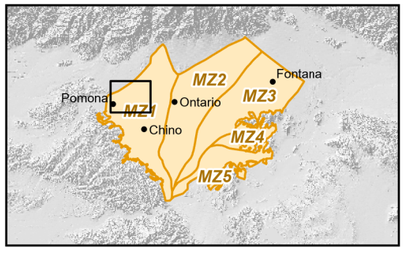


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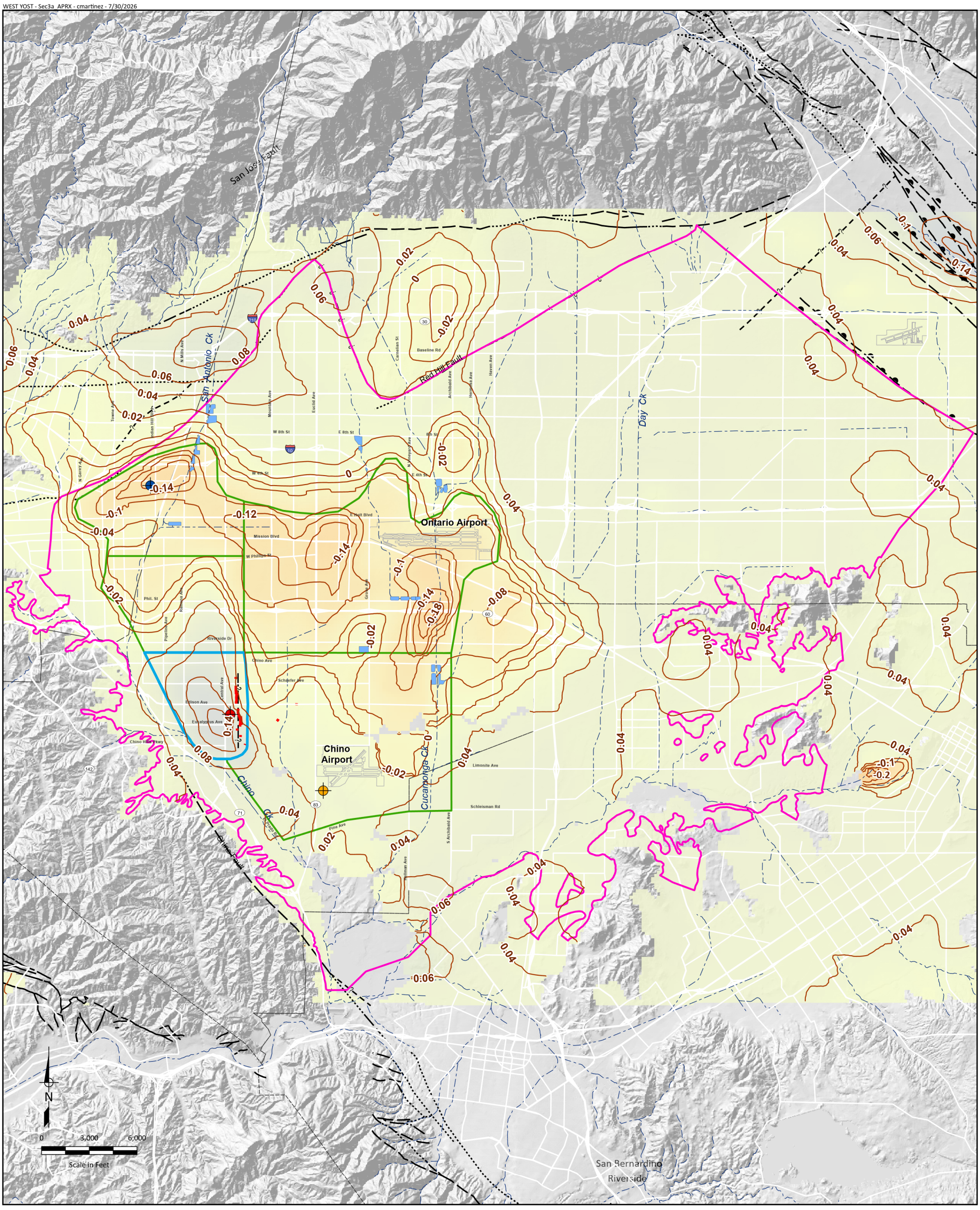
Figure 3-15

Sentinel-1A TerraSAR-X Estimates of Vertical Ground Motion in Northwest MZ-1 and the Northeast Area
June 2015 - March 2025



Relative Change in Land Surface Elevation
as Estimated by InSAR
(June 2015 to March 2025)

High : 0.6 ft

0 ft

Low : -0.6 ft

InSAR absent or incoherent

Managed Area

Areas of Subsidence Concern

Chino Basin Hydrologic Boundary

Historical Ground Fissures

Approximate Location of the Riley Barrier

Fault (solid where accurately located; dashed where approximately located or inferred; dotted where concealed)

Flood Control and Conservation Basins

Pomona Extensometer

Ayala Park Extensometer

Chino Creek Extensometer



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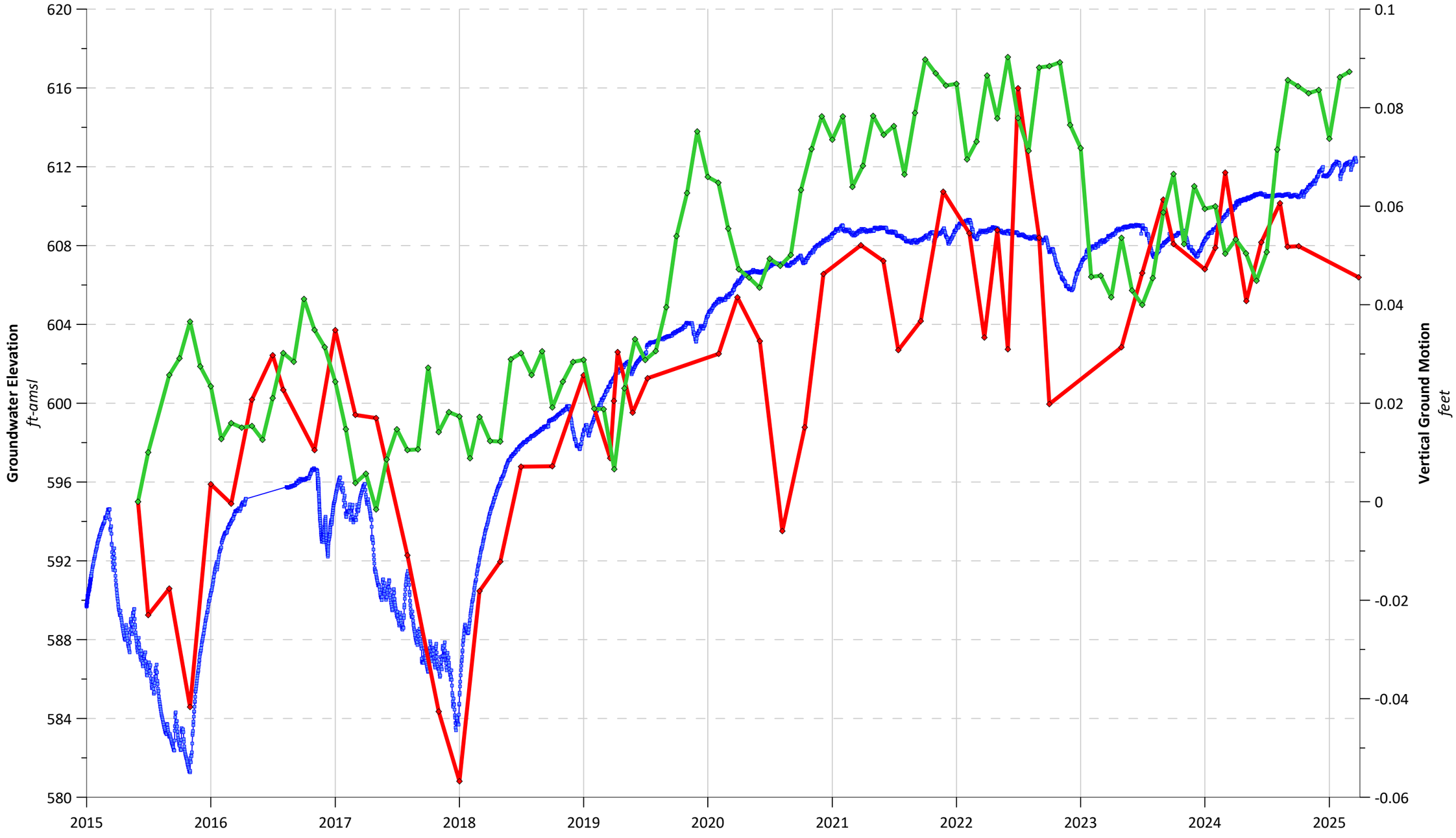
Figure 3-16

Vertical Ground Motion Across Chino Basin Estimated from Sentinel-1A

June 2015 - March 2025



WEST YOST - F3-SC15_InSAR_PumpRecharge.gpj

Chino Basin Watermaster
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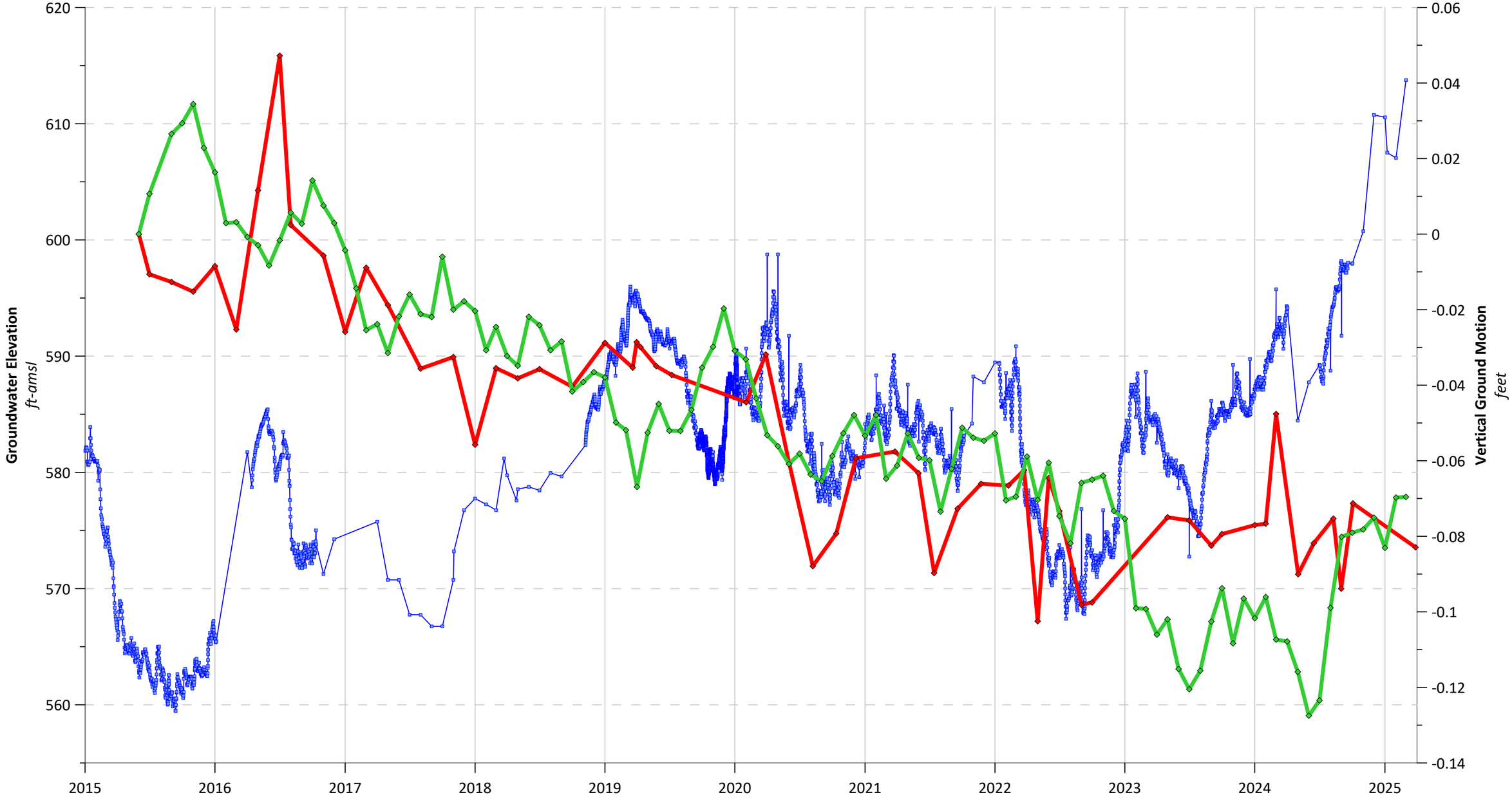
Figure 3-17

