Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report: Covering Water Years 2016 through 2019

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Fox Canyon Groundwater Management Agency

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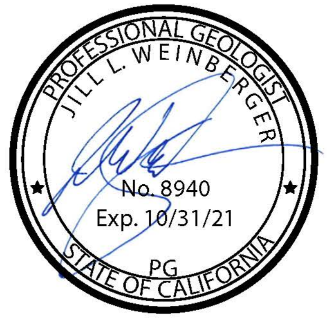

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Executive Summary

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 first annual report for the Las Posas Valley Basin 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. SGMA regulations require that an annual report be submitted to the Department of Water Resources (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. This annual report provides an update on the groundwater conditions in the LPVB for water years 2016 through 2019 (October 1, 2015 through September 30, 2019).

Since 2015, the LPVB experienced two dry water years, 2016 and 2018, in which precipitation was below 75% of the long-term average precipitation for the LPVB, and two above normal water years, 2017 and 2019, in which precipitation was greater than the average precipitation. The only area of the LPVB in which groundwater elevation trends responded to water year precipitation, was adjacent to Arroyo Las Posas in the East Las Posas Management Area (ELPMA). This response is correlated with greater flow in Arroyo Las Posas during above normal water years. Elsewhere in the LPVB, groundwater elevations did not respond to water year precipitation.

Calculations of change in storage in the LPVB are constrained by data coverage, with insufficient data in the Upper San Pedro Formation, Epworth Gravels aquifer, and Grimes Canyon aquifer to calculate a change in storage between 2016 and 2019. Groundwater elevation data in the Fox Canyon aquifer were used to calculate change in storage in both the ELPMA and the West Las Posas Management Area (WLPMA), however, the change in storage calculations for these areas were limited by the data coverage to an area smaller than the lateral extent of the basin. In the WLPMA, the volume of groundwater in storage in the Fox Canyon aquifer declined by approximately 1,400 acre-feet between water years 2016 and 2019, within the area over which change in storage could be calculated. In the ELPMA, the volume of groundwater in storage in the Fox Canyon aquifer declined by approximately 2,000 acre-feet between water years 2016 and 2019, within the area over which change in storage could be calculated.

Data gaps identified in the GSP remain in this annual report. Some of the critical data gaps include the timing and number of groundwater elevation measurements available for creating spring and fall contour maps, and the current timeframe for reporting groundwater production, which facilitates reporting groundwater production on a calendar year, rather than on water year basis. These data gaps will be closed as implementation of the GSP progresses.

FCGMA has already undertaken several steps toward implementing the GSP, with implementation planning occurring concurrently with the GSP development process. Critically, FCGMA successfully requested stakeholder facilitation services through DWR's Facilitation Support Services program to support implementation of the GSP. The FCGMA Board of Directors continues to prioritize stakeholder feedback in the implementation phase of the GSP because of the vital role stakeholders play in ensuring the long-term sustainable use of groundwater resources in the LPVB.

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1 Plan Area and Background

1.1 Background

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 basin, has prepared this first annual report for the Las Posas Valley Basin Groundwater Sustainability Plan (GSP) in compliance with the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.). SGMA requires that an annual report be submitted to the Department of Water Resources (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 2020).

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 an MOU, and FCGMA and the County have formed a JPA.

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, the Oxnard Subbasin, the Pleasant Valley Basin, and the Arroyo Santa Rosa Valley Basin (ASRVB).

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[1], (4) five incorporated cities which are all or a portion of each is within the FCGMA jurisdictional area[2], and (5) a farmer representative (FCGMA 2020). 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 (FCGMA 2020).

1 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.

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

1.1.2 LPVB Groundwater Sustainability Plan

On December 13, 2019, the FCGMA Board held a public hearing and adopted a GSP for the LPVB. The purpose of the GSP was to define 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 east and west parts of the LPVB (FCGMA 2019). Hydrologic 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 underling Fox Canyon and Grimes Canyon aquifers.

The GSP evaluated groundwater conditions in three hydrostratigraphic units in the WLPMA: the shallow alluvial system, the upper San Pedro Formation, and the Fox Canyon aquifer (FCGMA 2019). The deepest aquifer in the WLPMA is the Grimes Canyon aquifer. The WLPMA is hydrologically 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 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 in order 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. This annual report evaluates 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 since the fall of 2015, through the end of water year 2019[3].

1.2 Plan Area

The LPVB (DWR Bulletin 118 Groundwater Basin 4-008) 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 (DWR Groundwater Basin 4-04.02; Figure 1-1, Vicinity Map for the Las Posas Valley Basin).

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 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, the majority 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; Precipitation and Stream Gauges in the Las Posas Valley Basin). Water year precipitation, measured at Stations 002 and 190, in the central LPVB is highly variable, ranging from 5.1 inches in 1958 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 2019.

The GSP for the LPVB included precipitation through the 2015 water year (FCGMA 2019). Since 2015, the LPVB has experienced two above normal[4] water years (2017 and 2019), and two dry water years (2016 and 2018). The average precipitation during this period was 14.7 inches, which is less than the long-term mean precipitation in the LPVB. 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, which is 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 greater than the area of the LPVB, is a source of recharge to the

[3] 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 2019 water year begins on October 1, 2018, and ends on September 30, 2019.

[4] 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.

ELPMA. Dry weather flows in Arroyo Las Posas result from upstream wastewater treatment plant and dewatering well discharges to the Arroyo (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, is located on Arroyo Simi above Hitch Blvd (Figures 1-2 and 1-4). Streamflow measured at gauge 841 for the past 10 water years is presented in Table 1-1.

Table 1-1. Streamflow on Arroyo Las Posas for Water Years 2010 through 2019

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

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

Winter 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 and 2011, which were both above normal water years. The average daily flow recorded during water year 2017, which was also an above normal water year, was the third highest average daily flow measured at gauge 841A over the past 10 years. In water years 2016 and 2018, which were both dry water years, the annual daily average flow was less than half the cumulative daily average flow measured in 2017 (Table 1-1; Figure 1-4). The average daily flow was higher in 2019, an above normal precipitation year, than it was in 2018 (Table 1-1; Figure 1-4).

1.3 Annual Report Organization

This is the first 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 Fox Canyon Groundwater Management Agency. 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 since 2015, which is the end of the data used to develop the GSP.

2.1 Groundwater Elevations

Groundwater elevation contour maps are presented in Figures 2-1 through 2-35: the Shallow Alluvial aquifer in Figures 2-1 through 2-7, the Epworth Gravels aquifer in Figures 2-8 through 2-14, the upper San Pedro Formation in Figures 2-15 through 2-21, the Fox Canyon aquifer in Figures 2-22 through 2-28, and the Grimes Canyon aquifer in Figures 2-29 through 2-35. These maps show the seasonal high and low groundwater elevations between the spring of 2016 and the spring of 2019. The data collected each spring and fall varies by aquifer. Groundwater elevations are best defined in the Fox Canyon aquifer (Figures 2-22 through 2-28), and least well constrained in the Grimes Canyon aquifer (Figures 2-29 through 2-35).

Spring groundwater elevations were defined as any groundwater elevation measured within a four-week window between March 2 and March 29 of each year. Fall groundwater elevations were defined as any groundwater elevation measured between October 2 and October 29 of each year. The GSP recommended collecting groundwater elevations within a two-week window in the future (FCGMA 2019). 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

Groundwater elevations in the Shallow Alluvial aquifer were stable between 2016 and 2019 (Figures 2-1 through 2-7). The highest groundwater elevations measured in the Shallow Alluvial aquifer were in well 02N19W09E01, which is the easternmost well in the alluvium, and the lowest groundwater elevations measured were in well 02N20W17J06, which is the westernmost well screened in the shallow alluvium.

2.1.1.2 Epworth Gravels Aquifer

There are only two wells in the Epworth Gravels aquifer for which groundwater elevations were reported between 2016 and 2019 (Table 2-1; Figures 2-8 through 2-14). The groundwater elevation in well 03N19W30M02 declined approximately 80 feet between the spring of 2016 and 2017, but recovered in the spring of 2018 and was stable between the spring of 2018 and 2019. The groundwater elevation in well 03N19W29F06, was stable between the spring of 2016 and 2019.

Table 2-1. Water Year 2019 Groundwater Elevations, Minimum Thresholds, Measurable Objectives, and Interim Milestones for Representative Monitoring Wells in the LPVB

Well Number	Management Area	Aquifer	Fall 2018 Groundwater Elevation (ft MSL)	Spring 2019 Groundwater Elevation (ft MSL)	Minimum Threshold (ft MSL)	Measurable Objective (ft MSL)	2025 Interim Milestone (ft MSL)
03N19W29F06	Epworth Gravels	Epworth Gravels	NM	602.10	555	585	581
02N20W09Q08	ELPMA	Shallow Alluvial	262	273	170	270	—
02N20W12MMW1	ELPMA	Shallow Alluvial	368	373.87	300	370	—
02N20W01B02	ELPMA	Fox	NM	NM	80	120	—
02N20W03H01	ELPMA	Fox	NM[a]	NM[a]	100	135	—
02N20W04F02	ELPMA	Fox	Destroyed	Destroyed	100	145	—
02N20W10D02	ELPMA	Fox	132.9	140.93	80	130	—
02N20W10G01	ELPMA	Fox	NM	253.07	100	230	—
02N20W10J01	ELPMA	Fox	NM	285.87	110	250	—
03N19W19J01	ELPMA	Fox	NM	166.20	130	160	—
03N19W28N03	ELPMA	Fox	176	175	130	170	—
03N19W31B01	ELPMA	Fox	124.1	131.1	105	145	—
03N20W34G01	ELPMA	Fox	NM	132.28	75	130	—
03N20W35R03	ELPMA	Fox	NM	156.27[c]	105	145	139
03N20W26R03	ELPMA	Fox	NM	141.11	100	120	—
03N20W35R02	ELPMA	Grimes	130.57	148.87	105	145	133
02N20W06R01S	WLPMA	LAS[b]	NM	-137.91	-170	-125	-147
02N20W08F01S	WLPMA	LAS	NM[d]	NM[d]	-195	-150	—
02N21W16J03S	WLPMA	LAS	NM[e]	NM[e]	-75	-45	-71
02N21W11J03S	WLPMA	LAS	-73.01	-56.41	-70	-50	-64
02N21W12H01S	WLPMA	LAS	NM	-39.61	-70	-45	—

ft MSL = feet mean sea level
NM = not measured
[a] Groundwater elevations not reported after 5/01/2017.
[b] In the WLPMA, the LAS consists of the Fox Canyon aquifer and Grimes Canyon aquifer (FCGMA 2019)
[c] Measurement collected on 6/18/2019. Groundwater elevations not measured in Spring 2019.
[d] Groundwater elevations not reported after 4/01/2017.
[e] Groundwater elevations not reported after 5/25/2016.

2.1.1.3 Upper San Pedro Formation

Groundwater elevations in the upper San Pedro Formation vary with depth (Figures 2-14 through 2-21). In the spring of 2016 groundwater elevations in the Upper San Pedro Formation ranged from -45.7 to 242.1 feet mean sea level (ft MSL) in the WLPMA. In the spring of 2019 groundwater elevations ranged from -66.1 to 245.8 ft MSL (Figure 2-21). The low groundwater elevation in each year was measured in well 02N21W15M03 (screened 406-1030 ft. below ground surface [bgs]), and the high groundwater elevation was measured in well 02N21W16J01 (screened 182-295 ft. bgs). These wells, both of which are in western WLPMA, are only separated by approximately 0.2 miles, but have different screen intervals, which accounts for the difference in the groundwater elevation between the wells.

In the ELPMA, observed groundwater elevations ranged from 264.2 ft MSL at well 03N20W35R04 to 439 ft MSL at well 02N19W07K03 in the spring of 2016 (Figure 2-15). Well 02N19W07K03 is adjacent to Arroyo Las Posas, and the groundwater elevation in this well remained stable between the spring of 2016 and the spring of 2019. The groundwater elevation in well 03N20W35R04 was not measured in the spring of 2019 (Figure 2-21).

2.1.1.4 Fox Canyon Aquifer

Although annual changes in groundwater elevations vary by well, spring 2019 groundwater elevations were generally lower than spring 2016 groundwater elevations throughout much of the Fox Canyon aquifer in the WLPMA (Table 2-1; Figures 2-22, 2-24, 2-26, and 2-28). Adjacent to the boundary with the Oxnard Subbasin, the groundwater elevation in well 02N21W08L03 declined approximately 21 feet between the spring of 2016 and the spring of 2019. In the eastern WLPMA, adjacent to the Somis Fault, the groundwater elevation in well 02N20W06R01 declined approximately 16 feet between the spring of 2016 and the spring of 2018, but rose approximately five feet between the spring of 2018 and 2019. The overall groundwater elevation at this well was approximately 11 feet lower in the spring of 2019 than it was in the spring of 2016. Fall groundwater elevations are typically 10 to 50 feet lower than the spring groundwater elevations in the WLPMA (Figures 2-23, 2-25, and 2-27).

In the ELPMA, spring groundwater elevations in the vicinity of Arroyo Las Posas responded to water year precipitation and flows in the Arroyo Las Posas, rising in water years 2017 and 2019, and falling in water years 2016 and 2018 (Table 2-1; Figures 2-22, 2-24, 2-26, and 2-28). Spring groundwater elevation trends elsewhere in the ELPMA do not correlate with water year precipitation. In the northwestern and northeastern areas of the ELPMA groundwater elevations in wells 03N20W28N03, 03N19W34G01, and 02N20W03H01 declined between the spring of 2016 and the spring of 2019 (Figures 2-22, 2-24, 2-26, and 2-28). In contrast, groundwater elevations in wells 03N20W25R04 and 03N20W35J01 in the central ELPMA were stable, or rose between spring 2016 and spring 2019 (Figures 2-22, 2-24, 2-26, and 2-28).

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 02N21W28A02 and 02N22W22G01 during water years 2016 through 2019 (Figures 2-29 through 2-35). The groundwater elevation in these wells was not measured in the spring of 2016 (Figure 2-29). Between the spring of 2017 and the spring of 2019, the groundwater elevation in well 02N21W28A02 declined by approximately 8 feet. The groundwater elevation in well 02N22W22G01 declined approximately 4 feet over the same time period. Fall groundwater elevations measured at these wells were approximately 8 to 18 feet lower than the spring groundwater elevations (Figures 2-29 through 2-35).

Groundwater elevations were not measured in the two wells screened solely in the Grimes Canyon aquifer in the ELPMA between 2016 and 2019 (Figures 2-29 through 2-35).

2.1.2 Groundwater Elevation Hydrographs

Groundwater elevation hydrographs for each of the key wells identified in the GSP are presented in Figures 2-36 through 2-38. These key wells are the designated representative monitoring sites for the LPVB (FCGMA 2019). Since the GSP was prepared, well 02N20W04F02, 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 the next annual report. Additionally groundwater elevations in wells 02N20W03H01, 02N20W08F01S, and 02N21W16J03S have not been measured since 2016 or 2017 (Table 2-1). FCGMA is currently working to identify whether or not these wells can be accessed and included in future monitoring, or whether suitable replacement wells need to be identified.

The spring 2019 groundwater elevation measured at well 03N19W29F06 in the Epworth gravels management area was 47 feet higher than the minimum threshold groundwater elevation defined for this well (Table 2-1; Figure 2-38; FCGMA 2019). In the WLPMA, the spring 2019 groundwater elevations were above the minimum threshold groundwater elevation in four of the five representative monitoring sites (Table 2-1; Figure 2-36). The spring 2019 groundwater elevation measured in the ELPMA was above the minimum threshold selected at each representative monitoring point (Table 2-1; Figures 2-37a through 2-37c).

2.2 Groundwater Extraction

Historically, groundwater extractions in the FCGMA have been reported in two periods over the course of a single calendar year. Because groundwater extractions are not reported monthly, groundwater production cannot be reported on a water year basis. Therefore, the groundwater extractions reported in Tables 2-2 and 2-3 and shown on Figures 2-39 through 2-41 follow the historical precedent and are for calendar years 2016, 2017 and 2018.

It should be noted that groundwater extraction reporting for 2018 and the first half of 2019 are preliminary and expected to change. Additional extraction reporting is anticipated. Based on the available data, groundwater production in the WLPMA and ELPMA was stable in 2016 and 2017 (Tables 2-2 and 2-3). Reported groundwater extractions in the WLPMA decreased in 2018 (Table 2-2). Reported groundwater extractions in the ELPMA for calendar year 2018 were similar to the reported extractions for calendar year 2016 (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. Calendar Year Groundwater Extractions in the WLPMA by Aquifer System and Water Use Sector

Calendar 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*	
2016	1,555	0	1	*1,556*	11,052	2,371	0	*13,423*	178	372	33	*583*	**15,562**
2017	1,536	0	1	*1,537*	11,009	2,321	0	*13,330*	569	386	44	*999*	**15,866**
2018[a]	1,103	0	1	*1,104*	9,984	1,511	0	*11,495*	1,297	376	42	*1,715*	**14,314**
2019[b]	378	0	0	*378*	4,263	660	0	*4,923*	794	125	17	*936*	**6,237**

Notes: AG = Agriculture ; Dom = domestic; M&I = Municipal and Industrial

[a] Groundwater extraction reporting for 2018 is preliminary and expected to change. Additional extraction reporting is anticipated.

