Las Posas Valley Basin Groundwater Sustainability Plan 2022 Annual Report: Covering Water Year 2021

Prepared for:

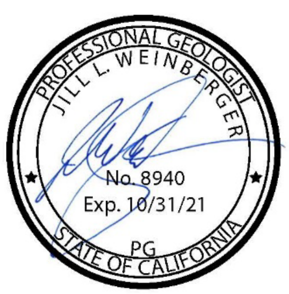
Fox Canyon Groundwater Management Agency

800 South Victoria Avenue
Ventura, California 93009-1610
Contact: Kimball Loeb, PG, CHG, CEG

Prepared by:

DUDEK

605 Third Street
Encinitas, California 92024
Contact: Trevor Jones, Ph.D.
Jill Weinberger, Ph.D., P.G.



MARCH 2022

Printed on 30% post-consumer recycled material.

Table of Contents

SECTION **PAGE NO.**

TABLES

FIGURES

APPENDICES

INTENTIONALLY LEFT BLANK

Executive Summary

The Fox Canyon Groundwater Management Agency (FCGMA), the Groundwater Sustainability Agency (GSA) for the portions of the Las Posas Valley Basin (LPVB) within its jurisdictional boundaries, in coordination with the other two GSAs in the LPVB, has prepared this third annual report for the Las Posas Valley Basin (LPVB) Groundwater Sustainability Plan (GSP) in compliance with the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.). This annual report covers the entire LPVB. The GSP for the LPVB was submitted to the Department of Water Resources (DWR) on January 13, 2020 and was approved by DWR on January 13, 2022. SGMA regulations require that an annual report be submitted to DWR by April 1 of each year following the adoption of the GSP. The data presented in the LPVB GSP ends in water year 2015. The first and second annual reports provided an update on conditions in the LPVB from water year 2016 through water year 2020. This annual report provides an update on the groundwater conditions in the LPVB for water year 2021 (October 1, 2020 through September 30, 2021).

Since 2015, the LPVB experienced two dry[1] water years (2016 and 2018), in which precipitation was below 75% of the long-term average precipitation for the LPVB, three above normal water years[2] (2017, 2019, and 2020) in which precipitation was greater than average, and one critically dry[3] water year (2021), in which precipitation was approximately 23% of the historical average within the LPVB. Water year 2021 was the driest water year on record in the LPVB.

Groundwater elevations in the Fox Canyon Aquifer declined throughout the majority of the LPVB between spring 2020 and 2021. In the West Las Posas Management Area (WLPMA), groundwater elevations declined by approximately 10 to 40 feet, with the largest declines occurring in the eastern part of the WLPMA. In the ELPMA, groundwater elevations were lower in 2021 than 2020 in most of the wells measured, with the notable exception of well 03N20W03H01S, where the groundwater elevation was approximately 30 feet higher in the spring of 2021 than in the spring of 2020. In the ELPMA, groundwater elevations along the Moorpark anticline declined by approximately 11 to 50 feet between spring 2020 and spring 2021. In water year 2021, Calleguas Municipal Water District (CMWD) injected approximately 680 acre-feet (AF) of imported water into this region of the ELPMA for temporary storage via operation of its Aquifer Storage and Recovery (ASR) well field.

Calculations of change in storage were updated as part of the 2021 Annual Report. These calculations provided coverage over approximately 66% of the area of the Fox Canyon aquifer in the WLPMA and 78% of the area of the Fox Canyon aquifer in the ELPMA. This is an improvement over the previous calculation technique which provided variable spatial estimates of storage change depending on the distribution of groundwater elevations measured each year. In the WLPMA, the volume of groundwater in storage declined by approximately 5,900 AF in water year 2021, with the largest declines occurring in the eastern portion of management area, adjacent to the Somis Fault. In the ELPMA, the volume of groundwater in storage declined by approximately 5,400 AF in water year 2021. The total reduction of groundwater in storage of approximately 11,300 AF is the largest estimated single-year reduction since water year 2015.

[1] "Dry" water year type is defined as ≥50% and <75% of mean.
[2] "Above Normal" water year type is defined as ≥100% and <150% of mean.
[3] "Critical" water year type is defined as <50% of mean.

Data gaps identified in the GSP remain in this annual report. One of the critical data gaps is the limited spatial coverage of dedicated monitoring wells in the ELPMA and WLPMA, which impacts the resolution of groundwater elevation contour maps and corresponding estimates of change in groundwater storage. These data gaps will be closed as implementation of the GSP progresses.

FCGMA has undertaken several steps toward implementing the GSP, with implementation planning occurring concurrently with the GSP development process. At the request of FCGMA, DWR installed a nested well cluster in 2019 near the boundary between the Pleasant Valley Basin (PVB) and ELPMA, an area identified in the GSP as a critical location where groundwater elevation measurements were lacking. Construction of this well cluster helps address critical gaps in the monitoring network that impact the aerial coverage of groundwater elevation measurements.

The FCGMA Board of Directors adopted a new extraction allocation ordinance effective October 1, 2021. The new ordinance transitioned to water year reporting and provides the regulatory framework to manage extractions consistent with the sustainable yield of the LPVB. The adoption of this allocation ordinance occurred concurrently with an ongoing adjudication of the LPVB that is pending in the Superior Court of the State of California. In the event the Superior Court comprehensively determines groundwater rights to the Basin, it is the intent of the FCGMA Board to amend the ordinance in a manner consistent with water right priorities in any final judgment entered in the adjudication. In anticipation of additional reporting associated with the allocation ordinance, FCGMA is conducting an analysis of its data management system needs to target specific updates to the current data management system that facilitate FCGMA moving toward sustainable management of the LPVB by 2040.

INTENTIONALLY LEFT BLANK

1 Background and Plan Area

1.1 Background

The FCGMA, the GSA for the portions of the Las Posas Valley Basin (LPVB; DWR Bulletin 118 Basin No. 4-008) within its jurisdictional boundaries, has prepared this third annual report for the LPVB GSP in compliance with SGMA (California Water Code, Section 10720 et seq.). SGMA requires that an annual report be submitted to DWR by April 1 of each year following the adoption of the GSP. FCGMA adopted a GSP for the LPVB in December 2019 and submitted the GSP to DWR on January 13, 2020. DWR approved the LPVB GSP on January 13, 2022.

FCGMA is one of three Groundwater Sustainability Agencies (GSAs) in the LPVB. The other two GSAs are the Camrosa Water District (CWD) Las Posas Basin GSA and the Las Posas Basin Outlying Areas GSA (County of Ventura). This annual report applies to the entirety of the LPVB. To coordinate management and reporting in the LPVB, FCGMA and CWD have executed a Memorandum of Understanding, and FCGMA and the County have formed a Joint Powers Authority.

1.1.1 Fox Canyon Groundwater Management Agency

FCGMA is an independent special district formed by the California Legislature in 1982 to manage and protect the aquifers within its jurisdiction for the common benefit of the public and all agricultural, and M&I users (FCGMA et al. 2007). FCGMA's boundaries include all land overlying the Fox Canyon Aquifer (FCA) and includes portions of the LPVB (4-008), the Oxnard Subbasin (4-004.02), the Pleasant Valley Basin (4-006), and the Arroyo Santa Rosa Valley Basin (ASRVB; 4-007).

FCGMA is governed by a Board of Directors (Board) with five members who represent: (1) the County of Ventura (County), (2) the United Water Conservation District (UWCD), (3) seven mutual water companies and water districts within the Agency[4], (4) five incorporated cities which are all or a portion of each is within the FCGMA jurisdictional area[5], and (5) a farmer representative. The Board members representing the County, UWCD, the mutual water companies and water districts, and the incorporated cities are appointed by their respective organizations or groups. The representative for the farmers is appointed by the other four seated Board members from a list of candidates jointly supplied by the Ventura County Farm Bureau and the Ventura County Agricultural Association. An alternate Board member is selected by each appointing agency or group in the same manner as the regular member and acts in place of the regular member in case of absence or inability to act. All members and alternates serve for a 2-year term of office, or until the member or alternate is no longer an eligible official of the member agency. Information regarding current FCGMA Board representatives can be found on the FCGMA website[6].

4 The seven mutual water companies and water districts are: Alta Mutual Water Company, Pleasant Valley County Water District (PVCWD), Berylwood Mutual Water Company, Calleguas Municipal Water District (CMWD), CWD, Zone Mutual Water Company, and Del Norte Mutual Water Company.

5 The five incorporated cities within the FCGMA jurisdictional area are: Ventura, Oxnard, Camarillo, Port Hueneme, and Moorpark

6 FCGMA Website: https://fcgma.org/

1.1.2 LPVB Groundwater Sustainability Plan

The GSP for the LPVB defined the conditions under which the groundwater resources of the entire LPVB will be managed sustainably in the future (FCGMA 2019). Although DWR has defined the LPVB as a single groundwater basin, there is limited hydraulic connection between the eastern and western parts of the LPVB (FCGMA 2019). Hydrogeologic differences in the controls on groundwater recharge and groundwater production necessitated the definition of three management areas in the LPVB. These management areas are the West Las Posas Management Area (WLPMA), the East Las Posas Management Area (ELPMA) and the Epworth Gravels Management Area. The Epworth Gravels Management Area is a shallow unconfined aquifer located within the geographic boundaries of the ELPMA, but separated from the underlying Fox Canyon and Grimes Canyon aquifers.

The GSP evaluated groundwater conditions in four hydrostratigraphic units in the WLPMA: the shallow alluvial system, the Upper San Pedro Formation, the Fox Canyon aquifer, and the Grimes Canyon aquifer (FCGMA 2019). The WLPMA is hydrogeologically connected to the Oxnard Subbasin to the west. The shallow alluvial system is connected with the Upper Aquifer System (UAS) in the Oxnard Subbasin, and the Upper San Pedro Formation, Fox Canyon aquifer, and Grimes Canyon aquifer compose the Lower Aquifer System (LAS) in the LPVB and the Oxnard Subbasin (FCGMA 2019).

In the ELPMA the GSP evaluated groundwater conditions in the Epworth Gravels, Shallow Alluvial aquifer, the Upper San Pedro Formation, the Fox Canyon aquifer, and the Grimes Canyon aquifer (FCGMA 2019). The Upper San Pedro Formation is not a primary aquifer but is a source of water to the underlying Fox Canyon aquifer. Geologic folding and faulting of the region has resulted in large differences in thickness, elevation, and exposure of the Fox Canyon aquifer in the ELPMA. This folding was found to result in differential impacts from groundwater elevation declines in the ELPMA (FCGMA 2019).

The primary sustainability goal for the LPVB adopted in the GSP is “to maintain a sufficient volume of groundwater in storage in each management area so that there is no significant and unreasonable decline in groundwater elevation or storage over wet and dry climatic cycles” (FCGMA 2019). Additionally, “groundwater levels in the WLPMA should be maintained at elevations that are high enough to not inhibit the ability of the Oxnard Subbasin to prevent net landward migration of the saline water impact front after 2040” (FCGMA 2019). These goals were established based on both historical and potential future undesirable results to the groundwater resources of the LPVB from six sustainability indicators: chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface water. The LPVB was found not to experience direct impacts from seawater intrusion or depletion of interconnected surface water.

The GSP established minimum threshold groundwater elevations, which varied geographically within the WLPMA and ELPMA (FCGMA 2019). These groundwater elevations were selected to avoid undesirable results in the LPVB. In addition to minimum threshold groundwater elevations, the GSP also established measurable objective groundwater elevations. Measurable objective groundwater elevations are higher than the minimum threshold groundwater elevations to allow for operational flexibility during drought periods (FCGMA 2019). Minimum threshold and measurable objective groundwater elevations were established at one representative monitoring point (or “key well”) in the Epworth Gravels Management Area, fifteen representative monitoring points in the ELPMA, and five representative monitoring points in the WLPMA (FCGMA 2019).

The GSP documented conditions throughout the LPVB through the fall of 2015. The first and second annual reports evaluated progress toward sustainability based on a review of groundwater elevation data, groundwater extraction data, surface water supply used, or surface water supply available for use, total water used, and change in groundwater storage between the fall of 2015 and the end of water year 2020[7]. This annual report documents the conditions in the LPVB and the progress toward sustainability for water year 2021.

1.2 Plan Area

The LPVB is bounded to the north by South Mountain and Oak Ridge; to the northeast and east by the foothills of Big Mountain; to the south by the Springville Fault (western segment of the Simi–Santa Rosa Fault) and the Las Posas Hills; and to the west by the Oxnard Subbasin of the Santa Clara River Valley Basin (Figure 1-1).

In the Camarillo Hills area, the Springville Fault Zone is believed to form a groundwater flow barrier at depth between the aquifers in the LPVB and the PVB, based on historical hydraulic head differences of up to 60 feet across the fault zone (Turner 1975). However, shallow alluvial deposits in the vicinity of Arroyo Las Posas and the Somis Gap are in hydraulic communication with the PVB (CMWD 2017). On the west, the WLPMA is in hydrogeologic communication with the Oxnard Subbasin. The boundary between the LPVB and Oxnard Subbasin is a jurisdictional boundary.

1.2.1 Climate

The climate of the LPVB is typical of coastal Southern California, with average daily temperatures ranging generally from 54°F to 84°F in summer and from 40°F to 74°F in the winter (FCGMA 2019). Typically, most of the precipitation in the Ventura County region falls between November and April. Precipitation is measured at several stations in the LPVB (Figure 1-2). Water year precipitation, measured at Stations 002 and 190, in the central LPVB is highly variable, ranging from 3.5 inches in 2021 to 39.0 inches in 2005 (Figure 1-3; Las Posas Valley Basin Historical Water Year Precipitation). On average, the LPVB received approximately 15.1 inches of precipitation per water year between 1956 and 2021.

The GSP for the LPVB included precipitation through the 2015 water year (FCGMA 2019). Since 2015, the LPVB has experienced three above normal[8] water years (2017, 2019, and 2020), two dry water years (2016 and 2018), and one critically dry water year (2021). Water year 2021 was the driest water year on record in the LPVB, in which the total precipitation was approximately 77% lower than the long-term mean precipitation[9]. Overall, the LPVB has continued to experience drier than average conditions since 2015.

1.2.2 Surface Water and Drainage Features

The dominant surface water body in the LPVB is Arroyo Las Posas, located in the ELPMA. In the easternmost portion of the LPVB, Arroyo Las Posas is named Arroyo Simi, and Arroyo Las Posas becomes Calleguas Creek in the PVB. Arroyo Las Posas, which drains a watershed larger than the area of the LPVB, is a source of recharge to the ELPMA.

---

7 A water year begins on October 1 and ends on September 30 of the following year. The convention for naming the water year is to name the water year based on the year in which it ends. For example, the 2020 water year begins on October 1, 2019, and ends on September 30, 2020.

8 Water years have been classified into five types based on their relationship to the mean water year precipitation. The five types are: critical, dry, below normal, above normal, and wet. Critical water years are < 50% of the mean annual precipitation. Dry water years are ≥ 50% and <75% of the mean annual precipitation. Below normal water years are ≥ 75% and <100% of the mean annual precipitation. Above normal water years are ≥ 100% and <150% of the mean annual precipitation. Wet water years are ≥ 150% of the mean annual precipitation.

9 Long-term mean precipitation was calculated using precipitation measured at Station 190 over the period from water year 1956 through 2021

Dry weather flows in Arroyo Las Posas result from upstream wastewater treatment plant and dewatering well discharges to the Arroyo Simi (FCGMA 2019).

There is only one active streamflow gauging station in the LPVB. This station, gauge 841A, which is maintained by the Ventura County Watershed Protection District (VCWPD), is located on Arroyo Simi above Hitch Blvd (Figures 1-2 and 1-4). Streamflow measured at gauge 841 since water year 2010 is presented in Table 1-1.

Table 1-1. Streamflow on Arroyo Las Posas for Water Years 2010 through 2021

Water Year	Average Daily Flow (cfs) at Gauge 841A
2010	38.5
2011	51.1
2012	25.3
2013	17.5
2014	NM
2015	17.7
2016	15.0
2017	31.0
2018	14.7
2019	22.5
2020	22.6
2021	9.49

Notes: cfs - cubic feet per second
NM – Not Measured

Average daily flows in Arroyo Las Posas reflect the water year precipitation (Section 1.2.1) with the highest daily average flows measured at gauge 841A over the past 10 years occurring in 2010, 2011.and 2017. Water years 2010, 2011 and 2017 were above normal water years in which water year precipitation was approximately 140% of the long-term mean. The average daily flow measured in water year 2021 was approximately 38% of the 2010-2020 average, which reflects the critically dry water year conditions (Table 1-1; Figure 1-4).

1.3 Annual Report Organization

This is the third Annual Report prepared since the GSP for the LPVB was submitted to DWR. This annual report is organized according to the GSP Emergency Regulations. Chapter 1 provides the background information on the GSP, the LPVB, and the FCGMA. Chapter 2 provides information on the groundwater conditions in the LPVB since 2015, including groundwater elevations, groundwater extractions, surface water supply, total water available, and change in groundwater storage. Chapter 3 provides an update on the GSP implementation.

2 Groundwater Conditions

This chapter presents the change in groundwater conditions in the LPVB from water year 2020. Comparison of water year 2021 conditions to water year 2020 conditions characterizes the impact that water year type, groundwater production, surface water, imported water and recycled water availability in water year 2021 have had on groundwater conditions in the LPVB. Additionally, data from water year 2015 is provided for context.

2.1 Groundwater Elevations

Groundwater elevation contour maps are presented in Figures 2-1 through 2-10: the Shallow Alluvial aquifer in Figures 2-1 and 2-2, the Epworth Gravels aquifer in Figures 2-3 and 2-4, the Upper San Pedro Formation in Figures 2-5 and 2-6, the Fox Canyon aquifer in Figures 2-7 and 2-8, and the Grimes Canyon aquifer in Figures 2-9 through 2-10. These maps show the seasonal low groundwater elevations for the fall of 2020 and seasonal high groundwater elevations for the spring of 2021. Groundwater elevations are best defined in the Fox Canyon aquifer (Figures 2-7 and 2-8), and least well constrained in the Grimes Canyon aquifer (Figures 2-9 and 2-10).

Fall and spring groundwater elevations were defined as any groundwater elevation measured between October 2 and October 29, 2020, and March 2 and March 29, 2021, respectively. These four-week measurement windows are approximately the same measurement windows used to generate fall and spring groundwater elevation contours for the 2020 Annual Report covering water years 2016 through 2019. The 2021 Annual Report covering water year 2020 utilized a six-week measurement window to ensure similar spatial coverage of groundwater elevation measurements for comparison of groundwater contours, and corresponding changes in groundwater storage, between water years 2016 through 2020. The GSP recommended collecting groundwater elevations within a two-week window in the future (FCGMA 2019a). FCGMA has begun the process of prioritizing recommendations made in the GSP and evaluating the timeframe and feasibility of implementing these recommendations.

The groundwater elevation contour maps are based on the groundwater elevations measured at wells screened solely within an individual aquifer. The intent of using groundwater elevations from wells screened within a single aquifer is to accurately represent groundwater flow directions within an aquifer, as well as vertical gradients between aquifers. It is important to note that production wells in the LPVB may be screened in multiple aquifers.

2.1.1 Groundwater Elevation Contour Maps

2.1.1.1 Shallow Alluvial Aquifer

Fall 2020 groundwater elevations in the Shallow Alluvial aquifer in the ELPMA ranged from a low of 150 feet mean sea level (ft msl) at well 02N20W17J06S to a high of 482 ft msl at well 02N19W09E01S (Figure 2-1). The groundwater elevation low of 150 ft msl occurred along the western most reach of Arroyo Las Posas within the LPVB, near the boundary with the PVB (Figure 2-1). The groundwater elevation high of 482 ft msl occurred along the easternmost reach of Arroyo Las Posas within the LPVB, near the boundary with the Simi Valley Basin (Figure 2-1). Fall 2020 groundwater elevations were within 1 foot of the fall 2019 and fall 2015 conditions at all wells except well 02N20W17J06S. The fall 2020 groundwater elevation measured at well 02N20W17J06S was approximately 10 feet lower than fall 2015 conditions. Groundwater elevation was not measured at well 02N20W17J06S in fall 2019.

Spring 2021 groundwater elevations were measured at six wells in the Shallow Alluvial aquifer (Figure 2-2). During this measurement period, groundwater elevations ranged from a low of approximately 181 ft msl at well 02N20W17J06S to a high of 482 ft msl at well 02N19W09E01S (Figure 2-2). Spring 2021 groundwater elevations ranged from approximately 1 to 5 feet lower than spring 2020 conditions except at well 02N20W09Q08S, where the spring 2021 groundwater elevation was approximately 1 foot higher than the spring 2020 groundwater elevation. Since 2015, spring groundwater elevations have declined in the Shallow Alluvial aquifer. These declines are largest near the boundary with the PVB, where the spring 2021 groundwater elevation was approximately 6 feet lower than spring 2015 conditions.

2.1.1.2 Epworth Gravels Aquifer

There are only two wells in the Epworth Gravels aquifer for which groundwater elevations were reported in fall 2020: 03N19W29F06S and 03N19W30M02S (Table 2-1; Figures 2-3 and 2-4). The fall 2020 groundwater elevations were approximately 490 ft msl and 537 ft msl at wells 03N19W30M02S and 03N19W29F06S, respectively (Figure 2-3). These fall conditions are approximately 20 to 57 feet lower than fall 2019 conditions and approximately 60 to 130 feet lower than fall 2015 conditions.

Spring 2021 groundwater elevations in the Epworth Gravels aquifer were measured at the same two wells as fall 2020. During the spring 2021 measurement period, the groundwater elevation at well 03N19W29F06S was approximately 552 ft msl, and approximately 623 ft msl at well 03N19W30M02S. The spring 2021 groundwater measurement at well 03N19W30M02S is approximately two feet higher than spring 2019 and three feet higher than spring 2015 conditions. The spring 2021 groundwater elevation at well 03N19W29F06S is approximately 50 feet lower than spring 2015 and 55 feet lower than spring 2020.

2.1.1.3 Upper San Pedro Formation

Groundwater elevations in the Upper San Pedro Formation vary with depth (Figures 2-5 and 2-6) and generally reflect the presence of laterally discontinuous lenses of permeable sediments that characterize the Upper San Pedro Formation in the LPVB. The influence of these discontinuous lenses on local groundwater conditions is reflected in the groundwater elevation measurements collected at nested wells located in the WLPMA, wells 02N21W11J05S (screened 340-380 feet below ground surface [ft bgs]) and 02N21W11J06S (screened 190-230 fts bgs; Figure 2-5 and 2-6). In fall 2020, the groundwater elevation measured at well 02N21W11J06S, the shallowest completion of the nested well cluster, was approximately 37 feet higher than the groundwater elevation measured well at 02N21W11J05S (Figure 2-5). The fall 2020 groundwater elevation measured at well 02N21W15M03S, which is located approximately 2 miles southwest of wells 02N21W11J05/6S, was -68 ft msl (Figure 2-5). In western WLPMA, fall 2020 groundwater elevations, as measured at well 02N21W15M03S, were approximately 11 feet higher than fall 2019 and approximately 10 feet lower than fall 2015. In central WLPMA, fall 2020 groundwater conditions were the same as fall 2019, and 7 to 13 feet lower than fall 2015.

Fall 2020 groundwater elevations in the ELPMA ranged from 437 ft msl near Arroyo Las Posas to approximately 264 ft msl within the trough of the Moorpark syncline (Figure 2-5). These groundwater elevations are within 1 foot of fall 2019 conditions. The fall 2020 groundwater elevation measured at well 02N19W07K03S, which is located adjacent to Arroyo Las Posas, was approximately 0.5 feet lower than fall 2015 conditions. Groundwater elevation declines between fall 2015 and fall 2020 increased with distance from Arroyo Las Posas, with the largest declines measured at well 03N20W35R04S. At this well, the fall 2020 groundwater elevation was approximately 18 feet lower than fall 2015.

In the spring of 2021, groundwater elevations in the Upper San Pedro Formation in the WLPMA ranged from a low of -68 ft msl at well 02N21W15M03S to high of 194 ft msl at well 02N21W11J05S (Figure 2-6). Between spring 2020 and 2021, groundwater elevations in the Upper San Pedro decreased by approximately 1 foot in western WLPMA and 5 feet in central WLPMA. Spring 2020 groundwater elevations were approximately 44 feet below spring 2015 conditions in western WLPMA and approximately 8 to 14 feet below fall 2015 in central WLPMA.

In the ELPMA, spring 2021 groundwater elevations ranged from 437 ft msl near Arroyo Las Posas to approximately 265 ft msl north of the Moorpark anticline at well 03N20W35R04S (Figure 2-6). Spring 2021 groundwater elevations along Arroyo Las Posas were one-foot lower than spring 2020. Within the trough of the Moorpark syncline, spring groundwater elevations declined by approximately 8 feet between 2015 and 2021.

2.1.1.4 Fox Canyon Aquifer

Fall 2020 groundwater elevations in the Fox Canyon aquifer in the WLPMA ranged from a low of approximately -191 ft msl in eastern WLPMA at well 02N20W06R01S to a high of approximately -42 ft msl in central WLPMA at well 02N20W12H01S (Figure 2-7). Groundwater elevations in eastern WLPMA generally declined from fall 2019 to fall 2020. Over this period, groundwater elevation declines ranged from approximately 6 feet at well 03N20W32H03S to approximately 31 feet at well 02N20W06R01S. The exception to this is at well 02N20W08B01S, where groundwater elevations recovered by approximately 18 feet between fall 2019 and fall 2020. In central WLPMA, the change in groundwater elevation between fall 2019 and fall 2020 ranged from a decline of approximately 10 feet at well 02N21W11J03S to an increase of approximately 2 feet at well 02N20W12H01S.

Fall 2020 groundwater elevations in the WLPMA ranged from approximately 14 to 50 feet lower than fall 2015 conditions (measured at wells 02N21W11J03S and 02N21W13A01S, respectively). The only well in which groundwater elevations rose between fall 2015 and 2020 was 02N20W08B01S, which is located adjacent to the Somis Fault. At this well, the groundwater elevation in fall 2020 was approximately 14 feet higher than fall 2015.

In the ELPMA, fall 2020 groundwater elevations ranged from a high of approximately 279 ft msl at well 02N20W10J01S to a low of approximately 109 ft msl at well 02N20W03H01S (Figure 2-7). Between fall 2019 and fall 2020, groundwater elevations in southern ELPMA, near Arroyo Las Posas, declined by 1 to 5 feet. Near the Moorpark anticline, groundwater elevation declines ranged from approximately 2 feet at well 02N20W02D02S to approximately 47 feet at well 03N20W35R02S. Within the trough of the Moorpark syncline, fall groundwater elevation declines between 2019 and 2020 ranged from approximately 15 feet at well 03N20W36A02S to approximately 42 feet at well 02N02W36G01S.

In central ELPMA, fall groundwater elevations have declined by approximately 15 to 43 feet since 2015 (measured at wells 02N20W10D02S and 02N20W03H01S, respectively). Along the base of the Moorpark anticline and within the trough of the Moorpark syncline, where groundwater elevations are influenced by CMWD's Aquifer Storage and Recovery (ASR) operations, fall groundwater elevations were approximately 4 to 45 feet higher in 2020 than 2015 (measured at wells 03N20W36G01S and 03N20W35J01S, respectively). Along the base of Oak Ridge, the fall 2020 groundwater elevation measured at well 03N19W19J01S was approximately 6 feet lower than fall 2015.