Cumulative Vertical Ground Motion Measured by Sentinel-1A and TerraSAR-X at C-15
June 2015 - March 2025



WEST YOST - F3-10_P30_InSAR_PumpRecharge.gpj - CK - 20250630

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Chino Basin Watermaster
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Figure 3-18

Cumulative Vertical Ground Motion Measured by Sentinel-1A and TerraSAR-X at P-30
(June 2015-March 2025)

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions and Recommendations

The major conclusions and recommendations of this 2025/26 Annual Report for the GLMP are:

- At the Ayala Park Extensometer in the Managed Area, hydraulic heads within the shallow and deep aquifer-systems are at or near their highest levels since the inception of the GLMP in 2003, and the Ayala Park Extensometers recorded elastic compression and expansion of the aquifer-system during the current reporting period of March 2025 to March 2026. The elevated hydraulic heads were due to the small volumes of pumping in the Managed Area, which was largely due to the presence of water-quality contaminants in groundwater that constrain its use as drinking water. Hydraulic heads in the deep aquifer-system remain well above the Guidance Level, and the Ayala Park Extensometers recorded no inelastic compaction of the aquifer-system during the current reporting period. In other locations of the Managed Area, the long-term subsidence trend at C-15 also appears to have stopped since 2018, which is consistent with the predominantly elastic deformation measured at the Ayala Park Extensometers and the recovery of hydraulic heads in the Managed Area. There have been no documented reports of additional ground fissuring or damage to overlying infrastructure.

  RECOMMENDATION: Watermaster should continue the existing monitoring program in the Managed Area at its current scope and frequency.

- Across most of the other Areas of Subsidence Concern, prior annual reports have noted long-term trends of gradual land subsidence since 1992, even during periods of stable or increasing heads. The long-term trends in downward vertical ground motion have been of particular concern in Northwest MZ-1, where subsidence occurs differentially across the San Jose Fault. Differential subsidence may pose a threat for ground fissuring. The long-term trends of land subsidence have been attributed to the delayed drainage and compaction of aquitards as they slowly equilibrate with lower heads in the aquifers that were caused by historical pumping. Over the past several years, pumping has decreased across much of the western Chino Basin, partly due to the presence of contaminants in groundwater that constrain its use as drinking water. Also, artificial recharge of imported and storm waters in Northwest MZ-1 (Upland, College Heights, Montclair, and Brooks basins) has increased mainly due to “put” cycles in the Dry-Year Yield Program and relative wet years that resulted in increased storm water recharge. The decreases in pumping and increases in recharge have caused heads to stabilize or increase, and InSAR estimates of ground motion across most of the Areas of Subsidence Concern have shown that the long-term trends of land subsidence have slowed. There have been no documented reports of ground fissuring or damage to overlying infrastructure. These observations suggest:
  - The reductions in pumping, increases in recharge, and increases in hydraulic head may be causing equilibration of hydraulic heads in the aquitards and aquifers, which is slowing the drainage and compaction of the aquitards.

- Hydraulic heads may be near "threshold levels" that, if achieved and maintained, could abate the future occurrence of permanent land subsidence. These hydraulic head thresholds, and various pumping and recharge strategies to maintain heads above these thresholds, were explored in 2023-24 using numerical, one-dimensional aquifer-system compaction models in Northwest MZ-1. The past few years of reduced pumping and increased recharge in Northwest MZ-1 functioned as an empirical test of the model simulations and generally confirmed the model results that elevated hydraulic heads can minimize or abate ongoing subsidence.

- The recent reduction in the rates of land subsidence across the Areas of Subsidence Concern does not mean that the future occurrence of subsidence and ground fissuring is no longer a threat. Future declines in hydraulic heads, which may be caused by increases in pumping or decreases in recharge, may cause aquitard compaction and rates of land subsidence to increase. For example, the pumpers in Northwest MZ-1 could increase pumping in the future, or there could be reduced or infrequent "put" cycles for the Dry-Year Yield Program. The future occurrence of subsidence remains possible in the event of future head declines.

  RECOMMENDATION: Watermaster, with input from the GLMC, should continue implementation of the *Work Plan to Develop a Subsidence-Management Plan for the Northwest MZ-1 Area* to develop management strategies to avoid future occurrences of subsidence. This will include:

  - Continuing aquifer-system monitoring and data analysis in Northwest MZ-1, including continued calibration and evaluation of hydraulic head and aquifer-system deformation data from the PX, as well as collection of hydraulic head data from Pomona and MVWD wells equipped with transducers.
  - Continuing the development and evaluation of subsidence-management alternatives using the PX 1D compaction model and results from the 2025 Safe Yield Reevaluation. The methods, results, and findings from this work will be documented in a separate technical memorandum in FY 2026/27. The modeling results, together with recent monitoring data, should be used to finalize the Guidance Level(s) at PX and the *Subsidence Management Plan for Northwest MZ-1*. Any decision to incorporate the recommended Guidance Levels into the Subsidence Management Plan for Northwest MZ-1 will be subject to recommendations from the GLMC, advice from the Watermaster Pools and Advisory Committee, and approval by the Watermaster Board.

  These recommendations support the objectives of OBMP Program Elements 1 and 4, including the monitoring of land subsidence and the development and implementation of management strategies to minimize the potential for future subsidence and ground fissuring in MZ-1. It should be noted that future monitoring and analyses always hold the potential for revisions to the Guidance Level(s), consistent with the adaptive management approach called for in the Chino Basin Subsidence Management Plan.

- Since the inception of the GLMP, Watermaster has employed various methods to monitor ground motion via extensometers, InSAR, and traditional ground-level surveys. Analysis of these data over time has shown that InSAR (using data from the TerraSAR-X satellite) has become an increasingly reliable and accurate method for monitoring of vertical ground motion across most of the Areas of Subsidence Concern for the following reasons:

  - Improvements in satellite technology over time have increased the spatial resolution, temporal resolution, and accuracy of InSAR. InSAR provides higher spatial and temporal resolution compared to traditional leveling surveys.

- Sean Yarborough (formerly Neva Ridge Technologies, Inc.), a long-time subconsultant to the Watermaster, has been able to stay abreast of the newest InSAR products and processing techniques which in turn provides InSAR deliverables to the GLMC with high accuracy, resolution, and coherence.
- Where and when the extensometer, InSAR, and traditional ground-leveling datasets overlap, InSAR shows a similar spatial pattern and magnitude of ground motion. Research conducted for the GLMC has shown that the errors inherent in InSAR and traditional ground-level methods are similar.
- Land-use changes from agricultural to urban uses have added hard, consistent radar wave reflectors to the ground surface over time. InSAR results are now coherent and useful across most of the Areas of Subsidence Concern.
- During FY 2025/26, Watermaster evaluated Sentinel-1A InSAR data published by DWR across the Chino Basin and compared the results with TerraSAR-X. Both datasets show generally similar regional patterns of vertical ground motion; however, TerraSAR-X provides greater spatial detail and better delineates localized areas of differential subsidence. The Sentinel-1A data also indicate relatively little vertical ground motion across much of the eastern Chino Basin.

RECOMMENDATION: Watermaster should continue to prepare annual high-quality, high-resolution InSAR estimates of vertical ground motion using TerraSAR-X as the primary dataset for monitoring in the Areas of Subsidence Concern.

RECOMMENDATION: Sentinel-1A provides a useful supplemental dataset for evaluating vertical ground motion across the entire Chino Basin. Watermaster should review the publicly available Sentinel-1A data approximately every five years to evaluate vertical ground motion in the eastern Chino Basin and determine whether expansion of routine TerraSAR-X monitoring is warranted.

RECOMMENDATION: Watermaster should consider reducing the traditional ground-level surveying and transition to annual GPS surveys at four control points located in the Managed Area, Northwest MZ-1, Northeast Area, and Southeast Area. This change is recommended because InSAR now provides reliable, high-resolution estimates of vertical ground motion across most of the Areas of Subsidence Concern, reducing the need for extensive traditional leveling surveys. The four GPS control points will provide independent ground-based measurements to verify the InSAR results and support future calibration of the 1D Models.

- Section 3.5 described the results and conclusions of the Whispering Lakes Subsidence Investigation and concluded that shallow soil consolidation associated with the golf course and/or prior land uses is the most plausible cause of the ongoing subsidence in this area. Although deeper aquifer-system compaction cannot be ruled out as a contributing mechanism, Watermaster was unsuccessful in obtaining access to nearby wells to install additional groundwater level monitoring equipment. The most recent InSAR data in 2026 also indicate a decrease in the rate of subsidence.

RECOMMENDATION: Discontinue outreach efforts to obtain access to additional monitoring wells in the vicinity of the Whispering Lakes Subsidence Feature in FY 2026/27. The Watermaster should continue to monitor and evaluate vertical ground motion at the Whispering Lakes Subsidence Feature using the high-resolution InSAR analyses performed for the GLMP. Additional groundwater level monitoring should be reconsidered if future InSAR results indicate a substantial change in the magnitude or spatial pattern of vertical ground motion or if Watermaster obtains access to nearby wells suitable for groundwater level monitoring.

4.2 Recommended Scope and Budget for Fiscal Year 2026/27

The scope-of-work for the GLMP for FY 2026/27 was recommended by the GLMC in April 2026 and approved by Watermaster in May 2026. Appendix A is the technical memorandum prepared by the GLMC, titled *Recommended Scope and Budget for the Ground-Level Monitoring Program for FY 2026/27*.

In March 2027, Watermaster staff and the Watermaster Engineer will present the preliminary results of the GLMP through 2026 and a recommended FY 2027/28 scope and budget to the GLMC for consideration. As is typically done, the GLMC members can recommend changes to the proposed scope of work for the GLMP.