[b] Partial year results reported. Groundwater production is through July 2019.

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

Calendar 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*	
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**
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**
2018[a]	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**
2019[b]	470	0	0	*470*	42	0	0	*42*	4,215	591	0	*4,806*	146	44	0	*190*	2,780	75	8	*2,863*	**8,371**

Notes: AG = Agriculture; Dom = domestic; M&I = Municipal and Industrial

[a] Groundwater extraction reporting for 2018 is preliminary and expected to change. Additional extraction reporting is anticipated.

[b] Partial year results reported. Groundwater production is through July 2019.

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 and a blend of CMWD-supplied water, Conejo Creek water, and/or pumping groundwater supplied by the Camrosa Water District from the PVB and Arroyo Santa Rosa Valley Basin. Imported water is primarily used for agricultural, and municipal and industrial uses within the LPVB. Table 2-4 reports the total volume of imported water supplied by CMWD and Camrosa to the WLPMA and ELPMA of the LPVB for water years 2016 through 2019.

Camrosa Water District (CWD) imports groundwater pumped from the Pleasant Valley Basin (PVB) and Arroyo Santa Rosa Valley Basin (ASRVB) for agricultural and M&I uses within the ELPMA of the LPVB. At the time of reporting, CWD had not provided data characterizing the volume of groundwater pumped in the PVB and ASRVB that was delivered to the LPVB for water years 2016 to 2019. Table 2-4 contains columns with values of "NR" for these components of the imported water supplies, denoting that these data were not provide for LPVB Groundwater Sustainability Plan 2020 annual report.

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

Water Year	CMWD (acre-feet)						CWD [a] (acre-feet)			Total (acre-feet)
	WLPMA		*ELPMA*				*ELPMA*			
	M&I	*Ag*	*M&I*	*Ag*	*ASR Injections [b]*	*Sub-total*	*M&I*	*Ag*	*Sub-total*	
2016	697	762	5,210	1,966	946	9,581	NR	NR	NR	**9,581**
2017	541	372	5,526	1,896	4,066	12,401	NR	NR	NR	**12,401**
2018	1,011	772	6,296	2,298	2,056	12,433	NR	NR	NR	**12,433**
2019	666	384	5,195	1,802	6,814	14,861	NR	NR	NR	**14,861**

Notes: M&I = Municipal and Industrial; Ag = Agriculture; ASR = Aquifer Storage and Recovery; NR = Not Reported
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.

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 water use is reported in Table 2-5 by water year. In order to convert the reported groundwater pumping from calendar year to water year, 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. FCGMA is in the process of switching reporting periods to the water year. When FCGMA groundwater extraction reporting is shifted to a water year schedule, the approximation will no longer be necessary.

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	2,728	5,907	48,318
2017	35,610	69	4,031	765	2,268	6,067	48,810
2018[c]	34,296	72	3,848	897	3,070	7,307	49,490
2019[d]	18,249	37	2,069	823	2,186	5,861	29,225

Notes: Ag = Agriculture; Dom = Domestic; M&I = Municipal and Industrial.

a Imported water is preliminary, pending receipt of data requested from CMD.

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, and 6,814 AF 2019.

c Groundwater extraction reporting for 2018 is preliminary and expected to change. Additional extraction reporting is anticipated.

d Groundwater production is through June for domestic and M&I extractions, and through July 2019 for agricultural extractions.

2.6 Change in Groundwater Storage

Change in storage estimates were calculated in the LPVB by comparing seasonal high groundwater elevations between 2015 and 2019. Annual change in storage was calculated for four water years by comparing groundwater elevations between: (1) spring 2015 and spring 2016, (2) spring 2016 and spring 2017, (3) spring 2017 and spring 2018, and (4) spring 2018 and spring 2019. Change in storage was calculated using the change in groundwater elevation for each period and the aquifer storage properties defined by the Ventura Regional Groundwater Flow numerical model (UWCD, 2018) in the WLPMA and the CMWD numerical groundwater flow model in the ELPMA (CMWD 2018). Due to limited data coverage within the Upper San Pedro, Shallow Alluvial aquifer, Epworth Gravels, and Grimes Canyon aquifer, storage change was only calculated for the Fox Canyon aquifer.

Change in groundwater elevations was calculated by mapping the spring 2015 through spring 2019 groundwater elevation contours onto two uniform grids that covered the areal extent of the WLPMA and ELPMA, separately. Each grid was assigned a groundwater elevation equal to half the elevation of the up-gradient and down-gradient contours. This way the seasonal high groundwater elevation in each grid cell could be subtracted from the previous seasonal high groundwater elevation in the same cell to generate a gridded map of groundwater elevation change on the same scale as the grid used in the Ventura Regional Groundwater Flow numerical model and the groundwater flow model developed for the ELPMA. Change in storage was subsequently calculated for each grid cell using the aquifer properties defined for each grid cell in the two models and the storage change equations presented in Appendix K of the Groundwater Sustainability Plan developed for the Las Posas Valley Basin (FCGMA 2019)

Groundwater elevations were not measured over the same areal extent in each aquifer during the spring of each water year. The data coverage between consecutive water years (color flood) and the common area between all the years (black outline) is shown in Figures 2-42 through 2-47. Change in storage calculated within the common area for all water years is reported in Tables 2-6a and 2-6b.

2.6.1 Fox Canyon Aquifer

Change in groundwater storage in the Fox Canyon aquifer was calculated for 3,200 acres of the 17,400 acres of the WLPMA and 5,100 acres of the 27,200 acres of the ELPMA. Therefore the change in storage estimates below describe storage change for approximately 18% of the WLPMA and 19% of the ELPMA. Between water years 2015 and 2016, groundwater in storage increased in the WLPMA along the Camarillo Hills. Groundwater in storage decreased in the western-central portion of the WLPMA (Figure 2-42). In the ELPMA, groundwater in storage decreased in the central portion of the management area, and increased near Arroyo Las Posas and along the northern margins of the ELPMA (Figure 2-42). Overall, groundwater in storage declined in both the WLPMA and ELPMA between water years 2015 and 2016 (Tables 2-6a and 2-6b).

Between water years 2016 and 2017, groundwater in storage declined across the majority of the WLPMA (Figure 2-43). In the ELPMA, groundwater in storage increased in the central part of the management area. Between spring 2016 and spring 2017, CMWD injected approximately 2,900 AF of water into the central ELPMA as part of their ASR program. Between water years 2016 and 2017, groundwater in storage decreased near Arroyo Las Posas and along the northern margins of the basin boundary (Figure 2-43). Overall, groundwater in storage decreased between water year 2016 and 2017 (Tables 2-6a and 2-6b).

Between water years 2017 and 2018, groundwater in storage declined in the WLPMA along the boundary between the LPVB and Oxnard Subbasin and increased in the eastern portion of the management area (Figure 2-44). During spring 2018, a groundwater elevation of -43.5 ft MSL was measured at 02N21W12H01 in the eastern WLPMA; this well was not measured during spring 2017. The estimated change in groundwater storage in this region is likely an artifact of well 02N21W12H01 not being measured in consecutive water years. In the ELPMA, the change in groundwater in storage was variable in the central part of the management area, while groundwater in storage declined in the western and northern parts of the ELPMA (Figure 2-44).

Between water years 2018 and 2019, groundwater in storage either increased or did not change along the boundary between the Oxnard Subbasin and WLPMA, and decreased in the eastern portion of the WLPMA. This location of groundwater in storage declines also corresponds to the location of well 02N21W12H01, which was not measured in spring 2019. In the northern ELPMA, groundwater in storage decreased while it increased near Arroyo Las Posas (Figure 2-45). Overall, groundwater in storage declined between water years 2018 and 2019.

The change in groundwater storage in the Fox Canyon aquifer is reported by management area in Tables 2-6a and Table 2-6b, and compared to groundwater production in each management area in Figures 2-46 through 2-49. Neither annual nor cumulative changes in groundwater storage correspond to water year types (Tables 2-6a and 2-6b; Figures 2-46 through 2-49). Based on the available data, groundwater storage declined at similar rates in 2016 (dry water year) and 2017 (above normal water year). However, it should be noted that (1) the change in storage volumes reported in Tables 2-6a and 2-6b are an approximate change in storage over the areas of the aquifer in which groundwater elevations were measured and (2) the change in storage volumes reported include ASR injections between 2016 and 2019.

Annual and cumulative change in storage from 1985 through 2015 were reported in the GSP (FCGMA 2019). The change in storage volumes reported in the GSP were extracted from UWCD and CMWD model calculations and covered the entire lateral extent of the LPVB for each principal aquifer. Therefore, the results of the long-term change in storage calculations presented in the GSP cannot be directly compared to the change in storage estimates in the annual report.

Table 2-6a. Annual Change in Storage (Acre-feet) in the Fox Canyon Aquifer in the LPVB for the Area with Water Level Measurements

Water Year	Water Year Type	LPVB		
		WLPMA	*ELPMA*	*Total*
2016	Dry	-705	-861	-1,566
2017	Above Normal	-596	-914	-1,510
2018	Dry	-36	-35	-71
2019	Above Normal	-38	-621	-659

Notes: ELPMA change in storage includes ASR injections in 2016 through 2019.

Table 2-6b. Cumulative Change in Storage (Acre-feet) in the Fox Canyon Aquifer in the LPVB for the Area with Water Level Measurements

Water Year	Water Year Type	LPVB		
		WLPMA	*ELPMA*	*Total*
2016	Dry	-705	-861	-1,566
2017	Above Normal	-1,301	-1,774	-3,076
2018	Dry	-1,338	-1,809	-3,147
2019	Above Normal	-1,376	-2,430	-3,806

Notes: ELPMA change in storage includes ASR injections in 2016 through 2019.

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3 GSP Implementation Progress

The GSP for the LPVB was submitted to DWR in January 2020. This is the first annual report to be prepared since the GSP was submitted. The GSP implementation progress reported in this report covers work begun during development of the GSP as well as work that has been conducted over the three months since the GSP was submitted.

During development of the GSP, FCGMA identified critical areas in which aquifer specific water levels were lacking. One of these areas is northern Pleasant Valley, adjacent to the boundary between the PVB and the ELPMA. This is an area where subsurface flows between the two basins are poorly constrained. DWR, through the Technical Support Services Program, installed two new nested monitoring wells in northern PVB in 2019 (FCGMA 2020). 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 will be incorporated into future annual reports, to better represent groundwater conditions at the boundary between the LPVB and PVB.

The GSP identified several areas in which additional work needed to be conducted over the next 20 years. These areas include filling spatial and temporal data gaps, conducting basin optimization studies, developing project feasibility studies, updating the numerical groundwater model, and revising the existing data management system. Since submittal of the GSP, FCGMA has begun to develop a post-GSP work-plan that will guide the implementation of the GSP and help ensure that the LPVB is managed sustainably within the next 20 years. Critical to the success of this effort is stakeholder feedback. FCGMA successfully requested stakeholder facilitation services through DWR's Facilitation Support Services program to support implementation of the GSP. The FCGMA Board of Directors continues to prioritize stakeholder feedback in the implementation phase of the GSP because of the vital role stakeholders play in ensuring the long-term sustainable use of groundwater resources in the LPVB.

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4 References

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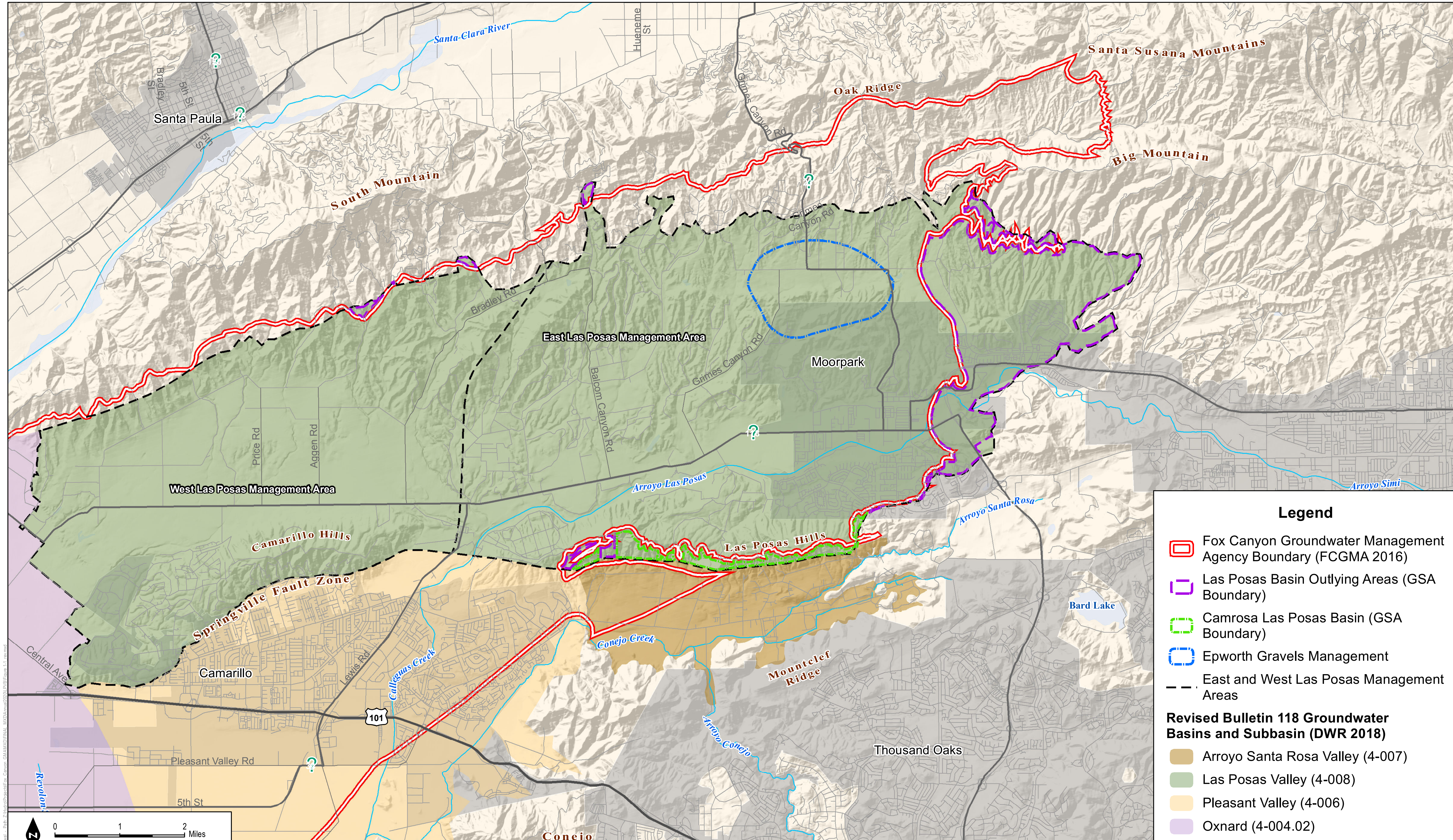
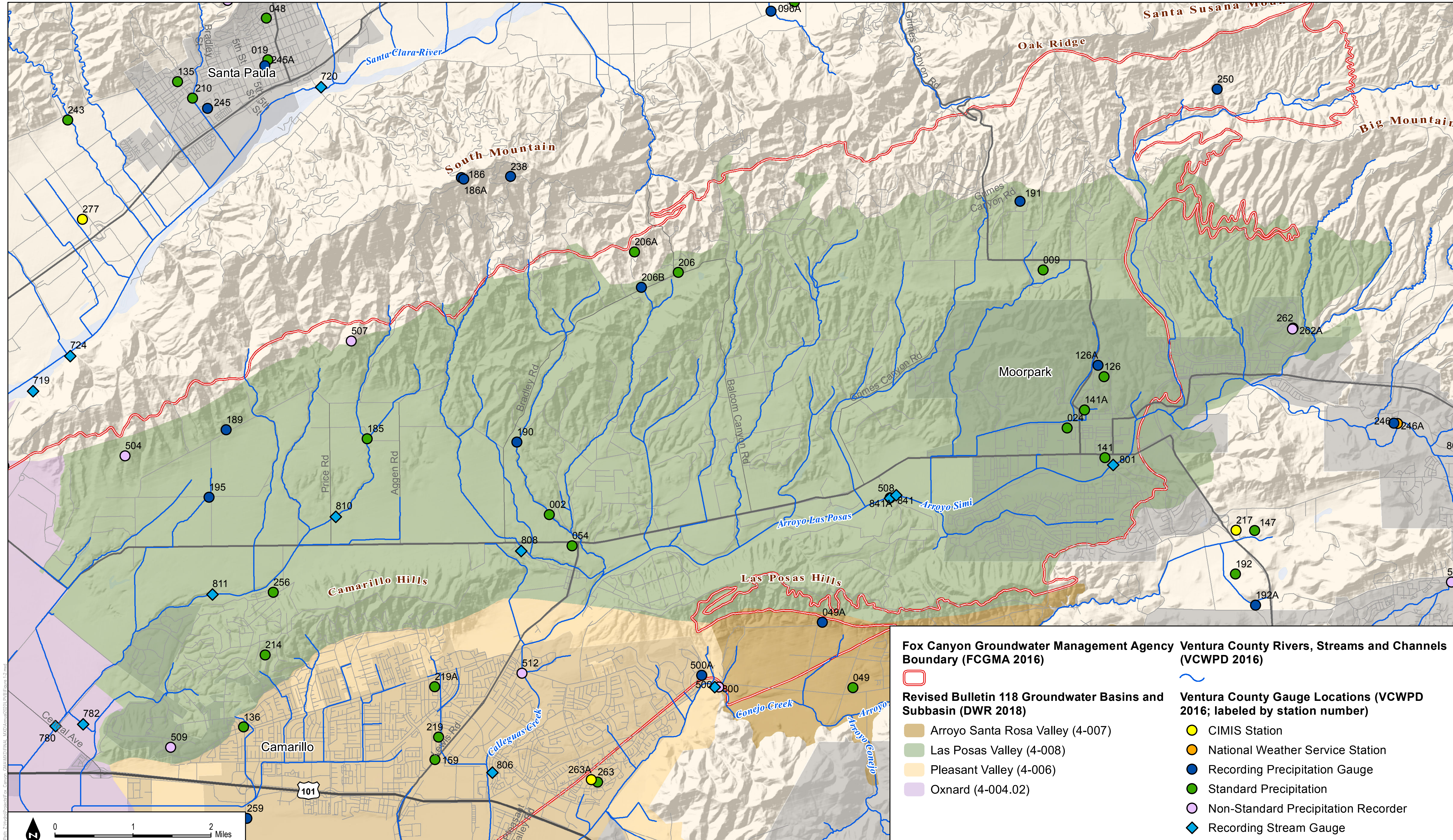