Spring 2021 groundwater elevations in the WLPMA ranged from a low of approximately -210 ft msl at well 02N20W06R01S to a high of approximately -37 ft msl at well 02N20W12H01S (Figure 2-8). Spring groundwater elevations declined across the WLPMA between 2020 and 2021, with the largest declines occurring in eastern WLPMA at well 02N20W06R01S. At this well, the spring 2021 groundwater elevation was approximately 40 feet lower than spring 2020 and 85 feet lower than spring 2015. In central WLPMA, the spring 2021 groundwater elevations ranged from approximately 14 feet lower than spring 2020 at well 02N21W11J03S to approximately 11 feet lower than spring 2020 at well 02N21W13A01S. In this part of the WLPMA, spring 2020 groundwater elevations were approximately 20 to 55 feet lower than spring 2015.

Spring 2021 groundwater elevations in the ELPMA ranged from a high of approximately 280 ft msl at well 02N20W10J01S to a low of approximately 115 ft msl at well 02N20W03J01S (Figure 2-8). In the central ELPMA, spring groundwater elevation changes between 2020 and 2021 ranged from a decline of approximately 20 feet at well 02N20W03J01S to a recovery of approximately 30 feet at well 02N20W03H01S. Near the Moorpark anticline and within the Moorpark syncline, spring groundwater elevations declined between 2020 and 2021. These groundwater elevation declines ranged from approximately 11 feet at well 03N20W25R04S to approximately 50 feet at well 03N20W35R01S. The one exception to this was the 28-foot groundwater elevation increase between spring 2020 and 2021 measured at well 03N20W35J01S.

Spring 2021 groundwater elevations were lower than spring 2015 conditions across the majority of the ELPMA. In the southern portion of the ELPMA, near Arroyo Las Posas, groundwater elevations ranged from approximately 10 to 36 feet below spring 2015 groundwater elevations. Along the Moorpark anticline, groundwater elevations measured at wells 03N20W35R02S and 03N20W35R03S were approximately 10 feet lower than spring 2015, and within the Moorpark syncline, spring 2020 groundwater elevations ranged from approximately 5 to 15 feet lower than fall 2015 groundwater elevations (measured at wells 03N20W26R03S and 03N20W36G01S, respectively).

2.1.1.5 Grimes Canyon Aquifer

Of the eight wells screened solely within the Grimes Canyon aquifer in the WLPMA, groundwater elevations were only measured in wells 02N21W18A02S and 02N21W22G01S in fall 2020 and at well 02N21W22G01S in spring 2021 (Figures 2-9 and 2-10). Fall 2020 groundwater elevations were 2 feet lower than fall 2019 conditions at well 02N21W22G01S and 4 feet higher than fall 2019 conditions at well 02N21W28A02S. The fall 2020 groundwater elevation measured at these wells were approximately 7 to 10 feet lower than fall 2015. The spring 2021 groundwater elevation measured at well 02N21W22G01S is equal to the spring 2020 groundwater elevation and approximately 11 feet lower than spring 2015.

Groundwater elevations were not measured in either of the two wells screened solely in the Grimes Canyon aquifer in the ELPMA (Figures 2-9 through 2-10).

Table 2-1. Water Year 2021 Groundwater Elevations, Minimum Thresholds, Measurable Objectives, and Interim Milestones for Representative Monitoring Wells in the LPVB

Well Number	Management Area	Aquifer	Fall Groundwater Conditions		Spring Groundwater Conditions		Minimum Threshold (ft MSL)	Measurable Objective (ft MSL)	2025 Interim Milestone (ft MSL)
			2019 Groundwater Elevation (ft MSL)	Change from 2018 to 2019 (feet)[a]	2020 Groundwater Elevation (ft MSL)	Change from 2019 to 2020 (feet)[a]			
03N19W29F06	Epworth Gravels	Epworth Gravels	537.2	**-57.1**	551.6	**-54.6**	555	585	581
02N20W09Q08	ELPMA	Shallow Alluvial	NM		273	**-1**	170	270	—
02N20W12MMW1	ELPMA	Shallow Alluvial	368.5	**-0.5**	NM		300	370	—
02N20W01B02	ELPMA	Fox	138.0		149		80	120	—
02N20W03H01	ELPMA	Fox	109.0	**-31.0**	143.5	**-14.5**	100	135	—
02N20W04F02	ELPMA	Fox	Destroyed		Destroyed		100	145	—
02N20W10D02	ELPMA	Fox	136.5	**-5.7**	145.28	**-5.15**	80	130	—
02N20W10G01	ELPMA	Fox	244.1	**-6.5**	248.62	**-11.65**	100	230	—
02N20W10J01	ELPMA	Fox	279.7	**-0.4**	280.12	**-6.98**	110	250	—
03N19W19J01	ELPMA	Fox	170.3	**-4.5**	166.2	**-15**	130	160	—
03N19W28N03	ELPMA	Fox	NM		NM		130	170	—
03N19W31B01	ELPMA	Fox	108.0	**-55.0**	NM		105	145	—
03N20W34G01	ELPMA	Fox	136.98		143.38	**-10.4**	75	130	—
03N20W35R03	ELPMA	Fox	146.7	**-36.4**	144.87	**-38.2**	105	145	139
03N20W26R03	ELPMA	Fox	137.01	**-37.8**	141.01		100	120	—
03N20W35R02	ELPMA	Grimes	146.2	**-35.6**	144.17		105	145	133
02N20W06R01S	WLPMA	LAS[b]	-191.3	**-31.3**	-210.61	**-40.0**	-170	-125	-147
02N20W08F01S	WLPMA	LAS	NM[c]		NM[c]		-195	-150	—
02N21W16J03S	WLPMA	LAS	NM[d]		NM[d]		-75	-45	-71
02N21W11J03S	WLPMA	LAS	-80.01	**-10.3**	-72.21	**-14.1**	-70	-50	-64
02N21W12H01S	WLPMA	LAS	-41.7	1.8	-37.61	**-2.2**	-70	-45	—

ft MSL = feet mean sea level
NM = not measured

[a] Data in this column shows the difference between water year 2021 and water year 2020 groundwater elevations measured at each representative monitoring site. Positive (+) values indicate that seasonal high or low groundwater elevations have increased from water year 2020 conditions. Negative (-) values indicate that seasonal high or low groundwater elevations have decreased from water year 2020 conditions. Groundwater elevation declines from 2020 conditions are presented in bold font. Blank cells in this column indicate that data was not measured in the current, or previous, water year.
[b] In the WLPMA, the LAS consists of the Fox Canyon aquifer and Grimes Canyon aquifer (FCGMA 2019)
[c] Groundwater elevations not reported after 4/01/2017.
[d] Groundwater elevations not reported after 5/25/2016.

2.1.2 Groundwater Elevation Hydrographs

Groundwater elevation hydrographs for each of the key wells identified in the GSP are presented in Figures 2-11 through 2-13. These key wells are the designated representative monitoring sites for the LPVB (FCGMA 2019). Since the GSP was prepared, well 02N20W04F02S, one of the representative monitoring wells in the ELPMA, was destroyed (Table 2-1). FCGMA is currently working to identify a suitable replacement monitoring site for inclusion in subsequent annual reports. Additionally, groundwater elevations in wells 02N20W08F01S and 02N21W16J03S have not been measured since 2016 or 2017 (Table 2-1). Groundwater elevations at wells 02N20W08F01S and 02N21W16J03S have historically been monitored by VCPWD, Zone Mutual Water Company, and UWCD; FCGMA is continuing to assess whether these wells can be accessed and included in future monitoring, or whether suitable replacement wells need to be identified.

In the WLPMA, spring 2021 groundwater elevations were measured in three of the five representative monitoring wells (Table 2-1). Groundwater elevations declined by approximately 2 to 40 feet between spring 2020 and spring 2021 and ranged from approximately 40 feet below the minimum threshold groundwater elevation at well 02N20W06R01S to approximately 33 feet above the minimum threshold groundwater elevation at well 02N21W12H01S. The spring 2021 groundwater elevation at well 02N21W12H01S was higher than the measurable objective groundwater elevation (Table 2-1).

Spring 2021 groundwater elevations were measured at one well in the Shallow Alluvial aquifer in the ELPMA and one well in the Epworth Gravels aquifer. In the Shallow Alluvial aquifer, the spring groundwater elevations declined by approximately 1 foot from 2020 to 2021 and were approximately equal to the established measurable objective groundwater elevation (Table 2-1). In the Epworth Gravels aquifer, groundwater elevations declined by approximately 55 feet between spring 2020 and spring 2021. The spring 2021 groundwater elevation measured in the Epworth Gravels aquifer was approximately 3 feet below the established minimum threshold groundwater elevation (Table 2-1).

Spring 2021 groundwater elevations were measured in nine of the twelve representative monitoring wells screened in the Fox Canyon aquifer in the ELPMA (Table 2-1). Groundwater elevations declined from spring 2020 to spring 2021 in each of the six wells with consecutive water year measurements (Table 2-1). The spring 2021 groundwater elevations measured at these wells were approximately equal to, or higher than, the established measurable objective groundwater elevations (Table 2-1).

2.2 Groundwater Extraction

On December 14, 2020, the FCGMA adopted an Ordinance to Establish an Extraction Allocation System for the Las Posas Valley Groundwater Basin. The ordinance was designed to facilitate sustainable groundwater management under SGMA. The new allocation system went into effect on October 1, 2021 and transitioned from calendar year to water year reporting for groundwater extractions.

Historically, groundwater extractions in the LPVB have been reported to the FCGMA in two periods (semi-annually) over the course of a single calendar year. Because groundwater extractions are not reported monthly, groundwater production prior to 2021 cannot be reported on a water year basis. Therefore, the groundwater extractions for 2016 through 2020 reported in Table 2-2 and Table 2-3, and shown on Figures 2-16 through 2019, follow the historical precedent and represent calendar year extractions. Groundwater extractions for calendar year 2019 and 2020 were updated as part of this report to reflect additional extraction reporting received after submittal of the 2021 Annual Report.

Due to the transition from calendar year to water year reporting, the 2021 groundwater extractions reported in Tables 2-2 and 2-3 represent: (i) a combination of reported and estimated extractions for the period from October 1, 2020 through December 31, 2020, and (ii) a combination of reported and estimated extractions for the period from January 1, 2021 through September 30, 2021. Agricultural extractions for the October to December 2020 period were estimated using monthly AMI data that were validated against the 2020 calendar year extraction reports, and the October to December 2020 extractions for municipal and domestic water supply wells were estimated by assuming that 50% of the June-December extraction reporting occurred during the October to December timeframe. Groundwater extractions for water year 2021 are preliminary and will be updated as additional reporting becomes available.

Since 2015, groundwater extractions in the WLPMA have ranged from a minimum of approximately 14,100 AF in 2019 to a maximum of approximately 16,200 AF in 2020 (Table 2-2). These groundwater extraction rates are similar to the historical extraction rates reported for the period from calendar year 1985 through 2015 (FCGMA 2019). During the 2016 to 2021 period, approximately 84% of the groundwater extracted from the WLPMA was used for agricultural applications, 15% was used to support M&I, and less than 1% was used as a source of domestic water supply. In the ELPMA, groundwater extractions have ranged from a minimum of approximately 20,400 AF in 2019 to a maximum of approximately 24,200 AF in 2020 (Table 2-3). During the 2016 to 2021 period, approximately 92% of the groundwater extracted from the ELPMA was used for agricultural applications, 7% was used to support M&I, and less than 1% was used as a source of domestic water supply.

The sustainable yield of the ELPMA and WLPMA is estimated to be approximately 17,800 ± 2,300 AFY, 12,500 ± 1,200 AFY, respectively (FCGMA 2019). Combining these values leads to an estimate of the total sustainable yield for the LPVB that ranges from 26,800 AFY to 33,800 AFY. Since 2015, groundwater extractions in the WLPMA have exceeded the upper bound of the estimated sustainable yield (13,600 AFY) by approximately 500 to 2,600 AFY. During this period, groundwater extractions were highest in 2020 and 2021, and exceeded the upper bound of the estimated sustainable yield by approximately 2,600 AFY and 2,500 AFY, respectively. In the ELPMA, recent groundwater extraction rates exceeded the upper bound of the estimated sustainable yield by 300 AFY to 4,100 AFY.

Total groundwater extractions from the LPVB have ranged from a low of approximately 34,500 AF in calendar year 2019 to a high of approximately 40,100 AF in calendar year 2017. These extraction rates indicate that groundwater production from the LPVB has remained above the estimated sustainable yield since 2015 (Table 2-2 and Table 2-3).

2.3 Surface Water Supply

There are no locally derived sources of surface water in the LPVB (FCGMA 2019).

Table 2-2. Annual Groundwater Extractions in the WLPMA by Aquifer System and Water Use Sector

Year	Shallow Alluvial System (Acre-Feet)				Lower Aquifer System (Acre-Feet)				Wells in Unassigned Aquifer Systems (Acre-Feet)				Total (Acre-Feet)
	AG	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	
CY 2016[a]	1,316	0	1	1,317	11,291	2,371	0	13,662	178	372	33	583	**15,562**
CY 2017[a]	1,348	0	1	1,349	11,197	2,321	0	13,518	569	386	44	999	**15,866**
CY 2018[a]	903	0	1	904	10,184	1,511	0	11,695	1,287	376	42	1,705	**14,304**
CY 2019[b]	675	0	16	691	10,171	2,023	0	12,194	1,013	218	25	1,256	**14,141**
CY 2020[b]	1,031	0	18	1,049	11,622	2,115	0	13,737	1,214	183	41	1,437	**16,223**
WY 2021[c]	1,077		14	1,091	11,675	2,068	0	13,743	925	237	17	1,178	**16,013**

Notes: AG = Agriculture ; Dom = domestic; M&I = Municipal and Industrial; CY = Calendar Year (January 1 through December 31); WY = Water Year (October 1 through September 30)

[a] Groundwater extractions in the Shallow Alluvial and Lower Aquifer System were revised based on additional evaluation of well-construction information.

[b] Groundwater extraction updated using additional extraction reporting.

[c] Groundwater extractions are preliminary and expected to change. Additional extraction reporting is anticipated.

Table 2-3. Annual Groundwater Extractions in the ELPMA by Aquifer System and Water Use Sector

Year	Epworth Gravels Aquifer (Acre-Feet)				Upper San Pedro Formation (Acre-Feet)				Fox Canyon Aquifer (Acre-Feet)				Grimes Canyon Aquifer (Acre-Feet)				Wells in Multiple or Unassigned Aquifers (Acre-Feet)				Total (Acre-Feet)
	AG	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	*AG*	*M&I*	*Dom*	*Sub-total*	
CY 2016	1,052	0	0	1,052	583	0	0	583	11,270	1,128	0	12,398	384	87	1	472	8,424	98	18	8,540	**23,045**
CY 2017	924	0	0	924	580	0	0	580	11,900	1,093	0	12,993	453	91	1	545	9,008	131	29	9,168	**24,210**
CY 2018	766	0	0	766	562	0	0	562	10,944	1,393	0	12,337	500	92	1	593	8,579	418	29	9,026	**23,284**
CY 2019[a]	744	0	0	744	217	0	0	217	11,059	1,295	0	12,354	272	99	0	371	6,573	128	20	6,721	**20,407**
CY 2020[a]	865	0	0	865	133	0	0	133	11,791	1,626	0	13,417	569	121	1	692	8,287	289	19	8,595	**23,702**
WY 2021[b]	651	0	0	651	153	0	0	153	10,864	1,727	0	12,591	489	172	2	663	8,373	31	91	8,494	**22,553**

Notes: AG = Agriculture; Dom = domestic; M&I = Municipal and Industrial; CY = Calendar Year (January 1 through December 31); WY = Water Year (October 1 through September 30)

[a] Groundwater extractions updated using additional extraction reporting.

[b] Groundwater extractions are preliminary and expected to change. Additional extraction reporting is anticipated.

2.4 Imported Water Supply

Imported water supplies consist of imported Metropolitan Water District of Southern California (State Water Project and/or Colorado River water) water provided by the CMWD to local water purveyors and imported groundwater and Conejo Creek water provided by CWD. CMWD is largest imported water supplier to the LPVB and has provided approximately 97% of the imported water to the LPVB since water year 2015 (Table 2-4). Table 2-4 summarizes imported water supplies to the LPVB from water year 2016 to water year 2021.

CWD provided imported water to the LPVB during calendar years 2016 through 2020. In order to convert the imported water supply data from calendar year to water year, 25% of CWD's imported water from a given calendar year was assigned to the following water year, and 75% of the calendar year imported water was assigned to the current water year. This division, while approximate, is based on the monthly split between water year and calendar year, with January through September (75% of the calendar year) belonging to the current water year, and October through December (25% of the calendar year) belonging to the following water year.

Table 2-4. Total Imported Water Supplies in the LPVB

Water Year	*CMWD (Acre-Feet)*						*CWD (Acre-feet)*								Total[c]
	WLPMA		*ELPMA*				*GW Pumped in PVB and used in LPVB*		*GW Pumped in SRV and used in LPVB*		*Imported from CMWD to ELPMA*				
	M&I	*Ag*	*M&I*	*Ag*	*ASR Injections* [b]	*Sub-total*	*M&I*	*Ag*	*M&I*	*Ag*	*M&I*	*Ag*	*Sub-total*	Nonpotable water delivered for Ag	
2016	697	762	5,210	1,966	946	9,581	10	13	21	29	54	76	203	122	**9,906**
2017	541	372	5,526	1,896	4,066	12,401	9	13	33	43	51	69	218	99	**12,718**
2018	1,011	772	6,296	2,298	2,056	12,433	10	13	33	45	53	71	225	97	**12,754**
2019	666	384	5,195	1,802	6,814	14,861	9	13	26	35	54	73	210	139	**15,210**
2020	544	379	5,460	1,884	2,866	*11,133*	11	15	17	24	69	90	226	132	**11,493**
2021	968	352	6,041	2,023	683	10,067	15	21	15	21	69	91	233	144	**10,444**

Notes: M&I = Municipal and Industrial; Ag = Agriculture; ASR = Aquifer Storage and Recovery; NR = Not Reported, SRV = Santa Rosa Valley Basin, PVB = Pleasant Valley Basin
CWMD = Calleguas Municipal Water District; CWD = Camrosa Water District

a Total imported water is preliminary pending receipt of data requested from CWD.
b ASR injections are stored water in the ELPMA.
c Total imported water supplies for water year 2016 through 2019 updated to incorporate CWD imported water supply data that was not available during 2020 Annual reporting.

2.5 Total Water Available

Total available water was tabulated from the groundwater extractions reported in Tables 2-2 and 2-3, the imported water supplies reported in Table 2-4, and treated wastewater sent to the Moorpark Wastewater Treatment Plant (MWTP) percolation ponds. Total available water is reported in Table 2-5 by water year. In order to convert the reported groundwater pumping from calendar year to water year for 2016 through 2020, 25% of groundwater production from a given calendar year was assigned to the following water year, and 75% of the calendar year production was assigned to the current water year. This division, while approximate, is based on the monthly split between water year and calendar year, with January through September (75% of the calendar year) belonging to the current water year, and October through December (25% of the calendar year) belonging to the following water year.

Similar to Table 2-2, the groundwater extractions for water year 2021 presented in Table 2-5 represent reported extractions for the period from October 1, 2020 through September 30, 2021.

Table 2-5. Total Water Available in the LPVB

Water Year	Groundwater (acre-feet)			Recycled Water (acre-feet)	Imported Water[a] (acre-feet)		Total[b] (acre-Feet)
	Ag	*Dom*	*M&I*	*M&I*	*Ag*	*M&I*	
2016	34,872	53	4,160	598	2,969	5,991	48,643
2017	35,610	69	4,031	765	2,492	6,160	49,127
2018	34,296	72	3,848	897	3,296	7,402	49,811
2019[c]	31,474	64	3,770	823	2,446	5,950	44,527
2020[c]	34,315	74	4,191	861	2,525	6,102	48,068
2021[d]	34,208	124	4,234	1,244	2,652	7,108	49,570

Notes: Ag = Agriculture; Dom = Domestic; M&I = Municipal and Industrial.
a Imported water updated to include data provided by CWD.
b Total water available in the LPVB does not include CMWD ASR injections which are considered stored water in the ELPMA. ASR injection totals were 946 AF in 2016, 4,066 AF in 2017, 2,056 in 2018, 6,814 AF in 2019, 2,866 AF in 2020, and 683 in 2021.
c Groundwater extraction reporting for 2019 and 2020 were updated based on additional extraction reporting.
d Groundwater extraction reporting for 2021 are preliminary and expected to change. Additional extraction reporting is anticipated.

2.6 Change in Groundwater Storage

Change in storage estimates were calculated in the LPVB by comparing annual seasonal high groundwater elevations from water years 2016 through 2021. Annual and cumulative change in storage for water years 2016 through 2021 are presented in Tables 2-6A and 2-6C and Figures 2-16 through 2-19. The change in storage for the Fox Canyon aquifer between spring 2020 and spring 2021 is shown in Figure 2-15.

Change in groundwater in storage was calculated using a series of linear regression models that correlate measured groundwater elevations to simulated storage change values extracted from the Ventura Regional Groundwater Flow Model (UWCD, 2018) for the WLPMA and the CMWD numerical groundwater flow model for the ELPMA (CMWD, 2018). This methodology differs from previous estimates of storage change presented in the 2020 and 2021 Annual Reports. The methodology presented in Appendix A builds on the approach used in the previous Annual Reports and addresses identified data gaps by: (1) removing the influence of contouring algorithms on the resulting estimates of storage change, and (2) providing an estimate of storage change across the majority of the ELPMA and WLPMA. The updated estimates are presented in Table 2-6A, Table 2-6C, and Figures 2-16 through 2-19. A comparison of the estimated change in storage using the two methodologies is provided in Appendix A.

2.6.1 Fox Canyon Aquifer

Change in groundwater storage in the Fox Canyon aquifer was calculated for approximately 11,500 acres of the 17,400 acres of the WLPMA and 21,300 acres of the 27,200 acres of ELPMA. This corresponds to change in storage estimates that represent approximately 66% of the Fox Canyon aquifer in the WLPMA and 78% of the Fox Canyon aquifer in the ELPMA. Prior estimates of storage change presented in the 2019 and 2020 Annual Reports for the Las Posas Valley Basin represented changes in storage within the Fox Canyon aquifer over approximately 18% of the WLPMA and 19% of the ELPMA.

Groundwater in storage decreased between spring 2020 and spring 2021 across the majority of the LPVB. In the ELPMA, groundwater storage declines ranged from approximately 11 acre-feet per 100 acres (AF/100A) in the southern region of the ELPMA, to approximately 57 AF/100A north of the Moorpark syncline (Figure 2-15). Near Arroyo Las Posas, groundwater elevations declined by approximately 7 feet between spring 2020 and 2021, which resulted in groundwater storage reduction in this area of approximately 19 AF/100A. Total change in storage between spring 2020 and spring 2021 in the ELPMA was approximately -5,400 AF (Table 2-6b).

Declines in groundwater in storage in the WLPMA were highest in the area near the Somis Fault. In this part of the WLPMA, groundwater elevations declined up to 40 feet, which corresponded to storage reductions ranging from approximately 47 AF/100A to 250 AF/100A. In western WLPMA, near the boundary between the LPVB and Oxnard Subbasin, groundwater in storage declined by approximately 11 to 24 AF/100A. In central WLPMA, groundwater in storage declined by less than 100 AF/100A. Total change in storage between spring 2020 and spring 2021 in the WLPMA was approximately -5,900 AF.

Table 2-6a. Annual Change in Storage (Acre-feet) in the Fox Canyon Aquifer in the LPVB

Water Year	Water Year Type	LPVB[a]		
		WLPMA	*ELPMA*[b]	*Total*
2016	Dry	-224	-1,289	-1,513
2017	Above Normal	-4,411	-526	-4,936
2018	Dry	-1,592	-3,880	-5,472
2019	Above Normal	129	-446	-316
2020	Above Normal	2,474	5,698	8,173
2021	Critically Dry	-5,895	-5,372	-11,266

Notes: ELPMA change in storage includes ASR injections in 2016 through 2019.
[a]Change in groundwater storage for water years 2016 through 2020 was updated using correlation between measured groundwater elevations and modeled storage change extracted from the Ventura Regional Flow Model (UCWD 2018) and CMWD numerical groundwater flow model (CMWD, 2018). A discussion of this approach is provided in Appendix A

Estimates of groundwater change in storage described above require consecutive water year measurements. Spring groundwater elevations were not measured during consecutive water years at well 02N20W07R02S in the WLPMA and at wells 03N20W34G01S and 03N19W31B01S in the ELPMA. The missing groundwater elevations were estimated for wells 03N20W34G01S and 03N19W31B01S (Table 2-6b). Because there was not sufficient measurement overlap between well 02N20W07R02S and nearby wells, the local change in storage value for water year 2021 was estimated using a correlation between modeled change in storage and groundwater elevations measured at well 02N20W18A01S.

Table 2-6b. Estimated Groundwater Elevations

SWN	Missing Period	Correlation Well	Correlation Statistic (R^2)	Groundwater Elevation Measured at Correlation Well (ft msl)	Estimated Groundwater Elevation (ft msl)
03N20W34G01S	Spring 2020	02N20W03H01S	0.6011	155.0	**143.4**
03N19W31B01S	Spring 2021	03N19W31H01S	0.6132	140.30	**137.1**

Neither annual nor cumulative changes in groundwater storage correspond to water year types in the LPVB (Tables 2-6a and 2-6b; Figures 2-16 through 2-19). Based on the available data, groundwater storage declined at similar rates in 2017 (above normal water year) and 2018 (dry water year). Groundwater storage declines in water year 2021 were the largest that the LPVB has experienced since water year 2015. The change in storage volumes reported include ASR operations between 2016 and 2020[10].

10 CMWD's ASR operations impact groundwater elevations in the vicinity of the Moorpark Anticline in the ELPMA. Groundwater elevation changes that result from CMWD's ASR operations are included in the linear regression models used to estimate storage change.

Table 2-6c. Cumulative Change in Storage (Acre-feet) in the Fox Canyon Aquifer in the LPVB

Water Year	Water Year Type	LPVB		
		WLPMA	*ELPMA*	*Total*
2016	Dry	-224	-1,289	-1,513
2017	Above Normal	-4,635	-1,814	-6,449
2018	Dry	-6,227	-5,694	-11,921
2019	Above Normal	-6,098	-6,140	-12,237
2020	Above Normal	-3,623	-441	-4,064
2021	Critically Dry	-9,518	-5,813	-15,331

Notes: ELPMA change in storage includes ASR injections in 2016 through 2021.

[a] Change in groundwater storage for water years 2016 through 2020 was updated using correlation between measured groundwater elevations and modeled storage change extracted from the Ventura Regional Flow Model (UCWD 2018) and CMWD numerical groundwater flow model (CMWD, 2018). A discussion of this approach is provided in Appendix A.

INTENTIONALLY LEFT BLANK

3 GSP Implementation Progress

The GSP for the LPVB was submitted to DWR in January 2020 and approved by DWR in January 2022. This is the third annual report to be prepared since the GSP was submitted. The GSP implementation progress described in this report covers work begun during development of the GSP as well as work that has been conducted over the 2 years since the GSP was submitted. Concurrent with FCGMA's ongoing GSP implementation efforts in the LPVB, the basin is under adjudication in the California Superior Court. FCGMA continues to engage with stakeholders as part of the GSP implementation efforts.