4.3 Changes to the Subsidence Management Plan

The Subsidence Management Plan calls for ongoing monitoring, data analysis, and annual reporting, and if the monitoring data in the Areas of Subsidence Concern indicate the potential for adverse impacts due to subsidence, Watermaster will revise the Subsidence Management Plan pursuant to the process outlined in Section 4 of the Subsidence Management Plan.

Although there are no recommended changes to the Subsidence Management Plan in this report, Watermaster is continuing implementation of the *Work Plan to Develop a Subsidence-Management Plan for the Northwest MZ-1 Area*. During FY 2026/27, the Watermaster Engineer plans to complete the evaluation of subsidence-management alternatives and use the results to finalize the Guidance Criteria and the *Subsidence Management Plan for Northwest MZ-1*. The Guidance Criteria for Northwest MZ-1 will then be added to the Chino Basin Subsidence Management Plan. This update will require review and input by the GLMC and the Watermaster Pools, Advisory Committee, and Board. Watermaster will apprise the Court of revisions to the Subsidence Management Plan as part of its OBMP implementation status reporting. The updated Chino Basin Subsidence Management Plan is anticipated to be completed by the end of FY 2026/27.

5.0 GLOSSARY

The following glossary contains the terms and definitions used in this report and generally in the discussions at GLMC meetings.

Aquifer – A saturated, permeable, geologic unit that can transmit significant quantities of groundwater under ordinary hydraulic gradients and is permeable enough to yield economic quantities of water to wells.

Aquifer-system – A heterogeneous body of interbedded permeable and poorly permeable geologic units that function as a water-yielding hydraulic unit at a regional scale. The aquifer-system may comprise one or more aquifers within which aquitards are interspersed. Confining units may separate the aquifers and impede the vertical exchange of groundwater between aquifers within the aquifer-system.

Aquitard – A saturated, but poorly permeable geologic unit that impedes groundwater movement and does not yield water freely to wells but may transmit appreciable water to and from adjacent aquifers and, where sufficiently thick, may constitute an important groundwater storage unit. A really, extensive aquitards may function regionally as confining units within aquifer-systems.

Artesian – An adjective referring to confined aquifers. Sometimes the term artesian is used to denote a portion of a confined aquifer where the altitudes of the potentiometric surface are above land surface (flowing wells and artesian wells are synonymous in this usage). But, more generally, the term indicates that the altitudes of the potentiometric surface are above the altitude of the base of the confining unit (artesian wells and flowing wells are not synonymous in this case).

Compaction – Compaction of the aquifer-system reflects the rearrangement of the mineral grain pore structure and largely non-recoverable reduction of the porosity under stresses greater than the pre-consolidation stress. Compaction, as used here, is synonymous with the term “virgin consolidation” used by soils engineers. The term refers to both the process and the measured change in thickness. As a practical matter, a very small amount (1 to 5 percent) of compaction is recoverable as a slight elastic rebound of the compacted material if stresses are reduced.

Compression – A reversible compression of sediments under increasing effective stress; it is recovered by an equal expansion when aquifer-system heads recover to their initial higher values.

Consolidation – In soil mechanics, consolidation is the adjustment of a saturated soil in response to increased load, involving the squeezing of water from the pores and a decrease in the void ratio or porosity of the soil. For the purposes of this report, the term “compaction” is used in preference to consolidation when referring to subsidence due to groundwater extraction.

Confined Aquifer-system – A system capped by a regional aquitard that strongly inhibits the vertical propagation of head changes to or from an overlying aquifer. The heads in a confined aquifer-system may be intermittently or consistently different than in the overlying aquifer.

Deformation, Elastic – A fully reversible deformation of a material. In this report, the term “elastic” typically refers to the reversible (recoverable) deformation of the aquifer-system sediments or the land surface.

Deformation, Inelastic – A non-reversible deformation of a material. In this report, the term “inelastic” typically refers to the permanent (non-recoverable) deformation of the aquifer-system sediments or the land surface.

Differential Land Subsidence – Markedly different magnitudes of subsidence over a short horizontal distance, which can be the cause of ground fissuring.

Drawdown – Decline in aquifer-system head typically due to pumping by a well.

Expansion – In this report, expansion refers to the expansion of sediments. A reversible expansion of sediments under decreasing effective stress.

Extensometer – A monitoring well housing a free-standing pipe or cable that can measure vertical deformation of the aquifer-system sediments between the bottom of the pipe and the land surface datum.

Ground Fissures – Elongated vertical cracks in the ground surface that can extend several tens of feet in depth.

Hydraulic Conductivity – A measure of the medium's capacity to transmit a particular fluid. The volume of water at the existing kinematic viscosity that will move in a porous medium in unit time under a unit hydraulic gradient through a unit area. In contrast to permeability, it is a function of the properties of the liquid, as well as the porous medium.

Hydraulic Gradient – Change in head over a distance along a flow line within an aquifer-system.

Hydraulic Head – A measure of the potential for fluid flow. The height of the free surface of a body of water above a given subsurface point.

InSAR (Synthetic Aperture Radar Interferometry) – A remote-sensing method (radar data collected from satellites) that measures ground-surface displacement over time.

Linear Potentiometer – A highly sensitive electronic device that can generate continuous measurements of displacement between two objects. Used to measure movement of the land-surface datum with respect to the top of the extensometer measuring point.

Nested Piezometer – A single borehole containing more than one piezometer.

Overburden – The weight of overlying sediments, including their contained water.

Piezometer – A monitoring well that measures groundwater levels, or piezometric level, at a point, or in a very limited depth interval, within an aquifer-system.

Piezometric (Potentiometric) Surface – An imaginary surface representing the total head of groundwater within a confined aquifer-system, defined by the level to which the water will rise in wells or piezometers that are screened within the confined aquifer-system.

Pore pressure – Water pressure within the pore space of a saturated sediment.

Rebound – Elastic rising of the land surface.

Stress, Effective – The difference between the geostatic stress and fluid pressure at a given depth in a saturated deposit, representing the portion of the applied stress that becomes effective as intergranular stress.

Stress, Pre-consolidation – The maximum antecedent effective stress to which a deposit has been subjected and can withstand without undergoing additional permanent deformation. Stress changes in the range less than the pre-consolidation stress produce elastic deformations of small magnitude. In fine-grained materials, stress increases beyond the pre-consolidation stress produce much larger deformations that are principally inelastic (non-recoverable). Synonymous with "virgin stress."

Stress – Stress (pressure) that is borne by and transmitted through the grain-to-grain contacts of a deposit, thus affecting its porosity and other physical properties. In one-dimensional compression, effective stress is the average grain-to-grain load per unit area in a plane normal to the applied stress. At any given depth, the effective stress is the weight (per unit area) of sediments and moisture above the water table plus the submerged weight (per unit area) of sediments between the water table and a specified depth plus or minus the seepage stress (hydrodynamic drag) produced by downward or upward components, respectively, of water movement through the saturated sediments above the specified depth. Effective stress may also be defined as the difference between the geostatic stress and fluid pressure at a given depth in a saturated deposit and represents the portion of the applied stress that becomes effective as intergranular stress.

Subsidence – Permanent or non-recoverable sinking or settlement of the land surface due to any of several processes.

Transducer – An electronic device that can measure piezometric levels by converting water pressure to a recordable electrical signal. Typically, the transducer is connected to a data logger, which records the measurements.

Water Table – The surface of a body of unconfined groundwater at which the pressure is equal to atmospheric pressure and is defined by the level to which the water will rise in wells or piezometers that are screened within the unconfined aquifer-system.

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Appendix A

Recommended Scope and Budget of the Ground-Level Monitoring Committee for FY 2026/27

TECHNICAL MEMORANDUM

DATE: May 1, 2026 Project No.: 941-80-25-21

TO: Ground-Level Monitoring Committee

FROM: West Yost Associates

REVIEWED BY: Andy Malone, PG

SUBJECT: Recommended Scope-of-Work and Budget for the Ground-Level Monitoring Program for Fiscal Year 2026/27 **(FINAL)**

BACKGROUND AND PURPOSE

Pursuant to the Optimum Basin Management Program Implementation Plan and the Peace Agreement, the Chino Basin Watermaster (Watermaster) implements a Subsidence Management Plan (SMP) for the Chino Basin to minimize or stop the occurrence of land subsidence and ground fissuring. The Court approved the SMP and ordered its implementation in November 2007 (2007 SMP). The 2007 SMP was updated in 2015 (2015 SMP) and can be downloaded from the Watermaster website. The SMP outlines a program of monitoring, data analysis, and annual reporting. A key element of the SMP is its adaptive nature—Watermaster can adjust the SMP as warranted by the monitoring/testing data.

The Watermaster Engineer, with the guidance of the Ground-Level Monitoring Committee (GLMC), prepares annual reports which include: the results of the Ground-Level Monitoring Program (GLMP); interpretations of the data; recommendations for the GLMP for the following fiscal year (FY); and recommendations for adjustments to the SMP, if any.

This Technical Memorandum (TM) describes the Watermaster Engineer's recommended activities for the GLMP for FY 2026/27 in the form of a proposed scope-of-work and budget.

Members of the GLMC are asked to:

- Review this draft TM prior to March 5, 2026.
- Attend a meeting of the GLMC at 10:00 am on March 5, 2026 to discuss the proposed scope-of-work and budget for FY 2026/27.
- Submit comments and suggested revisions on the proposed scope-of-work and budget for FY 2026/27 to the Watermaster by April 2, 2026.

Table 1. Work Breakdown Structure and Cost Estimates for the Ground-Level Monitoring Program: FY 2026/27