DUDEK

SOURCE: DWR; Ventura County

FIGURE 1-1

Vicinity Map for the Las Posas Valley Basin



SOURCE: DWR; Ventura County; VCWPD

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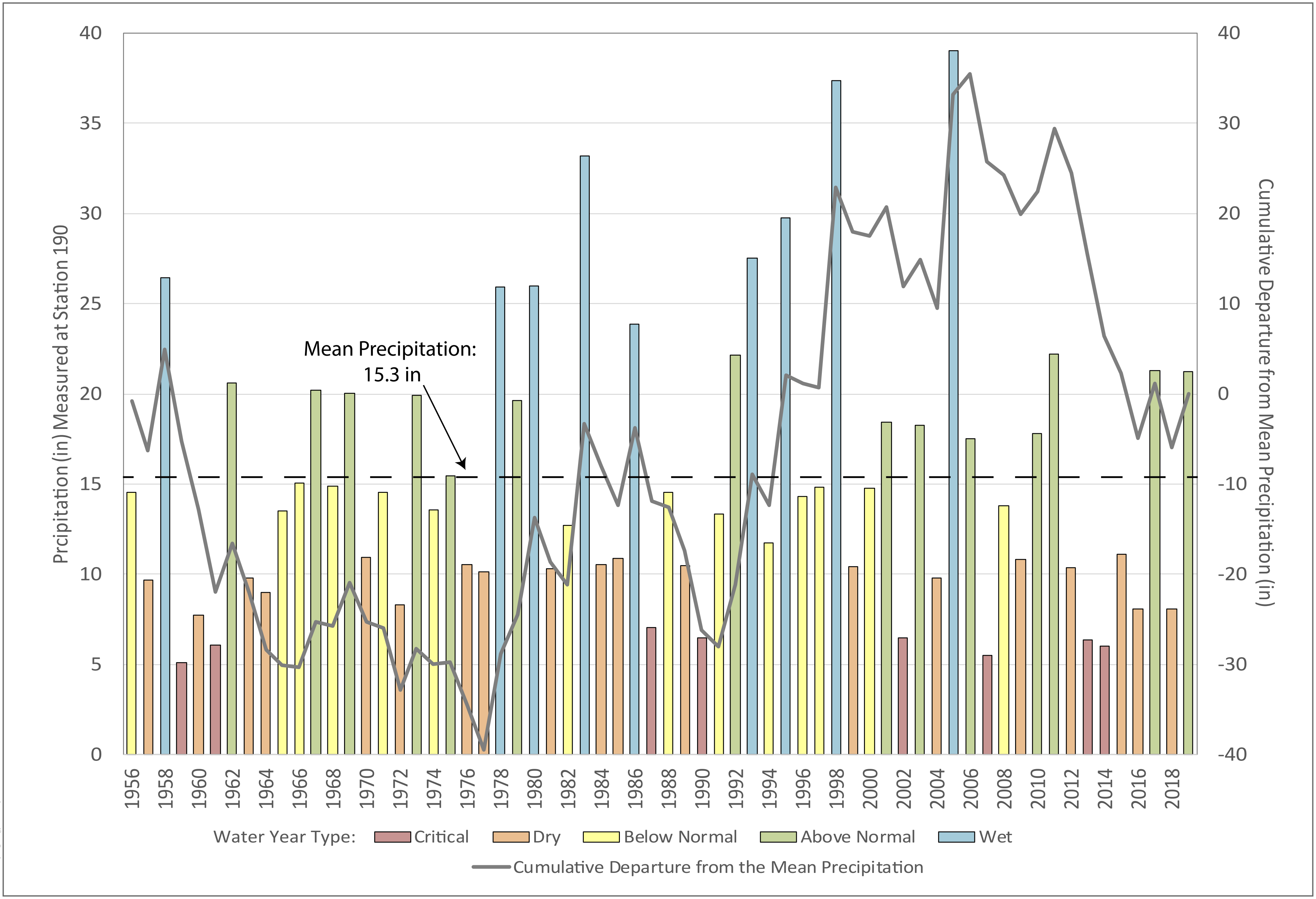
FIGURE 1-2

Precipitation and Stream Gauges in the Las Posas Valley Basin



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)

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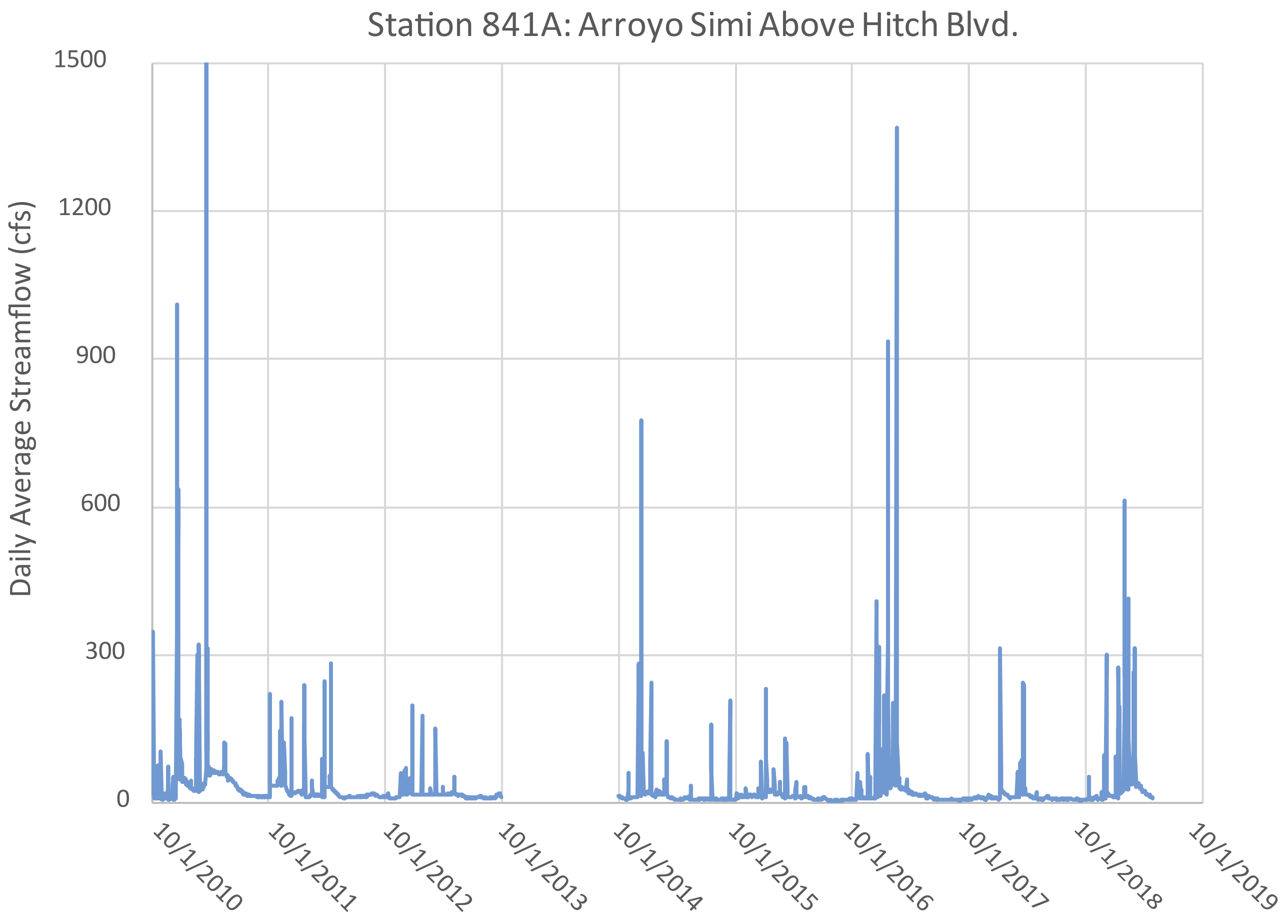
FIGURE 1-3
Las Posas Valley Basin Historical Water Year Precipitation



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

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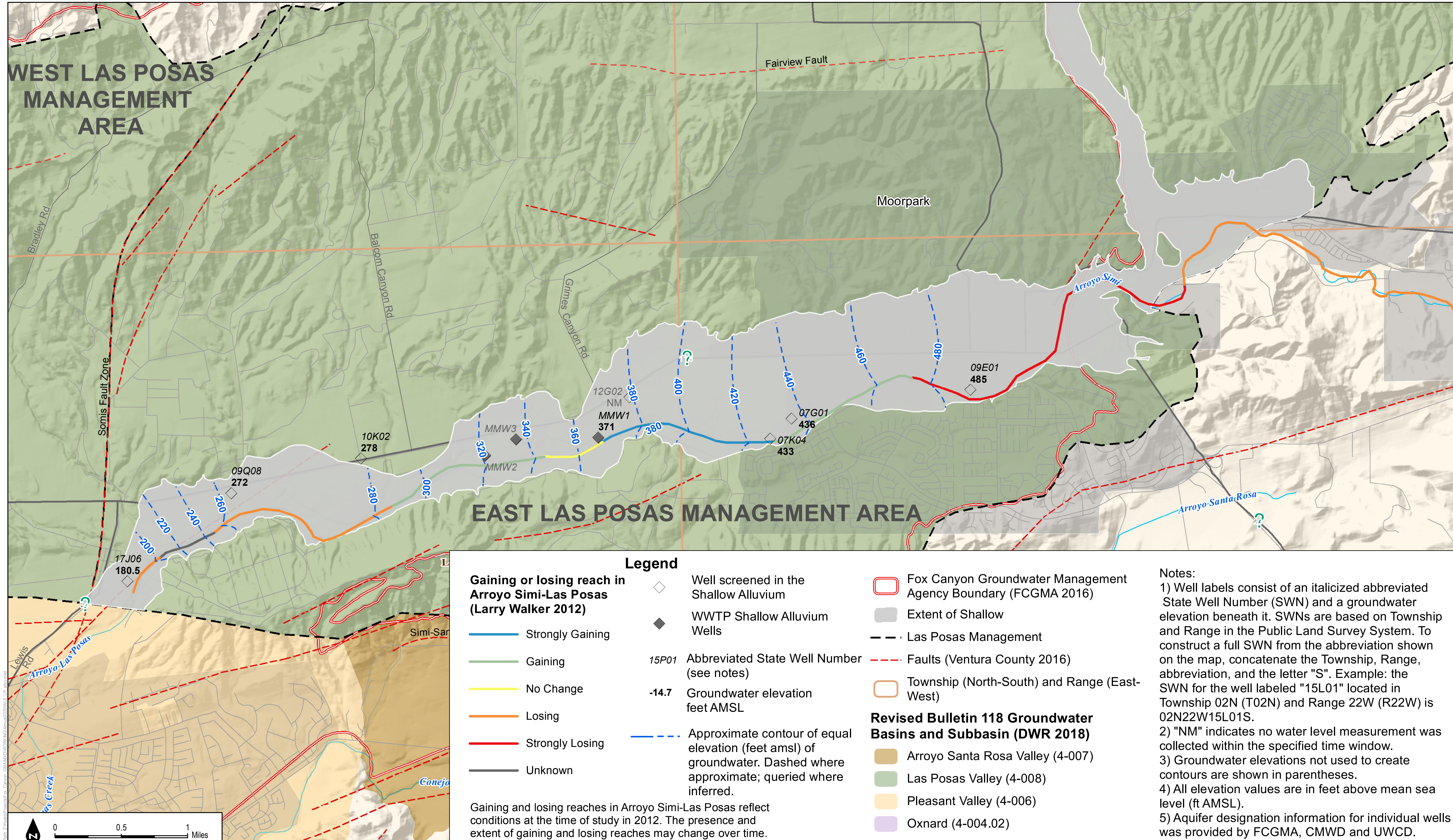

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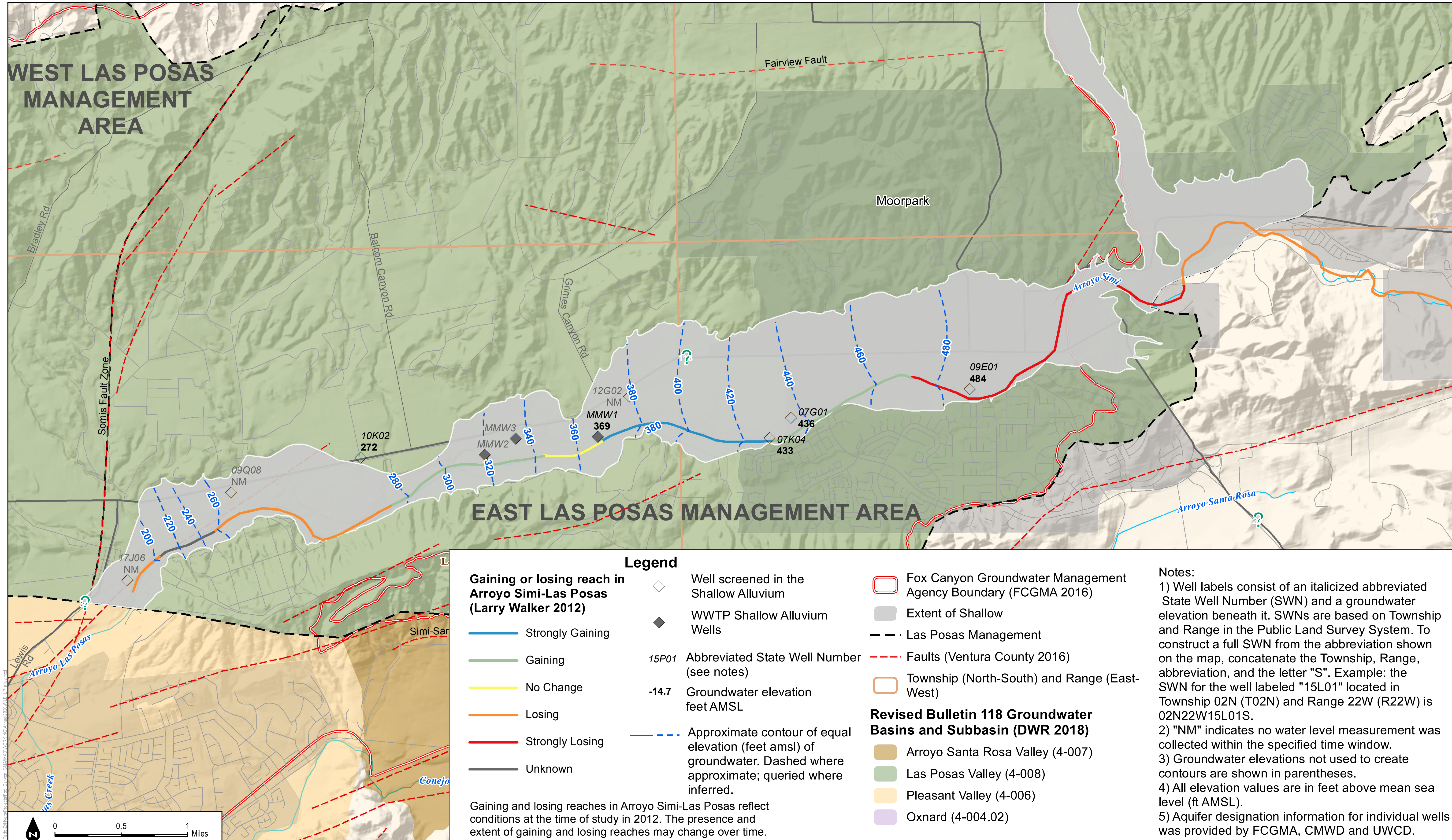
SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-1