Project Implementation Progress

During development of the GSP, FCGMA identified the northern Pleasant Valley, adjacent to the boundary between the PVB and the ELPMA, as a critical area in which aquifer specific groundwater elevations were lacking. This is an area where subsurface flows between the two basins are poorly constrained. At FCGMA's request, DWR installed two new nested monitoring wells in this area in 2019 per FCGMA's technical specifications. Combined, the new nested wells are screened in the Older Alluvium (one each in the Oxnard aquifer equivalent, and Mugu aquifer equivalent), Upper San Pedro Formation (Hueneme aquifer equivalent), and the Fox Canyon aquifer (one each in the upper and basal portions). Groundwater elevation data from these wells were incorporated into this annual report to better represent groundwater conditions at the boundary between the LPVB and PVB.

In anticipation of future funding potential through DWR's Sustainable Groundwater Management program, FCGMA solicited project descriptions and details for projects that were not included in the initial GSP. For the Las Posas Valley Basin, these include:

- Infrastructure improvements to Zone Mutual Water Company's water delivery system to increase the capacity for transferring water between the ELPMA and WLPMA;
- Construction of a groundwater desalter facility (Moorpark Desalter) to pump and treat poor quality groundwater from the southern portion of the ELPMA;
- Construction of a surface intake structure to divert storm flows in Arroyo Las Posas to existing percolation ponds at the Moorpark Water Reclamation Facility (MWRF) for recharge to the ELPMA;
- Development of a feasibility study for supplemental water deliveries north of the Moorpark anticline;
- New multi-depth monitoring wells to resolve data gaps identified in the GSP;
- Installation of pressure transducers at representative monitoring points, or key wells, to better constrain temporal variations in groundwater conditions;

The details for each of these projects are provide in Appendix B.

Management Action Implementation Progress

FCGMA has made progress on several management actions since publication of the 2020 annual report. First, the FCGMA Board adopted a fixed-extraction allocation ordinance for the LPVB in December 2020 that went into effect on October 1, 2021. The allocation system is designed to "facilitate the transition from [FCGMA's] current groundwater management programs to sustainable groundwater management under SGMA" (FCGMA, 2020). As part of the new allocation system, FCGMA changed the reporting time periods for groundwater production to better quantify groundwater production by water-year, rather than calendar year. The new allocation system sets fixed allocations for each well rather than variable efficiency allocations for agricultural pumpers, which will allow for improved management of the LPVB.

Second, in anticipation of the additional reporting associated with implementing the allocation ordinance, FCGMA is conducting an analysis of its data management system needs. The updated data management system will incorporate the new AMI data and will be structured to allow for land-based extraction assignments. Changes to the data management system will target the specific needs of the FCGMA moving toward sustainable management of the LPVB by 2040.

The progress made over the past year on projects and management actions applicable to the LPVB demonstrates FCGMA's commitment to allocating the necessary time and resources to ensure the long-term sustainable management of the groundwater resources of the LPVB.

INTENTIONALLY LEFT BLANK

4 References

CMWD (Calleguas Municipal Water District). 2017. *Development of a Conceptual Model for the Las Posas Valley Basin – East and South Sub-Basins*. Technical Memorandum – Final. Thousand Oaks, California: CH2M Hill Inc. January 2017.

CMWD (Calleguas Municipal Water District). 2018. *Groundwater Flow Model of the East and South Las Posas Sub-basins – Preliminary Draft Report*. Torrance, California: Intera Geoscience and Engineering Solutions. January 2018.

DWR (California Department of Water Resources). 2020. DWR SGMA Portal Website: All submitted GSPs. https://sgma.water.ca.gov/portal/gsp/all. Accessed February 17, 2020.

FCGMA (Fox Canyon Groundwater Management Agency). 2019. Groundwater Sustainability Plan for the Las Posas Valley Basin.

FCGMA (Fox Canyon Groundwater Management Agency). 2020a. Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report: Covering Water Years 2016 through 2019.

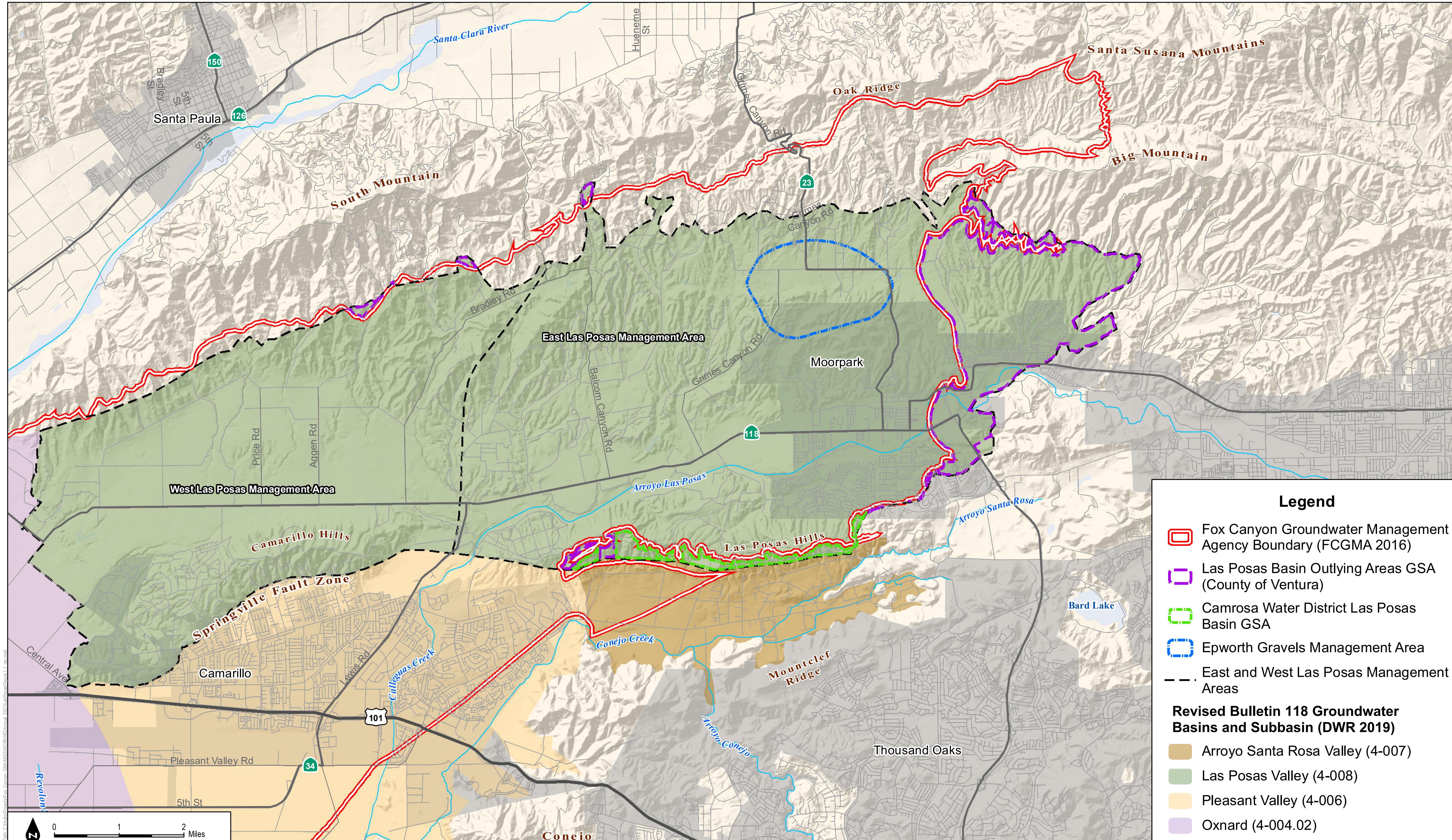
FCGMA (Fox Canyon Groundwater Management Agency). 2020b. An Ordinance to Establish and ExtractionAllocation System for the Las Posas Valley Groundwater Basin.

FCGMA (Fox Canyon Groundwater Management Agency). 2021. Las Posas Valley Basin Groundwater Sustainability Plan 2021 Annual Report: Covering Water Year 2020.

Turner, J.M. 1975. "Aquifer Delineation in the Oxnard-Calleguas Area, Ventura County." In *Compilation of Technical Information Records for the Ventura County Cooperative Investigation: Volume I*. Prepared by the Ventura County Public Works Agency Flood Control and Drainage Department for the California Department of Water Resources. 1-45.

United Water Conservation District (UWCD). 2018. Ventura Regional Groundwater Flow Model and Updated Hydrogeologic Conceptual Model: Oxnard Plain, Oxnard Forebay, Pleasant Valley, West Las Posas, and Mound Groundwater Basins. Open File Report 2018-02. July 2018.

5 Figures

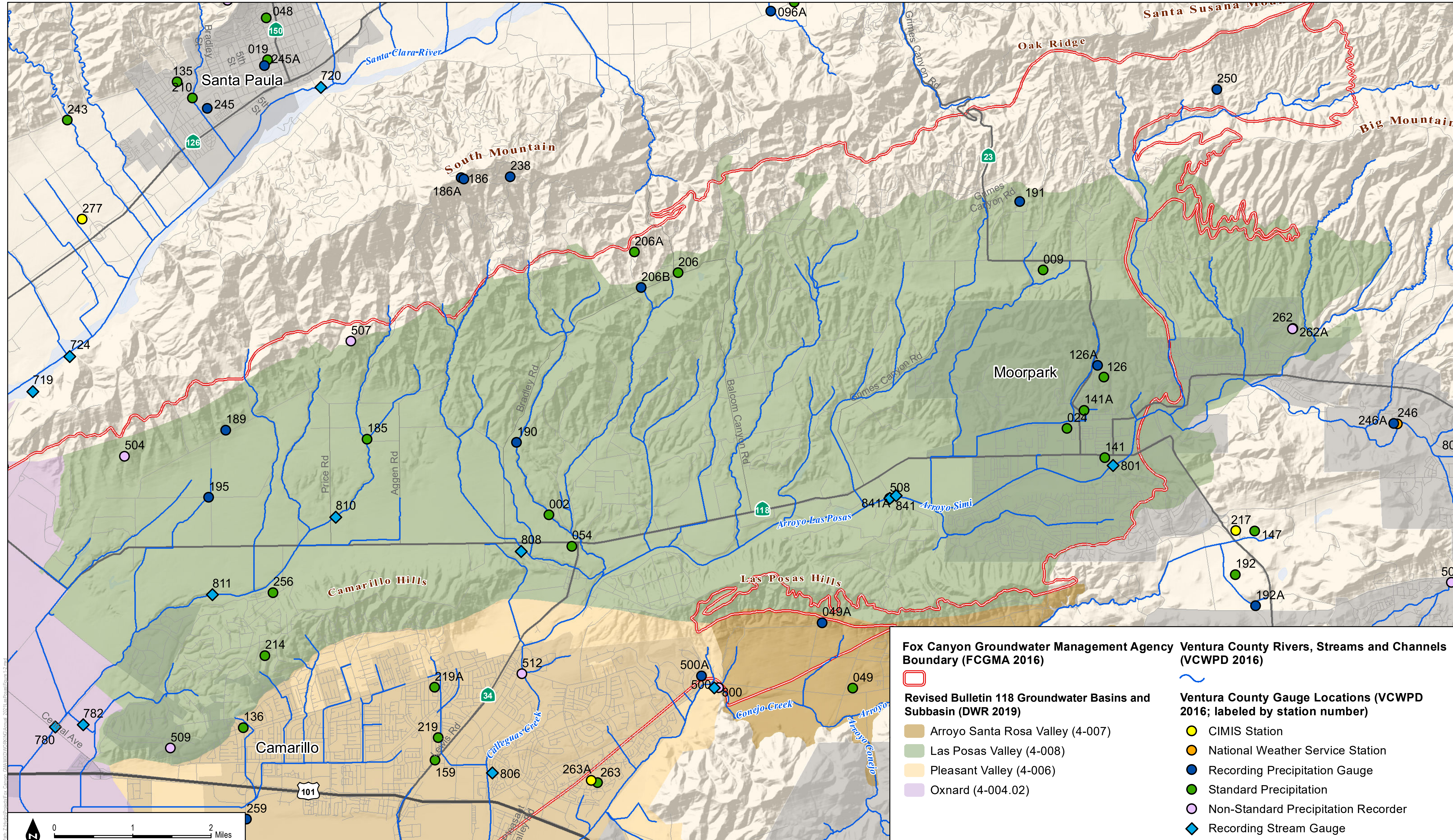


DUDEK

SOURCE: DWR; Ventura County

FIGURE 1-1

Vicinity Map for the Las Posas Valley Basin



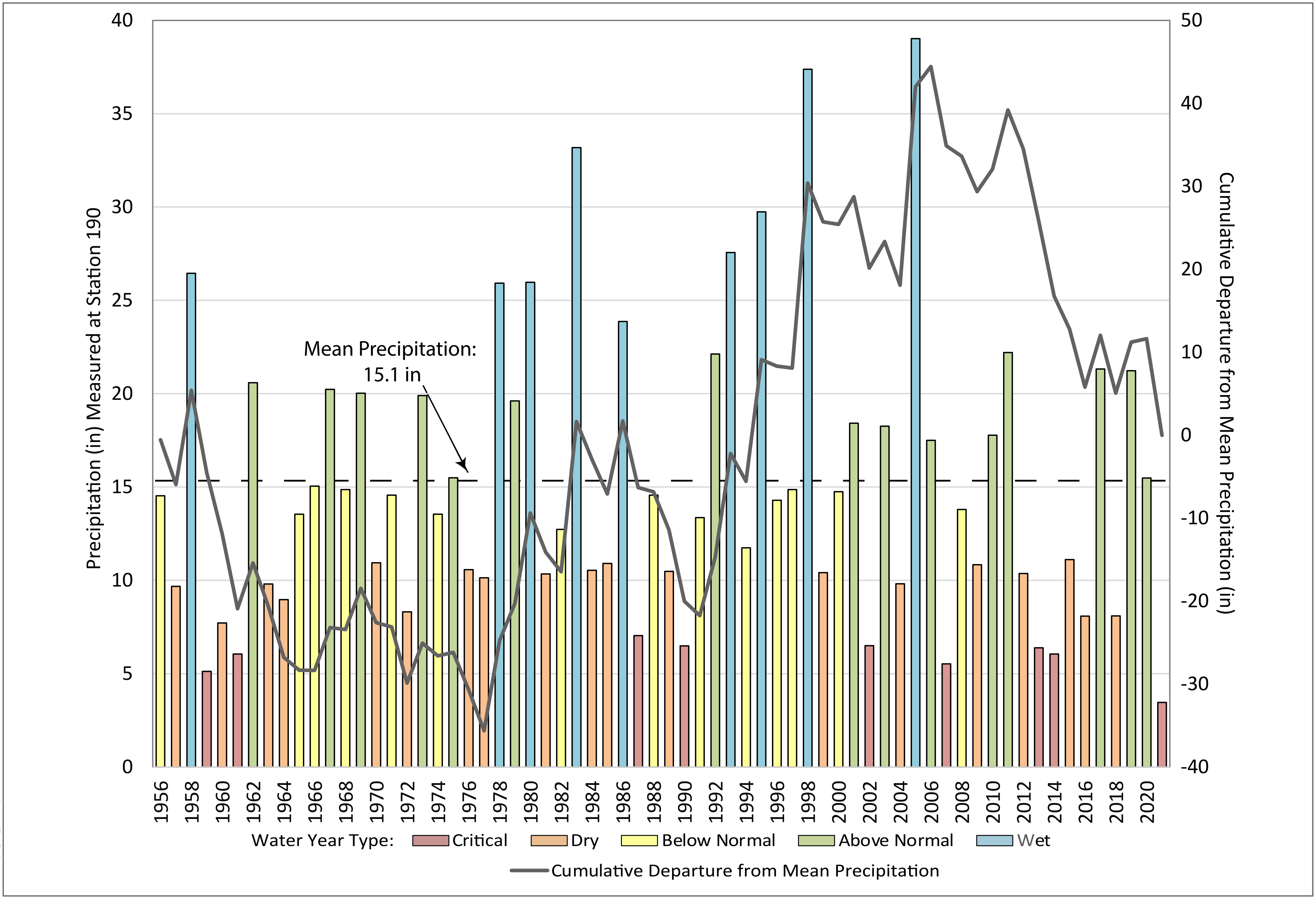
DUDEK

SOURCE: DWR; Ventura County; VCWPD

FIGURE 1-2

Precipitation and Stream Gauges in the Las Posas Valley Basin

Las Posas Valley Basin Groundwater Sustainability Plan 2022 Annual Report

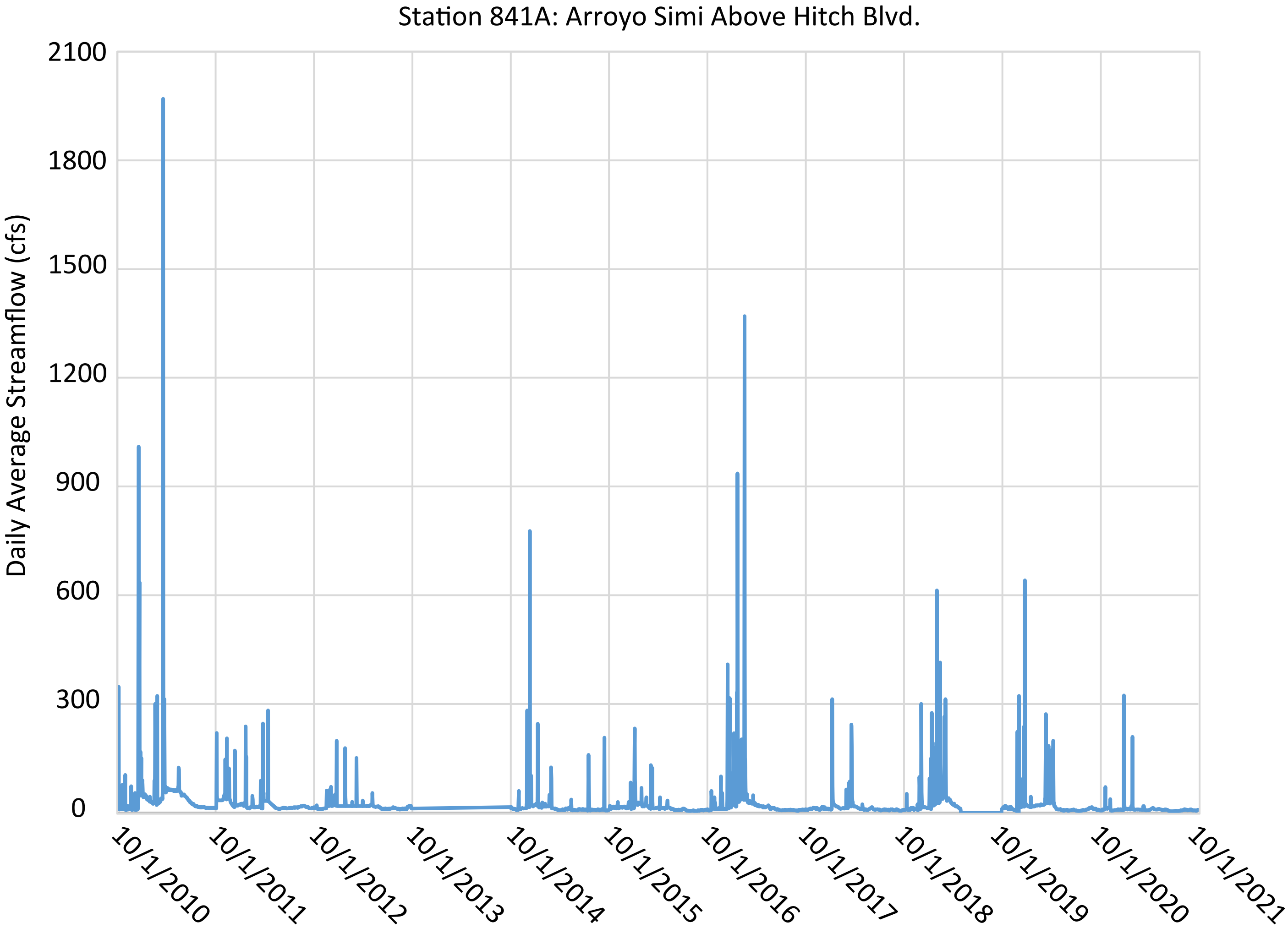


Note: Water year is from October 1 through September 30. Water year type is based on the percentage of the water year precipitation compared to the mean precipitation. Types are defined as: Wet (≥150% of mean), Above Normal (≥100% to <150% of mean), Below Normal (≥75% to <100% of mean), Dry (≥50% to <75% of average), and Critical (<50% of mean)

DUDEK

FIGURE 1-3

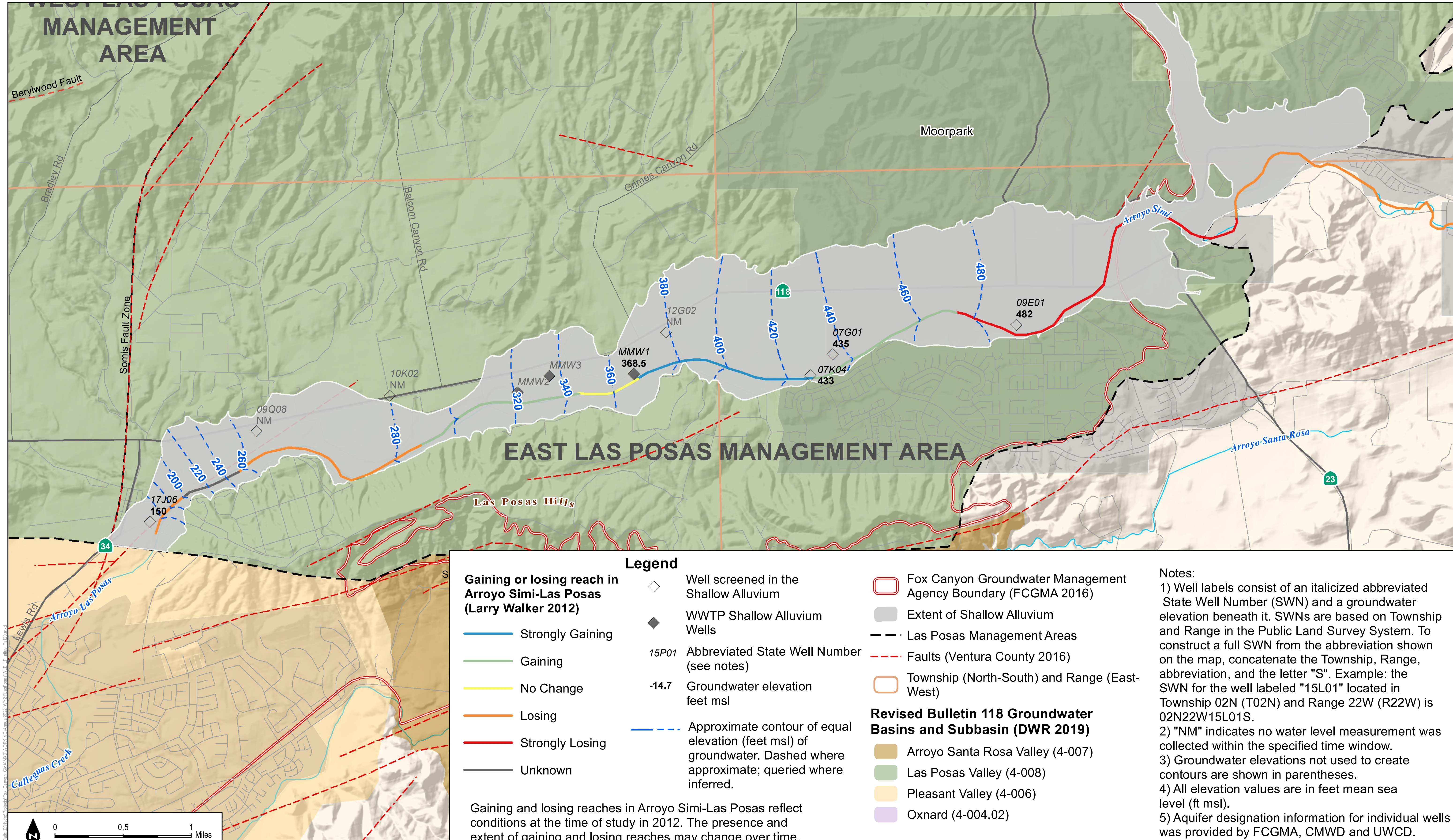
Las Posas Valley Basin Historical Water Year Precipitation



SOURCE: Ventura County Watershed Protection District (VCWPD) Hydrologic Data Server (https://www.vcwatershed.net/hydrodata/)

FIGURE 1-4

Las Posas Valley Basin Stream Gauge Data



Legend

Gaining or losing reach in Arroyo Simi-Las Posas (Larry Walker 2012)

- Strongly Gaining
- Gaining
- No Change
- Losing
- Strongly Losing
- Unknown

- Well screened in the Shallow Alluvium
- WWTP Shallow Alluvium Wells
- *15P01* Abbreviated State Well Number (see notes)
- -14.7 Groundwater elevation feet msl
- Approximate contour of equal elevation (feet msl) of groundwater. Dashed where approximate; queried where inferred.

Gaining and losing reaches in Arroyo Simi-Las Posas reflect conditions at the time of study in 2012. The presence and extent of gaining and losing reaches may change over time.