Task Description			Notes	Labor (days)		Other Direct Costs						Totals			
				Person Days	Total	Travel	New Equip.	Equip. Rental	Outside Pro	Misc.	Total	Totals by Task	Recommended Budget *2026/27*	Approved Budget *2025/26*	Net Change *from 2025/26*
													a	*b*	*a - b*
Task 1. Setup and Maintenance of the Monitoring Network					**$43,706**						**$10,916**	**$54,622**	**$54,622**	**$51,357**	**$3,264**
1.1	Maintain Extensometer Facilities														
	1.1.1	Routine maintenance of Ayala Park, Chino Creek, and Pomona extensometer facilities		21	$32,010	$1,720	$250	$920			$2,890	$34,900	$34,900	$32,250	$2,649
	1.1.2	Replacement/repair of equipment at extensometer facilities		6	$11,696	$430	$6,000				$6,430	$18,126	$18,126	$17,511	$615
1.2	Annual Lease Fees for the Chino Creek extensometer facility			0	$0					$1,596	$1,596	$1,596	$1,596	$1,596	$0
Task 2. MZ-1: Aquifer-System Monitoring and Testing					**$35,556**						**$1,740**	**$37,296**	**$37,296**	**$35,230**	**$2,066**
2.1	Conduct Quarterly Monitoring at Extensometers Facilities														
	2.1.1	Download data from the Ayala Park Extensometer facility		4	$5,916	$430		$150			$580	$6,496	$6,496	$6,111	$385
	2.1.2	Download data from the Chino Creek Extensometer facility		4	$5,916	$430		$150			$580	$6,496	$6,496	$5,760	$736
	2.1.3	Download data from Pomona Extensometer facility		4	$5,916	$430		$150			$580	$6,496	$6,496	$6,111	$385
	2.1.4	Process, check, and upload data to database		10	$17,808						$0	$17,808	$17,808	$17,248	$560
Task 3. Basin Wide Ground-Level Monitoring Program (InSAR)					**$73,304**						**$17,600**	**$90,904**	**$90,904**	**$111,216**	**-$20,312**
3.1	Satellite tasking and data selection with AirBus for 2026/27			0.5	$1,240					$1,000	$1,000	$2,240	$2,240	$2,200	$40
3.2	Assess SAR baselines for 2026/27 and select/purchase TerraSAR-X frames from Airbus			0.5	$1,240					$10,000	$10,000	$11,240	$11,240	$11,200	$40
3.3	Prepare and check interferograms for 2026/27			28	$68,344						$0	$68,344	$68,344	$66,144	$2,200
3.4	GAMMA software maintenance for InSAR processing			1	$2,480					$6,600	$6,600	$9,080	$9,080	$17,600	-$8,520
3.5	Compile and prepare DWR InSAR estimates for Chino Basin; Compare to TerraSAR-X			0	$0						$0	$0	$0	$14,072	-$14,072
Task 4. Perform Ground-Level Surveys					**$14,152**						**$31,140**	**$45,292**	**$45,292**	**$64,031**	**-$18,739**
4.1	Conduct Spring-2027 Elevation surveys in Northwest MZ-1			0	$0				$64,270		$0	$0	$0	$42,887	-$42,887
4.2	Conduct Spring-2027 Elevation Survey in the Northeast Area			0	$0				$122,480		$0	$0	$0	$0	$0
4.3	Conduct Spring-2027 Elevation Survey in the Southeast Area			0	$0				$78,695		$0	$0	$0	$0	$0
4.4	Conduct Spring-2027 Elevation and EDM Surveys in the Managed Area/Fissure Zone			0	$0				$75,890		$0	$0	$0	$0	$0
4.5	Conduct GPS Surveys at Four Control Points in the Northwest, Northeast, Southeast, and Managed Areas			0	$7,808				$26,140		$26,140	$33,948	$33,948	$5,000	$28,948
4.6	Replace Destroyed Benchmarks (if needed)			0	$0				$5,000		$5,000	$5,000	$5,000	$10,000	-$5,000
4.7	Process, Check, and Update Database			3	$6,344						$0	$6,344	$6,344	$6,144	$200
Task 5. Data Analysis and Reporting					**$72,012**						**$0**	**$72,012**	**$72,012**	**$81,668**	**-$9,656**
5.1	Prepare Draft 2025/26 Annual Report of the Ground-Level Monitoring Committee			18	$33,992						$0	$33,992	$33,992	$34,896	-$904
5.2	Prepare Final 2025/26 Annual Report of the Ground-Level Monitoring Committee			5.5	$12,612						$0	$12,612	$12,612	$14,432	-$1,820
5.3	Compile and Analyze Data from the 2026/27 Ground-Level Monitoring Program			13	$25,408						$0	$25,408	$25,408	$22,704	$2,704
5.4	Continue Whispering Lakes Subsidence Investigation			0	$0						$0	$0	$0	$9,636	-$9,636
Task 6. Develop a Subsidence-Management Plan for Northwest MZ-1					**$107,696**						**$0**	**$107,696**	**$107,696**	**$169,378**	**-$61,682**
6.1	Aquifer-System Monitoring														
	6.1.1	Collect pumping and piezometric data from agencies every three months; check and upload data to HDX		0	$0						$0	$0	$0	$0	$0
	6.1.2	Prepare and analyze charts and data graphics of pumping and recharge (Northwest MZ-1), piezometric levels, and aquifer-system deformation from PX		4	$7,104						$0	$7,104	$7,104	$4,792	$2,312
	6.1.3	PX Refurbishment - Continue to periodically check and adjust extensometers		0	$0						$0	$0	$0	$46,250	-$46,250
6.2	Refine and Evaluate Subsidence-Management Alternatives														
	6.2.1	Recalibrate PX 1D Model (if necessary) and update the CVM at the PX Site		0	$0						$0	$0	$0		
	6.2.2	Run PX 1D Model using the 2025 SYR results		0	$0						$0	$0	$0		
	6.2.3	Prepare draft TM summarizing model results and up to two SMAs, and meet with the GLMC for feedback		0	$0						$0	$0	$0		
	6.2.4	Run the SMAs with the CVM and 1D Models		23	$52,392						$0	$52,392	$52,392	$118,336	-$17,744
	6.2.5	Prepare draft TM to describe SMA results, interpretations and recommendations		12.5	$26,556						$0	$26,556	$26,556		
	6.2.6	Prepare for and meet with the GLMC to receive feedback on the draft TM		5	$11,512						$0	$11,512	$11,512		
	6.2.7	Prepare final TM to describe SMA results, interpretations and recommendations		4.5	$10,132						$0	$10,132	$10,132		
Task 7. Meetings and Administration					**$53,846**						**$364**	**$54,210**	**$54,210**	**$60,891**	**-$6,681**
7.1	Prepare for and Conduct Two Meetings of the Ground-Level Monitoring Committee		a	10	$22,712	$243					$243	$22,955	$22,955	$33,619	-$10,664
7.2	Prepare for and Conduct One As-Requested Ad-Hoc Meeting		a	4	$9,136	$121					$121	$9,257	$9,257	$7,216	$2,041
7.3	Perform Monthly Project Management			4.5	$9,516						$0	$9,516	$9,516	$8,112	$1,404
7.4	Prepare a Recommended Scope and Budget for the GLMC for FY 2027/28			5.75	$12,482						$0	$12,482	$12,482	$11,944	$538
Totals					**$400,272**						**$61,760**		**$462,032**	**$573,772**	**-$111,740**

Notes:

a Assumes in-person meetings.

A final recommended scope-of-work and budget that addresses the comments and suggested revisions of the GLMC will be included in the Watermaster staff's proposed budget for FY 2026/27. The final scope-of-work and budget for FY 2026/27 approved by the Watermaster will be included in Section 4 of the *2025/26 Annual Report for the GLMP*.

RECOMMENDED SCOPE-OF-WORK AND BUDGET – FY 2026/27

A proposed scope-of-work and budget for the GLMP for FY 2026/27 is shown in Table 1 as a line-item cost estimate. The proposed scope-of-work is summarized below.

Task 1. Setup and Maintenance of the Monitoring Network

The Chino Basin extensometer facilities are key monitoring facilities for the GLMP. They require regular and as-needed maintenance and calibration to remain in working order and to ensure the recording of accurate measurements.

Task 1.1. Maintain Extensometer Facilities

This subtask includes performing monthly visits to the extensometer facilities at Ayala Park (APX), Chino Creek (CCX), and Pomona (PX) to ensure functionality and calibration of the monitoring equipment and data loggers. Two staff members are required for these visits due to safety concerns.

Non-routine efforts to be performed under this subtask during FY 2026/27 may include:

- As-needed adjustments to the extensometers to ensure the accuracy of the measurements of aquifer-system deformation.
- As-needed repair or replacement of linear potentiometers, transducers, and/or the CR1000X data loggers.

Task 1.2. Annual Lease Fees for the Chino Creek Extensometer Site

The County of San Bernardino (County) owns the land the Chino Creek extensometer facility is located on. As such, the Watermaster entered into a lease agreement with the County in 2012 and pays the County and annual rental payment of $1,596.

Task 2. Aquifer-System Monitoring and Testing

This task involves the collection, compilation, and checking of hydraulic head and aquifer-system deformation data from the Ayala Park, Chino Creek, and PX extensometer facilities.

Task 2.1. Conduct Quarterly Monitoring at Extensometer Facilities

This subtask involves quarterly data collection, processing, and checking from the three extensometer facilities. This frequency of data collection/checking is needed to ensure that the monitoring equipment is in good working order and to minimize the risk of losing data because of equipment malfunction. For this subtask, the complete extensometer and piezometer

records from the APX, CCX, and PX facilities are loaded to HydroDaVE℠ (Hydrologic Database and Visual Explanations), the annual report figures are updated, and all the new data are checked for accuracy. If the data indicate malfunctioning equipment or inaccurate measurements, then any necessary adjustments to the monitoring equipment are made. Two staff members are required for these visits due to safety concerns.

Task 3. Basin-Wide Ground-Level Monitoring Program (InSAR)

This task involves the annual collection and analysis of Synthetic Aperture Radar (SAR) scenes to estimate the vertical ground motion across the western portion of Chino Basin from March 2026 to March 2027.[1]

In this subtask, five SAR scenes that are acquired by the TerraSAR-X satellite from March 2026 to March 2027 are purchased from the German Aerospace Center. West Yost will use the SAR scenes to prepare 12 interferograms (InSAR) that describe the incremental and cumulative vertical ground motion that occurred from March 2026 to March 2027, and since 2011. The associated costs to task, acquire, purchase, and process the InSAR data is as follows:

- Task TerraSAR-X for five SAR acquisitions for the western Chino Basin ($1,000)
- Purchase TerraSAR-X data ($10,000)
- Prepare and check InSAR results, including the interferograms and GIS-generated rasters ($76,448)

In addition, West Yost purchased and maintains the GAMMA software that is necessary to process the SAR data and prepare the InSAR estimates of vertical ground motion. The annual maintenance cost for the GAMMA software is $6,600.

Task 4. Perform Ground-Level Surveys

This task involves conducting traditional leveling and GPS elevation surveys at benchmark monuments across defined areas of western Chino Basin to estimate the vertical ground motion that occurred since the prior survey. Figure 1 shows the location of the benchmark monuments surveyed across the western Chino Basin. Electronic distance measurements (EDM surveys) are also performed periodically between monuments to estimate horizontal ground motion in areas where ground fissuring due to differential land subsidence is a concern. Table 2 documents the traditional leveling and GPS surveys conducted since 2018 as part of the GLMP.

[1] West Yost is performing this task internally instead of subcontracting the work. This was made possible by West Yost hiring the InSAR subconsultant directly and purchasing/maintaining the necessary hardware and software.