Groundwater Elevation Contours in the Shallow Alluvial Aquifer, March 2-29, 2016

Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report



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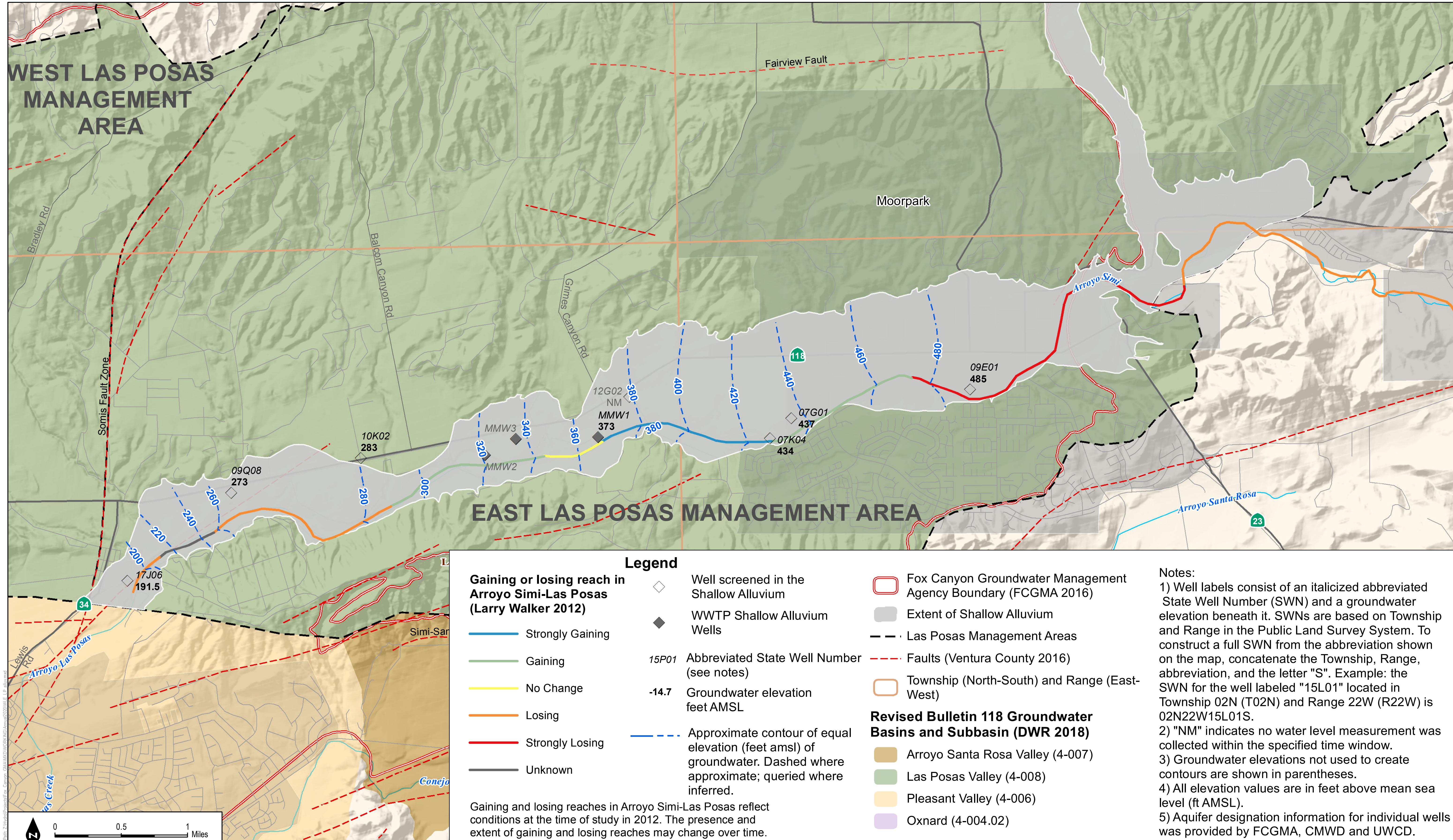
SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-2

Groundwater Elevation Contours in the Shallow Alluvial Aquifer, October 2-29, 2016



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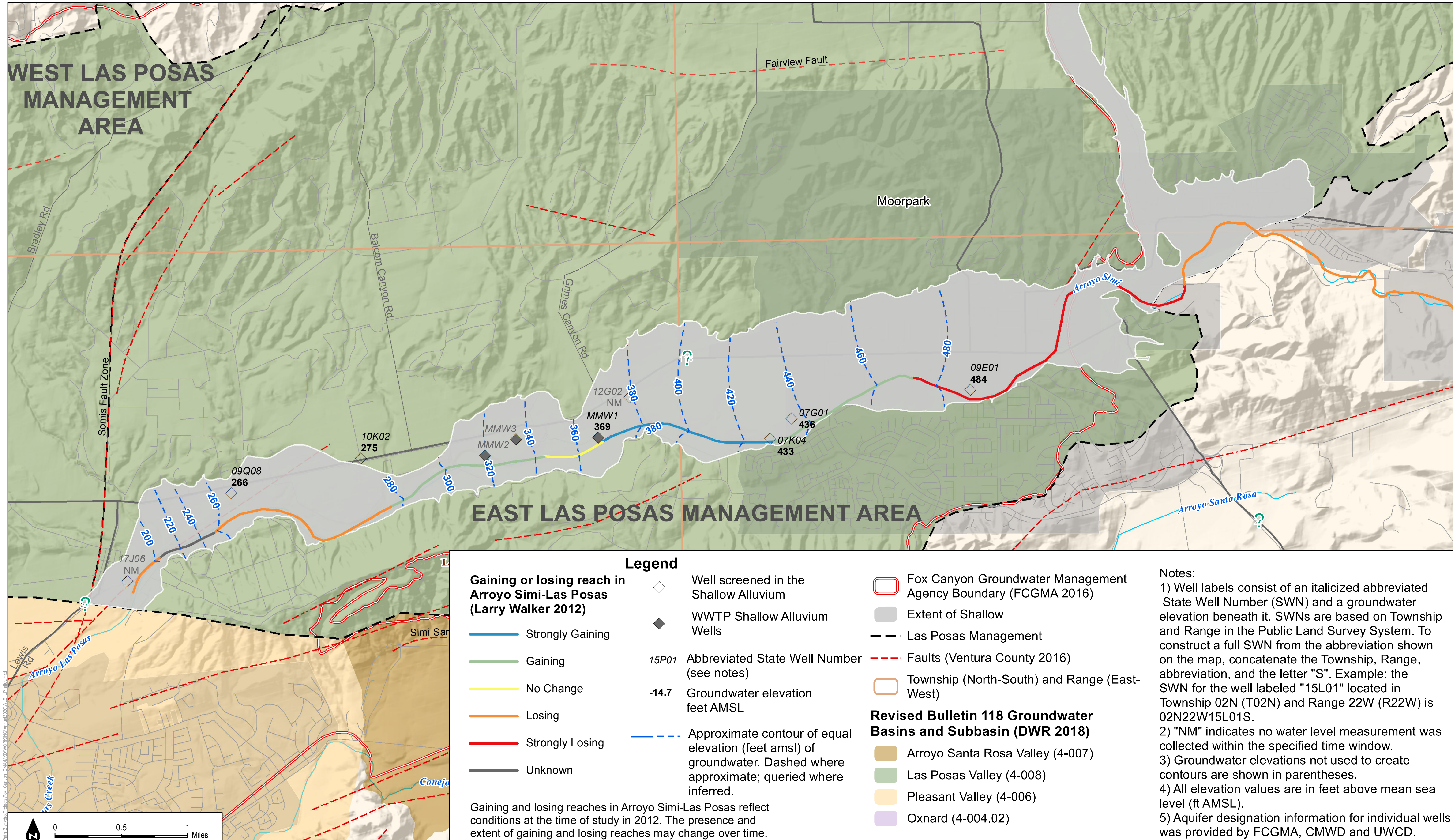
SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-3

Groundwater Elevation Contours in the Shallow Alluvial Crime, March 2-29, 2017

Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report



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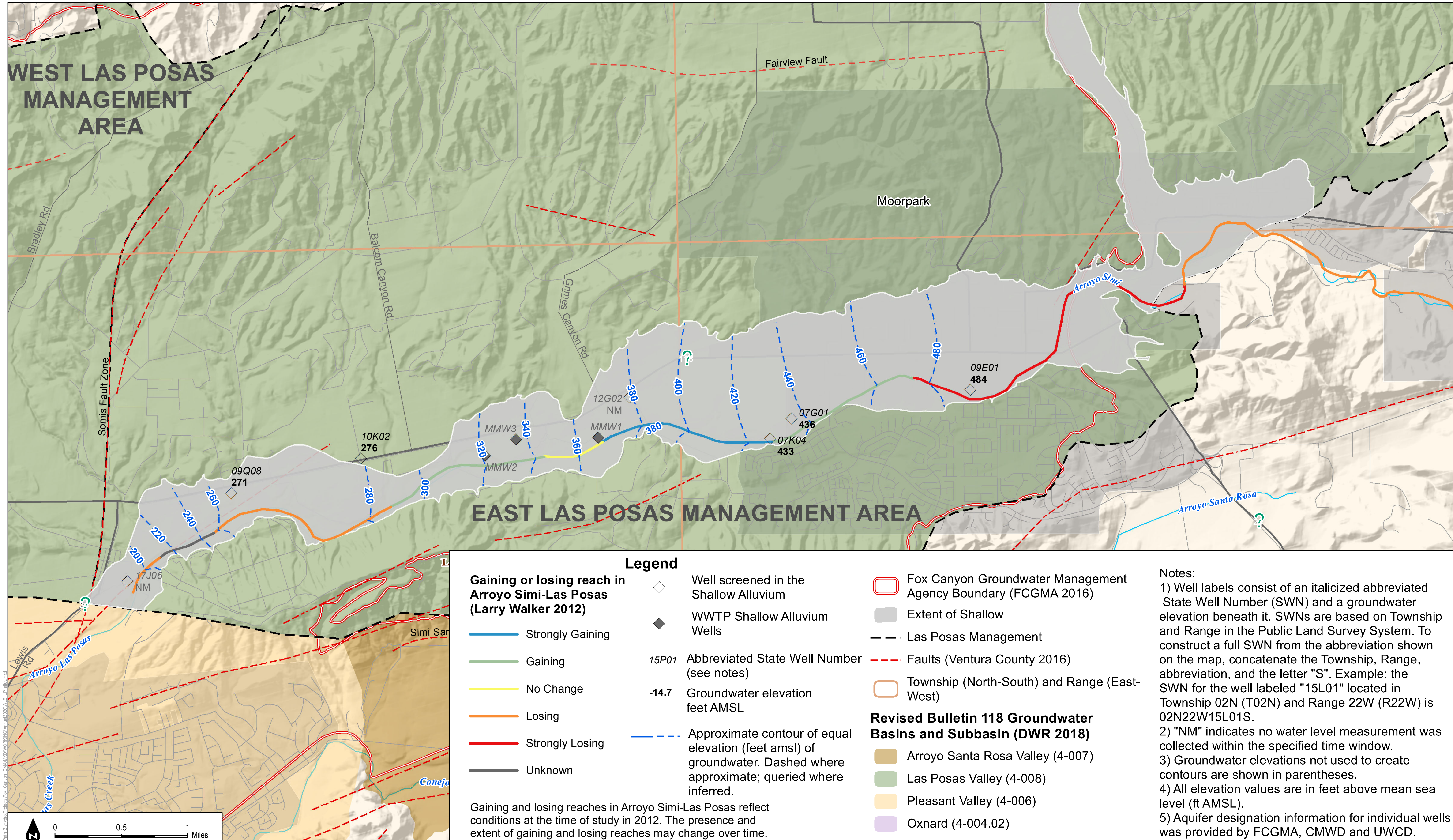
SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-4

Groundwater Elevation Contours in the Shallow Alluvial Aquifer, October 2-29, 2017



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-5

Groundwater Elevation Contours in the Shallow Alluvial Aquifer, March 2-29, 2018

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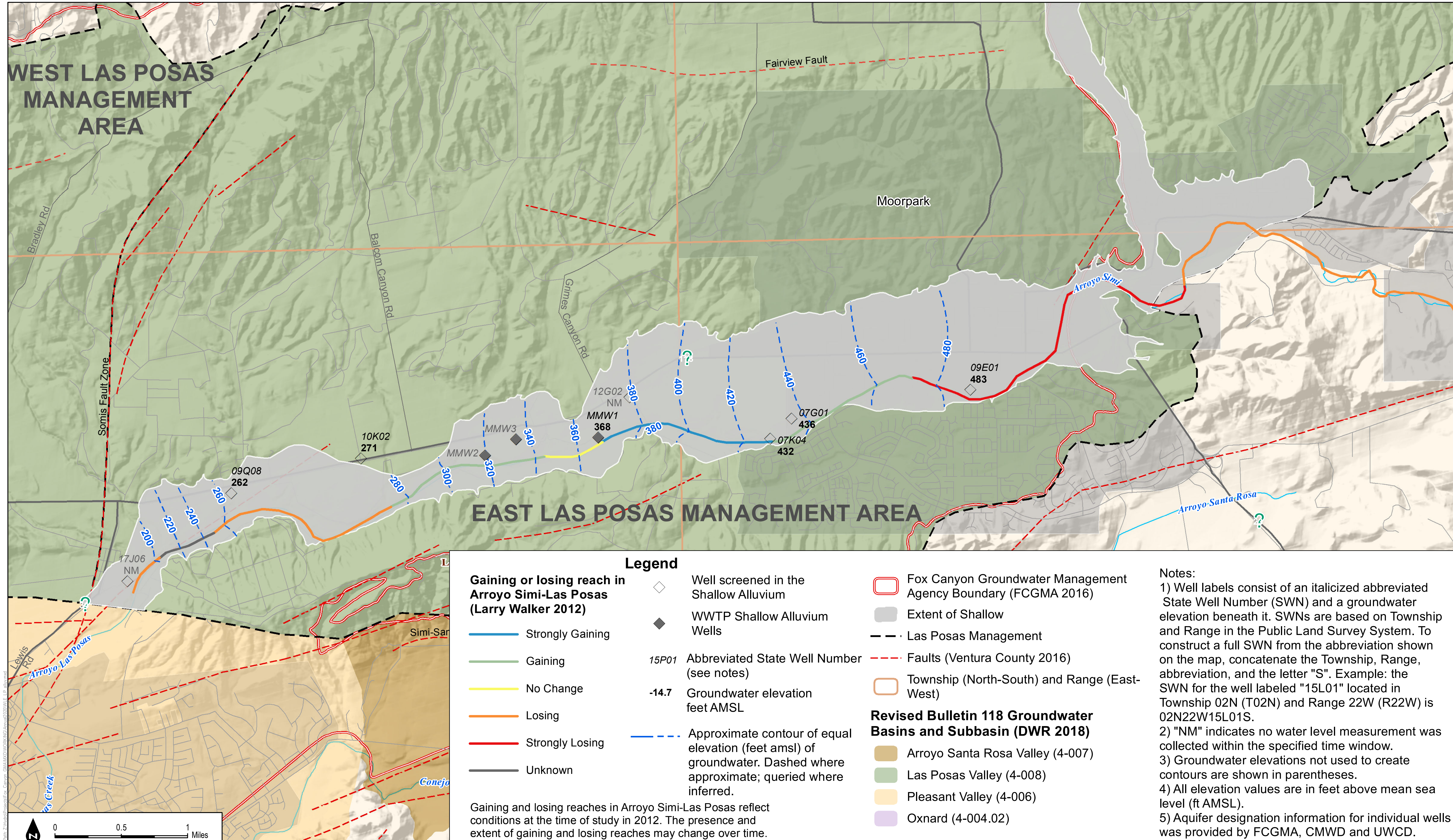
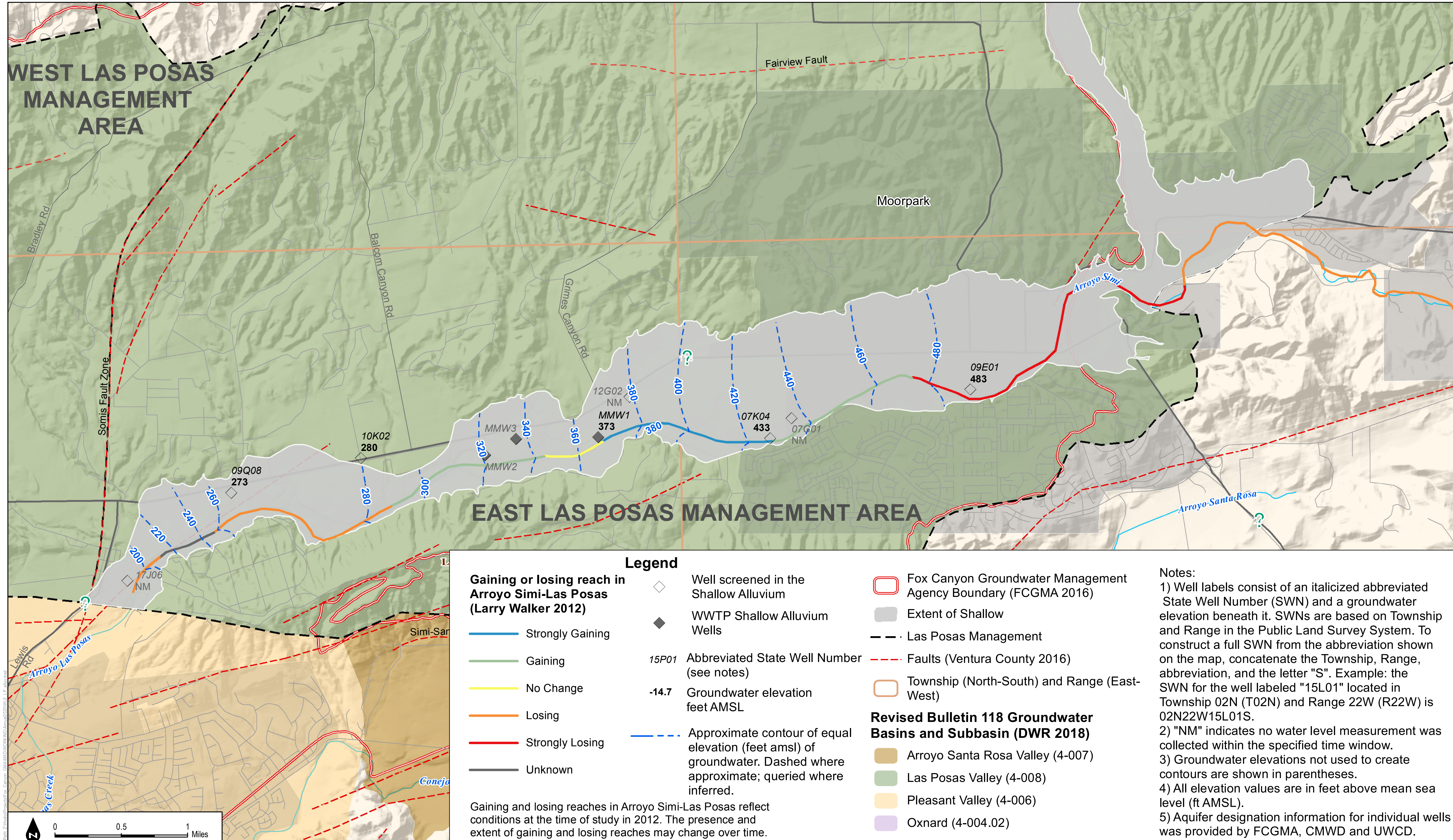