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Extent of Shallow Alluvium
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2019)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

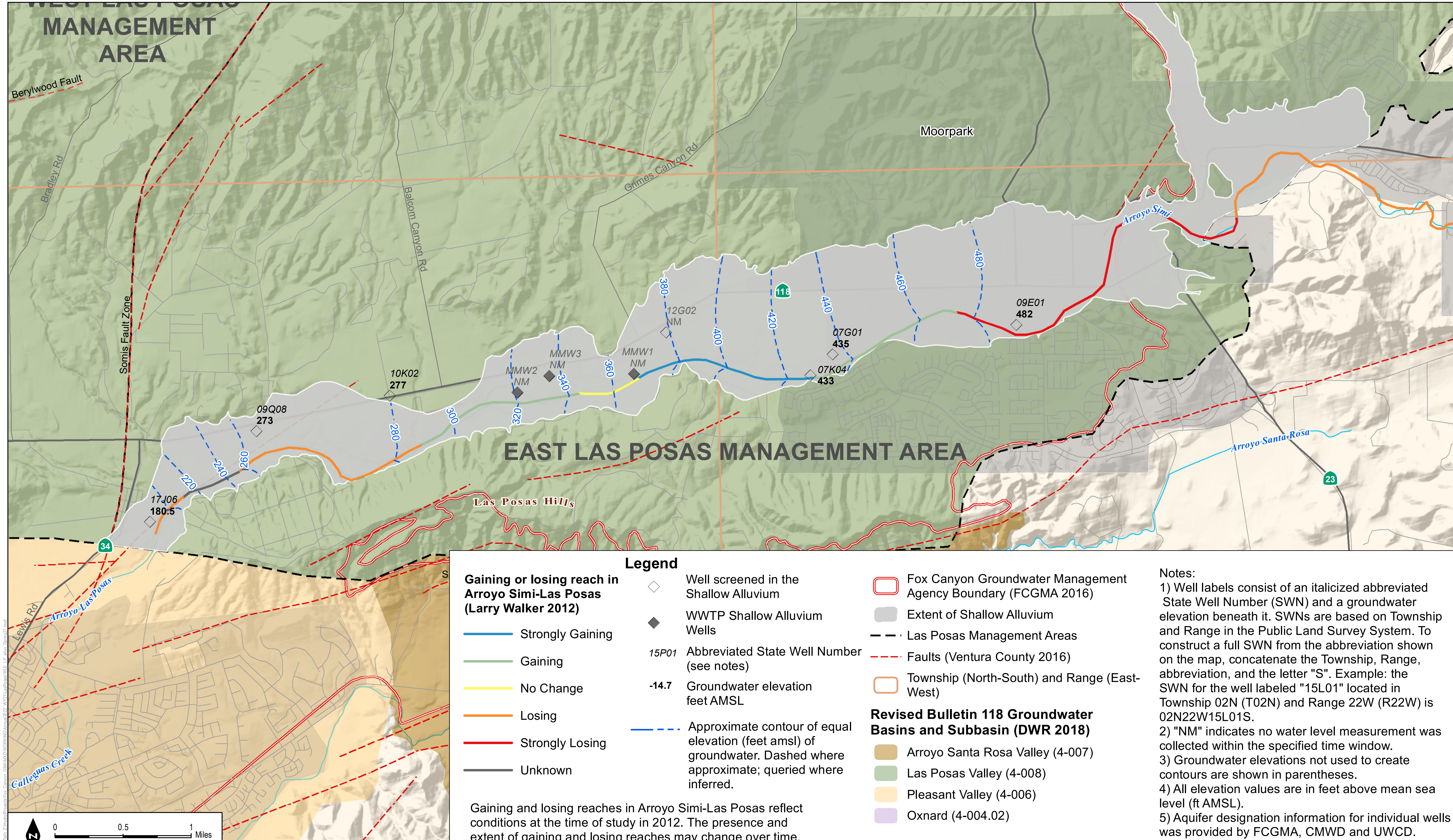
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet mean sea level (ft msl).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-1

Groundwater Elevation Contours in the Shallow Alluvium, October 2 to 29, 2020

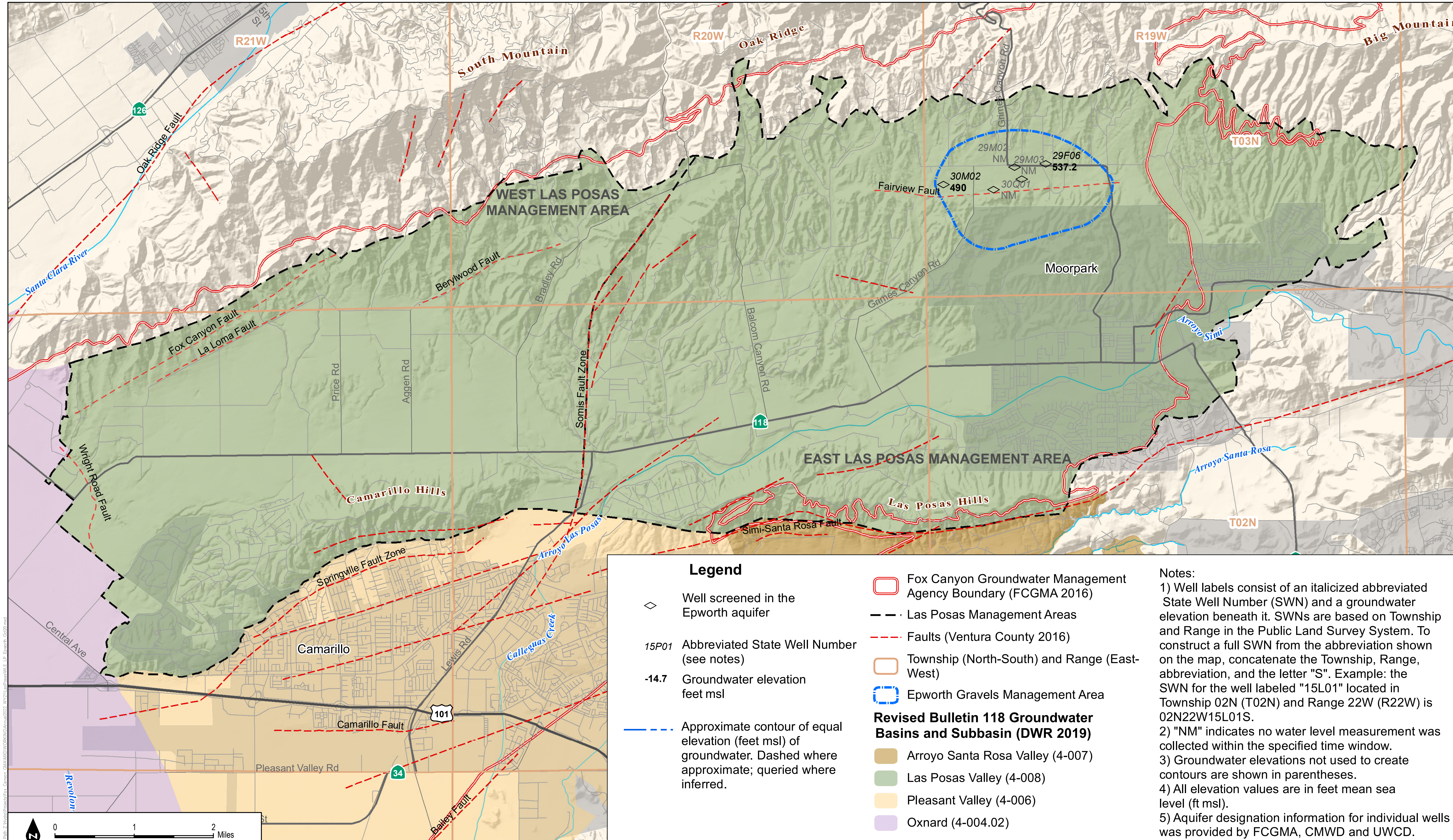


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-2

Groundwater Elevation Contours in the Shallow Alluvium, March 2 to 29, 2021

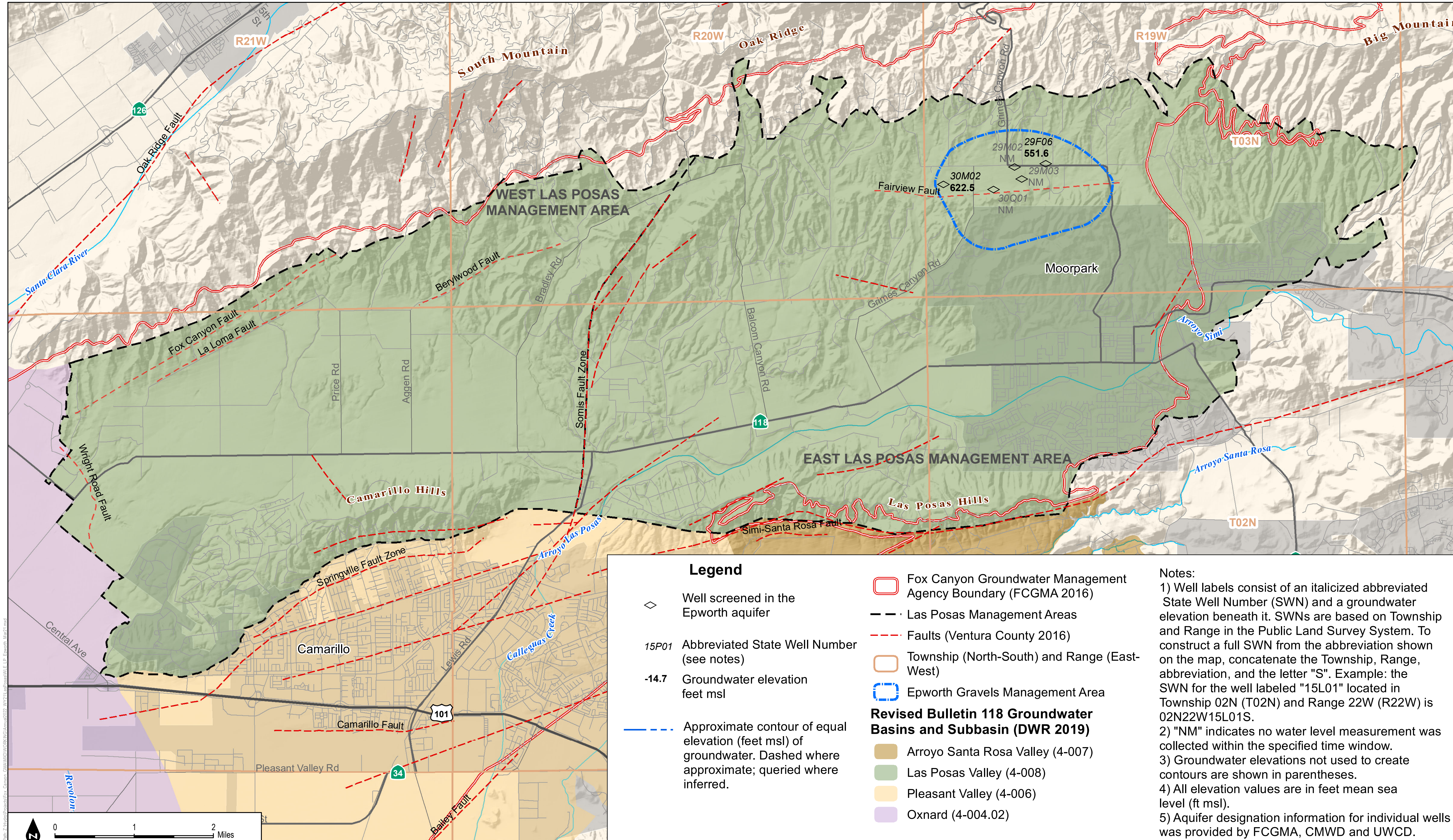


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-3

Groundwater Elevation Contours in the Epworth Gravels Aquifer, October 2 to October 29, 2020



Legend

- ◇ Well screened in the Epworth aquifer
- *15P01* Abbreviated State Well Number (see notes)
- -14.7 Groundwater elevation feet msl
- Approximate contour of equal elevation (feet msl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)
- Epworth Gravels Management Area

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2019)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

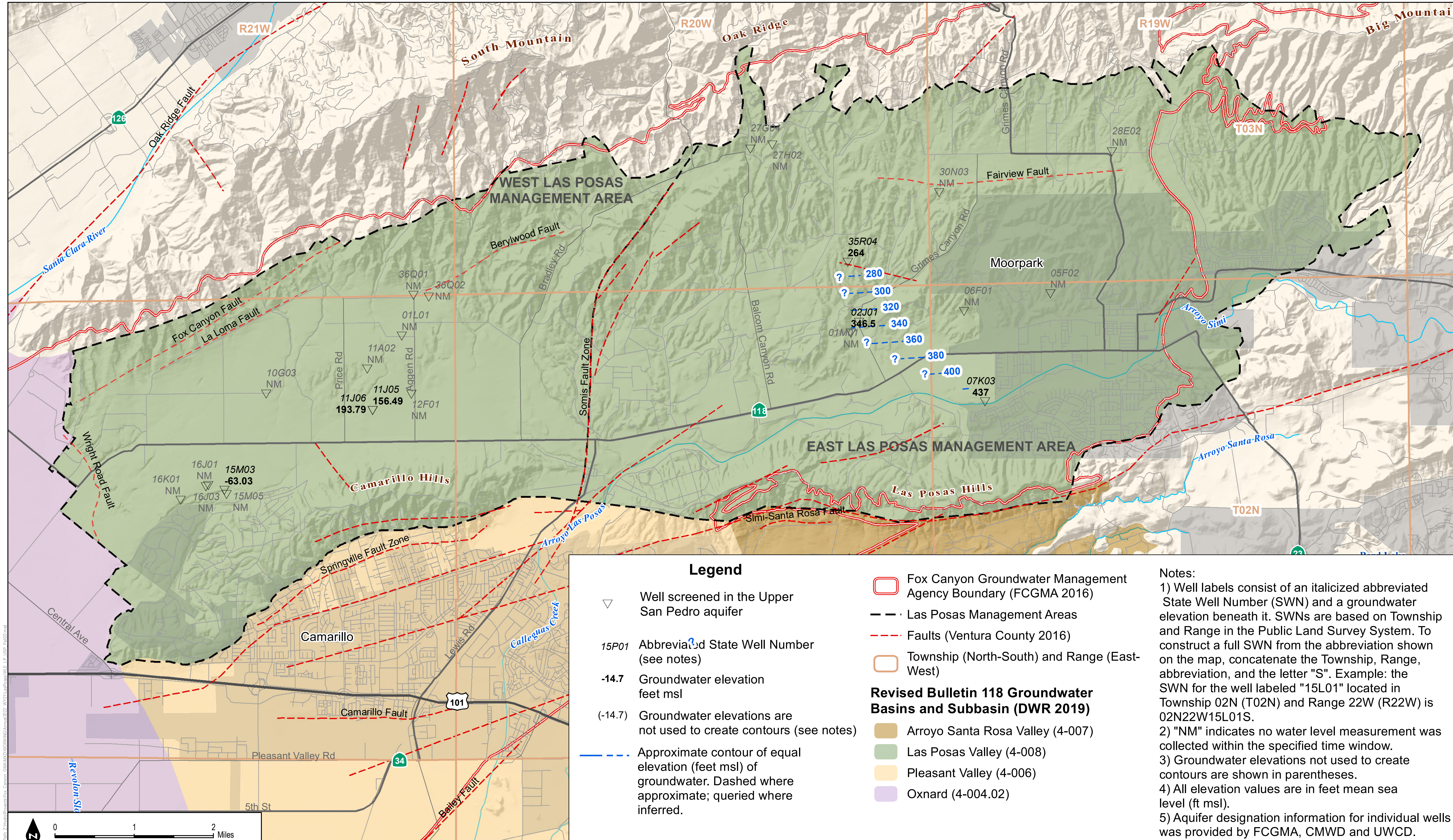
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet mean sea level (ft msl).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-4

Groundwater Elevation Contours in the Epworth Gravels Aquifer, March 2 to March 29, 2021



Legend

▽ Well screened in the Upper San Pedro aquifer

15P01 Abbreviated State Well Number (see notes)

-14.7 Groundwater elevation feet msl

(-14.7) Groundwater elevations are not used to create contours (see notes)

Approximate contour of equal elevation (feet msl) of groundwater. Dashed where approximate; queried where inferred.

Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)

Las Posas Management Areas

Faults (Ventura County 2016)

Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2019)

Arroyo Santa Rosa Valley (4-007)

Las Posas Valley (4-008)

Pleasant Valley (4-006)

Oxnard (4-004.02)

Notes:

1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.

2) "NM" indicates no water level measurement was collected within the specified time window.

3) Groundwater elevations not used to create contours are shown in parentheses.

4) All elevation values are in feet mean sea level (ft msl).

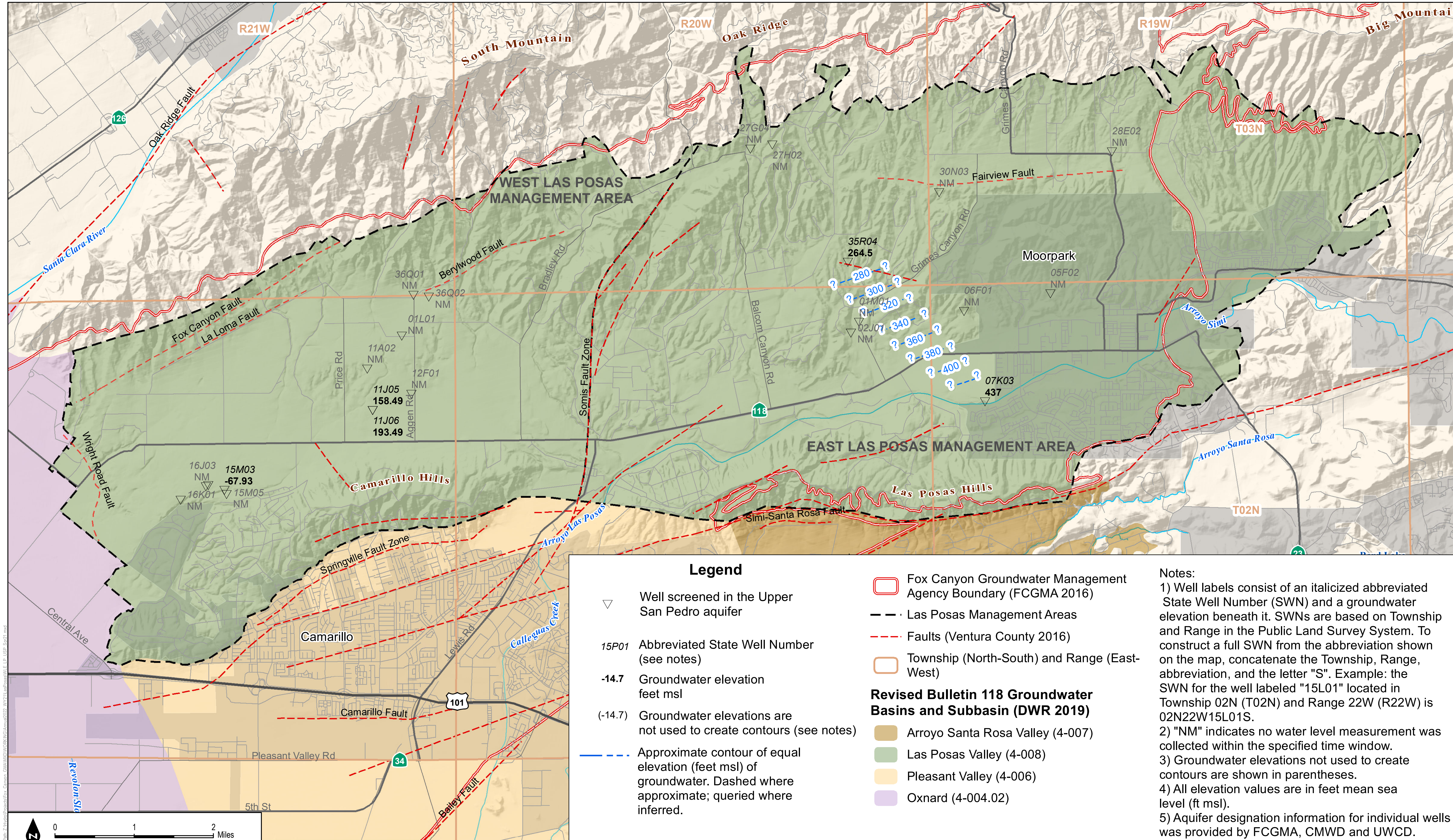
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-5

Groundwater Elevation Contours in the Upper San Pedro Formation, October 2 to October 29, 2020



Legend

- ▽ Well screened in the Upper San Pedro aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet msl
- (-14.7) Groundwater elevations are not used to create contours (see notes)
- Approximate contour of equal elevation (feet msl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2019)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

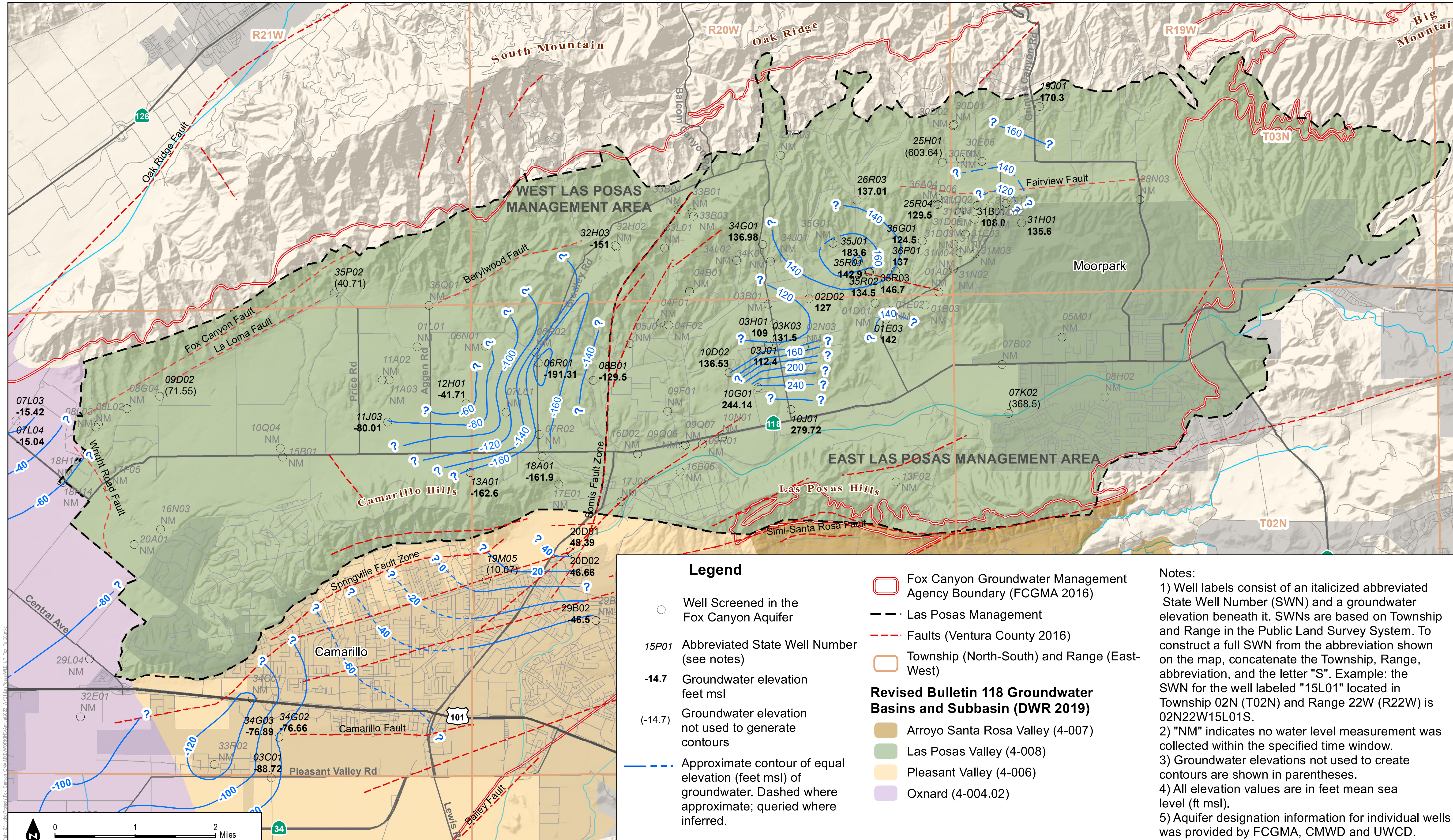
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet mean sea level (ft msl).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-6

Groundwater Elevation Contours in the Upper San Pedro Formation, March 2 to March 29, 2021



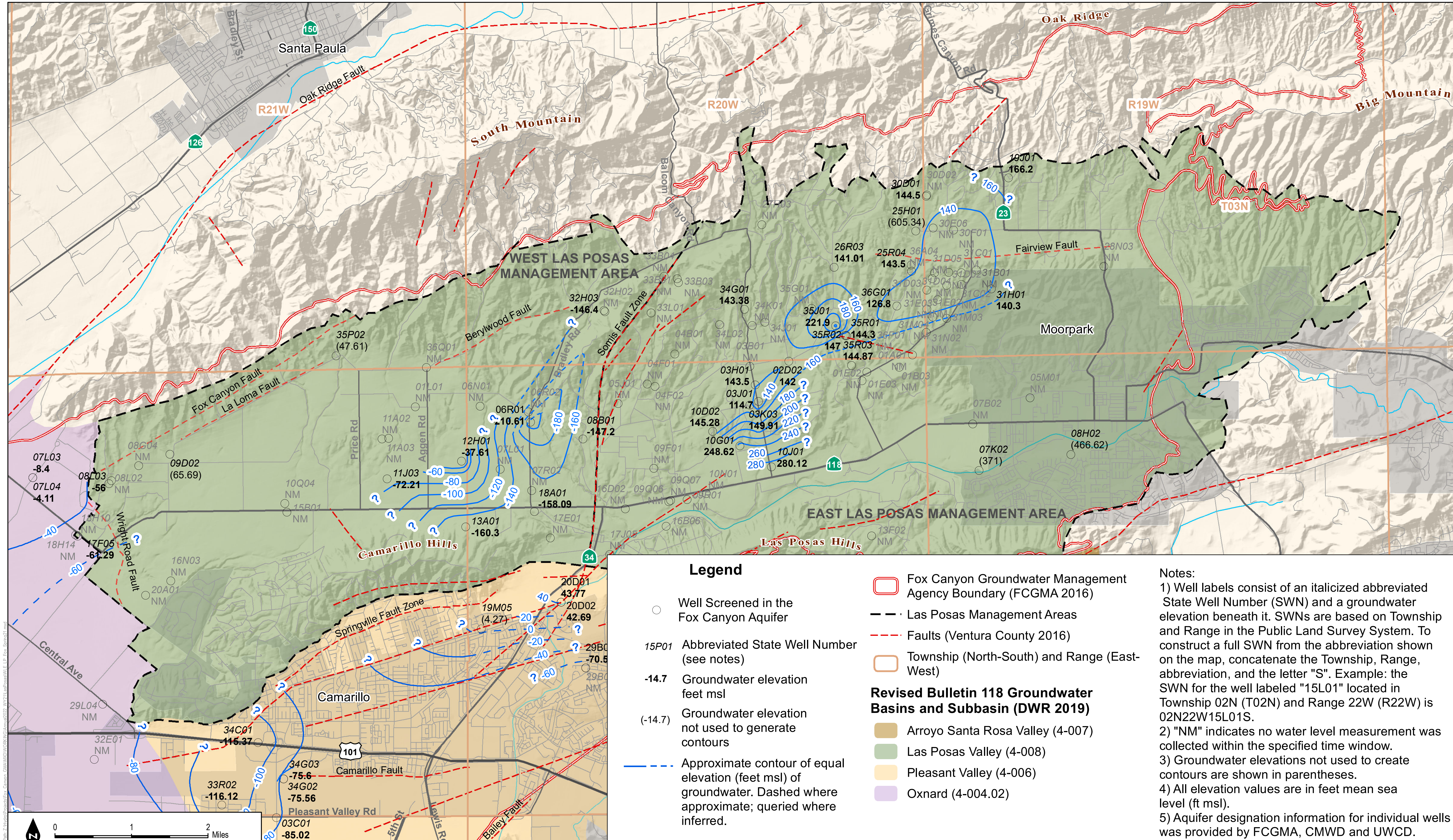
DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-7

Groundwater Elevation Contours in the Fox Canyon Aquifer, October 2 to October 29, 2020

Las Posas Valley Basin Groundwater Sustainability Plan 2022 Annual Report



Legend

- Well Screened in the Fox Canyon Aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet msl
- (-14.7) Groundwater elevation not used to generate contours
- Approximate contour of equal elevation (feet msl) of groundwater. Dashed where approximate; queried where inferred.
- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Las Posas Management Areas
- Faults (Ventura County 2016)
- Township (North-South) and Range (East-West)

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2019)

- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Notes:

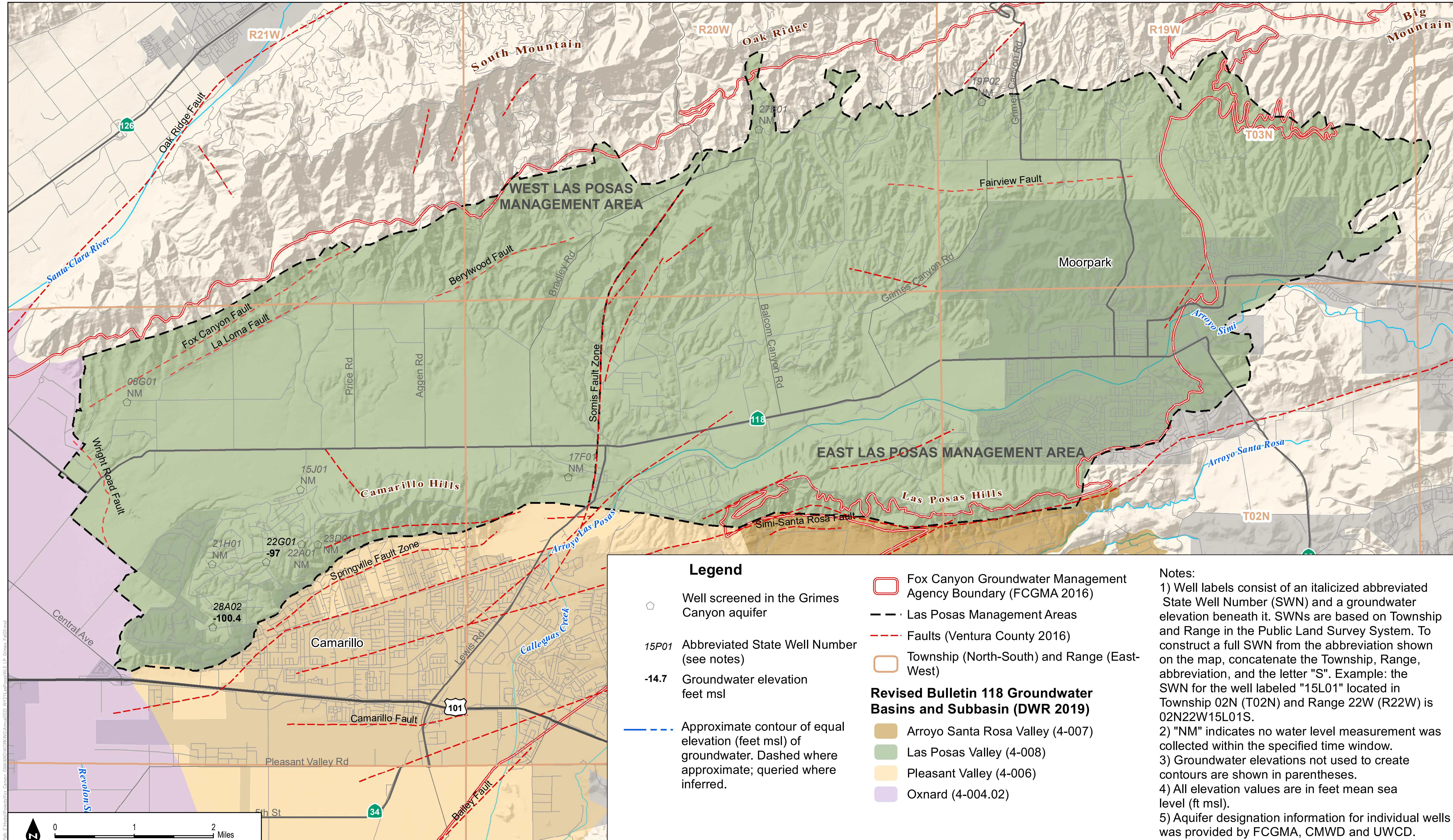
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "15L01" located in Township 02N (T02N) and Range 22W (R22W) is 02N22W15L01S.
2) "NM" indicates no water level measurement was collected within the specified time window.
3) Groundwater elevations not used to create contours are shown in parentheses.
4) All elevation values are in feet mean sea level (ft msl).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-8

Groundwater Elevation Contours in the Fox Canyon Aquifer, March 2 to March 29, 2021

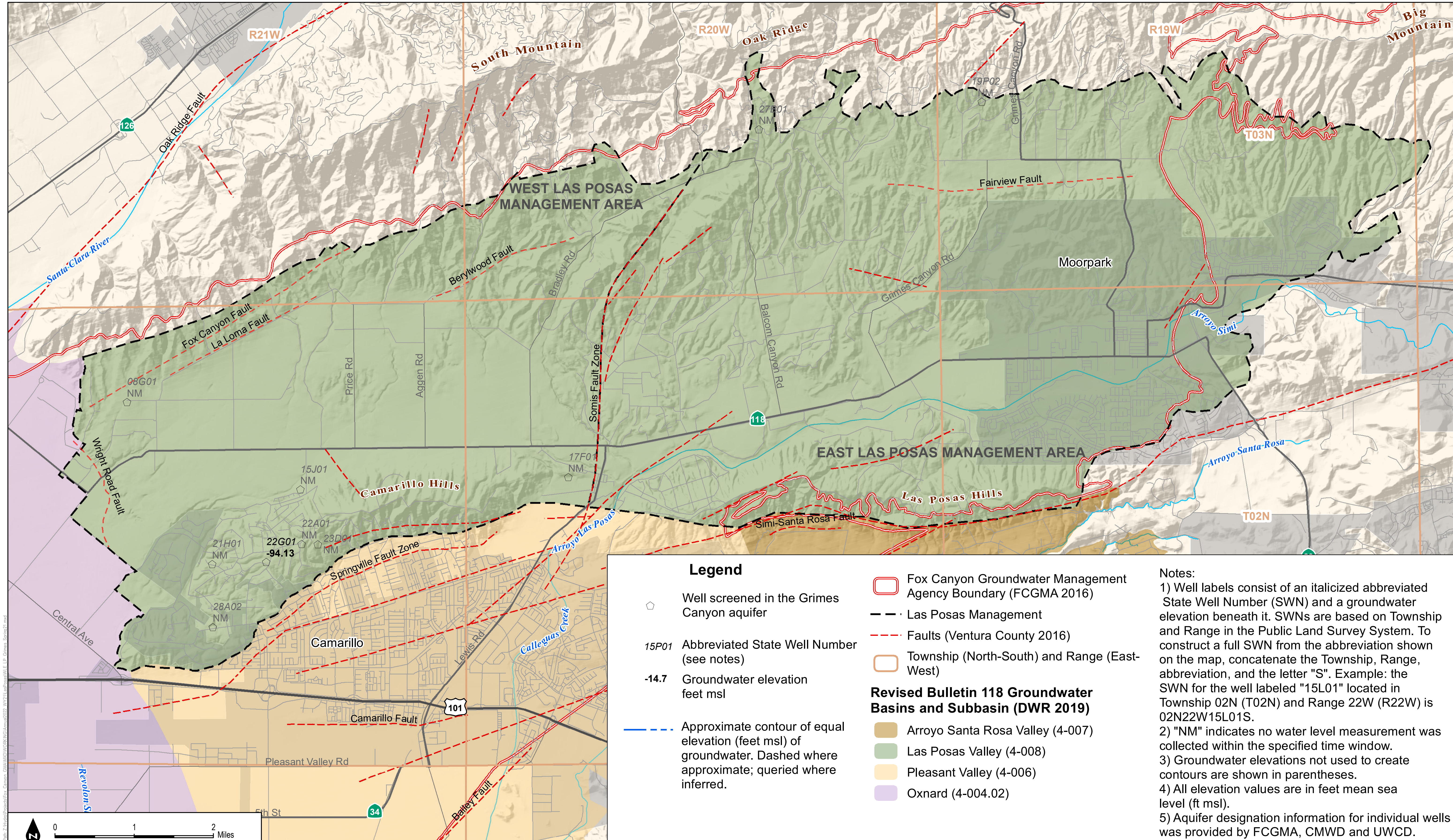


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-9

Groundwater Elevation Contours in the Grimes Canyon Aquifer, October 2 to 29, 2020

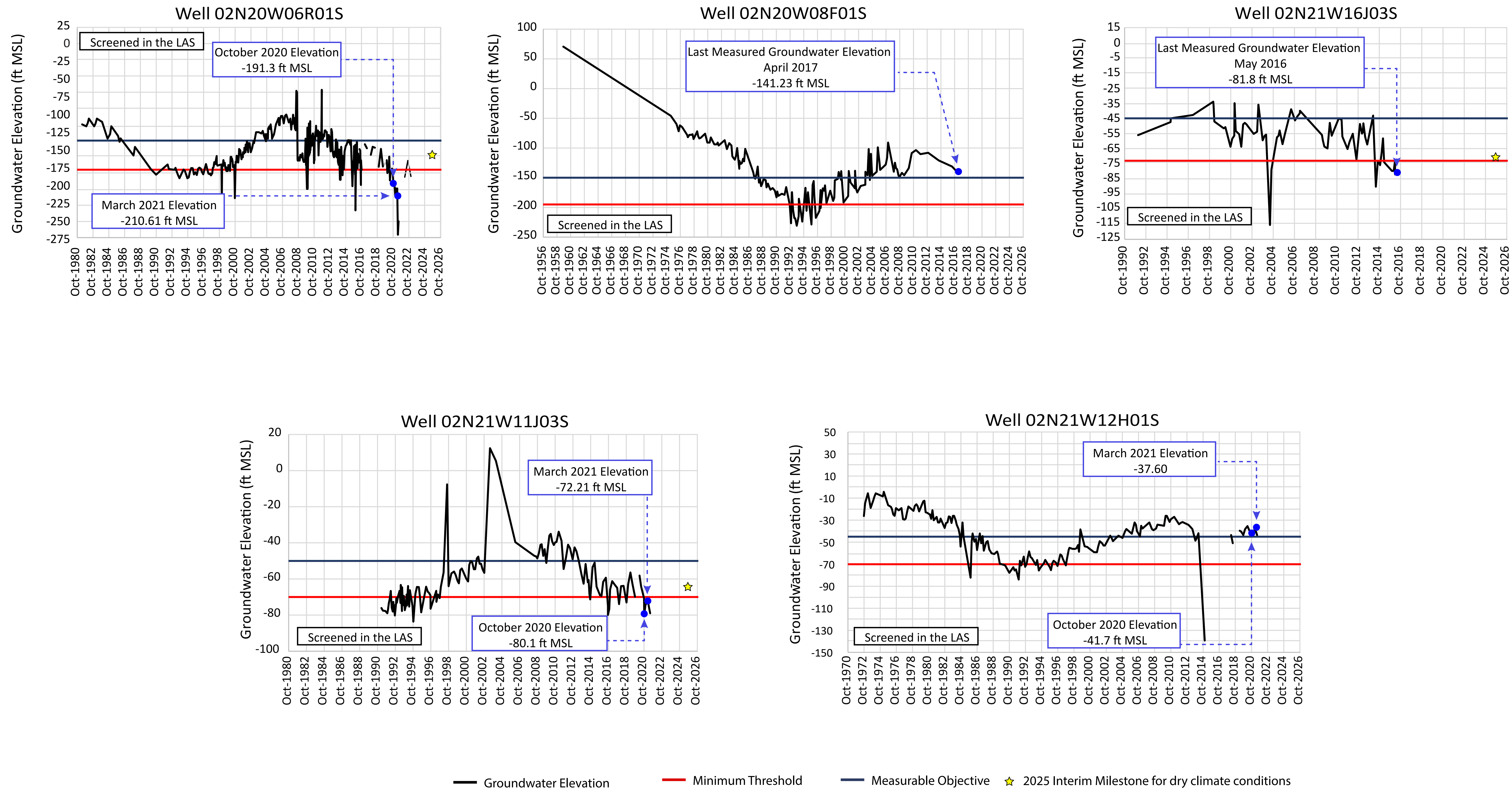


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-10

Groundwater Elevation Contours in the Grimes Canyon Aquifer, March 2 to 29, 2021

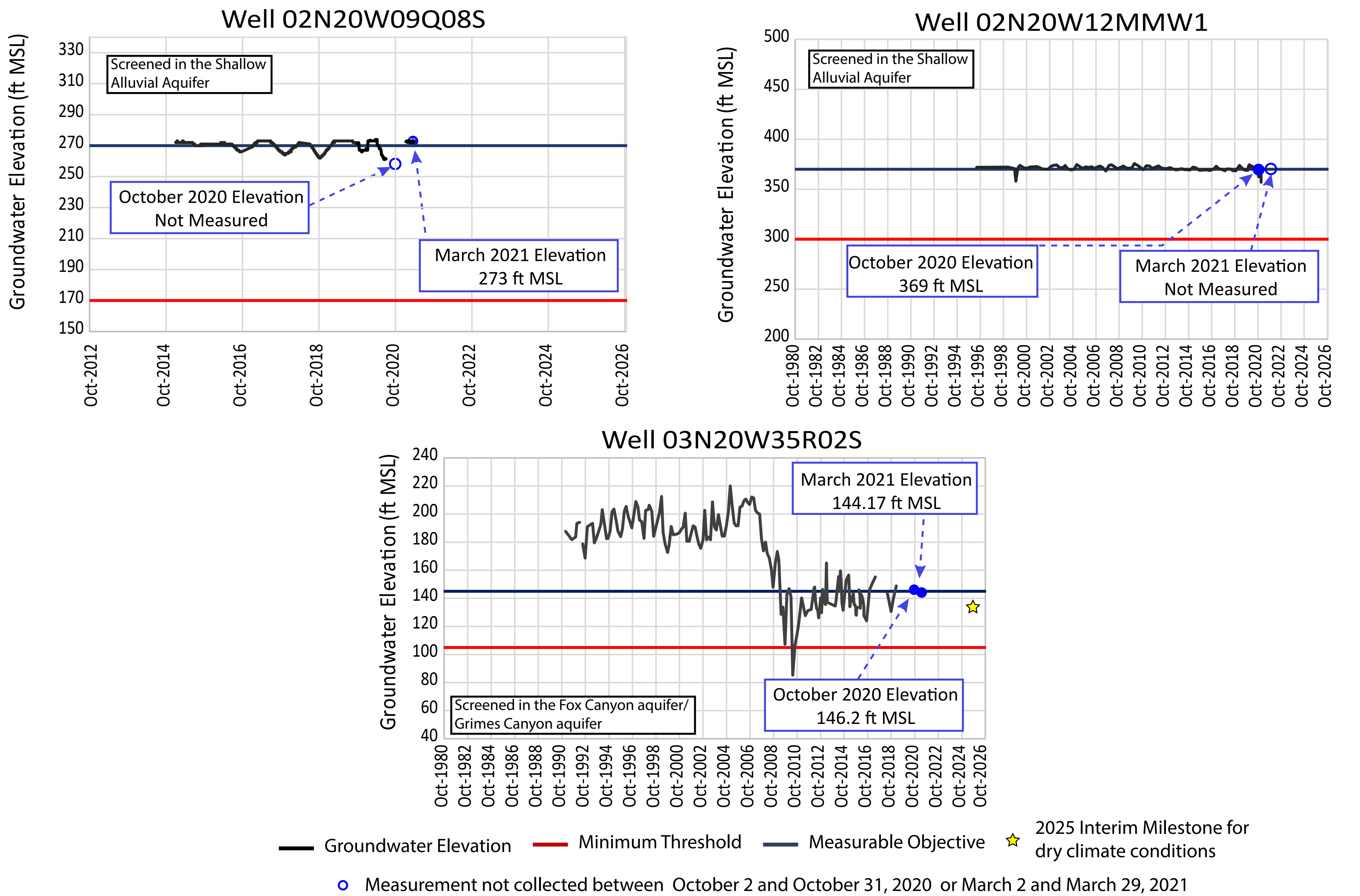


Note: 2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum thresholds

DUDEK

FIGURE 2-11

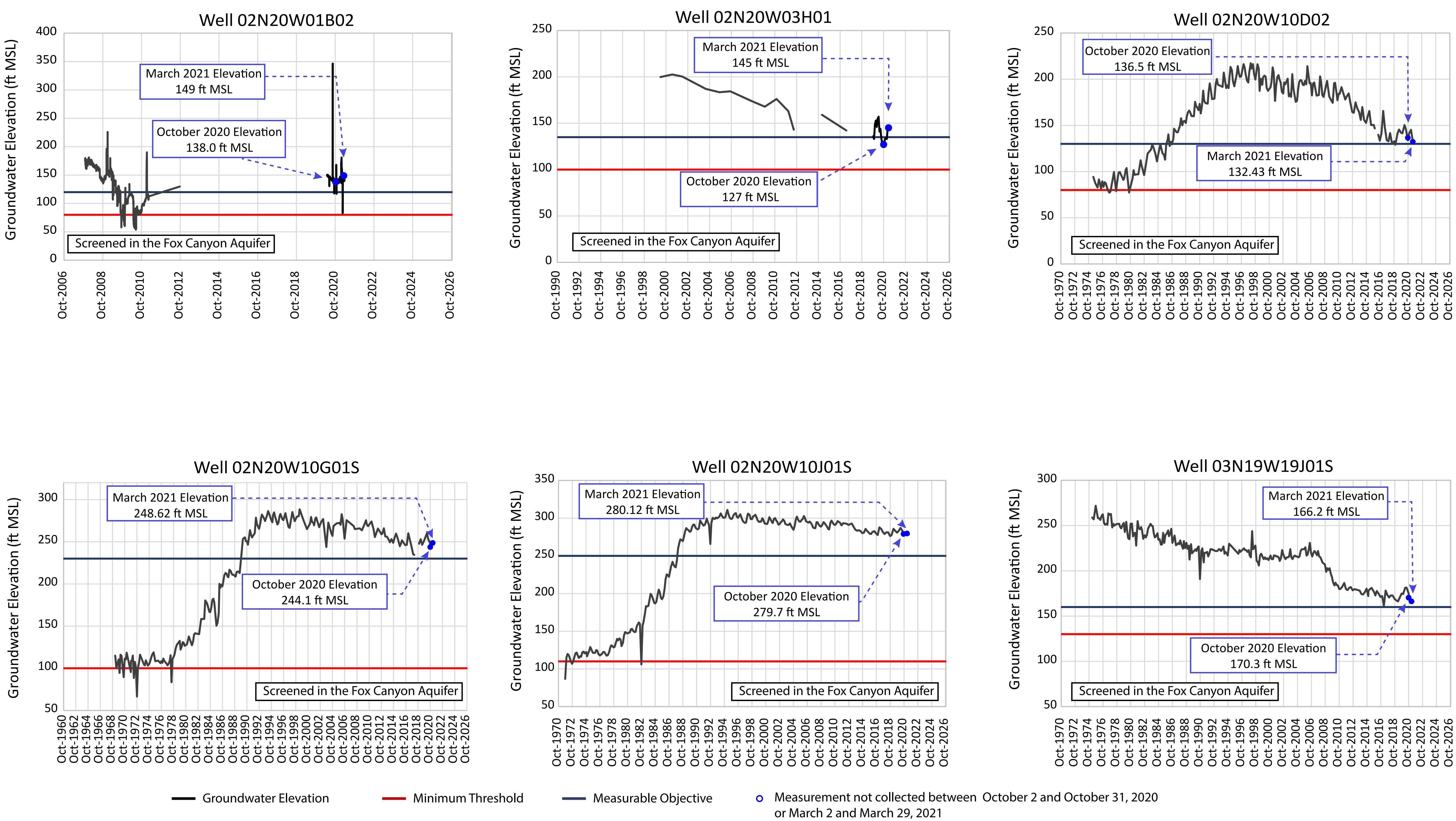
Groundwater Elevation Hydrographs for Representative Wells in the WLPMA



Note: 2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum thresholds

FIGURE 2-12a

Groundwater Elevation Hydrographs for Representative Wells Screened in the East Las Posas Management Area

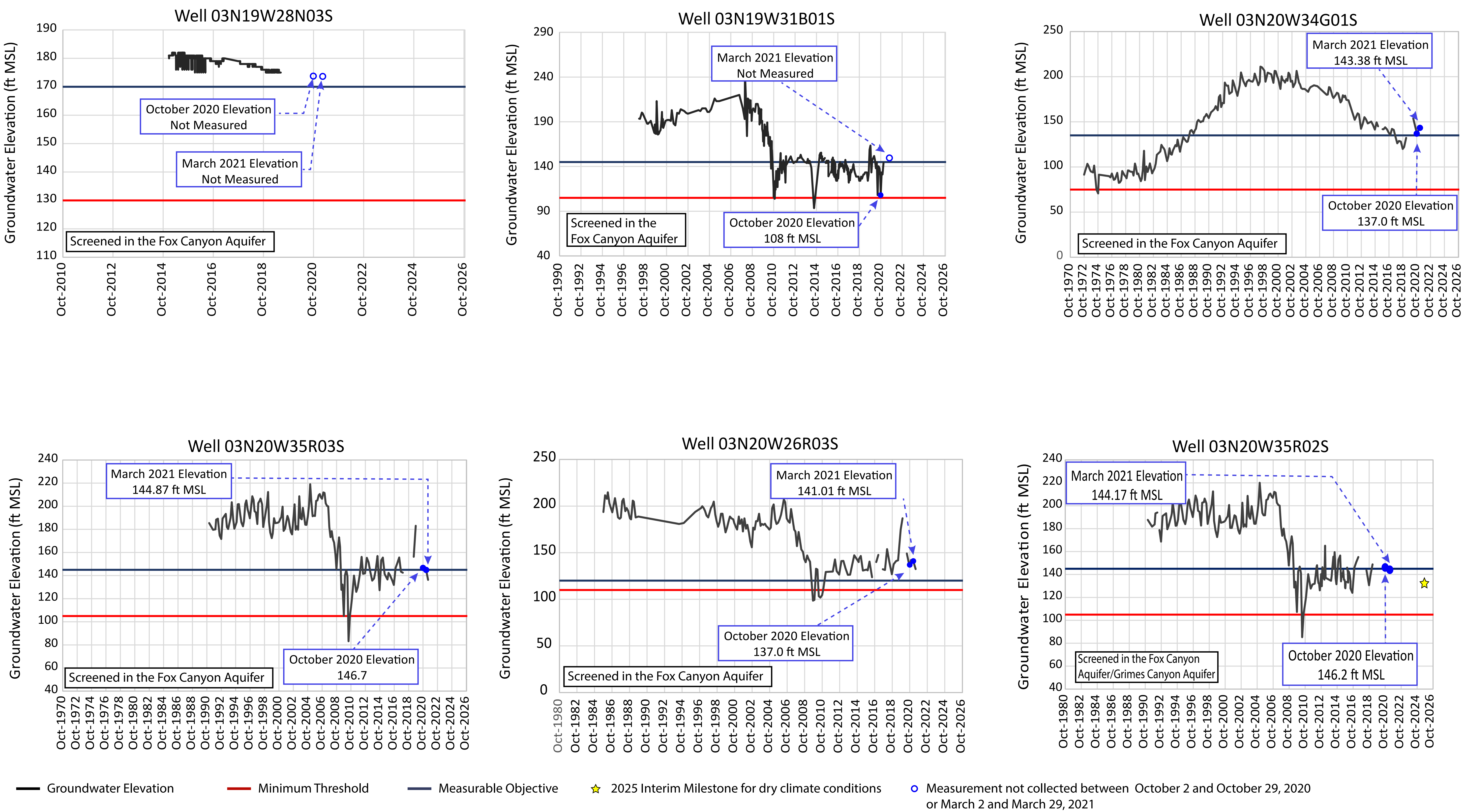


Note: 2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum thresholds

DUDEK

FIGURE 2-12b

Groundwater Elevation Hydrographs for Representative Wells in the East Las Posas Management Area



Note: 2025 Interim milestone groundwater elevations are not established for wells where 2015 groundwater elevations were higher than the established minimum thresholds

FIGURE 2-12c

Groundwater Elevation Hydrographs for Representative Wells in the East Las Posas Management Area

DUDEK

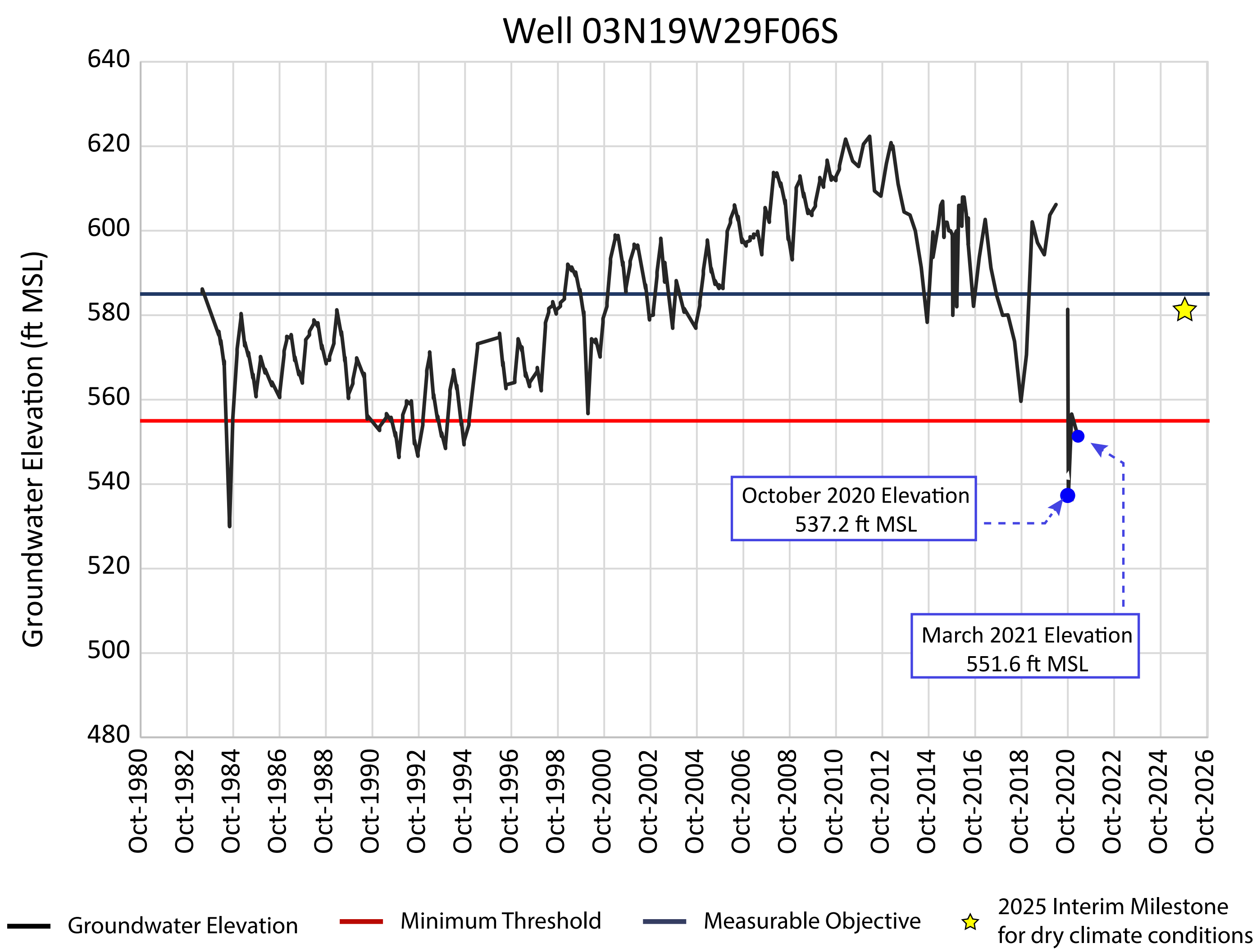
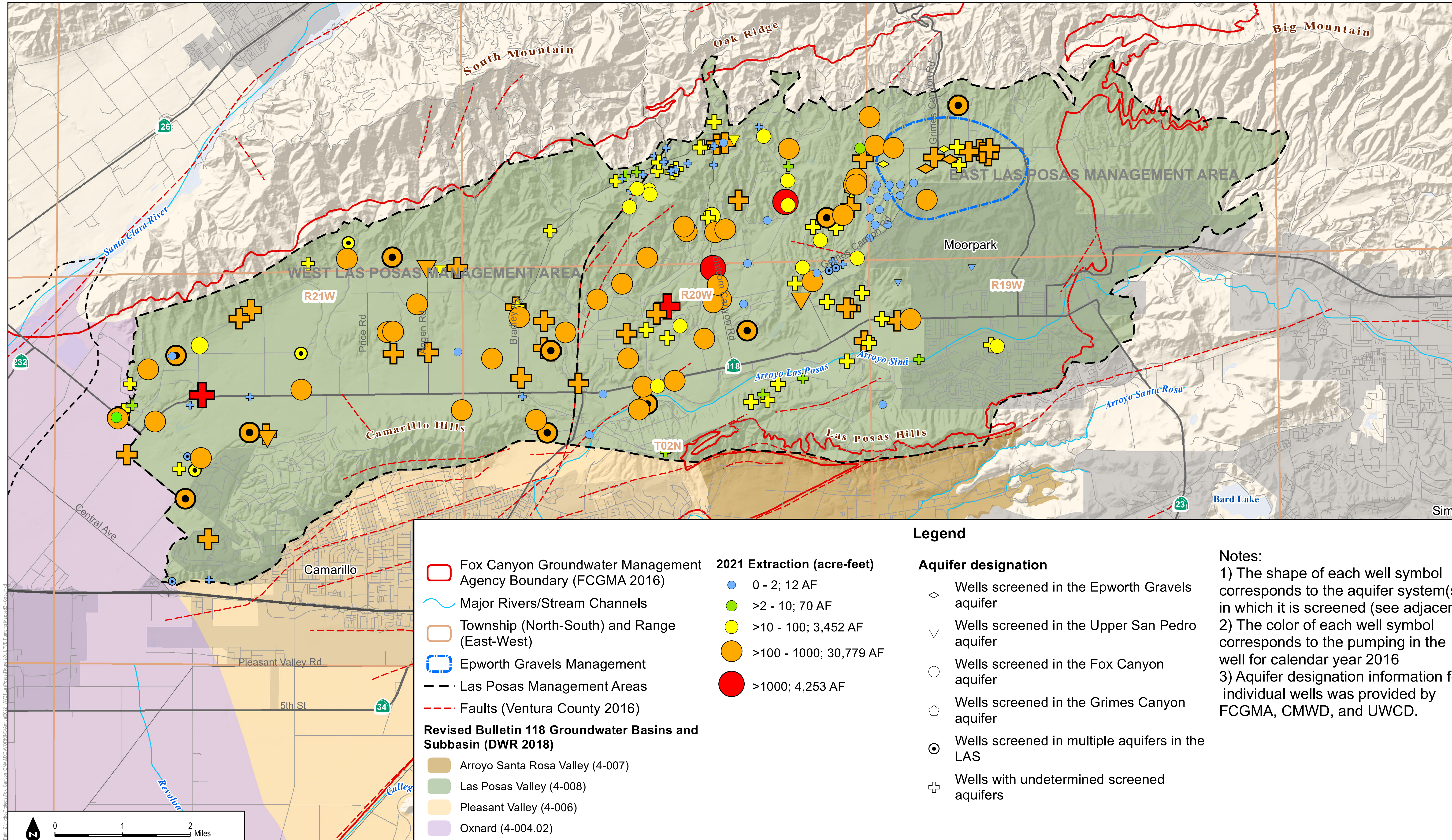