Relative Change in Land Surface Elevation
as Estimated by InSAR
(March 2011 to March 2025)

High : 0.75 ft

0 ft

Low : -0.75 ft

InSAR absent or incoherent

Areas of Subsidence Concern

Pomona Extensometer Facility

Chino Creek Extensometer Facility

Ayala Park Extensometer Facility

Ground-Level Survey Benchmark

Ground-Level GPS Station

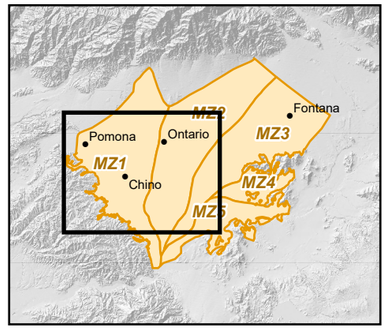
Chino Desalter Authority Well

SB County Extraction Well

Ground Fissures

Approximate Location of the Riley Barrier

Santa Ana Watershed Rivers



Chino Basin Watermaster
Ground-Level Monitoring Program

Figure 1

Ground-Level Monitoring Program
Fiscal Year 2026/27

N

0 0.5 1 2 Miles

WEST YOST - K:\Client\4941 Chino Basin Watermaster\WD2026\Master\GL_Ground Level\GIS\MXD\Scoping\GLMP_Scoping_Map.aprx - ckelly - 2/19/2026

Table 2. History of Ground-Level Surveys

Ground-Level Survey Area	Ground-Level Survey Completed (Y/N)?									
	2018	2019	2020	2021	2022	2023	2024	2025	2026[c]	2027[d]
Managed Area	Y	N	N	N	N	N	Y	N	N	N
Fissure Zone Area[a]	Y	N	N	N	N	N	N	N	N	N
Central Area	N	N	N	N	N	N	N	N	N	N
Northwest Area	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
San Jose Fault Zone Area[a]	Y	Y	Y	Y	Y	N	N	N	N	N
Southeast Area	Y	N	N	N	Y	N	N	N	N	N
Northeast Area	Y	Y	Y	N	N	N	N	N	N	N
GPS points in key areas[b]	-	-	-	-	-	-	-	-	-	Y

(a) Denotes EDM survey area (measurements of horizontal strain).

(b) As an alternative to traditional ground-level surveys, a new recommendation for Spring 2027 is to conduct GPS surveys at four key control points in the Managed, Northwest, Northeast, and Southeast areas.

(c) The 2026 surveys are scheduled to begin in March 2026.

(d) The 2027 surveys are scheduled to begin in March 2027.

The surveys recommended for FY 2026/27 include the following:

Task 4.5. Conduct GPS Surveys at Four Control Points in the Northwest, Northeast, Southeast, and Managed Areas

As an alternative to traditional ground-level surveys, a new recommendation for Spring 2027 is to conduct GPS surveys at four key control points in the Managed, Northwest, Southeast, and Northeast areas:

- APEXO-1 at the Ayala Park Extensometer (Managed Area)
- MPEXO-1 at the Pomona Extensometer (Northwest Area)
- B-290 at the Chino Creek Extensometer (Southeast Area)
- A new control point near the 1D modeling location at Ontario Well 33 (Northeast Area)

These control points will be referenced to the Ayala Park elevation datum at the APX.

This strategy offers a more cost-effective approach, since the results of the GLMP indicate that InSAR monitoring is providing accurate estimates of vertical ground motion at high spatial resolution and across all Areas of Subsidence Concern. The GPS survey results will be used to verify InSAR estimates of vertical ground motion, support calibration of the 1D subsidence models, and provide reference elevations for any future differential leveling surveys in these four Areas of Subsidence Concern. This subtask also includes labor by field staff to escort the contractor to each GPS control point.

Task 4.6. Replace Destroyed Benchmarks (if needed)

In this subtask, the surveyor replaces benchmark monuments that have been destroyed since the last survey, if any. If additional benchmarks are required, the surveyor will provide a cost estimate to complete the task.

Task 4.7. Process, Check, and Update Database

In this subtask, the Watermaster Engineer receives and catalogs the survey results provided by the surveyor, prepares the data for display as a GIS layer, and performs checks against InSAR and extensometer data for reasonableness and accuracy.

Ground-Level Surveys Not Recommended for Spring 2027

Ground-level surveys are **not** recommended for Spring 2027 in the Managed, Central, Northwest, Northeast and Southeast Areas. This recommendation is justified because:

- InSAR is proving to be an accurate, more efficient, higher-resolution method to monitor vertical ground motion across the western Chino Basin.
- Hydraulic heads and vertical ground motion in some of these areas are stable or increasing.
- The cost of conducting traditional leveling surveys has increased significantly in recent years.

Task 5. Data Analysis and Reporting

Task 5.1. Prepare Draft 2025/26 Annual Report for the Ground-Level Monitoring Program

Prepare the text, tables, and figures for a draft *2025/26 Annual Report for the GLMP* and submit the report to the GLMC by September 17, 2026, for review and comment.

Task 5.2. Prepare Final 2025/26 Annual Report for the Ground-Level Monitoring Program

Update the text, tables, and figures based on the comments received from the GLMC and prepare a final *2025/26 Annual Report for the GLMP* by November 2, 2026. Responses to GLMC comments will be included as an appendix to the final report. The report will be included in the agenda packet for the November 2026 Watermaster meetings for approval.

Task 5.3. Compile and Analyze Data from the 2026/27 Ground-Level Monitoring Program

During the winter and spring of 2027, the monitoring data generated from the GLMP during 2026/27 is checked, mapped, charted, and analyzed as the first step in the preparation of the subsequent annual report. Some of the maps, charts, and tables are shared with the GLMC at its meetings in early 2027 during the development of a recommended scope of services and budget for FY 2027/28.

Future Reporting Frequency and Format

Following completion of the 2025/26 Annual Report, the Watermaster Engineer recommends evaluating opportunities to improve reporting efficiency, including the potential to reduce the reporting frequency to bi-annual, which could be coordinated with the bi-annual State of the Basin Report, subject to Court approval.

Under this approach, the Watermaster Engineer would continue to provide annual data summaries and updates to the GLMC during a special meeting each spring. A written report would be prepared every two years and/or presented in coordination with the State of the Basin Report.

Any modification to the reporting frequency or format would be implemented only upon recommendation by the GLMC, the Watermaster Pools, Advisory Committee, and Board, and Court approval. This approach has the potential to reduce long-term administrative and reporting costs while maintaining annual oversight and GLMC collaboration.

Task 5.4. Conduct Whispering Lakes Subsidence Investigation of the Northeast Area

In the Northeast Area, the long-term and short-term InSAR estimates indicate that persistent downward ground motion has occurred in a concentrated area south of the Ontario International Airport between Vineyard Avenue and Archibald Avenue in the vicinity of Whispering Lakes Golf Course. This concentrated area of subsidence is herein referred to as the Whispering Lakes Subsidence Feature.

In FY 2021/22, the Watermaster Engineer conducted a Reconnaissance-Level Investigation that included the review and analysis of readily-available borehole and lithologic data, historical air photos, pumping and recharge data, hydraulic head data, and InSAR estimates of vertical ground motion. Figures and charts were prepared and analyzed to derive interpretations and recommendations for future investigations and monitoring. The investigation and recommendations were included in the *FY 2021/22 Annual Report for the GLMP*.

The investigation and subsequent monitoring show that the subsidence feature directly overlies the Whispering Lakes Golf Course, and hence, suggest that the most plausible mechanism for this subsidence feature is shallow soil consolidation associated with the golf course and/or the prior overlying land uses. If true, groundwater management will have no effect on the Whispering Lakes Subsidence Feature. However, the possibility remains that deeper aquifer-system compaction is at least a contributing mechanism for the land subsidence.

Based on these findings, the Watermaster Engineer does **not** recommend continuing the limited monitoring program in FY 2026/27 for the following reasons:

- Vertical ground motion in this area will continue to be evaluated using high-resolution InSAR analyses developed for the GLMP Annual Report.

- The Watermaster Engineer has been unsuccessful in outreach efforts to install transducers in nearby deep groundwater pumping wells at the Niagara Bottling Facility. However, pumping data reported for these wells will continue to be provided to Watermaster and summarized in the GLMP Annual Report.

Although the limited monitoring program is **not** recommended for FY 2026/27, it should be reconsidered in future fiscal years if InSAR patterns change substantially at the Whispering Lakes Subsidence Feature or if the Watermaster Engineer is granted permission to install and download transducer data at the nearby Niagara Bottling Facility. Such reassessment would help determine whether aquitard drainage and groundwater utilization are contributing factors to the observed subsidence.

Task 6. Develop a Subsidence-Management Plan for Northwest MZ-1

The 2007 SMP called for ongoing monitoring and data analysis of the Managed Area; including annual reporting and adjustments to the SMP, as warranted by the data. The 2007 SMP also called for expanded monitoring of the aquifer-system and land subsidence in other areas of subsidence and ground fissuring concern. Figure 1 shows the location of these so-called Areas of Subsidence Concern: Central MZ-1, Northwest MZ-1, Northeast Area, and Southeast Area. The expanded monitoring efforts outside of the Managed Area are consistent with the requirements of OBMP Program Element 1 and its implementation plan contained in the Peace Agreement.[2]

The 2007 SMP stated that if data from existing monitoring efforts in the Areas of Subsidence Concern indicate the potential for adverse impacts due to subsidence, the Watermaster would revise the SMP to avoid those adverse impacts. The 2014 Annual Report of the GLMP recommended that the 2007 SMP be updated to better describe the Watermaster's land subsidence efforts and obligations, including areas outside of MZ-1. As such, the update included a name change to the 2015 Chino Basin Subsidence Management Plan (2015 SMP) and a recommendation to develop a subsidence management plan for Northwest MZ 1.

The Watermaster had been monitoring vertical ground motion in Northwest MZ-1 via InSAR during the development of the 2007 SMP. Land subsidence in Northwest MZ-1 was first identified as a concern in 2006 in the MZ-1 Summary Report and again in 2007 in the 2007 SMP. Of particular concern was the occurrence of concentrated differential subsidence across the San Jose Fault in Northwest MZ-1—the same spatial pattern of differential subsidence that occurred in the Managed Area during the time of ground fissuring. Ground fissuring is the main subsidence-related threat to infrastructure. The issue of differential subsidence, and the potential for ground fissuring in Northwest MZ-1, has been discussed at prior GLMC meetings, and the subsidence has been documented and described as a concern in the Watermaster's

[2] http://www.cbwm.org/docs/legaldocs/Peace_Agreement.pdf.

State of the Basin Reports, the annual reports of the GLMP, and in the *Initial Hydrologic Conceptual Model and Monitoring and Testing Program for the Northwest MZ-1 Area* (WEI, 2017). The Watermaster increased monitoring efforts in Northwest MZ-1 beginning in FY 2012/13 to include ground elevation surveys and electronic distance measurements (EDM) to monitor ground motion and the potential for fissuring.

In 2015, the Watermaster's Engineer developed the *Work Plan to Develop a Subsidence Management Plan for the Northwest MZ-1 Area* (Work Plan; WEI 2015b).[3] The Work Plan is characterized as an ongoing Watermaster effort and includes a description of a multi-year scope-of-work, a cost estimate, and an implementation schedule. The Work Plan was included in the 2015 SMP as Appendix B. Implementation of the Work Plan began in July 2015. On an annual basis, the GLMP analyzes the data and information generated by the implementation of the Work Plan. The results and interpretations generated from the analysis are documented in the annual report for the GLMP and used to prepare recommendations for future activities.

Progress to Implement Work Plan through FY 2025/26

The progress that has been made to implement the Work Plan through FY 2025/26 is described below:

- An initial hydrogeologic conceptual model of the Northwest MZ-1 Area was developed, and a report was published in 2017.[4] This report described the hydrogeology of the area, speculated on the causes of the observed land subsidence, and included a recommended monitoring program.

- A preliminary one-dimensional (1D) compaction model, based on hydrogeologic information from the MVWD-28 well site, was constructed, calibrated and used to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater production and artificial recharge and to identify potential subsidence mitigation strategies. A report[5] was published to document the results and interpretations of the modeling, which were: ***the deep aquifer system is most susceptible to future compaction and associated land subsidence, and hence, heads will need to increase in the deep aquifer system to minimize or abate future subsidence in Northwest MZ-1***. The report also included a recommendation to construct the Pomona Extensometer.