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-6

Groundwater Elevation Contours in the Shallow Alluvial Aquifer, October 2-29, 2018

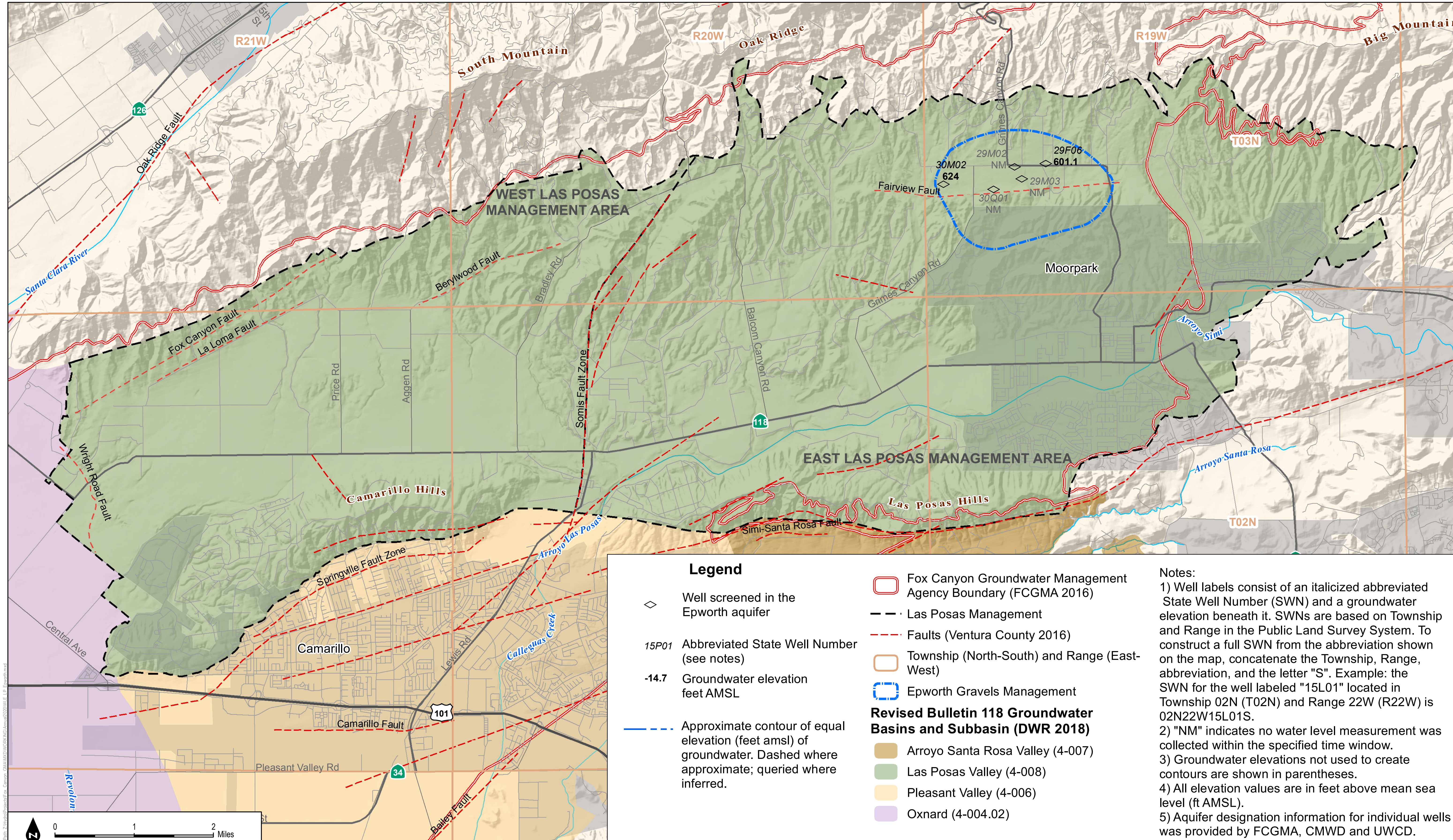


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-7

Groundwater Elevation Contours in the Shallow Alluvial Aquifer, March 2-29, 2019



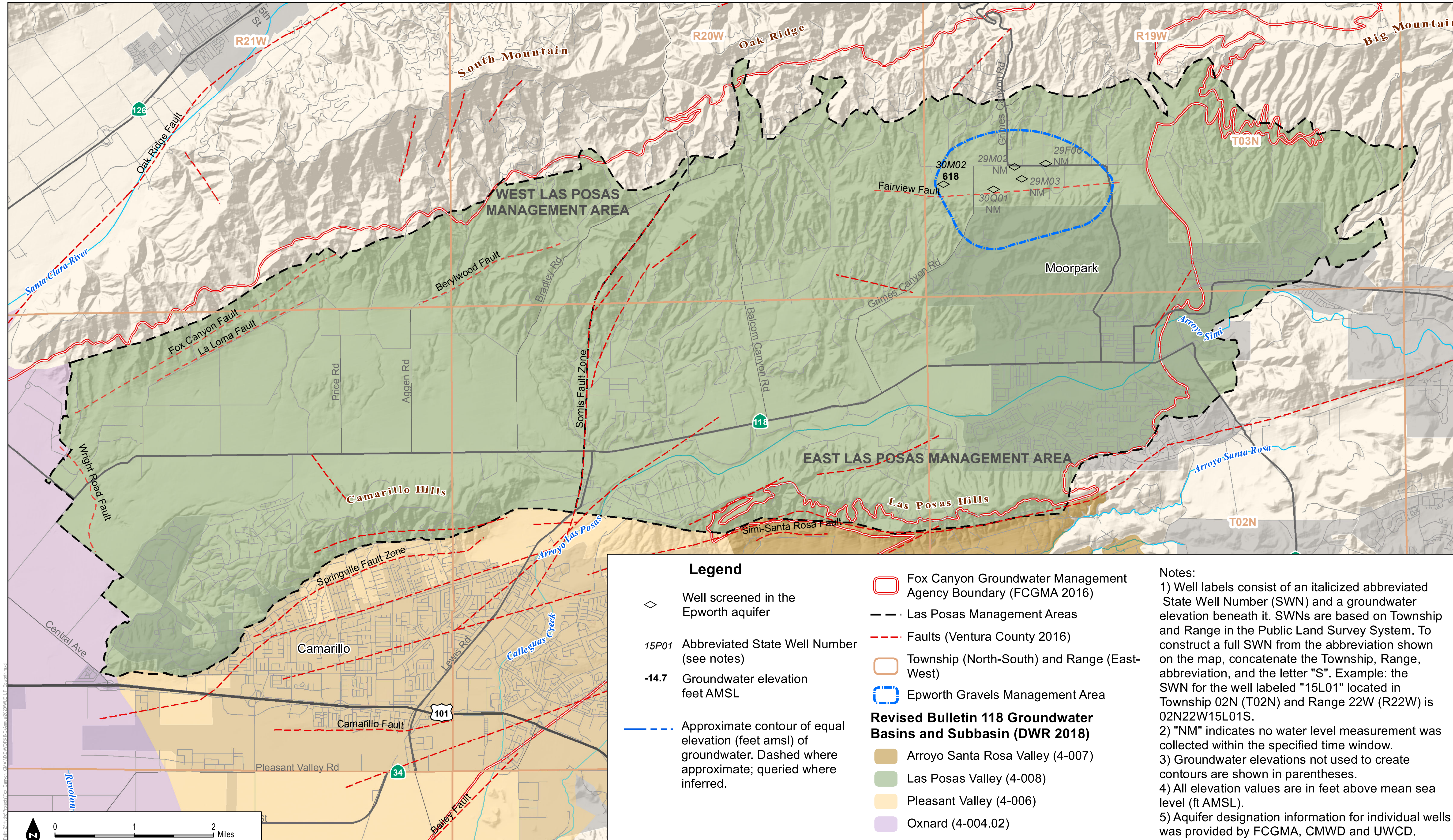
DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-8

Groundwater Elevation Contours in the Epworth Gravels Aquifer, March 2-29, 2016

Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report

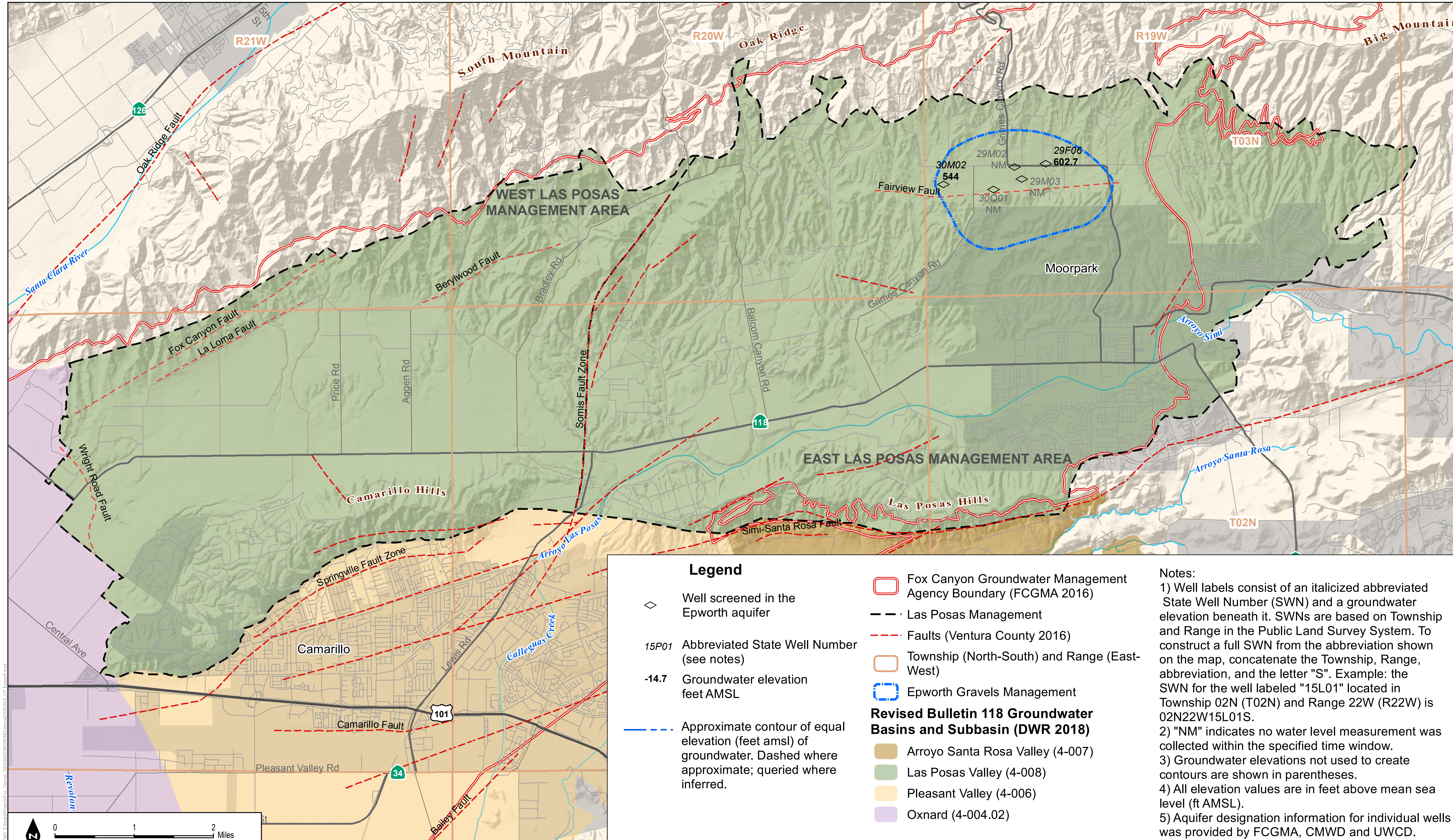


SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-9

Groundwater Elevation Contours in the Epworth Gravels Aquifer, October 2-29, 2016