FIGURE 2-13

Groundwater Elevation Hydrographs for Representative Wells Screened in the Epworth Gravels Aquifer

DUDEK

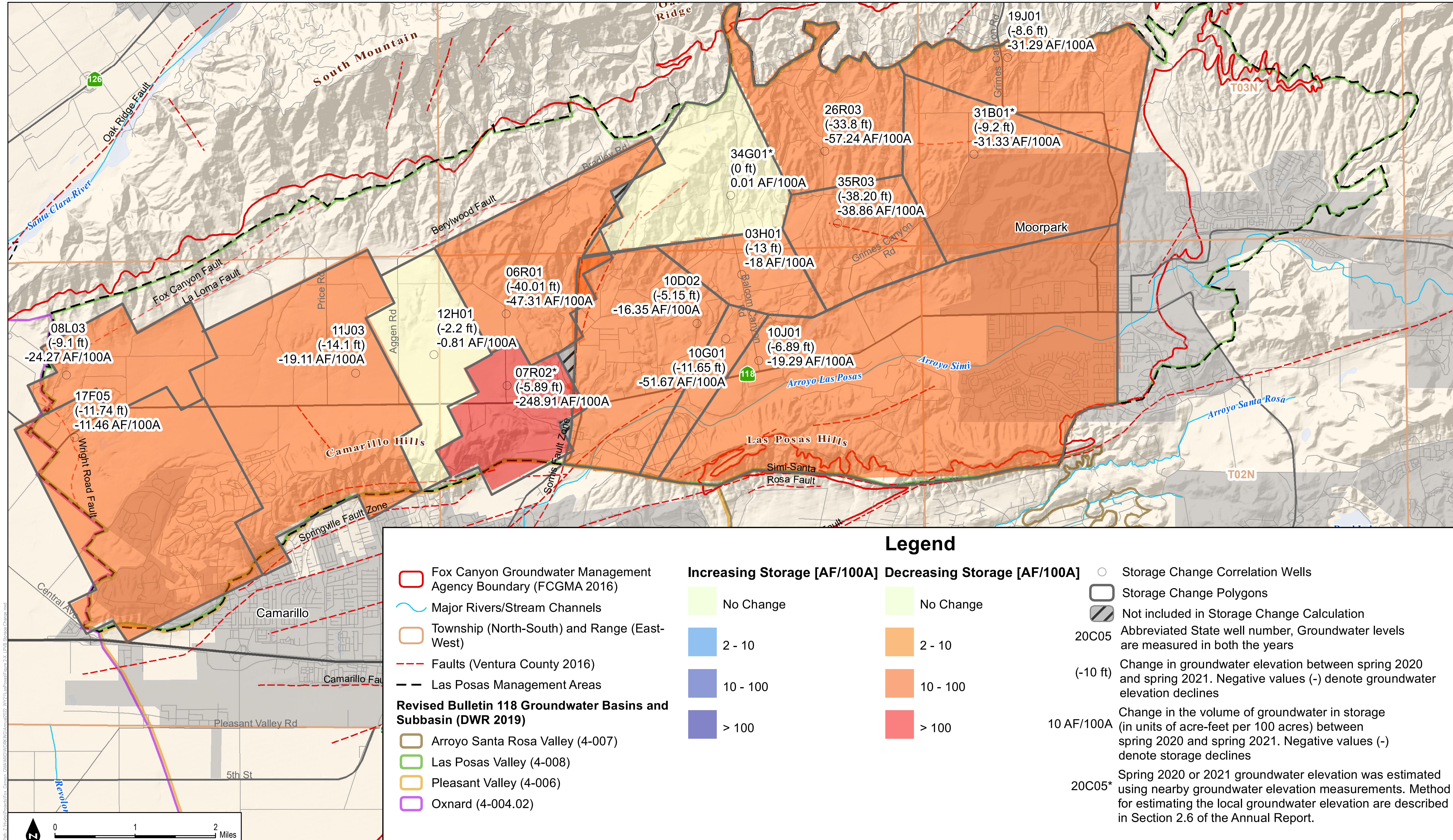


DUDEK

SOURCE: DWR, FCGMA, VCWPD, UWCD, CMWD

FIGURE 2-14

Groundwater Production (Acre-feet) in the Las Posas Valley Basin between October 1, 2020 and September 30, 2021

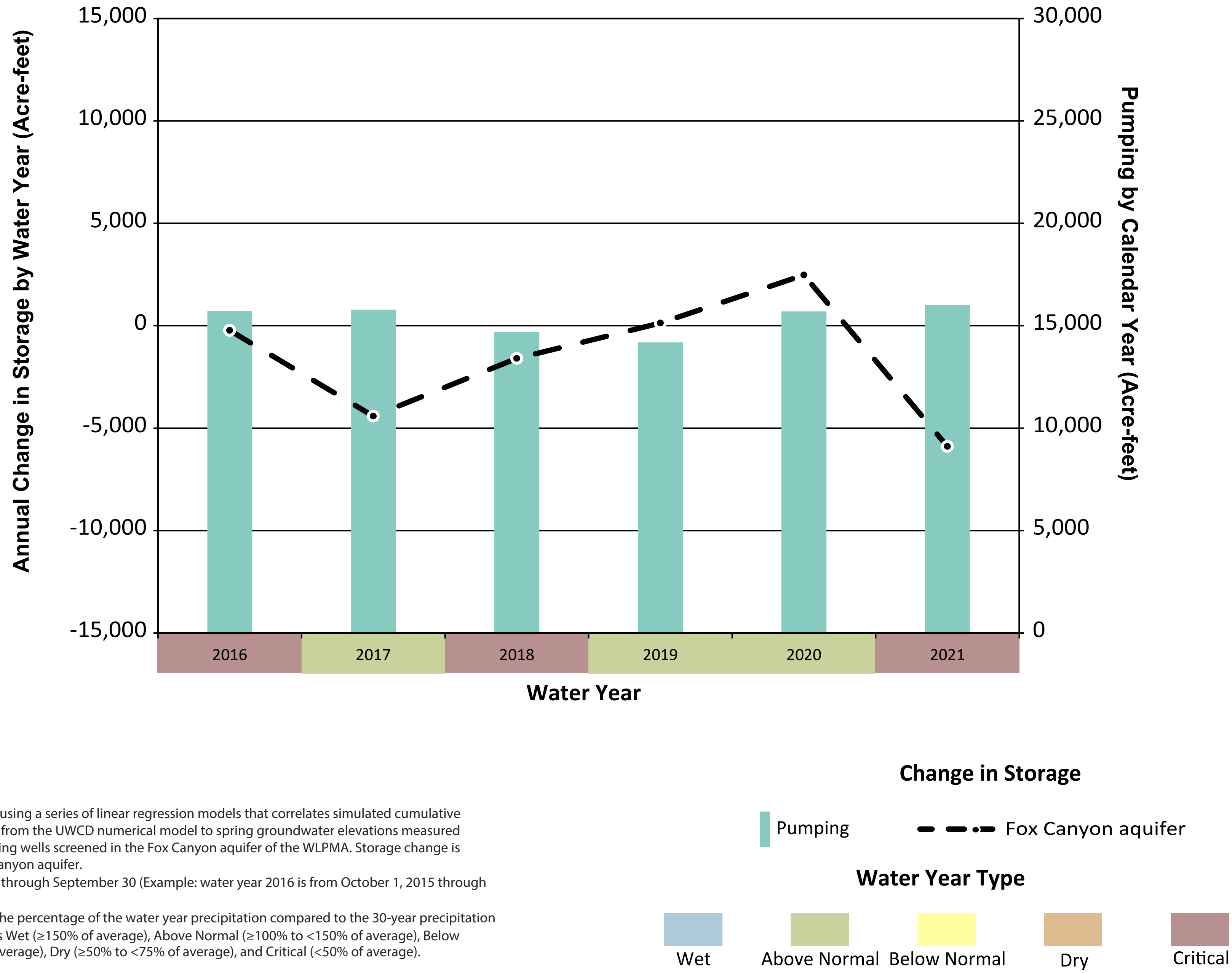


DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-15

Change in Storage in the Fox Canyon Aquifer: Spring 2020 to Spring 2021

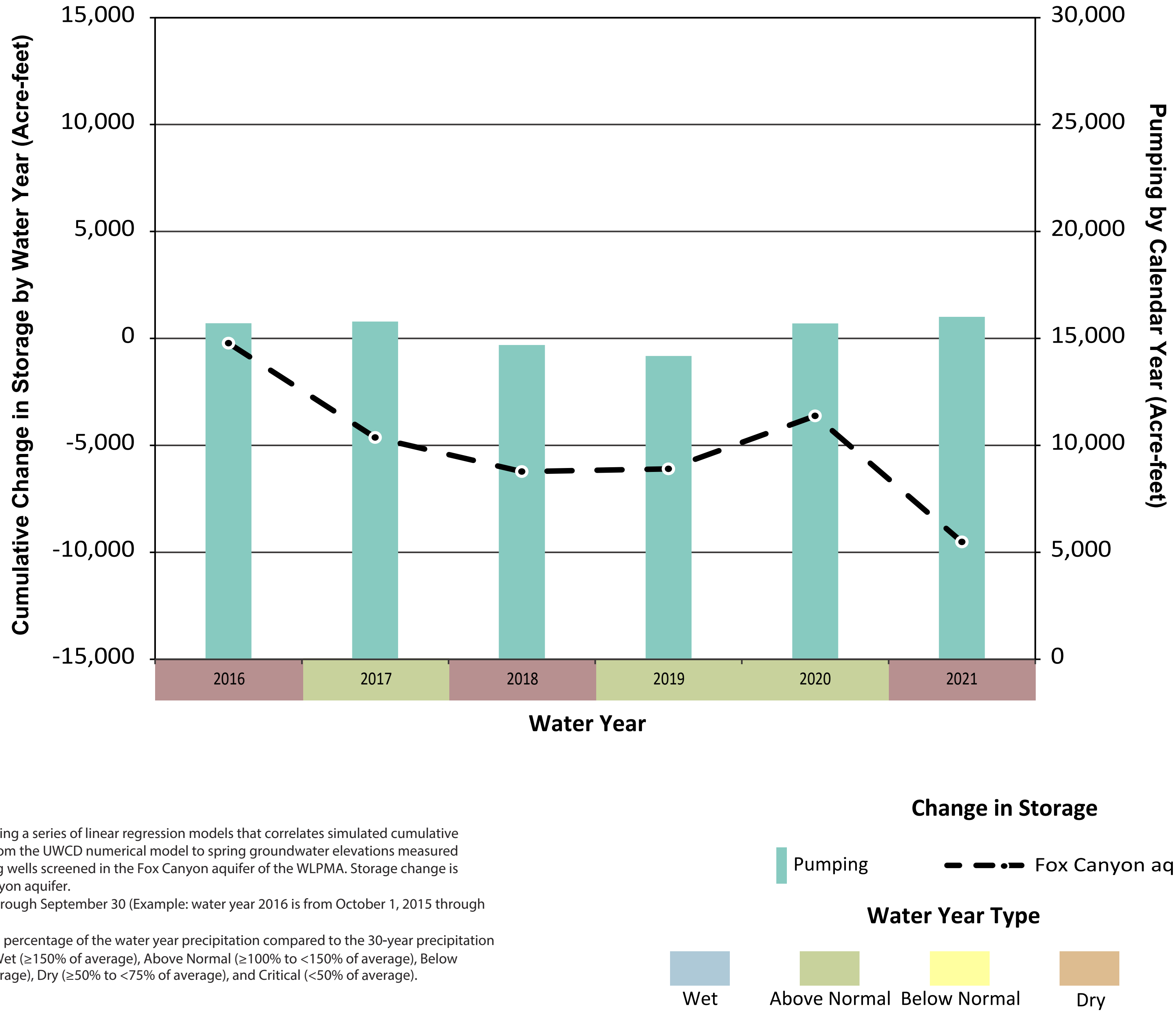


Notes:

1) Storage change is estimated using a series of linear regression models that correlates simulated cumulative change in storage extracted from the UWCD numerical model to spring groundwater elevations measured at a network seven monitoring wells screened in the Fox Canyon aquifer of the WLPMA. Storage change is only calculated for the Fox Canyon aquifer.
2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).
3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of average).

FIGURE 2-16

Water Year Type, Groundwater Use, and Annual Change in Storage in the West Las Posas Management Area

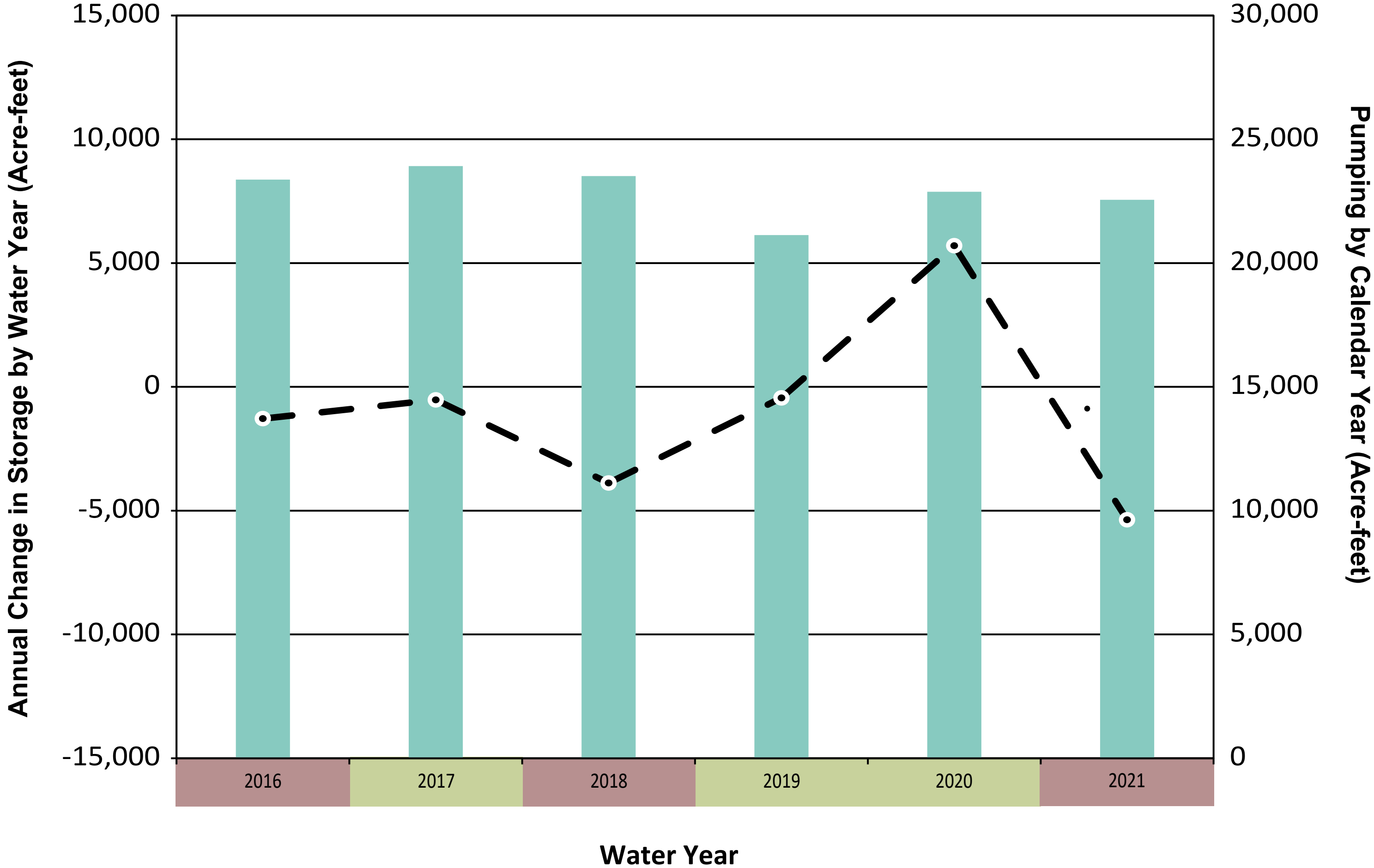


Notes:

1) Storage change is estimated using a series of linear regression models that correlates simulated cumulative change in storage extracted from the UWCD numerical model to spring groundwater elevations measured at a network seven monitoring wells screened in the Fox Canyon aquifer of the WLPMA. Storage change is only calculated for the Fox Canyon aquifer.
2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).
3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of average).

FIGURE 2-17

Water Year Type, Groundwater Use, and Cumulative Change in Storage in the West Las Posas Management Area



Notes:

1) Storage change is estimated using a series of linear regression models that correlates simulated cumulative change in storage extracted from the CMWD numerical model to spring groundwater elevations measured at a network of nine monitoring wells screened in the Fox Canyon aquifer of the WLPMA. Storage change is only calculated for the Fox Canyon aquifer.
2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).
3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of

Change in Storage

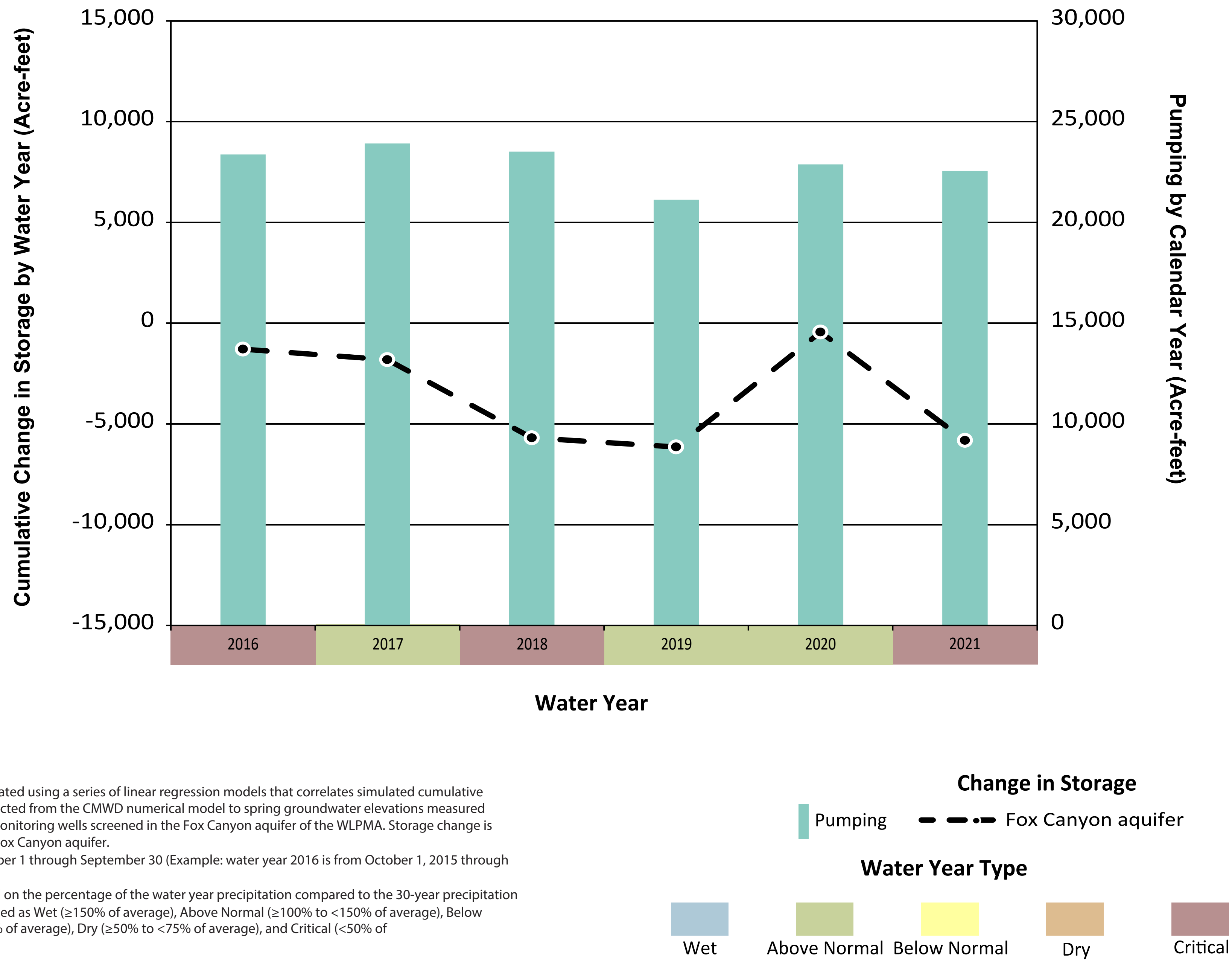
Pumping — Fox Canyon aquifer

Water Year Type

Wet — Above Normal — Below Normal — Dry — Critical

FIGURE 2-18

Water Year Type, Groundwater Use, and Annual Change in Storage in the East Las Posas Management Area



Notes:

1) Storage change is estimated using a series of linear regression models that correlates simulated cumulative change in storage extracted from the CMWD numerical model to spring groundwater elevations measured at a network of nine monitoring wells screened in the Fox Canyon aquifer of the WLPMA. Storage change is only calculated for the Fox Canyon aquifer.
2) Water year is from October 1 through September 30 (Example: water year 2016 is from October 1, 2015 through September 30, 2016).
3) Water year type is based on the percentage of the water year precipitation compared to the 30-year precipitation average. Types are defined as Wet (≥150% of average), Above Normal (≥100% to <150% of average), Below Normal (≥75% to <100% of average), Dry (≥50% to <75% of average), and Critical (<50% of

DUDEK

FIGURE 2-19

Water Year Type, Groundwater Use, and Cumulative Change in Storage in the East Las Posas Management Area

Appendix A: Change in Storage Technical Memorandum

A.1 Background

The Sustainable Groundwater Management Act's Emergency Groundwater Sustainability Plan Regulations require each Agency to submit an annual report by April 1 of each year characterizing the previous water year groundwater conditions, groundwater usage, and total water supplies (CWC 10733.2). As part of this, each agency is required to quantify the water year change in groundwater storage for each principal aquifer defined in the GSP (§356.2 (5)(A) and §356.2 (5)(B)). The FCGMA has computed annual change in groundwater storage for water years 2016 through 2020 as part of the 2020 and 2021 Annual Reports prepared for the Las Posas Valley Basin (LPVB). These estimates of change in groundwater in storage were computed by mapping spring groundwater elevation contours for each water year onto a uniform grid that covered the areal extent of the West and East Las Posas Management Areas (WLPMA and ELPMA) of the LPVB. The difference in spring groundwater elevations was then computed for each consecutive water year and multiplied by the model-estimated aquifer properties (UWCD 2018, CMWD 2018) to calculate localized changes in the volume of groundwater in storage. Due to data coverage, the change in groundwater storage in the LPVB was only calculated for the Fox Canyon aquifer between water years 2015 and 2020.

As noted in the 2020 and 2021 Annual Reports, this method for estimating storage change is sensitive to the contouring methods, and, importantly, to the network of groundwater elevation monitoring wells sampled each year (FCGMA 2020, 2021). Because the same wells were not consistently monitored during consecutive water years, and data gaps exist that limit the area over which groundwater elevations are measured in the LPVB, the estimated change in storage for water years 2016 through 2020 covered approximately 18% of the WLPMA and 19% of the ELPMA (FCGMA 2020, 2021).

To address these limitations, the FCGMA has revised the approach for estimating storage change as part of the 2022 Annual Report covering the 2021 water year. This revised methodology utilizes a fixed monitoring well network and correlates groundwater elevations measured at each well to simulated change in groundwater storage computed by the Ventura Regional Groundwater Flow Model developed by UWCD for the WLPMA (UWCD 2018) and the groundwater flow model developed for the ELPMA (CMWD 2018). This approach expands on method utilized for the 2020 and 2021 Annual Reports by providing estimates of storage change in the Fox Canyon aquifer for approximately 66% of the WLPMA and 78% of the ELPMA. This Appendix describes the details of this revised methodology (Section A.2) and provides updated estimates of the change in groundwater storage for water years 2016 through 2021 (Section A.3). A validation of this method is provided in Section A.3).