- The initial monitoring program was implemented to closely track groundwater-levels, groundwater production, recharge, and ground motion across Northwest MZ-1. This

[3] Work Plan to Develop a Subsidence-Management Plan for Northwest MZ-1

[4] https://www.cbwm.org/docs/engdocs/GLMC/nwmz1/Final_NWMZ1_Task1_Report.pdf

[5] https://www.cbwm.org/docs/engdocs/GLMC/nwmz1/20171220%20Final%20NWMZ1%20Task3-4%20Tech%20Memo.pdf

monitoring program included the construction of the Pomona Extensometer to measure and record depth-specific heads and aquifer-system deformation. Implementation of the monitoring program is ongoing.

- A new 1D model was constructed and calibrated using the hydrogeologic information collected at the Pomona Extensometer. The 1D model at MVWD-28 was also updated and recalibrated using current information. The objectives of this exercise were to: (i) describe the subsidence mechanisms and the pre-consolidation head by aquifer-system layer in Northwest MZ-1 and (ii) develop modeling tools that can be used to explore the future occurrence of subsidence in Northwest MZ-1 under various basin-operation scenarios of groundwater production and artificial recharge and to identify potential subsidence mitigation strategies. This work was reviewed by the GLMC, and additional model calibration refinements and sensitivity analyses were performed based on GLMC input. In November 2022, the Watermaster Engineer published a final report[6] on the 1D Model calibrations and sensitivity analyses (with review by the GLMC) and deemed the 1D Models sufficient to simulation future land subsidence under prospective plans for pumping and recharge.

- In 2023, the Watermaster Engineer, with review and input from the GLMC, developed an initial "Subsidence Management Alternative" for Northwest MZ-1 called SMA-1. SMA-1 is equivalent to the planning scenario that was simulated with the 2020 Chino Valley Model (CVM) to support the 2020 Safe Yield Recalculation (2020 SYR). The 2020 SYR was intended to represent and simulate the Parties' projected pumping, recharge, and use of storage through 2050. The results of the 2020 SYR (*i.e.,* projected hydraulic heads by CVM layer) were used as input data for the 1D Model simulations to predict the potential future occurrence of subsidence through 2050. In September 2023, the Watermaster Engineer published a draft TM titled *1D Model Simulation of Subsidence in Northwest MZ-1—Subsidence Management Alternative #1*. The Watermaster's recommendations from this work were the following:

    a. Establish a *preliminary* "Northwest MZ-1 Guidance Level" of 630 ft-amsl for hydraulic heads in Layers 3 and 5 at the PX location. The *preliminary* Guidance Level is based on the physics of aquitard drainage and an aspirational Watermaster recommendation that, if achieved, would likely slow or stop aquitard compaction and land subsidence in Northwest MZ-1. While it is true that the rate of subsidence has slowed in Northwest MZ-1, the threat of future groundwater level declines and associated subsidence (and ground fissuring) remains, which is a reason why the Watermaster conducts the subsidence

[6] https://www.cbwm.org/docs/engdocs/GLMC/nwmz1/TM%20-%20941%20-%201D%20Model%20-%20Final.pdf

monitoring program and is developing a Subsidence Management Plan for Northwest MZ-1.

b. Compliance with the Guidance Level should be measured at the PX-2/3 piezometer, which is generally representative of heads in Layers 3 and 5.

c. The methods to achieve the Guidance Level could include but are not limited to: voluntary modification of pumping patterns; in-lieu recharge; wet-water recharge via spreading and/or injection; or a combination of methods. These methods might necessitate: voluntary modification of water-supply plans of the purveyors in the Chino Basin; modification of Watermaster practices for recharge and replenishment; and/or the implementation of regional-scale storage or conjunctive-use programs.

d. Additional SMAs should be developed and evaluated with the 1D Models to generate the necessary information to finalize the Guidance Level and the *Subsidence Management Plan for Northwest MZ-1*. The additional SMAs could be developed during Watermaster's groundwater modeling efforts associated with the 2025 Safe Yield Reevaluation and the development of the Storage and Recovery Master Plan. The GLMC should participate in the scenario building exercises associated with these Watermaster efforts to develop the SMAs, so that the scenarios include various methods to achieve the Guidance Level. Then, the 1D Models should be used to evaluate the potential future subsidence in Northwest MZ-1 under the SMAs. These model results and evaluations will support the establishment of a Guidance Level in the *Subsidence Management Plan for Northwest MZ-1*. It should be noted that future monitoring and analyses always hold the potential for revisions to the Guidance Level, consistent with the adaptive management approach called for in the Chino Basin Subsidence Management Plan.

Based on the expected progress through FY 2025/26, the following work is recommended for FY 2026/27 to develop the *Subsidence Management Plan for Northwest MZ-1*:

Task 6.1. Aquifer-System Monitoring

The established monitoring program of piezometric levels and pumping at wells in Northwest MZ-1 will continue through various techniques, including: (i) SCADA-based monitoring by the Monte Vista Water District; (ii) monitoring of piezometric levels via sonar[7]; (iii) monitoring of piezometric levels via pressure transducers at City of Pomona production wells; and (iv) manual measurements of piezometric levels. These data, along with data collected from the PX in Task

[7] The use of sonar technology to measure piezometric levels in wells in currently being used in Monte Vista Water District wells 28 and 31.

2.1, will improve the understanding of the hydrogeology in Northwest MZ-1, will be used to develop the *Subsidence Management Plan for Northwest MZ-1*, and in the future, will be used to adapt the Chino Basin Subsidence Management Plan, as appropriate.

In this subtask, all data is collected, compiled, checked, and analyzed every three months. Charts and data graphics of pumping, piezometric levels, and aquifer-system deformation will be updated to support the data collection and analysis.

The Watermaster Engineer has previously reported that the PX monitoring facility is not recording accurate extensometer data. The primary causes of these inaccuracies include entanglement of the steel extensometer cables with transducer cables within the well casings, as well as malfunctioning linear potentiometers and/or data loggers. In FY 2025/26, the Watermaster Engineer refurbished the facility with assistance from an well rehab subcontractor, with completion expected in April 2026. For FY 2026/27, **no** additional funding is recommended for refurbishment of this facility, as periodic maintenance and repairs are included under Tasks 1 and 2.

Task 6.2. Refine and Evaluate Subsidence-Management Alternatives

During FY 2025/26, the Watermaster is conducting the 2025 SYR, which involves the development and evaluation of multiple projection scenarios of future hydrology, pumping, managed recharge, and use of managed storage in the Chino Basin. These projection scenarios are being simulated with an updated CVM. The CVM results provide basin-scale projections of groundwater levels by model layer and are used to evaluate the Safe Yield and the potential for MPI in the future. The evaluation of MPI in the 2025 SYR is based on groundwater-level criteria (i.e., minimum historical groundwater elevations that, if exceeded, may cause new land subsidence).

The GLMP Task 6.2 is a more detailed, subsidence-focused evaluation of potential future subsidence in Northwest MZ-1, where projected groundwater levels from the 2025 SYR are used as input data for the 1D Model at the PX location to evaluate the potential for future subsidence in Northwest MZ-1. Based on the 1D Model results, the Watermaster Engineer may recommend that additional SMAs be developed and evaluated with the CVM and 1D Model to generate the necessary information to finalize the Guidance Level and the Subsidence Management Plan for Northwest MZ-1.

In this way, the GLMP work augments the 2025 SYR analysis by providing a more detailed evaluation of potential future subsidence in Northwest MZ-1 and will support the development of management criteria aimed at reducing the risk of future subsidence-related MPI.

During FY 2025/26, the Watermaster Engineer plans to complete the following:

- Run the PX 1D Model using the results from the 2025 SYR.
- Develop up to two (2) additional SMAs that would be designed to mitigate any potential future subsidence predicted in Northwest MZ-1. A draft TM will be prepared to describe

the 1D Model results and the proposed SMAs—including groundwater production and replenishment/recharge plans of the Chino Basin parties. The TM is expected to be prepared and distributed to the GLMC in June 2026.

During FY 2026/27, the Watermaster Engineer plans to complete the following:

- Hold a GLMC meeting in June 2026 to review the recommended SMA(s) and to receive feedback on the TM. The verbal and written feedback from the GLMC will be used to finalize the SMA(s) in FY 2026/27 (using carryover budget from FY 2025/26).
- Evaluate the potential future subsidence in Northwest MZ-1 under the SMAs using the CVM and PX 1D Model. Again, the objective of this task is to recommend a final Guidance Level for Northwest MZ-1 and the Subsidence Management Plan for Northwest MZ-1.
- Document model results, interpretations, and recommendations in a draft TM for distribution to the GLMC.
- Hold a GLMC meeting to review the draft TM and receive GLMC feedback. The verbal and written feedback from the GLMC will be used to finalize the TM. The final TM and its recommendations will be shared with all Watermaster Parties through the monthly Pool, Advisory Committee, and Board meetings.

It should be noted that future monitoring and analyses always hold the potential for revisions to the Guidance Level, consistent with the adaptive management approach called for in the Chino Basin Subsidence Management Plan.

Task 7. Meetings and Administration

Task 7.1. Prepare for and Conduct Two Meetings of the Ground-Level Monitoring Committee

This subtask includes preparing for and conducting two meetings of the GLMC:

- October 2026 – Review the draft 2025/26 Annual Report for the GLMP.
- March 2027 – Review the draft recommended scope and budget for FY 2027/28.

Task 7.2. Prepare for and Conduct One As-Requested Ad-Hoc Meeting

This subtask includes preparing for and conducting one ad-hoc meeting of the GLMC, as requested by the GLMC or Watermaster staff.

Task 7.3. Perform Monthly Project Management

This subtask includes monthly project administration and management, including staffing, financial and schedule reporting to Watermaster and subcontractor coordination.

Task 7.4. Prepare a Recommended Scope and Budget for the GLMC for FY 2027/28

This subtask includes preparing a draft and final recommended scope of services and budget for FY 2027/28 for the GLMP to support the Watermaster's budgeting process.

Appendix A Response to Comments

Listed below are:

- Comments received from the GLMC as of April 9, 2026 on the draft *Recommended Scope-of-Work and Budget for the Ground Level Monitoring Program for Fiscal Year 2026/27* (dated March 18, 2026)
- Watermaster staff responses to GLMC comments

Comments from Monte Vista Water District (Justin Scott-Coe) – March 18, 2026

Comment 1 – Overall comment. PX Data Use for Final Guidance Level.

Issuance of a final guidance level is proposed for FY26/27 without some key inputs from monitoring and modeling efforts. The Pomona Extensometer (PX), where tangled datalogger cables have impeded extensometer monitoring for several years, has been rehabbed and may begin to collect data as early as April 2026. Extensometer data should be used to inform whether key hypotheses are correct (e.g. delayed dewatering in the deep aquifer from legacy dewatering, as a mechanism for current InSAR vertical ground motion in Northwest MZ-1.) The preliminary guidance level should be evaluated relative to the recent stabilization of vertical ground motion in Northwest MZ-1 prior to establishing a final guidance level.