DUDEK

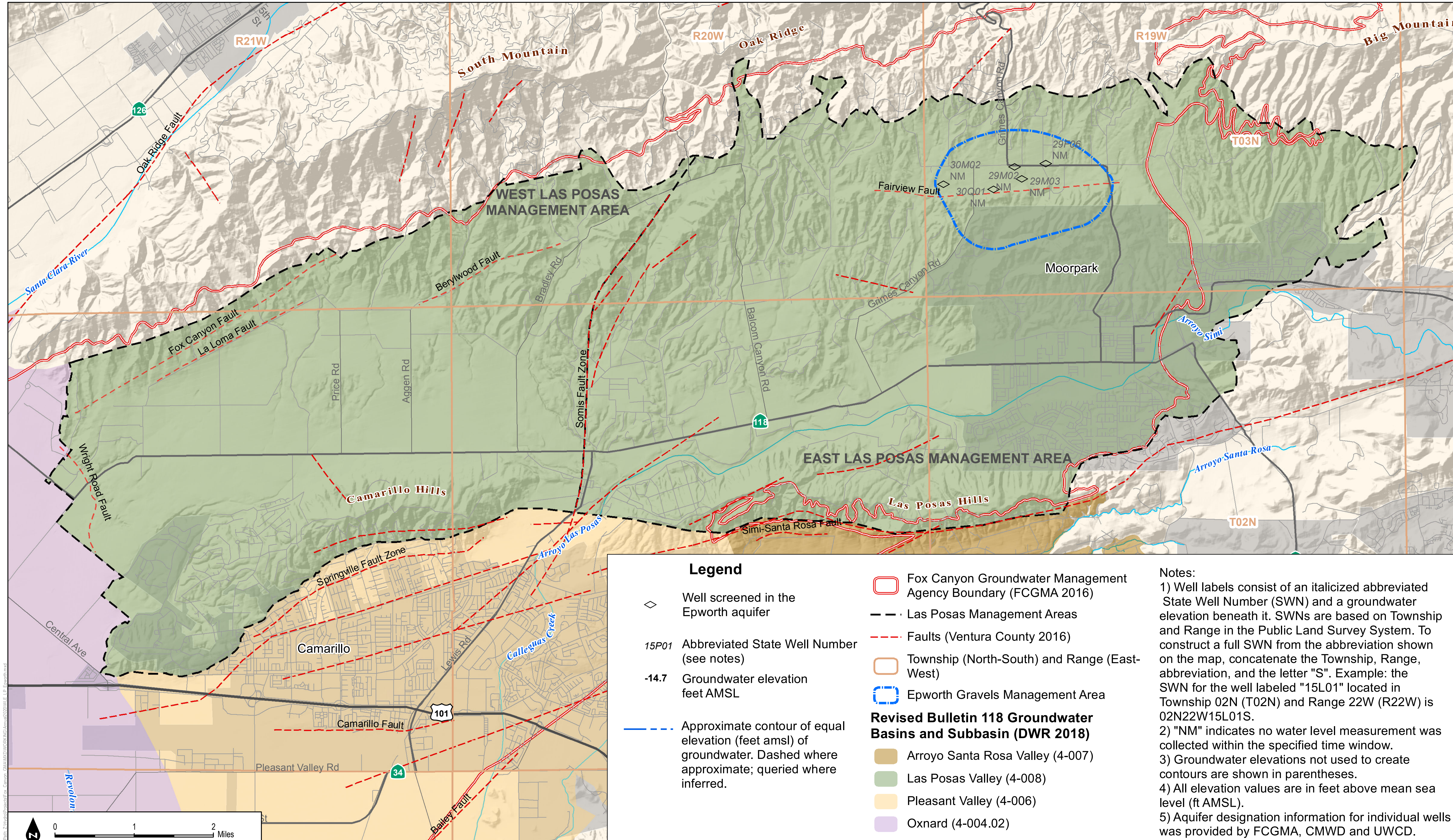


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-10

Groundwater Elevation Contours in the Epworth Gravels Aquifer, March 2-29, 2017



Legend

- ◇ Well screened in the Epworth aquifer
- *15P01* Abbreviated State Well Number (see notes)
- -14.7 Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) 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 2018)

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

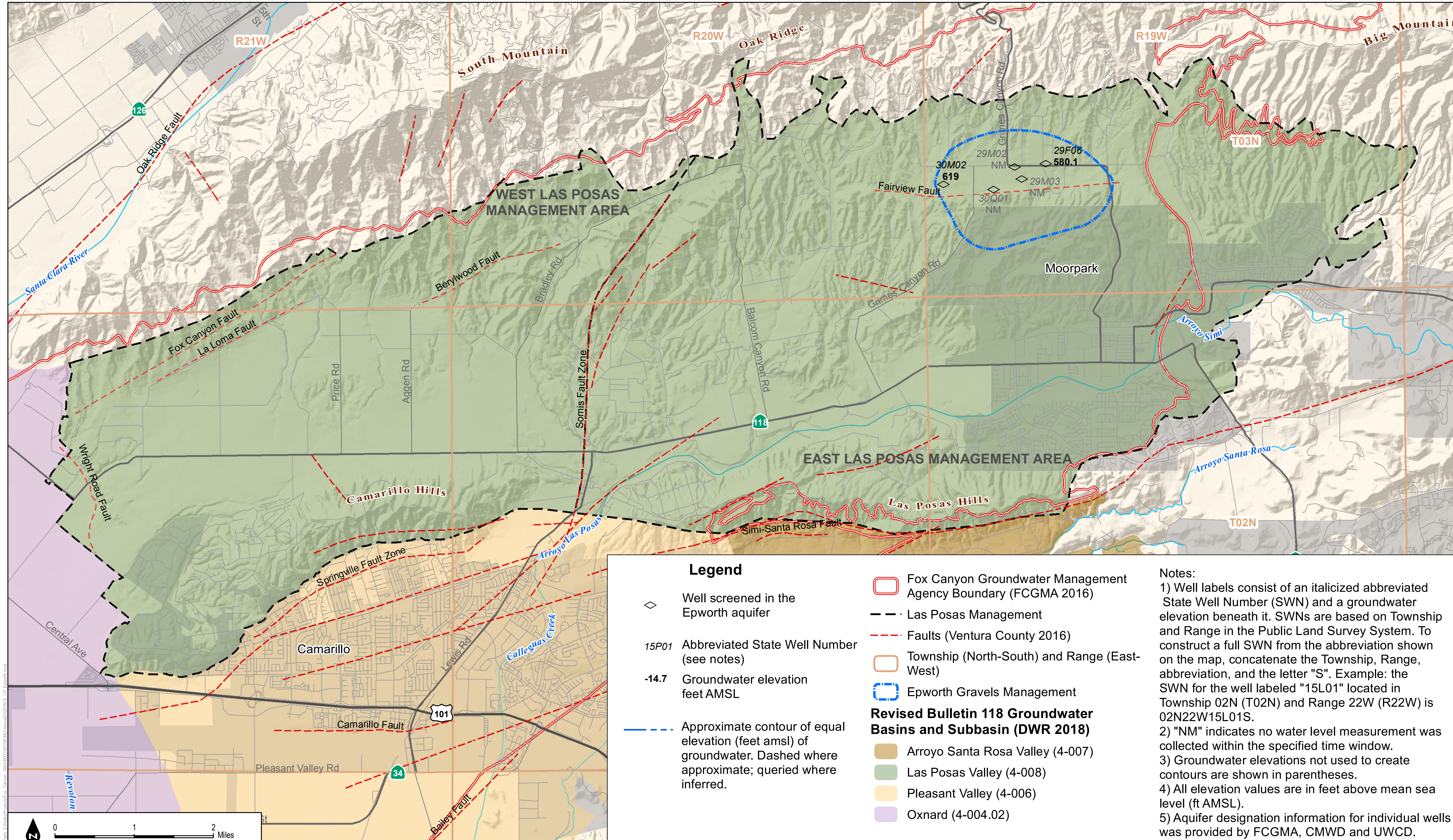
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, 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 above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-11

Groundwater Elevation Contours in the Epworth Gravels Aquifer, October 2-29, 2017



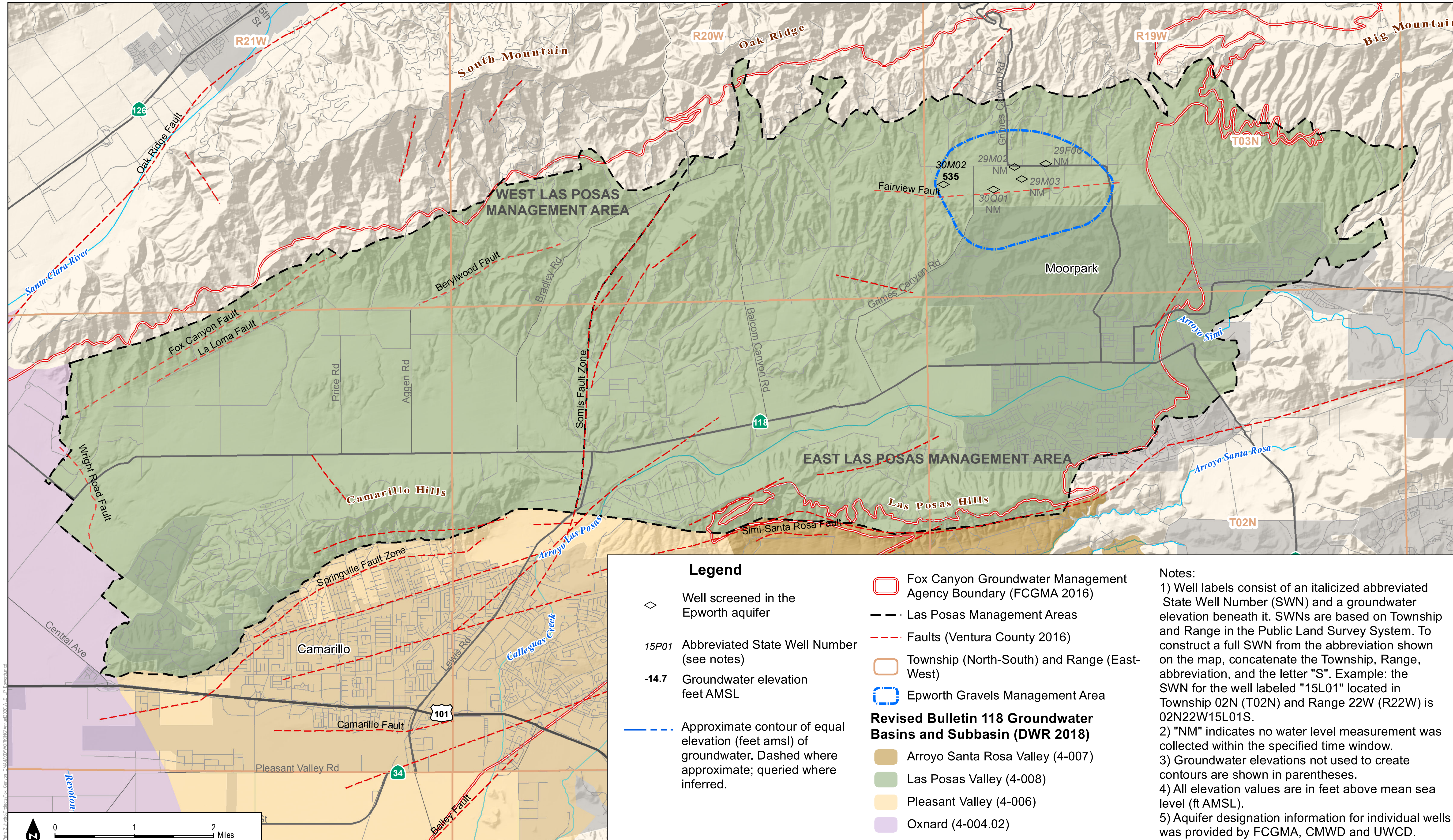
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, 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 above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-12

Groundwater Elevation Contours in the Epworth Gravels Aquifer, March 2-29, 2018

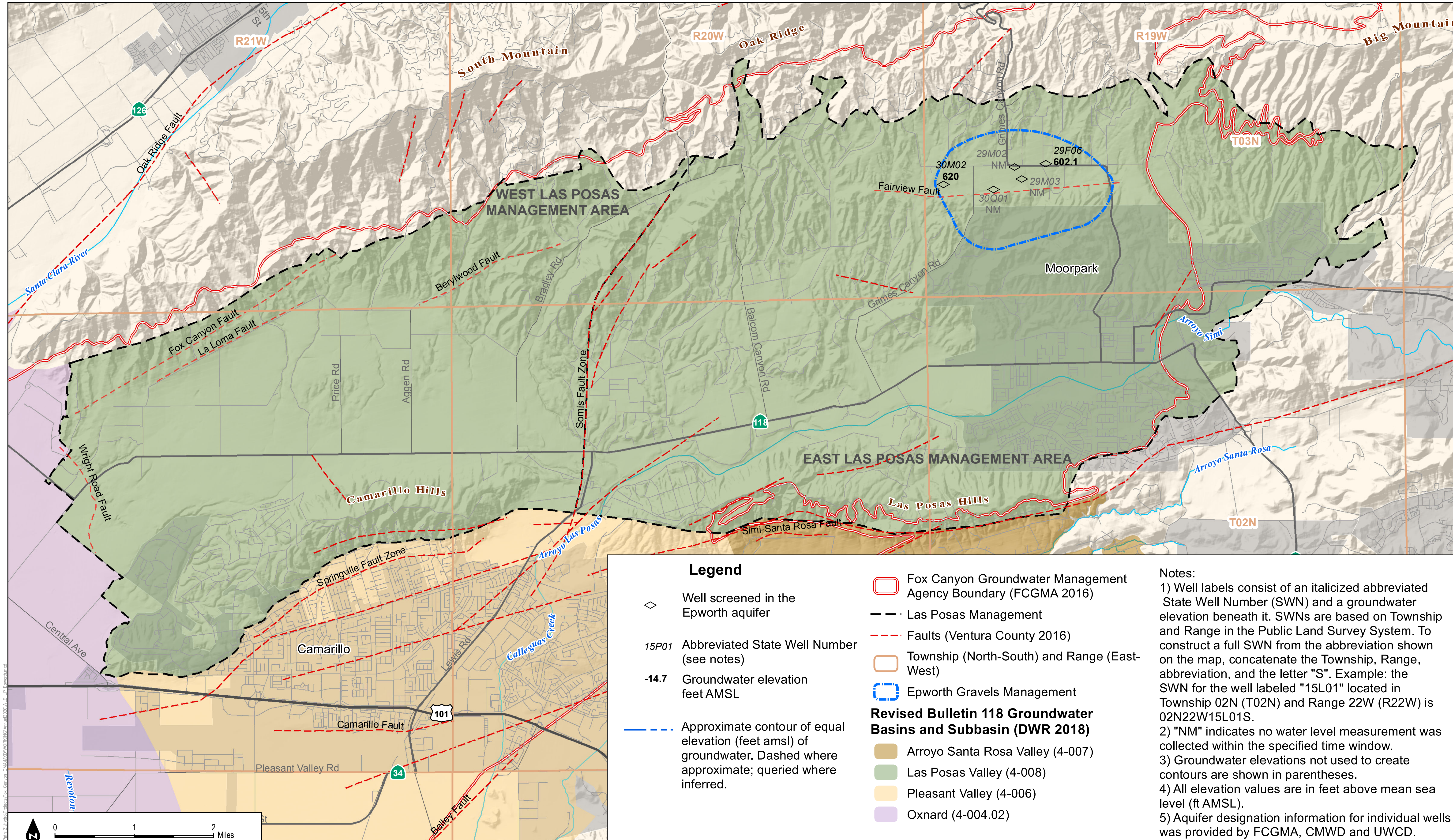


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-13

Groundwater Elevation Contours in the Epworth Gravels Aquifer, October 2-29, 2018

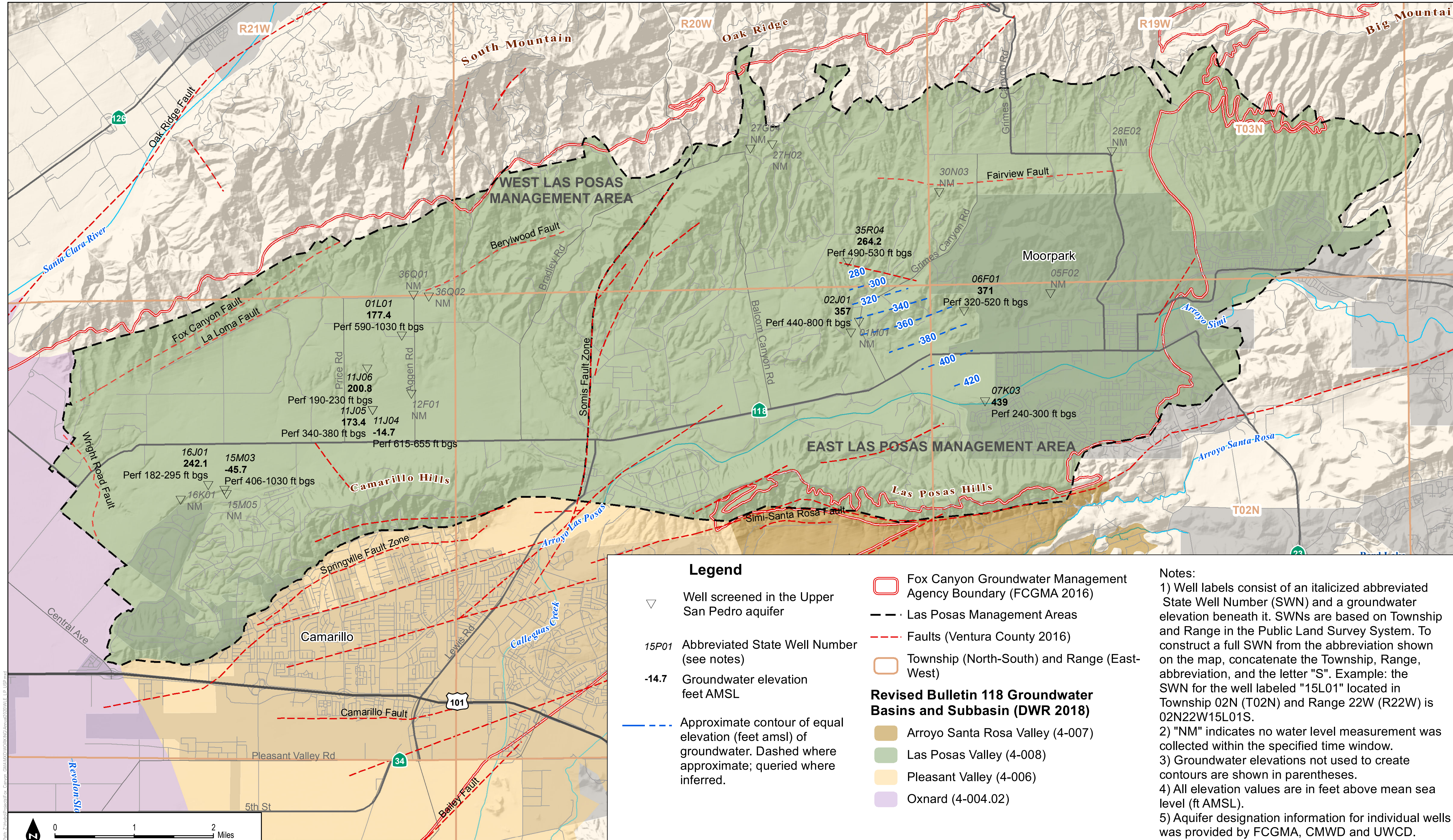


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-14

Groundwater Elevation Contours in the Epworth Gravels Aquifer, March 2-29, 2019



Legend

- Well screened in the Upper San Pedro aquifer
- *15P01* Abbreviated State Well Number (see notes)
- **-14.7** Groundwater elevation feet AMSL
- Approximate contour of equal elevation (feet amsl) 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 2018)