A.2 Methodology

Estimates of the change in groundwater in storage are based on spring groundwater elevations measured at a fixed set of monitoring wells. Each of these monitoring wells are individually screened within the Fox Canyon aquifer in the LPVB (FCGMA 2019a). This monitoring well network extends across the LPVB and includes the key wells identified in the GSP (FCGMA 2019a). In addition to the key wells, the storage change monitoring network includes a set of wells that were not designated as key wells but provide localized constraints on groundwater conditions within the WLPMA and ELPMA. The storage change well network is shown graphically in Figure A.2-1.

To estimate the change in storage corresponding to groundwater elevation changes measured at each well, a series of Thiessen Polygons were first generated using Geographical Information Software (GIS) to define representative areas surrounding each monitoring well. In the ELPMA, the Thiessen Polygons were extended to the boundaries of the management area[1], and mapped onto the numerical groundwater flow model grid (CMWD 2018). The model-

[1] The eastern extent of the model grid was truncated for these estimates because groundwater elevations in this part of the model are strongly influenced by the unconstrained boundary condition estimates informed by the BCM (FCGMA 2019b)

calculated annual change in storage values were extracted from the ELPMA groundwater model for each polygon area for water years 1971 through 2015[2]. In the WLPMA, the storage change polygons were extended to the western, southern, and eastern boundary of the management area, and the northern extent of the storage change polygons was defined using the base of South Mountain. The WLPMA polygons were then mapped onto the Ventura Regional Groundwater Flow Model grid, and model-calculated annual change in storage values were extracted from each polygon area for water years 1986 through 2015[3]. Because storage change for each annual report has been estimated using seasonal high (spring) conditions, the water year storage change extracted from the UWCD numerical model was computed from spring to spring[4].

Linear regression models were then calculated using the spring[5] groundwater elevation measured at each well and the cumulative change in storage extracted from the Ventura Regional Groundwater Flow Model and ELPMA groundwater model. These linear regression models provide a direct estimate of the cumulative change in groundwater storage within each representative polygon based solely on the corresponding spring groundwater elevation. Differences in the cumulative change in storage between consecutive water years computed using the regression models were then used to calculate the annual change in storage over a given water year.

A.3 Results

1.1 Fox Canyon aquifer in the ELPMA

Change in groundwater in storage for the Oxnard aquifer was estimated using network of nine monitoring wells (Figure A.2-1 and Table A.3.1). The correlation between simulated storage change within each Thiessen Polygon and the corresponding spring groundwater elevation measurements are shown in Figures A.3-1 and A.3-2 and summarized in Table A.3.1.

The largest simulated changes in groundwater storage in the Fox Canyon aquifer occur in the region of the ELPMA south of the Moorpark anticline and downgradient of Arroyo Las Posas. This part of the basin experienced periods of groundwater storage recovery between the early 1970s and 1990s in response to increasing flows in Arroyo Las Posas (e.g. see wells 02N20W10D02S, 02N20W10J01S, and 02N20W10G01S in Figure A.3-1). In this part of the ELPMA, the linear regression models reproduce model-estimates of cumulative change in storage well (e.g. R2 values ranging from 0.68 to 0.94, Table A.3.1).

North of the Moorpark anticline, groundwater in storage generally declined between water years 1970 and 1995, experienced a period of recovery between 1995 and 2000, and then declined between 2000 and 2015. This general trend is simulated change in storage is reflected in the groundwater elevations measured at wells 03N20W26R03S, 03N19W31B01S, and 03N19W19J01S (Figure A.3-1). While the general groundwater elevation trends are reflected in the model results, the correlation between spring elevations and storage change is weaker (R^2 ranging between 0.4 and 0.78) than south of the Moorpark anticline.

Across the entirety of the EPLMA, the linear regression models describe approximately 93% of the simulated storage change in the Fox Canyon aquifer (Figure A.3-3). The revised storage change values presented in the 2022 Annual Report are generally larger in magnitude than those presented in the 2020 and 2021 Annual Reports. This is largely because the contour maps only resolved storage change associated with groundwater elevation changes larger

[2] The groundwater flow model developed for the ELPMA was designed to simulate conditions for the period from January 1, 1970 through December 2015. Accordingly, the corresponding complete water years simulated by the model are 1971 through 2015.

[3] The Ventura Regional Groundwater Flow Model was designed to simulated conditions in the Oxnard Subbasin, Pleasant Valley Basin, and West Las Posas Management Area of the Las Posas Valley Basin for the period from January 1, 1985 through December 31, 2015. Accordingly, the corresponding complete water years simulated by the model are 1986 through 2015.

[4] Water year storage change was calculated as the change in storage between spring conditions. For example, the water year 1986 storage change extracted from the UWCD model corresponded to the 12-month period from March 1985 through April 1986

[5] Spring groundwater elevation was defined as a groundwater elevation measured during March or April of each year.

than 20-feet from year to year. This 20-foot resolution reflects the contour spacing used to prepare water year contour maps for the Fox Canyon aquifer. Conversely, the storage change values calculated using the linear regression models are limited by the measurement resolution associated with groundwater elevations collected at each storage change well. In addition, the total areal coverage of the linear regression model approach is approximately 4 times larger than the areal extent of the groundwater elevation contour method.

Table A.3.1 ELPMA Storage Change Wells and Correlation Statistics

State Well Number	Key Well?	Polygon Area [Acres]	Basin Region	ELPMA		
				Avg Annual Change in Storage (AF)	Correlation Coefficient (R^2)	Change in Storage * R^2
02N20W03H01S	Yes	860	ELPMA	15	0.86	13
02N20W10D02S	Yes	2,460	ELPMA	237	0.68	162
02N20W10G01S	Yes	560	ELPMA	100	0.94	94
02N20W10J01S	Yes	7,690	ELPMA	957	0.92	879
03N19W19J01S	Yes	1,790	ELPMA	-227	0.41	-93
03N20W26R03S	Yes	1,890	ELPMA	-124	0.40	-49
03N19W31B01S	Yes	2,740	ELPMA	-156	0.78	-122
03N20W34G01S	Yes	1,930	ELPMA	79	0.65	52
03N20W35R03S	Yes	1,400	ELPMA	-11	0.62	-3
Estimated Uncertainty				**7%**		

AF = Acre-Feet

1.2 Fox Canyon aquifer in the WLPMA

Change in groundwater in storage for the Oxnard aquifer was estimated using network of seven monitoring wells (Figure A.2-1 and Table A.3.1). The correlation between simulated storage change within each Thiessen Polygon and the corresponding spring groundwater elevation measurements are shown in Figures A.3-1 and A.3-2 and summarized in Table A.3.1.

Groundwater elevations in the eastern part of the WLPMA declined between the 1970s and mid-1990s, increased between the mid-1990s and the mid-2000s, and then declined through the end of 2015 (Figure A.3-4). Simulated groundwater storage changes follow these general trends (Figure A.3-4), but do not always reflect the year-to-year fluctuations in measured groundwater elevations (e.g. see well 02N20W06R01S in Figure A.3-4). In this part of the WLPMA, the correlation between measured spring groundwater elevations and simulated storage change ranges from an R^2 of 0.35 at well 02N20W06R01S to an R^2 of 0.59 at well 02N20W07R02S (Table A.3.2, Figure A.3-5). Similar trends in the simulated change in storage occur in the eastern part of the WLPMA, near the boundary with the Oxnard Subbasin. Here, the correlation between spring groundwater elevations and modeled storage change ranges from an R^2 value of 0.66 at well 02N21W17F05S to an R^2 of 0.68 at well 02N21W08L03S (Table A.3.2, Figure A.3-5). Across the entirety of the WLPMA, the linear regression models account for approximately 60% of the modeled storage change variations (Figure A.3-6).

The revised storage change values presented in the 2022 Annual Report are generally larger in magnitude than those presented in the 2020 and 2021 Annual Reports. As noted in Section 1.1, this is a result of the relatively course resolution, and limited areal extent, of the groundwater elevation contours prepared for the Fox Canyon aquifer. Compared to the ELPMA, there is a weaker correlation between spring groundwater elevations and simulated changes in groundwater storage. These estimates characterize the general trend in storage changes and may not capture the local variability in storage change across the WLPMA. The linear regression models may be reevaluated as part of the 5-year annual report update.

Table A.3.2 WLPMA Storage Change Wells and Correlation Statistics

State Well Number	Key Well?	Polygon Area [Acres]	Basin Region	WLPMA		
				Avg Annual Change in Storage (AF)	Correlation Coefficient (R^2)	Change in Storage * R^2
02N21W12H01S	Yes	1,480	WLPMA	-15.8	0.35	-5.5
02N20W06R01S	Yes	2,270	WLPMA	-168.8	0.35	-59.5
02N20W07R02S	No	1,310	WLPMA	99.5	0.59	58.8
02N21W11J03S	Yes	4,180	WLPMA	-20	0.94	-18.8
02N21W08L03S	No	1,260	WLPMA	-63.6	0.68	-43.2
02N21W17F05S	No	3,390	WLPMA	-191.5	0.66	-126.7
02N20W18A01S[a]	No	1,310	WLPMA	99.5	0.53	52.7
Estimated Uncertainty				**46%**		

AF = Acre-Feet
[a]Used only when spring groundwater elevations are not measured at well 02N20W07R02S

References

Calleguas Municipal Water District (CMWD). 2018. Groundwater Flow Model of the East and South Las Posas Sub-Basins – Preliminary Draft Report. Prepared by Intera Geoscience and Engineering Solutions. January 2018.

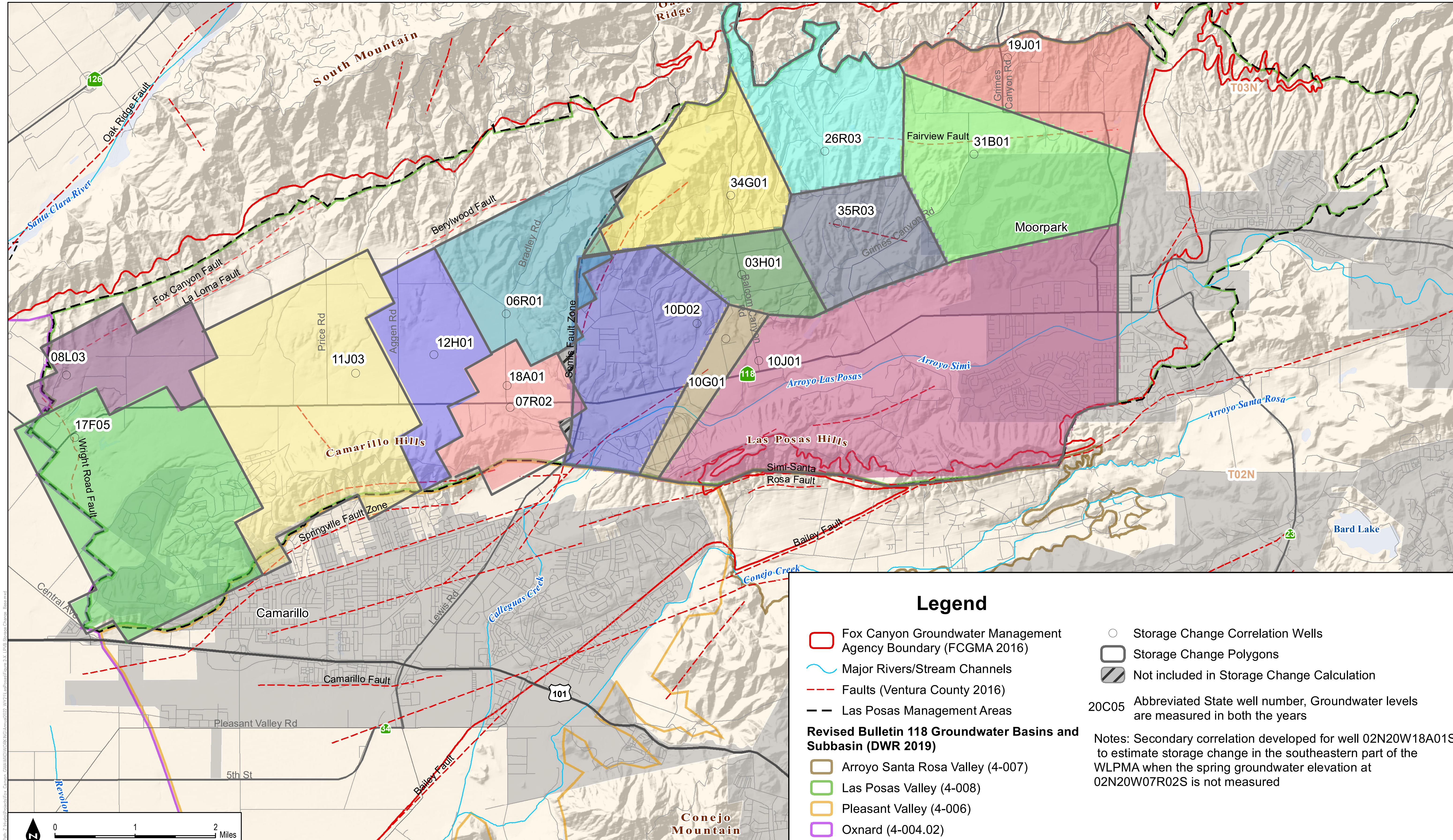
Fox Canyon Groundwater Management Agency (FCGMA). 2019a. Groundwater Sustainability Plan for the Las Posas Valley Basin.

Fox Canyon Groundwater Management Agency (FCGMA). 2019b. Technical memorandum evaluating the impact of chronic lowering of water levels on storage, recharge, and well yields in the ELPMA. Prepared by Dudek.

Fox Canyon Groundwater Management Agency (FCGMA). 2020. Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report: Covering Water Years 2016 through 2019.

Fox Canyon Groundwater Management Agency (FCGMA). 2021. Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report: Covering Water Year 2020.

United Water Conservation District (UWCD). 2018. Ventura Regional Groundwater Flow Model and Updated Hydrogeologic Conceptual Model: Oxnard Plain, Oxnard Forebay, Pleasant Valley, West Las Posas, and Mound Groundwater Basins. Open-File Report 2018-02. July 2018.



DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE A.2-1

Ch`ange in Storage Correlation Wells and Polygons for the LPVB

Las Posas Valley BasinGroundwater Sustainability Plan 2022 Annual Report

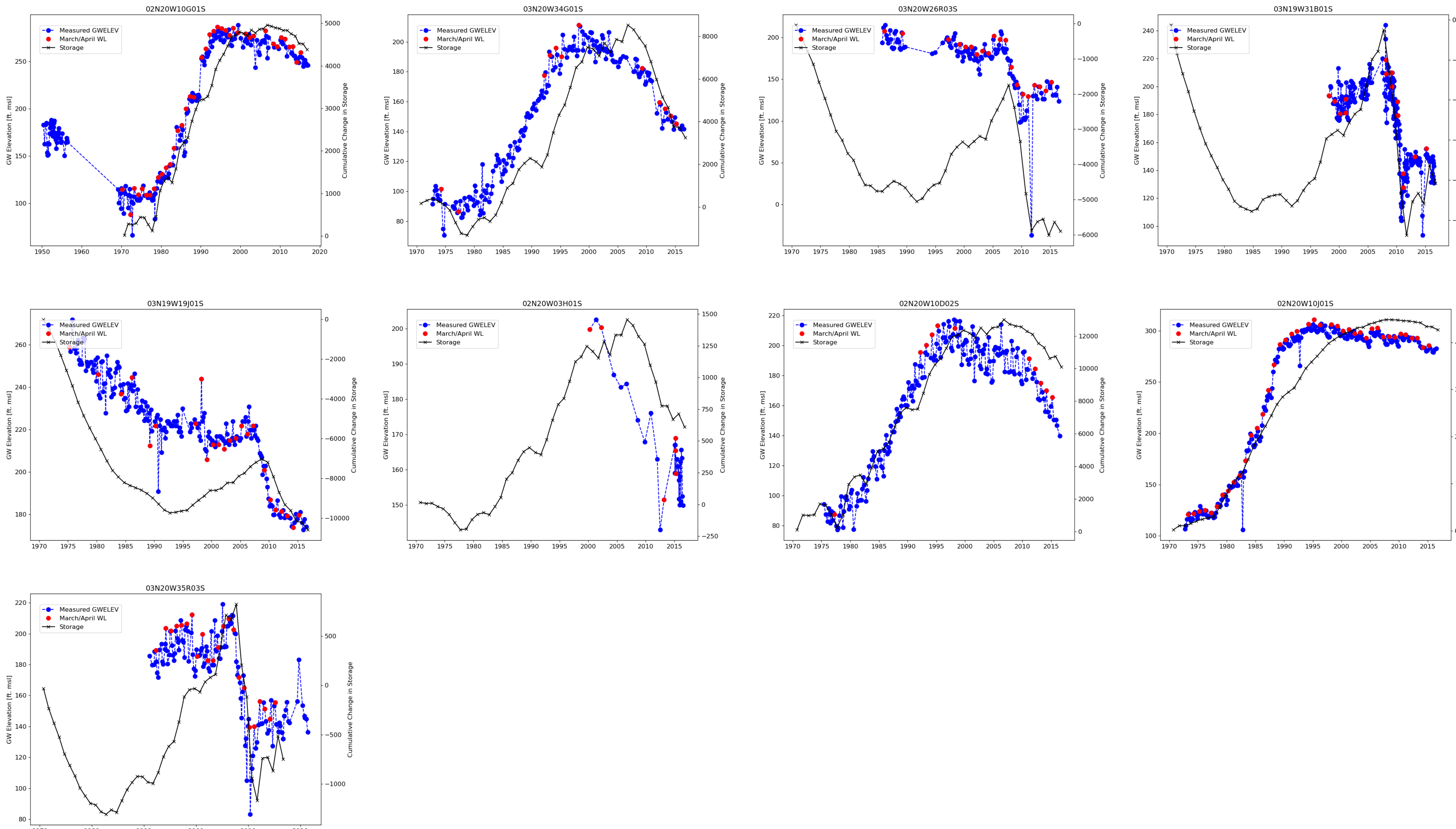


FIGURE A.3-1

Simulated Cumulative Change in Storage and Measured Groundwater Elevations in the Fox Canyon Aquifer of the ELPMA

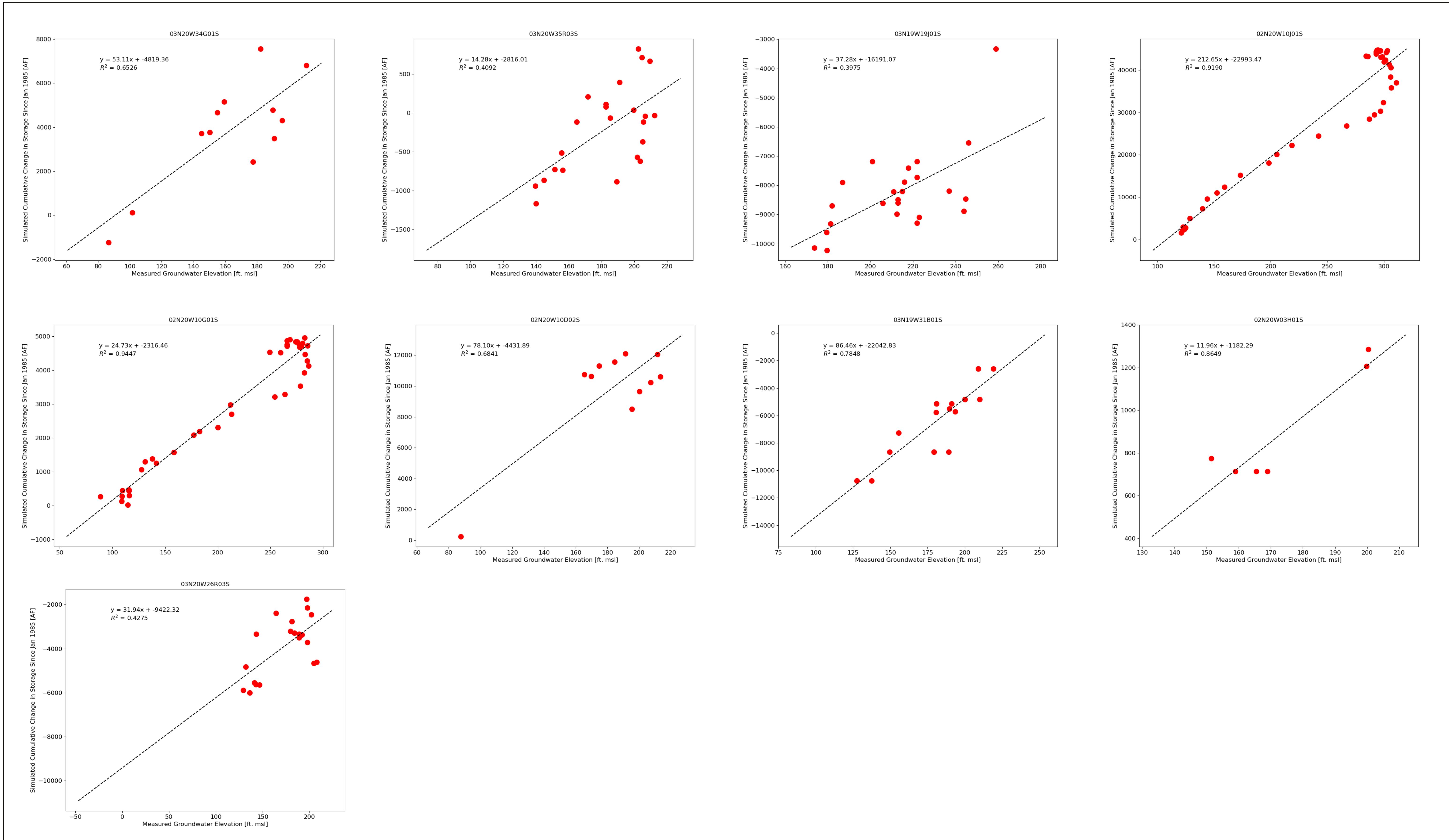


FIGURE A.3-2

Linear Regression Models Developed for the Fox Canyon aquifer in the ELPMA

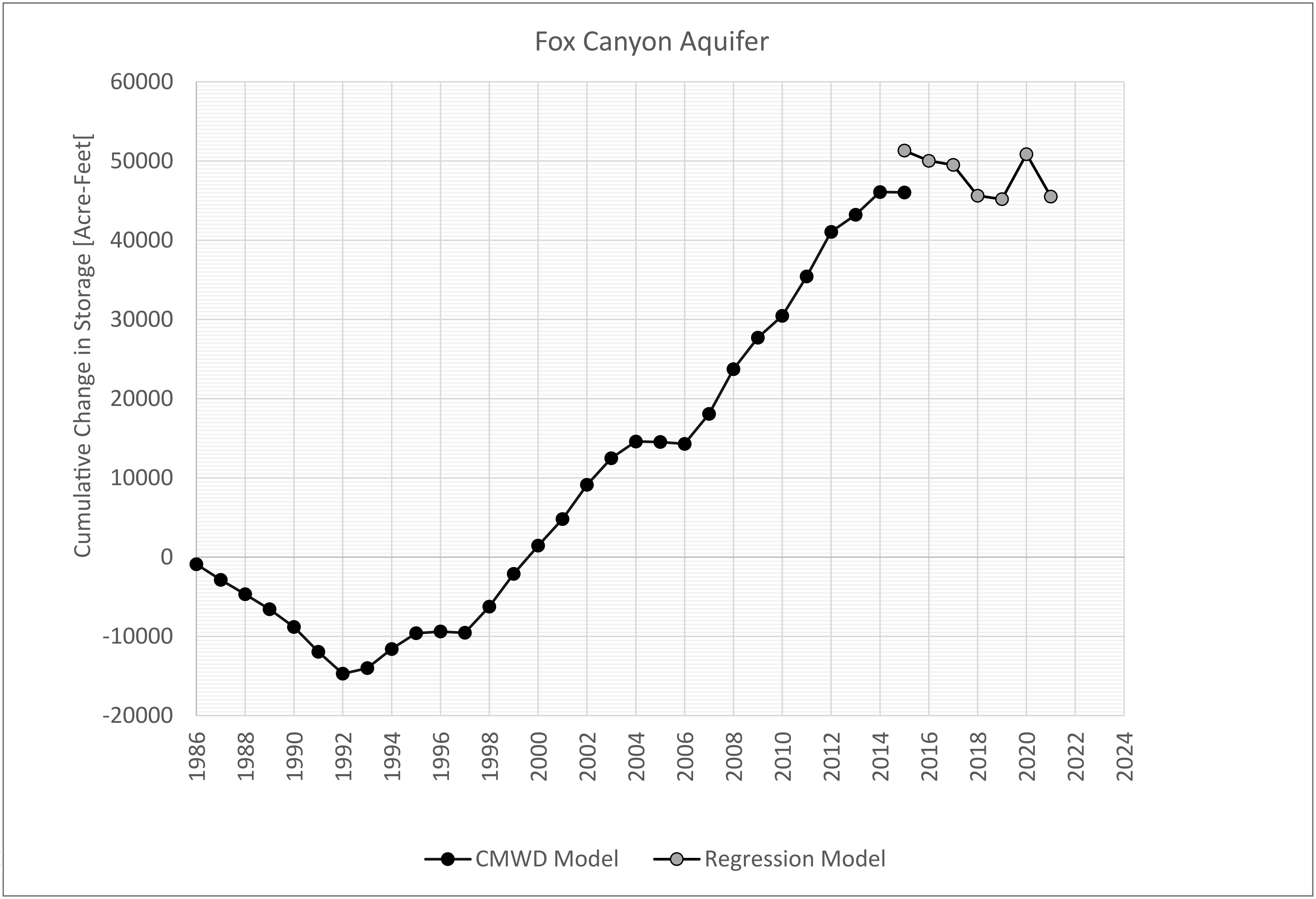


FIGURE A3.3

Validation of Linear Regression Model - Fox Canyon aquifer in the ELPMA

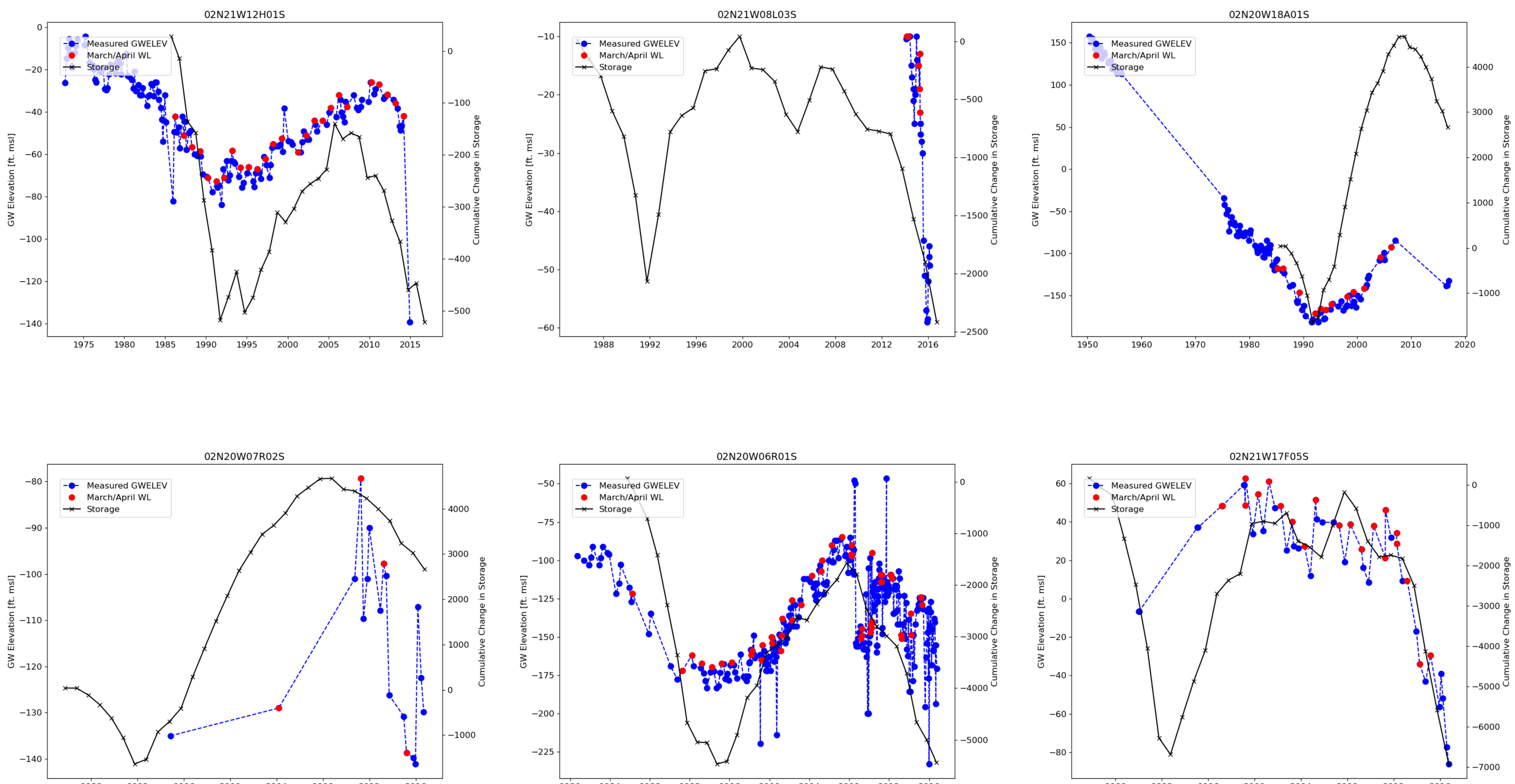


FIGURE A.3-4

Simulated Cumulative Change in Storage and Measured Groundwater Elevations in the Fox Canyon Aquifer of the WLPMA