Watermaster Response:

The PX facility may begin generating improved data as early as April 2026; however, several months of data collection and evaluation will be needed to assess its accuracy and reliability. If the data prove reliable, they may help inform the FY 2026/27 work, although the period of record will likely be too short to fully support key conclusions. Accordingly, the FY 2026/27 analyses will primarily rely on the 2025 SYR results together with the updated CVM and 1D modeling framework to evaluate future subsidence and support a recommendation for a Guidance Level for Northwest MZ-1.

The intent of the FY 2026/27 scope is not to treat the Guidance Level as fixed irrespective of new information. Rather, the Guidance Level will continue to be evaluated in light of additional monitoring data and model results, with input from the GLMC, consistent with the adaptive management approach outlined in the Subsidence Management Plan.

Comment 2 – Task 6. Develop a Subsidence-Management Plan for Northwest MZ-1

"…the same pattern of differential subsidence that occurred in the Managed Area during the time of ground fissuring."

- As commented previously, the language suggests that conditions in Northwest MZ-1 are the same as the Managed Area during the time of ground fissuring. MVWD recommends

clarifying the language so as not to suggest the two areas are experiencing identical conditions.

Watermaster Response:

The phrase has been revised to read "spatial pattern of differential subsidence" to distinguish it from rates and magnitudes of subsidence.

Comment 3 – Task 6.2. Refine and Evaluate Subsidence-Management Alternatives

"The CVM results are being used to evaluate the 2020 Safe Yield and the potential for MPI in the future. The evaluation for MPI associated with land subsidence in Northwest MZ-1 is being performed using the CVM results. However, the GLMP includes a more detailed evaluation where the CVM results (i.e., future groundwater levels by CVM layer) will be used as input data for the 1D Model at the PX location to predict the potential for future subsidence associated with the 2025 SYR. Based on the results of the 1D Modeling effort, the Watermaster Engineer may recommend that additional SMAs be developed and evaluated with the CVM and 1D Model to generate the necessary information to finalize the Guidance Level and the Subsidence Management Plan for Northwest MZ-1."

In the *Analysis of Material Physical Injury and Undesirable Results for the 2025 Safe Yield Reevaluation*, Watermaster Engineer defined the threshold for Material Physical Injury in Northwest MZ-1 as *"the historical rate of compaction measured by the interferometric synthetic aperture radar (InSAR) data between March 2011 and March 2024 (approximately 0.033 feet per year)."*

- Recommend including some additional discussion on the interrelation/timing between the Safe Yield Reevaluation and the scope of work here-in. How do the Guidance Level (to be established in FY26/27) and the threshold for Material Physical Injury relate/overlap in terms of this subsidence management scope? How will the SMAs proposed to evaluate Northwest MZ-1 inform the Safe Yield Reevaluation, or do they only inform the Guidance Level and Subsidence Management Plan?
- Why was the March 2011 to March 2024 period selected as a threshold for Material Physical Injury in the SYR work? That seems overly conservative given no Material Physical Injury occurred during that or earlier periods.

Watermaster Response:

- Regarding the first bulleted comment above:
    - The 2025 SYR/CVM work provides basin-scale projections of hydraulic heads by model layer and supports evaluation of Safe Yield and the potential for future MPI. The GLMP FY 2026/27 Task 6.2 effort then uses the projected heads as input to the 1D model at the Pomona Extensometer location to evaluate the potential for future subsidence in Northwest MZ-1 under the 2025 SYR scenarios and to

assess the potential need to develop and evaluate additional SMAs. In this way, the GLMP work augments the 2025 SYR analysis by providing a more detailed evaluation of potential future subsidence to support development of a Guidance Level and subsidence-management recommendations aimed at reducing the risk of potential future subsidence-related MPI in Northwest MZ-1 (i.e., finalize the Subsidence Management Plan for Northwest MZ-1). The description of the scope of work herein has been revised in Task 6.2 to provide additional clarification regarding the interrelationship and timing between the 2025 SYR and the GLMP scope of work.

- Regarding the second bulleted comment above:
    - The description of the MPI threshold based on the March 2011 to March 2024 InSAR-derived compaction rate reflects an earlier proposed approach. The 2025 SYR incorporates an updated metric for evaluating subsidence-related MPI that is based on groundwater levels rather than a historical subsidence rate. The revised approach to evaluate subsidence-related MPI using groundwater levels as a proxy for subsidence was made because the additional 1D models across all areas of subsidence concern were not available in time to utilize in the 2025 SYR. The revised approach was described in the first draft report for the 2025 SYR in October 2025.

Comment 4 – Task 6.2. Refine and Evaluate Subsidence-Management Alternatives

Previous scope discussion in FY 2025/26 included the development of SMAs to *"Evaluate the minimum recharge quantity of supplemental water in MZ-1, as required by the Peace II Agreement."*

- MVWD's understanding is that an evaluation of this recharge quantity has not been completed but mention of this purpose is absent from the scope of work for FY 2026/27. We recommend including language discussing recharge evaluation pursuant to Peace II obligations because, as commented previously, the Watermaster has yet to perform an assessment of minimum recharge quantity of supplemental water in MZ-1. It has taken Watermaster 15 years to finally fulfill this obligation under Peace II.
- MVWD also continues to recommend evaluating the existing model's ability to predict the recent stabilization of subsidence trends in Northwest MZ-1 at current groundwater levels in the deep aquifer. Does the current model match the latest observed data and trends with additional recharge in Northwest MZ-1? Is the preliminary guidance level appropriate given the recent stabilization in vertical ground motion at lower water levels than the guidance level? Will this evaluation occur during FY26/27 prior to issuance of a final Guidance Level?

Watermaster Response:

- Regarding the first bulleted comment above:
    - The omission of this language from the FY 2026/27 GLMP draft scope was not intended to suggest that the Peace II obligation no longer applies. The obligation will be fulfilled under a different CBWM FY 2026/27 task—*Model Update and Required Demonstrations*.
- Regarding the second bulleted comment above:
    - We agree that evaluation of the recent stabilization of subsidence trends, and the ability of the current modeling framework to reproduce those trends, is an important component of the FY 2026/27 effort. The 2024/25 Annual Report noted that the recent reductions in pumping and increases in recharge in Northwest MZ-1 functioned as an empirical test of the model simulations and generally confirmed the model results that decreased pumping and increased recharge could elevate hydraulic heads and minimize or abate ongoing subsidence.

      FY 2026/27 Task 6.2 will use the updated CVM and 1D modeling framework, together with recent monitoring data, to further evaluate whether the model results are consistent with the observed slowing or stabilization of vertical ground motion and to reassess the preliminary Guidance Level before recommending a final Guidance Level.

      Watermaster notes, however, that recent increases in groundwater levels and slowing of subsidence rates do not eliminate the risk of future subsidence if groundwater levels decline in the future.

Comment 5 – Task 7.1. Prepare for and Conduct Two Meetings of the Ground-Level Monitoring Committee

This subtask includes preparing for and conducting two meetings of the GLMC: *"Section 6.2: Hold a GLMC meeting in June 2026 to review the recommended SMA(s) and to receive feedback on the TM. The verbal and written feedback from the GLMC will be used to finalize the SMA(s) in FY 2026/27."*

- There is some conflict regarding the number and scheduling of GLMC meetings. The header discusses four meetings, the sub header identifies two meetings, and text in Section 6.2 mentions a GLMC meeting in June 2026 not identified in Section 7.1. Please resolve differences in scope.

Watermaster Response:

- The final scope has been updated to resolve the inconsistency in the Task 7.1 header. The proposed meeting schedule for the remainder of FY 2025/26 and FY 2026/27 is as follows:
    - Task 6.2.3**:** (1) meeting in FY 2025/26, tentatively scheduled for June 2026, but may be held in July 2026 using carryover funds, to review PX 1D Model simulations using results from the 2025 SYR and to discuss SMA recommendations to be evaluated in FY 2026/27;
    - Task 6.2.6**:** (1) meeting in FY 2026/27 to present SMA modeling results and receive feedback. These results will be used to support recommendation of a final Guidance Level and the Subsidence Management Plan for Northwest MZ-1; and
    - Task 7.1**:** (2) meetings in FY 2026/27 to review the draft 2025/26 Annual Report for the GLMP (October 2026) and the draft recommended scope and budget for FY 2027/28 (March 2027).

Appendix B

Response to GLMC Comments

MONTE VISTA WATER DISTRICT (JUSTIN SCOTT-COE)

Comment 1 – Section 2.1.1 Pomona Extensometer

Rehabilitation of the Pomona Extensometer (PX) took place in the spring of this year. Several measures including removal of tangled cables and replacement of extensometer monitoring equipment have taken place. The current state of the PX and the state of data collection are not described in this report. Please describe the current state of the extensometer and when data collected since the rehabilitation at the PX will be assessed and documented in Annual Reports.

Response:

Section 2.1.1.1 of the Annual Report describes the rehabilitation activities completed at the Pomona Extensometer (PX) facility during FY 2025/26, including removal of the tangled cables, rehabilitation of the piezometers, replacement of monitoring equipment, and improvements to the data acquisition software.

Following rehabilitation, monitoring resumed, and the Watermaster Engineer has continued to make incremental adjustments to the extensometers and evaluate the resulting data. Calibration and evaluation remain ongoing, and additional data are needed to confirm the reliability of the extensometer measurements.

The final paragraph of Section 2.1.1.1 has been revised to clarify the current status of the PX facility and the planned evaluation of post-rehabilitation data during FY 2026/27. The findings will be documented in future GLMP reporting once sufficient data are available.

Comment 2 – Section 3.4: Observations Regarding Vertical Ground Motion in Northwest MZ-1

Bullet Point 2: "A maximum of about 1.46 ft of subsidence occurred in this area from 1992 through March 2026—an average rate of about 0.04 ft/yr—while hydraulic heads remained relatively stable. The persistent subsidence that occurred from 1992 to 2026 cannot be entirely explained by the concurrent changes in hydraulic heads. A plausible explanation for this subsidence is that thick, slow-draining aquitards are permanently compacting in response to the historical declines in hydraulic heads that occurred between 1930 and 1978."

Bullet Point 6: "Figures 3-1c through 3-1e are InSAR maps that illustrate the slowing rate of subsidence in Northwest MZ1 from 2011-2026: about 0.28 ft of subsidence from 2011 to 2016; 0.12 ft of subsidence from 2016 to 2021; and 0.08 ft of subsidence from 2021 to 2026. This slowing rate of subsidence is likely due to increasing heads caused by reduced groundwater pumping and increased recharge as shown on Figure 3-9a".

- Groundwater levels in Northwest MZ-1 have remained stable since the late 1970s and early 1980s (Figure 3-9a). Measured vertical ground motion continues to decline (Figure 3-1c to Figure 3-1e), with essentially zero ground motion observed in Northwest MZ-1 over the most recent periods. This is a continuation of an attenuating trend seen in InSAR dating back to the inception of data collection documented in Figure 3-1c.

- Equilibration of heads in aquitards with stable post-1970s water levels is the mechanism hypothesized earlier (see previous paragraph), which should be added to the explanation of the slowing rate of subsidence as well. It is plausible that after nearly 50 years, hydraulic heads have equilibrated vertically even in thicker aquitards, and thus, the delayed drainage phenomenon hypothesized to be causing residual subsidence has abated.
- It is also important to note that no documented material physical injury has occurred in Northwest MZ-1 as a result of historical (model estimates of 7 to 9 ft of subsidence) or more recent trends in vertical ground motion documented in Figure 3-1.