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

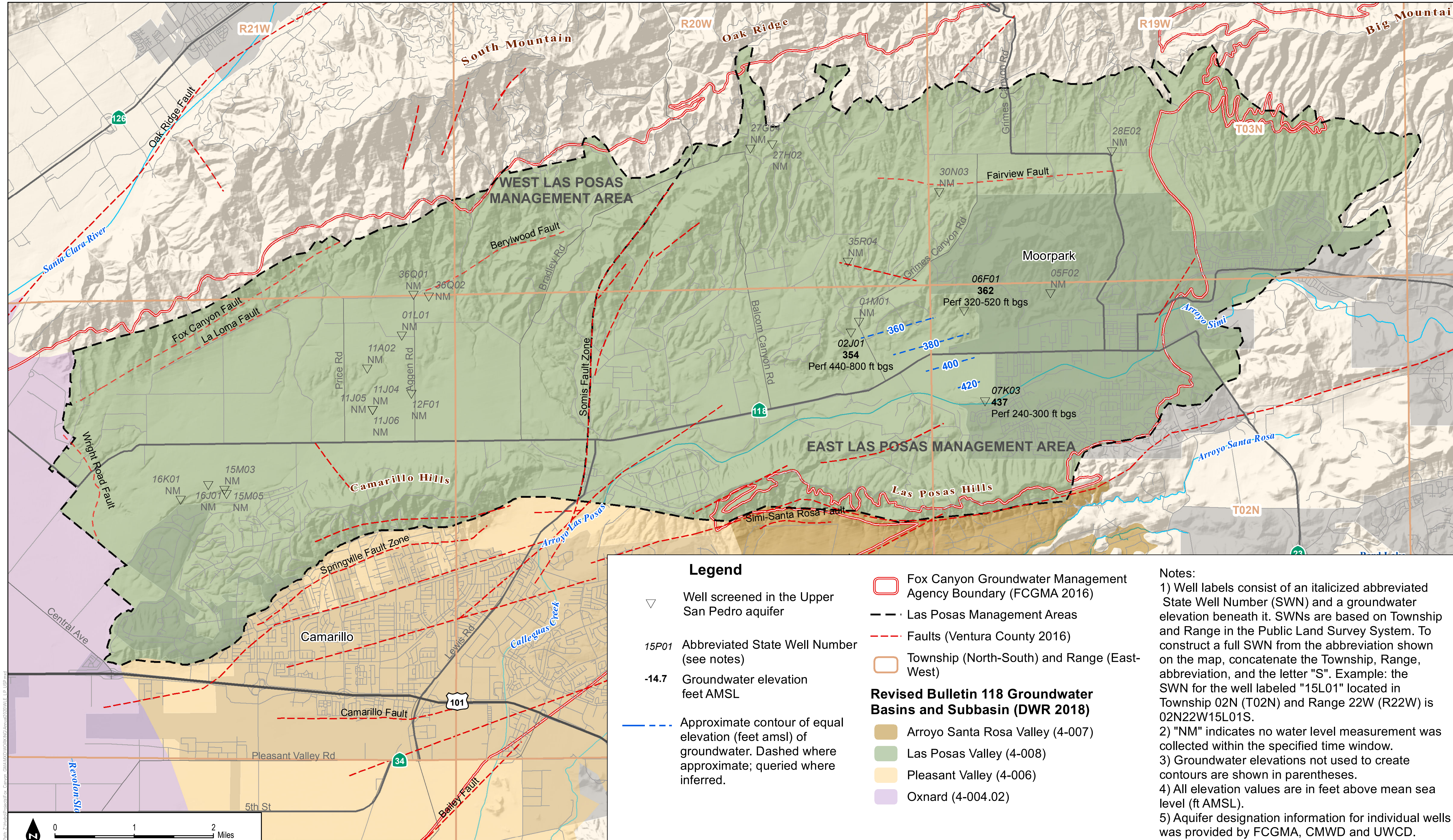
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, 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 above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-15

Groundwater Elevation Contours in the Upper San Pedro Formation, March 2-29, 2016

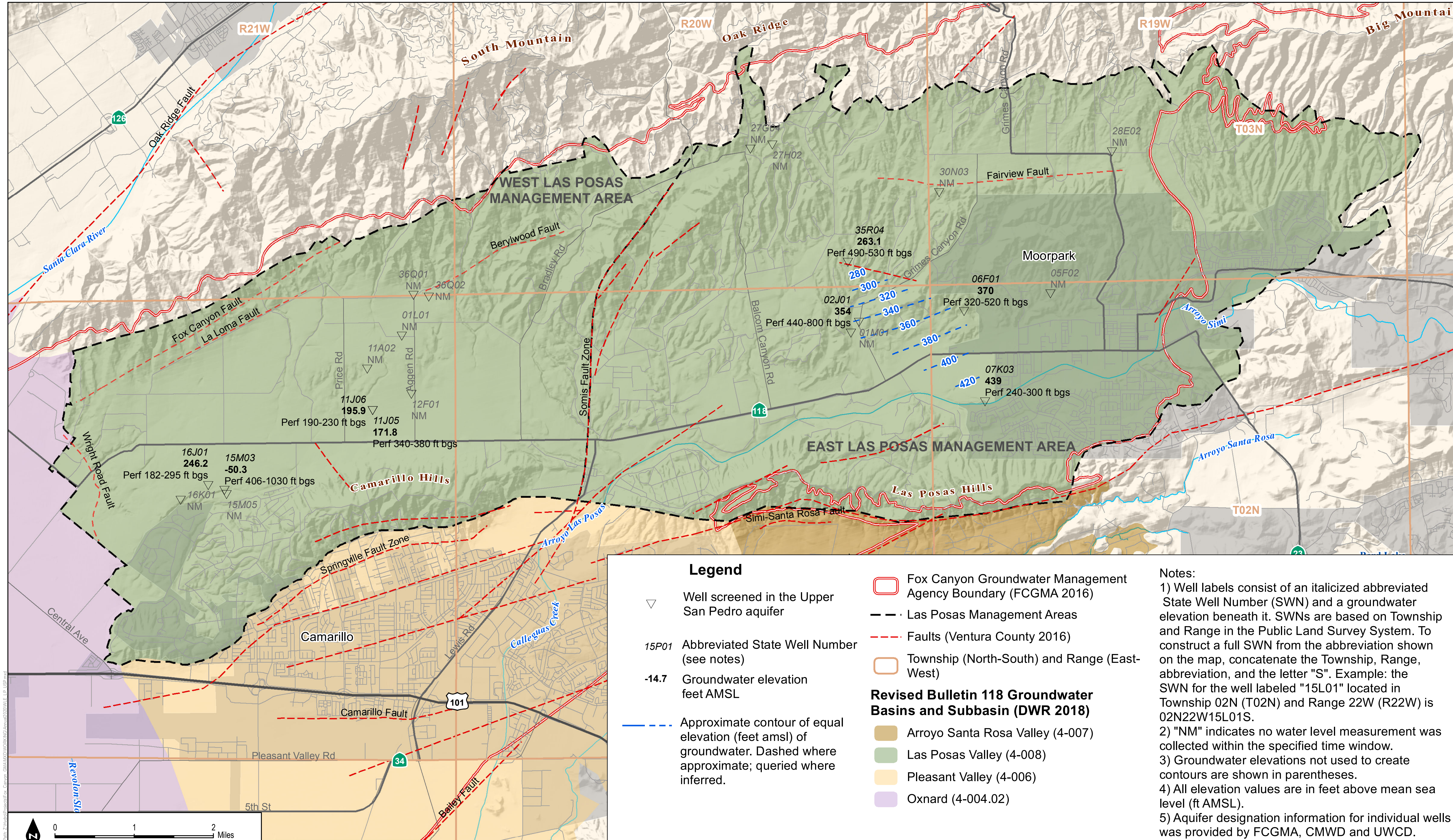


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-16

Groundwater Elevation Contours in the Upper San Pedro Formation, October 2-29, 2016

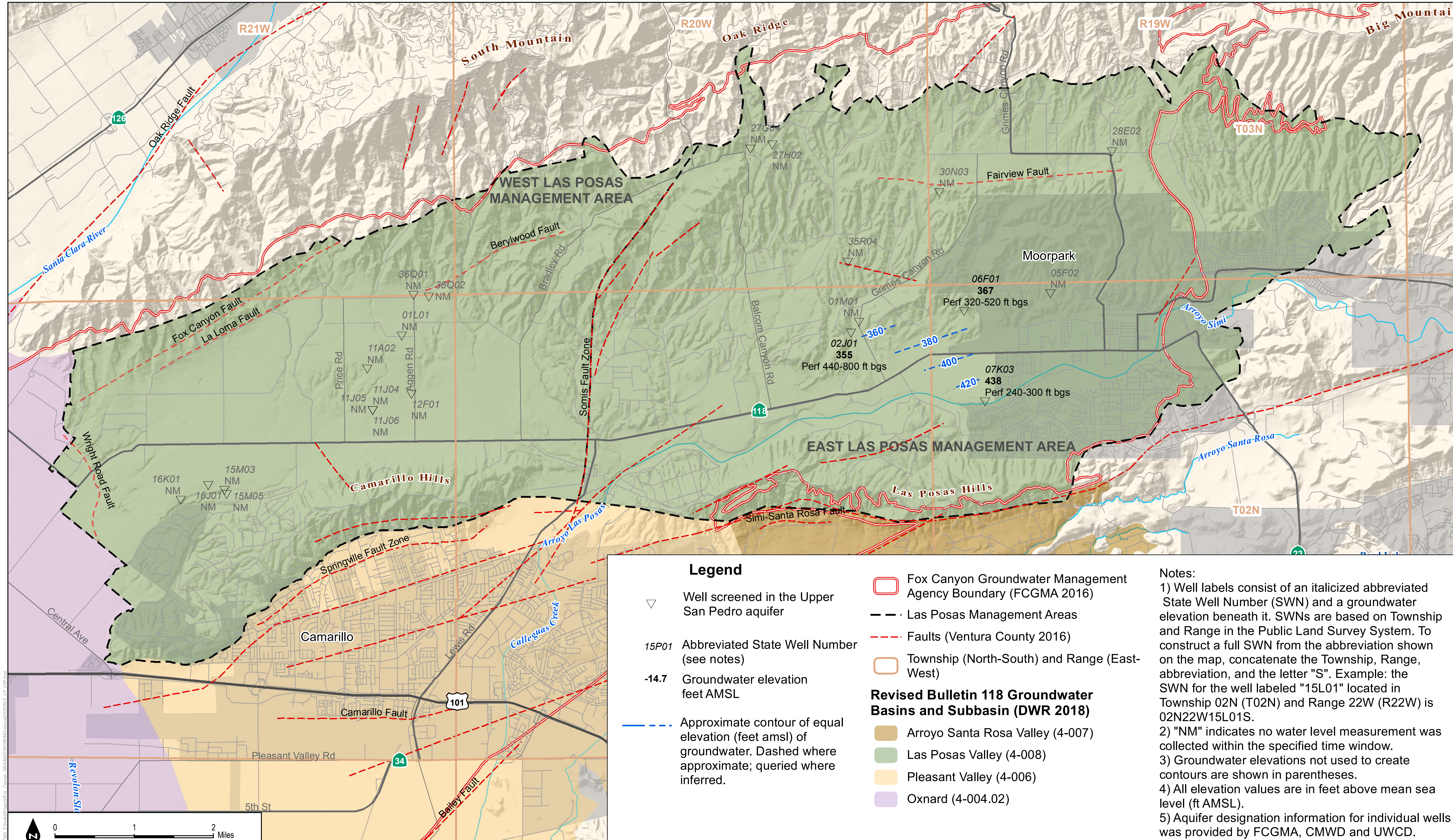


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-17

Groundwater Elevation Contours in the Upper San Pedro Formation, March 2-29, 2017



Legend

Well screened in the Upper San Pedro aquifer

15P01 Abbreviated State Well Number (see notes)

-14.7 Groundwater elevation feet AMSL

Approximate contour of equal elevation (feet amsl) 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 2018)

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 above mean sea level (ft AMSL).

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

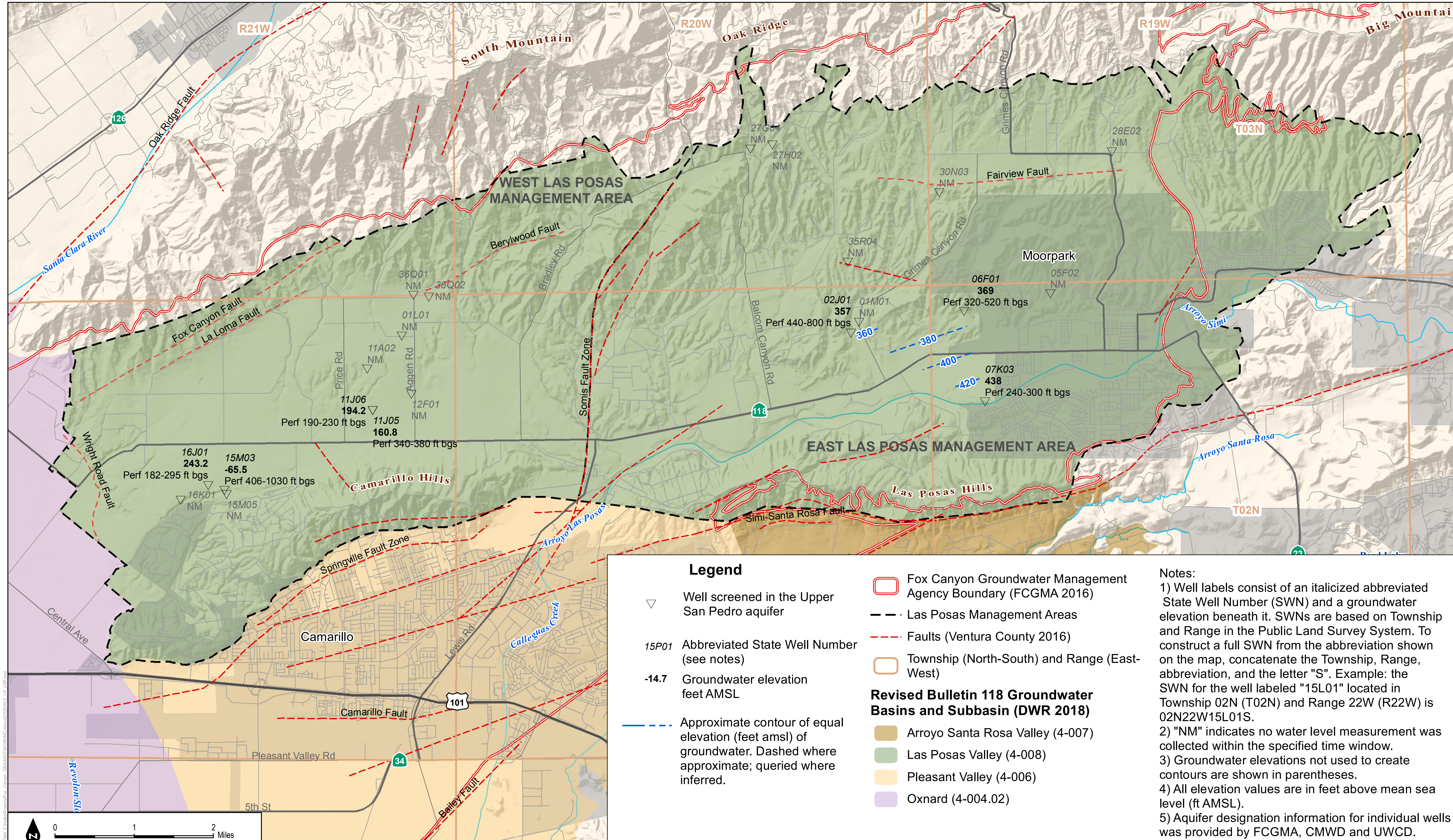
0 1 2 Miles

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-18

Groundwater Elevation Contours in the Upper San Pedro Formation, October 2-29, 2017