Las Posas Valley Basin Groundwater Sustainability Plan 2022 Annual Report

DUDEK

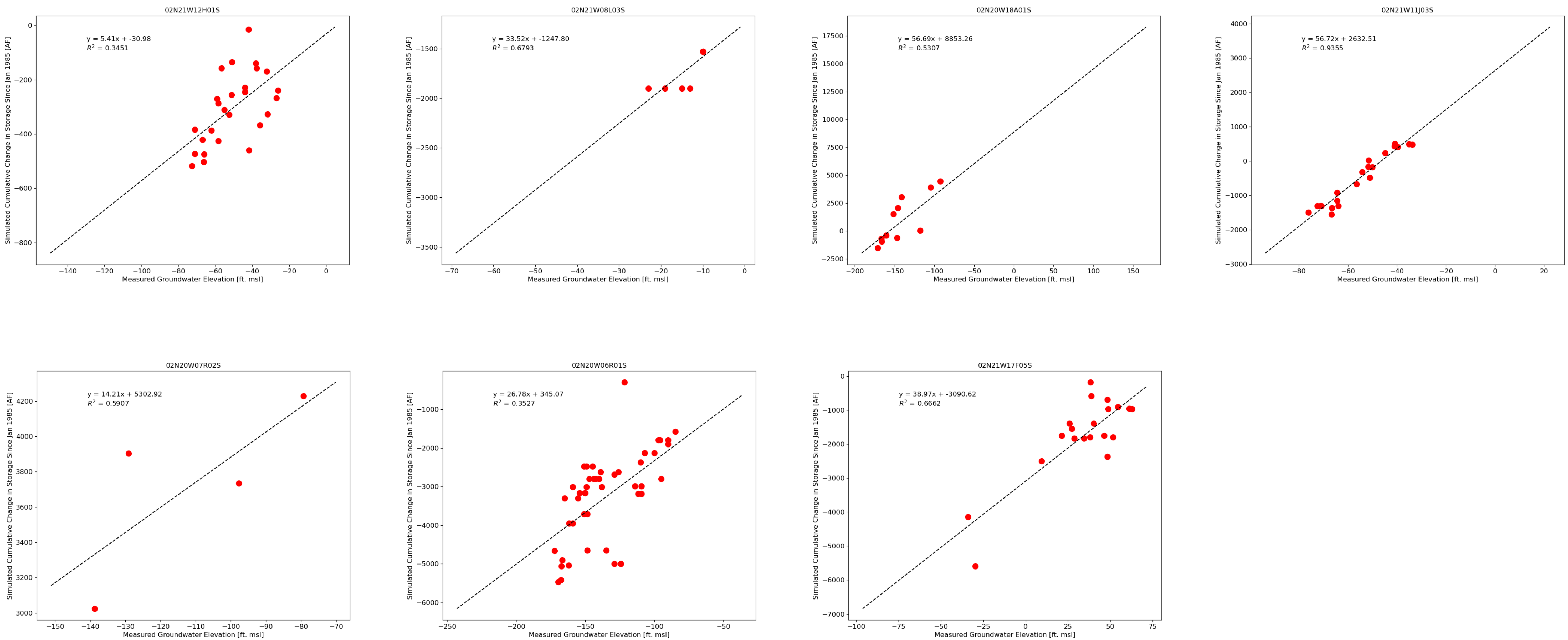


FIGURE A.3-5

Linear Regression Models Developed for the Fox Canyon aquifer in the WLPMA

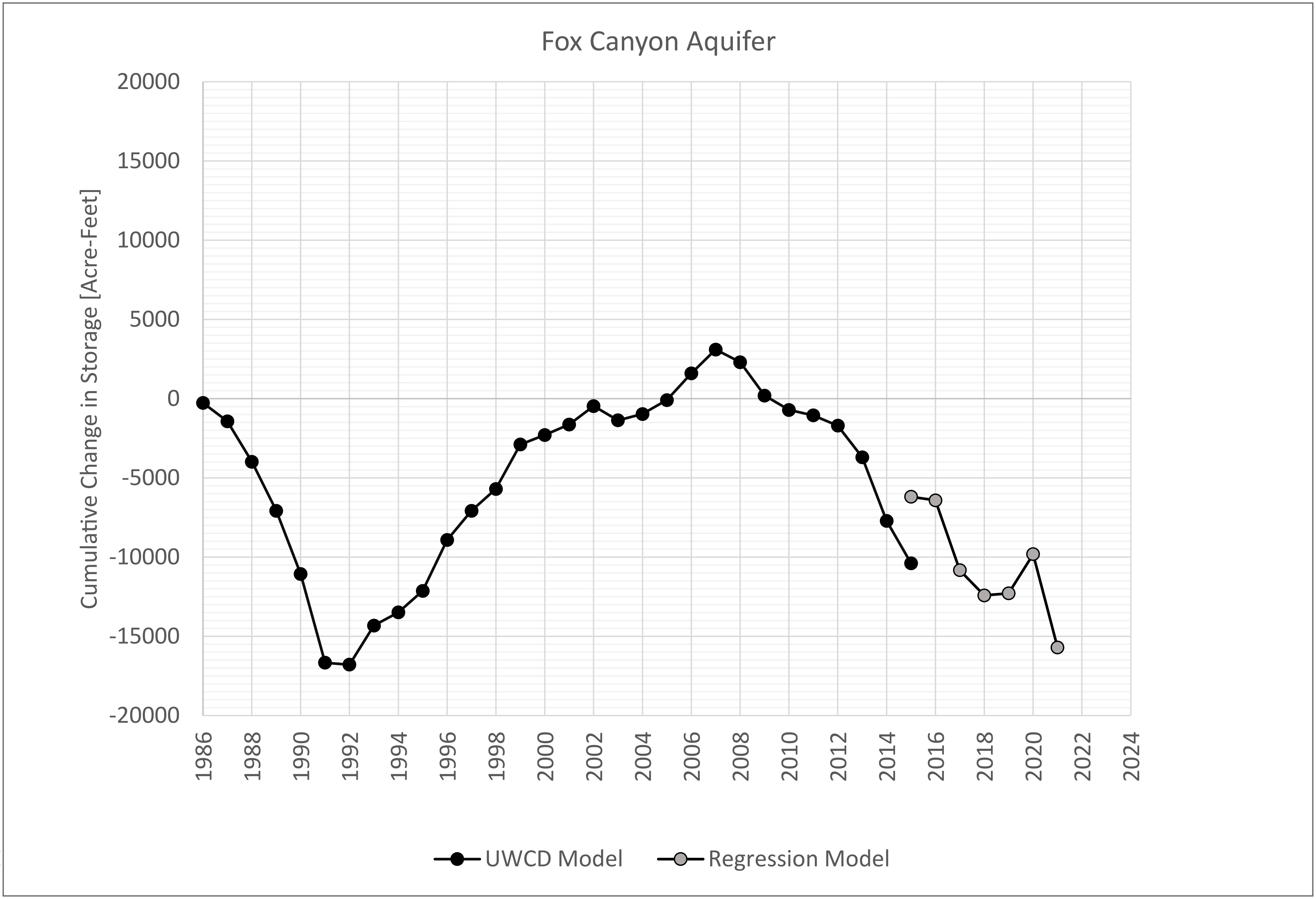


FIGURE A.3-6

Validation of Linear Regression Model - Fox Canyon aquifer in the WLPMA

Las Posas Valley Basin Groundwater Sustainability Plan 2022 Annual Report

DUDEK

Appendix B: Projects to be Appended to the GSP

B1. Infrastructure Improvements to Zone Mutual Water Company's water delivery system

Description

This project is intended to increase the capacity of Zone Mutual Water Company's (ZMWC) delivery system to physically transfer water between the ELPMA and WLPMA of the LPVB by converting the existing ZMWC delivery system from gravity to pressure. The conversion will require: the replacement of approximately 4.5 miles of concrete gravity pipeline with PVC, HDPE, or steel pipeline and associated appurtenances, and instrumenting the delivery system with system automation controls to provide on-demand services. Implementation of this project would contribute to GSP Project No. 1, *Purchase of Imported Water from CWMD for Basin Replenishment*, by allowing for in-lieu deliveries to farmers within, and potentially surrounding, the ZMWC service area. In addition, this project would increase water use efficiency through pipeline upgrades and system automation and increase the capacity to deliver blending water to agricultural well owners impacted by poor quality groundwater. It is estimated that this project would result in approximately 500 AFY of water savings and would decrease groundwater demand in the LPVB by 2,300 AFY.

Relationship to Sustainability Criteria

Relationship to Minimum Thresholds

Improving ZMWC's water delivery infrastructure will reduce groundwater demands within, and potentially surrounding, ZMWC's service area. By reducing groundwater demands in this region, this project will increase groundwater elevations and aid in achieving the minimum threshold groundwater elevations established at the representative monitoring points, or key wells, in the WLPMA. The reduction in groundwater demand is achieved via increased in-lieu deliveries, increased availability of blending water, and increased water use efficiency. Importantly, this project is expected to reduce groundwater demands in the pumping depression located in the eastern portion of the WLPMA.

Relationship to Measurable Objectives

The relationship between ZMWC's infrastructure improvement project and the measurable objective groundwater elevations is the same as the relationship to the minimum thresholds. By reducing groundwater demands within, and potentially surrounding, ZMWC's service area, this project will increase groundwater elevations and aid in achieving the measurable objective groundwater elevations established at the key wells in the WLPMA.

Expected Benefits

The project should aid in the achievement of measurable objectives and minimum thresholds for the four sustainability indicators applicable to the LPVB. This project will: (1) help raise groundwater levels, thereby increasing the volume of groundwater in storage and reducing the potential for land subsidence related to groundwater withdrawal, and (2) improve groundwater quality by providing blending water to agricultural pumpers impacted by low quality groundwater. Higher groundwater levels will also reduce pump lift, and therefore energy consumption, for municipal and agricultural pumpers

It is estimated that implementation of this project would decrease groundwater demand in the LPVB by approximately 2,300 AFY.

Timetable for Implementation

The design phase of this project is currently underway, and most easements have been obtained for the current and future project phases. Infrastructure improvements to ZMWC's delivery system are expected to be completed by early 2025.

Metrics for Evaluation

Evaluation of the infrastructure improvements to ZMWC's delivery system will be based on the increased transfer capacity of water between the ELPMA and WLPMA of the LPVB, as well as the ability to implement on-demand delivery to customers within ZMWC's service area. CMWD provides the FCGMA with annual sales to ZMWC; additionally, ZMWC reports the sources of all water and deliveries. These data can be used to quantify the increase in water transfers that result from completion of this project and confirm these in lieu transfers resulted in corresponding decrease in groundwater extraction. In addition, groundwater elevations will continue to be measured in the key wells discussed in the GSP, to characterize the impact that this project has on the achievement of minimum thresholds and measurable objectives in the WLPMA.

Economic Factors and Funding Sources

Total capital cost for the infrastructure improvements to ZMWC's delivery system is estimated to be $6,000,000. This project is partially funded through the National Resources Conservation Services (NRCS) Environmental Quality Incentives Program (EQIP). The capital required to implement additional phases of the infrastructure improvement may be available through additional NRCS EQIP funding opportunities, FCGMA replenishment fees, ZMWC, and DWR grant opportunities as they become available.

Any action taken by the FCGMA Board, acting as the Groundwater Sustainability Agency for the portion of the Las Posas Valley Basin within in its jurisdiction, to impose or increase a fee shall be taken by ordinance or resolution. Should the FCGMA Board decide to fund a project through imposition of a replenishment fee, it may need to seek voter approval.

B2. Moorpark Groundwater Desalter

Description

This project proposed by the Ventura County Waterworks District No. 1 (VCWWD-1) consists of construction of a new groundwater desalter facility located east of the Moorpark Water Reclamation Facility, along Los Angeles Avenue. The project goals are to improve water quality in the southern portion of the ELPMA and provide an additional source of potable water supply to the LPVB. The project aims to achieve these goals by pumping and treating high-TDS groundwater from southern portion of the ELPMA. In doing this, the project would: (1) assist the wastewater treatment plants in the Calleguas Creek Watershed in compliance with RWQCB TMDL limit for chloride, sulfate, and TDS, (2) reduce the dependence on imported water in the LPVB by providing new local potable supplies, (3) improve groundwater quality in the southern portion of the ELPMA, and (4) create additional underground storage within the ELPMA. Preliminary analyses of the project anticipate that the Moorpark Desalter operate at a maximum sustainable rate of 7,600 AFY.

Project components include: (1) construction of new groundwater extraction wells to pump high-TDS groundwater from the ELPMA, and (2) construction of a desalter facility that would treat the low-quality groundwater prior to incorporation into the VCWWD-1 delivery system. Preliminary analyses for the proposed desalter have been completed and the project is in the planning phase.

Relationship to Sustainability Criteria

Relationship to Minimum Thresholds

Implementation of this project may impact groundwater elevations across the ELPMA depending upon distribution of the desalted water. Groundwater elevation minimum thresholds were established at 15 wells to characterize the potential onset of undesirable results associated with the four sustainability indicators applicable to the LPVB. The impact of this project on groundwater elevations and their relation to minimum thresholds will be evaluated as project planning progresses.

Relationship to Measurable Objectives

Implementation of this project may impact groundwater elevations across the ELPMA depending upon distribution of desalted water. Groundwater elevation measurable objectives were established at 15 key wells to characterize quantifiable goals associated with the four sustainability indicators applicable to the LPVB. The impact of this project on groundwater elevations and their relation to measurable objectives will be evaluated as project planning progresses.

Expected Benefits

Depending on the operational conditions and distribution of desalted water, this project should aid in the achievement of measurable objectives and minimum thresholds for the four sustainability indicators applicable to the LPVB. This project would aid in achieving these metrics by: (1) removing constituents of concern from the southern portion of the ELPMA, which directly addresses undesirable results associated with degraded water quality, and (2) reducing groundwater demands in the LPVB. In addition, this project would be complementary to GSP Project No. 3, *Arroyo Simi-Las Posas Water Acquisition*, which aims to maintain dewatering well and/or Simi Valley Water Quality Control Plant discharges to the Arroyo Simi-Las Posas for downstream recharge to the LPVB, by increasing the available storage capacity in the aquifers underlying Arroyo Simi-Las Posas.

Timetable for Implementation

This project is the planning phase. It is estimated that the required permitting and construction of the desalter facility will be completed by the end of calendar year 2030.

Metrics for Evaluation

This project will be evaluated by measuring groundwater elevations and quality in the key wells discussed in the GSP to characterize the impact of desalter extractions on groundwater conditions in the southern portion of the ELPMA and reduced groundwater demands that result from new potable water supplies throughout the central and northern ELPMA.

Economic Factors and Funding Sources

Total capital cost for the desalter facility and associated groundwater extraction wells is estimated to be $40,000,000. The capital to construct these facilities may be available through DWR's Clean Water State Revolving Fund program, as well as DWR's SGM grant program, as funding becomes available.

B3. Arroyo Las Posas Storm Flow Diversions for Recharge to the ELPMA

Description

This project proposes to divert storm flows from Arroyo Simi-Las Posas for recharge to the ELPMA. The proposed diversions would occur during high flow events via a new surface intake located near the existing stabilizer structure in the Arroyo Simi-Las Posas adjacent to the Moorpark Wastewater Water Reclamation Facility operated by VCWWD-1. The storm flows would then be delivered to the existing percolation ponds to recharge the aquifers in the ELPMA. The project proposes to use the entire 40-acres of the existing percolation ponds and anticipates that the diversions would provide up to 2,000 AFY of recharge. The 2,000 AFY estimated recharge may increase the sustainable yield of the ELPMA up to the corresponding amount, provided adequate storage is available in the aquifers.

Relationship to Sustainability Criteria

Relationship to Minimum Thresholds

Providing additional recharge to the ELPMA will directly impact groundwater levels, which are used to characterize the potential onset of undesirable results associated with the four sustainability indicators applicable to the LPVB, by providing additional water supplies to the LPVB. The implementation of this project would aid in maintaining groundwater elevations above the minimum thresholds throughout the ELPMA.

Relationship to Measurable Objectives

The relationship of the Arroyo Las Posas Storm Flow Diversions for Recharge to the measurable objectives is the same as the relationship with the minimum thresholds. By increasing water levels in the southern portion of the ELPMA, this project will help reach or maintain groundwater elevations at the measurable objective groundwater levels.

Expected Benefits

The project should aid in the achievement of measurable objectives and minimum thresholds for the four sustainability indicators applicable to the LPVB. This project will: (1) help raise groundwater levels throughout the ELPMA by providing 2,000 AFY of additional recharge to the basin, thereby increasing the volume of groundwater in storage and reducing the potential for land subsidence related to groundwater withdrawal, and (2) improve groundwater quality in the southern portion of the ELPMA by recharging higher-quality water compared to the base flows in Arroyo Las Posas that are composed predominantly of discharges from the SVWQCP. Higher groundwater levels that result from this recharge project may also reduce pump lift, and therefore energy consumption, for municipal and agricultural pumpers.

This project is estimated to increase the sustainable yield of the ELPMA by up to 2,000 AFY.

Timetable for Implementation

Implementation of this project will require environmental permitting, water-rights determination, and construction of a surface intake along Arroyo Simi-Las Posas. This project is still in the planning phases and is anticipated to be complete by the end of calendar year 2025.

Metrics for Evaluation

This project will be evaluated by measuring the volume of storm flows diverted annually for recharge at the Moorpark Water Reclamation Facility percolation ponds. In addition, this project will be evaluated by measuring groundwater elevations in the key wells discussed in the GSP to characterize the impact of annual recharge amounts on groundwater conditions in the southern portion of the ELPMA.

Economic Factors and Funding Sources

Capital costs to acquire the appropriate environmental permits and construct the surface intake is estimated to be $4,000,000. The capital to construct these facilities may be available through DWR's Clean Water State Revolving Fund program, DWR's SGM grant program, or other federal grant opportunities, as funding becomes available.

B4. Installation of Additional Groundwater Monitoring Wells

Description

This project proposes installation of multi-depth monitoring wells in the WLPMA and ELPMA of the LPVB to assess groundwater conditions in the principal aquifers of the LPVB that lack data. The GSP determined that there were spatial data gaps in the understanding of aquifer conditions and identified 4 potential new well locations that would help fill the identified gaps. In the WLPMA, the GSP identified the boundary between the WLPMA and the Oxnard Subbasin as an area that would benefit from additional groundwater monitoring to improve characterization of groundwater gradients across the basin boundary. In the ELPMA, the GSP identified the potential groundwater dependent ecosystem located along Arroyo Simi-Las Posas as a region that would benefit from additional groundwater monitoring. A new multi-depth groundwater monitoring well in this location would provide data on whether the vegetation in the riparian corridor relies on groundwater or soil moisture from infiltrating surface water. In addition, the GSP notes that there are no dedicated monitoring wells screened in the Grimes Canyon aquifer in the ELPMA and that adding a monitoring well would improve the understanding of groundwater gradients between the Fox Canyon aquifer and Grimes Canyon aquifer.

Since submittal of the GSP, well 02N20W04F02S, a key well in the ELPMA, was destroyed. A new dedicated monitoring well to replace this well would provide better characterization of groundwater conditions in the western part of the ELPMA. In addition to this well, FCGMA identified the pumping depression in the eastern portion of the WLPMA as an area that would benefit from a new dedicated monitoring well.

Relationship to Sustainability Criteria

Relationship to Minimum Thresholds

This project does not have a direct influence on the minimum thresholds. It will, however, provide data that can be used to improve basin management as well as evaluate and potentially revise the minimum thresholds in the future.

Relationship to Measurable Objectives

This project does not have a direct influence on the measurable objectives. It will, however, provide data that can be used to improve basin management as well as evaluate and potentially revise the measurable objectives in the future.

Expected Benefits

The expected benefits of this project lie in the additional data gathered from the well installation process and the ongoing monitoring of the groundwater conditions at the well sites. This data can be used to refine the conceptual and numerical models of the LPVB. Such refinement may result in reevaluation and adjustment of the minimum thresholds or measurable objectives.

Timetable for Implementation

Installation of monitoring wells will be phased as funding becomes available and the data from the new wells helps define the placement of subsequent wells. It is anticipated that the installation of the first two monitoring wells can be completed within a 2-year timeframe following commitment of funds for the project, with additional wells to follow.

Metrics for Evaluation

This project will be evaluated by the number of new dedicated monitoring wells installed.

Economic Factors and Funding Sources

The cost per new well is anticipated to be approximately $850,000. Potential funding sources include DWR Technical Support Services (TSS) or SGM grant funds, as well as potential funding from FCGMA.

B5. Installation of Transducers in Groundwater Monitoring Wells

Description

This project proposes installation of transducers in representative monitoring points, or key wells, in the LPVB. The GSP determined that there were temporal data gaps in the understanding of aquifer conditions. These data gaps limit the number of wells that can be used to contour spring high and fall low groundwater conditions. These temporal data gaps also impact estimates of the change in groundwater in storage in the LPVB. The temporal data gaps have persisted in each annual report prepared after the GSP was submitted to DWR. Additionally, as most key wells are agricultural irrigation wells, transducers will help assure that measured groundwater levels are static water levels unaffected by recovery or potential well interference. The addition of transducers will help ensure that spring high and fall low groundwater levels are collected from representative monitoring points within a 2-week window, as recommended by DWR, and will provide a clearer understanding of groundwater conditions during the spring and fall measurement events. This will allow better comparison for annual change in storage estimates and will facilitate sustainable management of the LPVB.

Relationship to Sustainability Criteria

Relationship to Minimum Thresholds

This project does not have a direct influence on the minimum thresholds. It will, however, provide data that can be used to improve basin management as well as evaluate and potentially revise the minimum thresholds in the future.

Relationship to Measurable Objectives

This project does not have a direct influence on the measurable objectives. It will, however, provide data that can be used to improve basin management as well as evaluate and potentially revise the measurable objectives in the future.

Expected Benefits

The expected benefits of this project lie in the collection of data from a 2-week window each spring and fall and the ongoing monitoring of the groundwater conditions at the well sites including a better understanding of potential well interference and non-static conditions on the water level measurements. This data can be used to inform management decisions depending on the observed groundwater conditions.

Timetable for Implementation

It is anticipated that installation of transducers can be completed within a 2-year timeframe following commitment of funds for the project.

Metrics for Evaluation

This project will be evaluated by the number of transducers installed and the evaluation of annual change in storage that results from the transducer data.

Economic Factors and Funding Sources

The cost is anticipated to be approximately $140,000 for eleven well locations. Potential funding sources include DWR TSS or SGM grant funds, as well as potential funding from FCGMA.

B6. Feasibility Study to identify possible supplemental water supply sources for the northern ELPMA

Description

This project seeks to understand the feasibility of providing supplemental water supplies to the northern area of the ELPMA. The GSP identified the area of the ELPMA north of the Moorpark anticline as a region where groundwater elevations have exhibited historical declines that locally exceed 250 feet. Groundwater elevation trends in this part of the ELPMA differ from those measured in the southern portion of the ELPMA, where groundwater elevations have experienced periods of recovery in response to increasing flow in Arroyo Simi-Las Posas. Groundwater elevations north of the Moorpark anticline are less responsive to flows in Arroyo Simi-Las Posas and are primarily influenced by groundwater production and CMWD's Aquifer Storage and Recovery (ASR) operations. Supplemental water supplies to this area will reduce groundwater demand in this part of the ELPMA.

Relationship to Sustainability Criteria

Relationship to Minimum Thresholds

This is a feasibility study, so it does not have a direct influence on the minimum threshold groundwater levels. If projects are found to be feasible, however, they could reduce groundwater production demand, which would help groundwater levels remain above the minimum thresholds in the ELPMA.

Relationship to Measurable Objectives

This is a feasibility study, so it does not have a direct influence on the minimum threshold groundwater levels. If projects are found to be feasible, however, they could reduce groundwater production demand, which would help groundwater levels remain above the measurable objectives in the ELPMA.

Expected Benefits

This feasibility study is expected to provide a clear understanding of volume of supplemental water supplies, and corresponding piping infrastructure, required to offset groundwater demands and maintain groundwater elevations above the minimum thresholds in the northern portion of the ELPMA. In addition, this feasibility study will provide stakeholders with estimated costs associated with the supplemental water deliveries and corresponding infrastructure requirements and will also provide stakeholders with an estimate of the potential increase to the sustainable yield of the ELPMA.

Timetable for Implementation

It is anticipated that the feasibility study can be completed within a 2-year timeframe following commitment of funds for the project. If a feasible project is identified through this study, timetables for permitting, construction, and project implementation will be developed.

Metrics for Evaluation

Evaluation of the feasibility study will be based on the report produced documenting the data analyzed, work completed, and the findings of the study.

Economic Factors and Funding Sources

This feasibility study is anticipated to cost $100,000. Potential funding sources include DWR grant opportunities and FCGMA.