Response:

The Watermaster Engineer agrees that the gradual equilibration of hydraulic heads between aquifers and aquitards is a plausible explanation for the slowing subsidence rates. This interpretation is consistent with the conceptual model of delayed aquitard drainage and compaction. Section 3.4 has been updated to acknowledge this mechanism in addition to the effects of increasing hydraulic heads associated with reduced pumping and increased recharge.

Although subsidence rates have slowed, the most recent five-year InSAR results continue to indicate downward vertical ground motion in Northwest MZ-1. Therefore, the available data do not demonstrate that delayed aquitard drainage and inelastic compaction have ceased. Future groundwater-level declines could result in increasing rates of compaction and increase the potential for differential subsidence.

Sections 3.0 and 4.1 have been revised to acknowledge that "the rates of subsidence have been slowing, and there have been no documented reports of ground fissuring or damage to overlying infrastructure during the reporting period." While this statement is true for the current reporting period, the same conclusion cannot be confidently stated for the historical period where the available information indicates the occurrence of several feet of subsidence since the 1930s. Impacts to the ground surface and/or infrastructure can go un-reported, un-noticed, repaired, and never attributed to pumping-induced land subsidence. For example, some Parties in Northwest MZ-1 have reported deformed well casings in older wells to the extent that the well is unusable. Such damage to well casings is typical of aquifer-system compaction but in the Chino Basin has never been attributed to the historical compaction.

Comment 3 – Observations Regarding Benchmark and InSAR Data in Northwest MZ-1

- We have previously commented (24/25 Annual Report) on the InSAR overestimation of vertical ground motion relative to the benchmark data in both Figure 3-9a and b in Northwest MZ-1. These comments were not addressed thoroughly in the last Annual Report and are reiterated here. The benchmark data shows significantly less vertical ground motion in Northwest MZ-1 than indicated by InSAR. Sentinel 1A data also shows less subsidence in maps presented in Figure 3-15.
- Watermaster has indicated, in response to concerns over the differences in vertical ground motion, that:
  "The general consistency in these independently measured datasets increases confidence in the observed patterns, even though the InSAR estimates of downward ground motion are slightly greater in magnitude near PX. These small differences are within the expected range of

measurement uncertainty and do not affect the overall interpretation of differential subsidence across the San Jose fault."

- These differences in magnitude will become important as Watermaster develops management criteria, recommends a cessation of leveling surveys of vertical ground motion in Northwest MZ-1, without successful data collection at the PX to understand mechanisms for vertical ground motion.

Response:

The Watermaster Engineer acknowledges that differences exist between the magnitudes of vertical ground motion estimated by InSAR and traditional ground-level surveys in Northwest MZ-1. As described in Section 3.4, both methods generally indicate similar spatial patterns of ground motion, although TerraSAR-X estimates greater magnitudes of subsidence near the PX facility. These differences may be related to the timing of measurements, reference elevations, processing methods, and uncertainties associated with each monitoring technique. Despite these differences, both datasets support the conclusion that subsidence rates in Northwest MZ-1 have slowed in recent years.

The evaluation of Sentinel-1A and TerraSAR-X data described in Section 3.7 also identified differences in the estimated magnitudes of ground motion. Section 3.7 has been revised to clarify that the TerraSAR-X results are averaged to approximately 15-meter grid cells, compared to approximately 100-meter grid cells for the DWR-provided Sentinel-1A data. The coarser spatial resolution of the Sentinel-1A data tends to smooth localized ground-motion features and thereby reduce the apparent magnitude of differential subsidence. For this reason, TerraSAR-X remains the preferred dataset to accurately estimate vertical ground motion at specific locations—such as at the PX location where a 1D model has been constructed and will need accurate measurements of vertical ground motion for future 1D model recalibrations.

The Watermaster Engineer recognizes the importance of independent measurements of vertical ground motion as subsidence-management criteria are being developed. The transition to GPS surveys at the PX location are addressed in the response to Comment 4 (below).

Comment 4: Task 4.5. Conduct GPS Surveys at Four Control Points in the Northwest, Northeast, Southeast, and Managed Areas

"As an alternative to traditional ground-level surveys, a new recommendation for Spring 2027 is to conduct GPS surveys at four key control points in the Managed, Northwest, Southeast, and Northeast areas:"

We recommend continuation of periodic leveling surveys in Northwest MZ-1 due to the discrepancy between InSAR and benchmark data in Northwest MZ-1 and the ongoing lack of extensometer data at the PX.

Response:

The transition from traditional ground-level surveys to annual GPS surveys at four control points was discussed with the GLMC during the March 2026 meeting as a cost-saving measure and incorporated

into the FY 2026/27 GLMP scope of work. The GPS surveys will provide independent measurements of vertical ground motion for comparison with InSAR results and support future recalibrations of the 1D Models.

Although traditional leveling surveys are not included in the FY 2026/27 scope of work, Watermaster can consider reinstating periodic leveling surveys in Northwest MZ-1 during the FY 2027/28 scope and budget development process, with input from the GLMC.

Comment 5: Recommendation to Continue Work Plan and Finalize Guidance Levels and SMP for Northwest MZ-1 (page 4-2):

"RECOMMENDATION: Watermaster, with input from the GLMC, should continue implementation of the Work Plan to Develop a Subsidence-Management Plan for the Northwest MZ-1 Area to develop management strategies to avoid future occurrences of subsidence. This will include:

— Continuing aquifer-system monitoring and data analysis in Northwest MZ-1, including continued calibration and evaluation of hydraulic-head and aquifer-system deformation data from the PX, as well as collection of hydraulic head data from Pomona and MVWD wells equipped with transducers.

— Continuing the development and evaluation of subsidence-management alternatives using the PX 1D compaction model and results from the 2025 Safe Yield Reevaluation. The methods, results, and findings from this work will be documented in a separate technical memorandum in FY 2026/27. The modeling results, together with recent monitoring data, should be used to finalize the Guidance Level(s) at PX and the Subsidence Management Plan for Northwest MZ- 1."

- We continue to disagree with the recommendation that Guidance Level(s) at the PX and a Subsidence Management Plan for Northwest MZ-1 be finalized. As we continue to note, a lack of monitoring data at the PX impairs the ability to confirm key aspects of the conceptual model hypothesized for InSAR-observed vertical ground motion. In Northwest MZ-1, even InSAR, which overestimates the magnitude of vertical ground motion relative to other sources, shows no ongoing subsidence. Ongoing analyses should focus on identifying recharge volumes necessary to maintain hydrologic balance in the MZ per the Peace II Agreement, as previously noted. That information should be presented in the GLMC when available. Until then, we recommend that all work related to establishing Guidance Levels and a Subsidence Management Plan for Northwest MZ-1 be placed on hold, while efforts focused on continued monitoring proceed.

Response:

Although reliable PX data would help characterize the relationship between hydraulic-head changes and aquifer-system compaction in Northwest MZ-1, the ongoing challenges with the cable extensometers do not prevent Watermaster from using the available data and modeling analyses to recommend guidance criteria for managing land subsidence. The available data and understanding derived from borehole lithology, groundwater-levels, InSAR, GPS, ground-level surveys, and 1D-modeling have provided a basis for developing recommendations for Guidance Levels in Northwest MZ-1. That said, Guidance Levels are not being recommended in this annual report. Any decision to incorporate Guidance Levels into the Subsidence Management Plan will be discussed by the GLMC in 2027 and is subject to advice from the

Watermaster Pools and Advisory Committee and approval by the Watermaster Board. The SMP is adaptive in nature and can always be revised as additional monitoring data and analyses become available.

The evaluation of the balance of recharge and discharge in MZ-1 under the Peace II Agreement is being conducted under a separate Watermaster task (Model Update and Required Demonstrations). The results can be presented to the GLMC when available and can inform future subsidence-management recommendations. The Watermaster Engineer does not recommend delaying the ongoing GLMP modeling work pending completion of the evaluation of the balance of recharge and discharge in MZ-1.

Comment 6 – Northwest MZ-1

"These recommendations are consistent with the requirements of the OBMP Program Elements 1 and 4 and its implementation plan contained in the Peace Agreement. It should be noted that future monitoring and analyses always hold the potential for revisions to the Guidance Level(s), consistent with the adaptive management approach called for in the Chino Basin Subsidence Management Plan."

- Please cite language under Program Element 4 in the OBMP Implementation Plan (contained in the Peace Agreement) that is consistent with these recommendations. Also, please add the following language to the end of this paragraph: "It should also be noted that any capital or operations and maintenance expenses incurred in the implementation of any project or program, including the cost of relocating groundwater production facilities, that carries out the purposes of the OBMP and specifically relates to the prevention of subsidence in the Basin, may be subject to OBMP credits or reimbursement under Peace Agreement §5.4(d) as amended by the Second Amendment to the Peace Agreement."

Response:
The Peace Agreement, as amended, includes provisions for potential OBMP credits or reimbursement for expenditures associated with subsidence prevention. However, the determination of any applicable credits or reimbursement is subject to the discretion of the Watermaster Board pursuant to the process established in the Watermaster Rules and Regulations.

Including the proposed language in the GLMP Annual Report could imply that Watermaster Board has made a determination regarding the eligibility of future expenditures for credits or reimbursement. Accordingly, the proposed language has not been added to the Annual Report.

CHINO BASIN WATERMASTER
Case No. RCVRS 51010
Chino Basin Municipal Water District v. City of Chino, et al.

PROOF OF SERVICE

I declare that:

I am employed in the County of San Bernardino, California. I am over the age of 18 years and not a party to the action within. My business address is Chino Basin Watermaster, 9641 San Bernardino Road, Rancho Cucamonga, California 91730; telephone (909) 484-3888.

On November 23, 2026, I served the following:

1. DECLARATION OF BRADLEY J. HERREMA IN SUPPORT OF WATERMASTER'S MOTION FOR COURT TO RECEIVE AND FILE THE 2025/2026 ANNUAL REPORT OF THE GROUND-LEVEL MONITORING PROGRAM

/ X / BY MAIL: in said cause, by placing a true copy thereof enclosed with postage thereon fully prepaid, for delivery by the United States Postal Service mail at Rancho Cucamonga, California, addresses as follows:
See attached service list: Mailing List 1

/___/ BY PERSONAL SERVICE: I caused such envelope to be delivered by hand to the addressee.

/___/ BY FACSIMILE: I transmitted said document by fax transmission from (909) 484-3890 to the fax number(s) indicated. The transmission was reported as complete on the transmission report, which was properly issued by the transmitting fax machine.

/ X / BY ELECTRONIC MAIL: I transmitted notice of availability of electronic documents by electronic transmission to the email address indicated. The transmission was reported as complete on the transmission report, which was properly issued by the transmitting electronic mail device.
See attached service list: Master Email Distribution List

I declare under penalty of perjury under the laws of the State of California that the above is true and correct.

Executed on November 23, 2026, in Rancho Cucamonga, California.

By: Ruby Favela Quintero
Chino Basin Watermaster

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