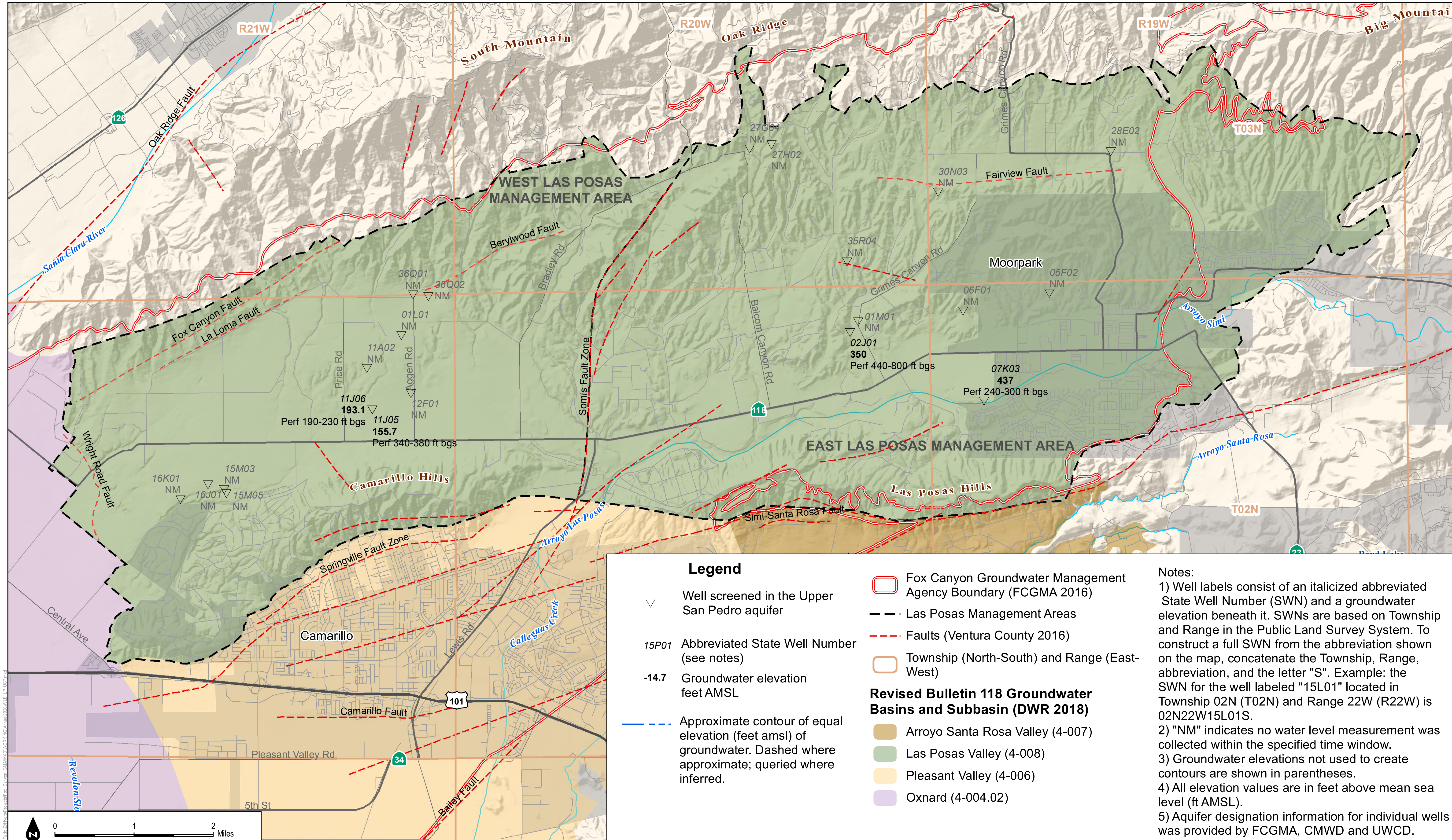


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-19

Groundwater Elevation Contours in the Upper San Pedro Formation, March 2-29, 2018

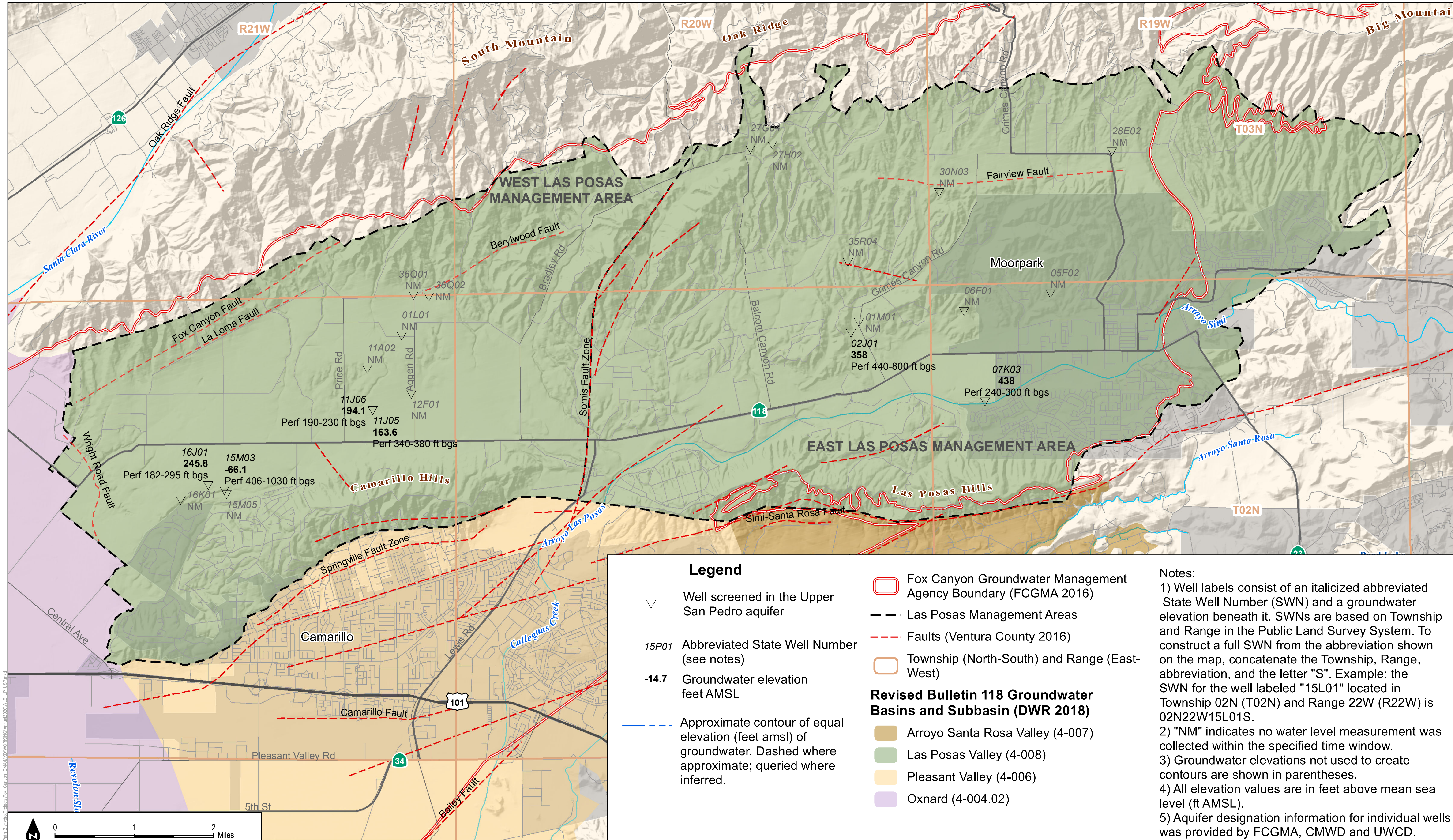


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-20

Groundwater Elevation Contours in the Upper San Pedro Formation, October 2-29, 2018



SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-21

Groundwater Elevation Contours in the Upper San Pedro Formation, March 2-29, 2019

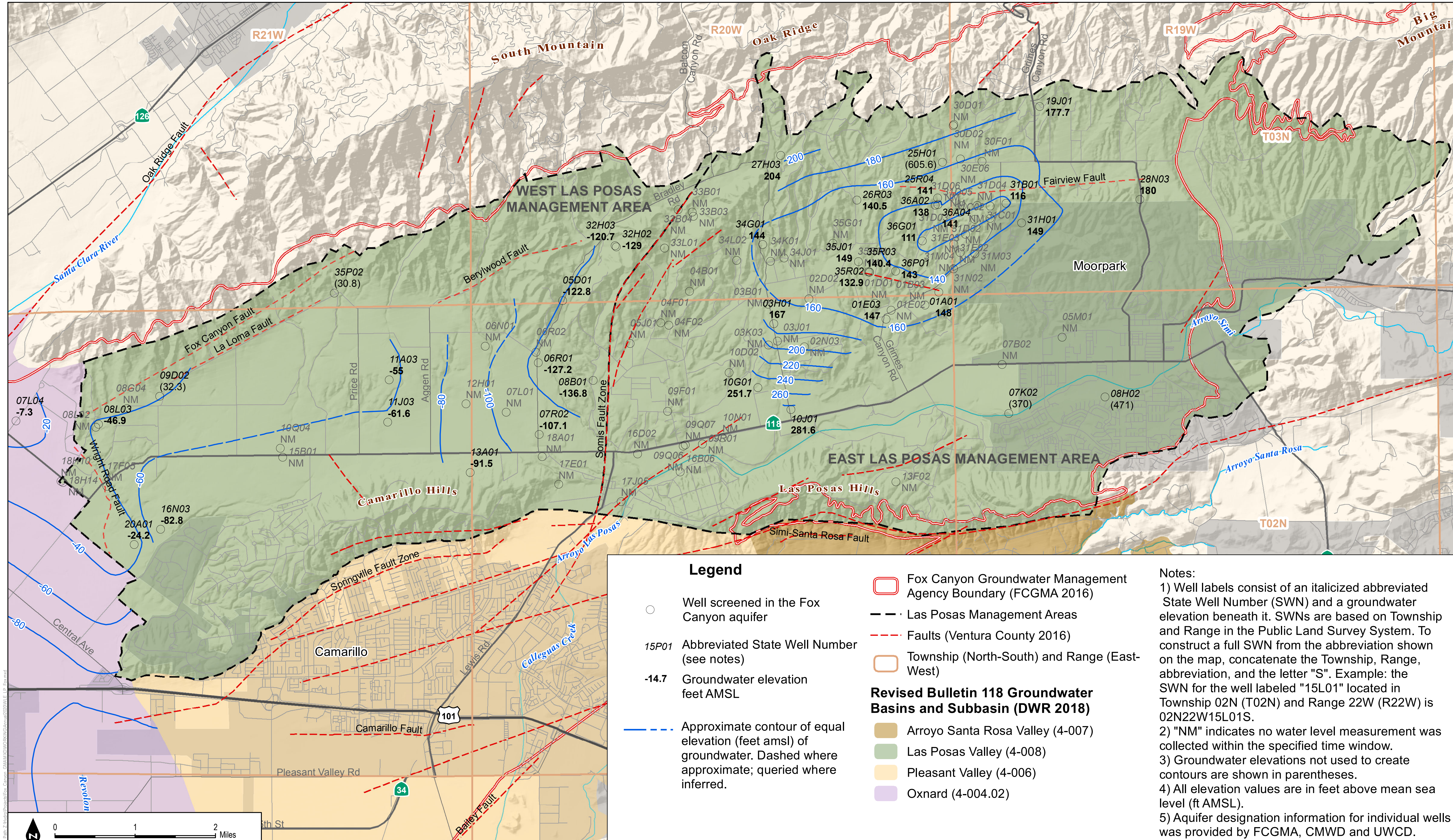
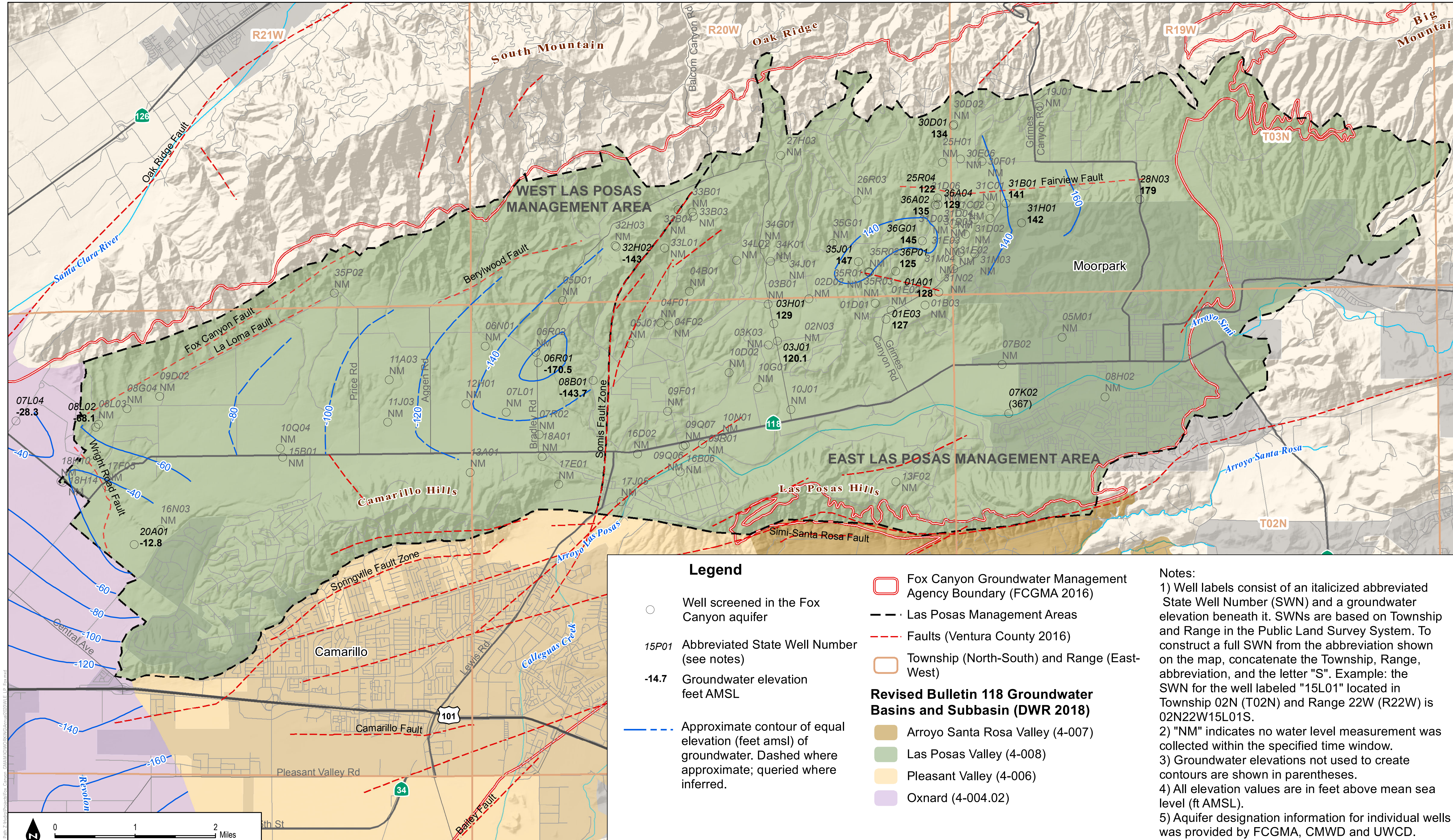


FIGURE 2-22

Groundwater Elevation Contours in the Fox Canyon Aquifer, March 2-29, 2016

SOURCE: DWR; Ventura County; UWCD; CMWD

DUDEK

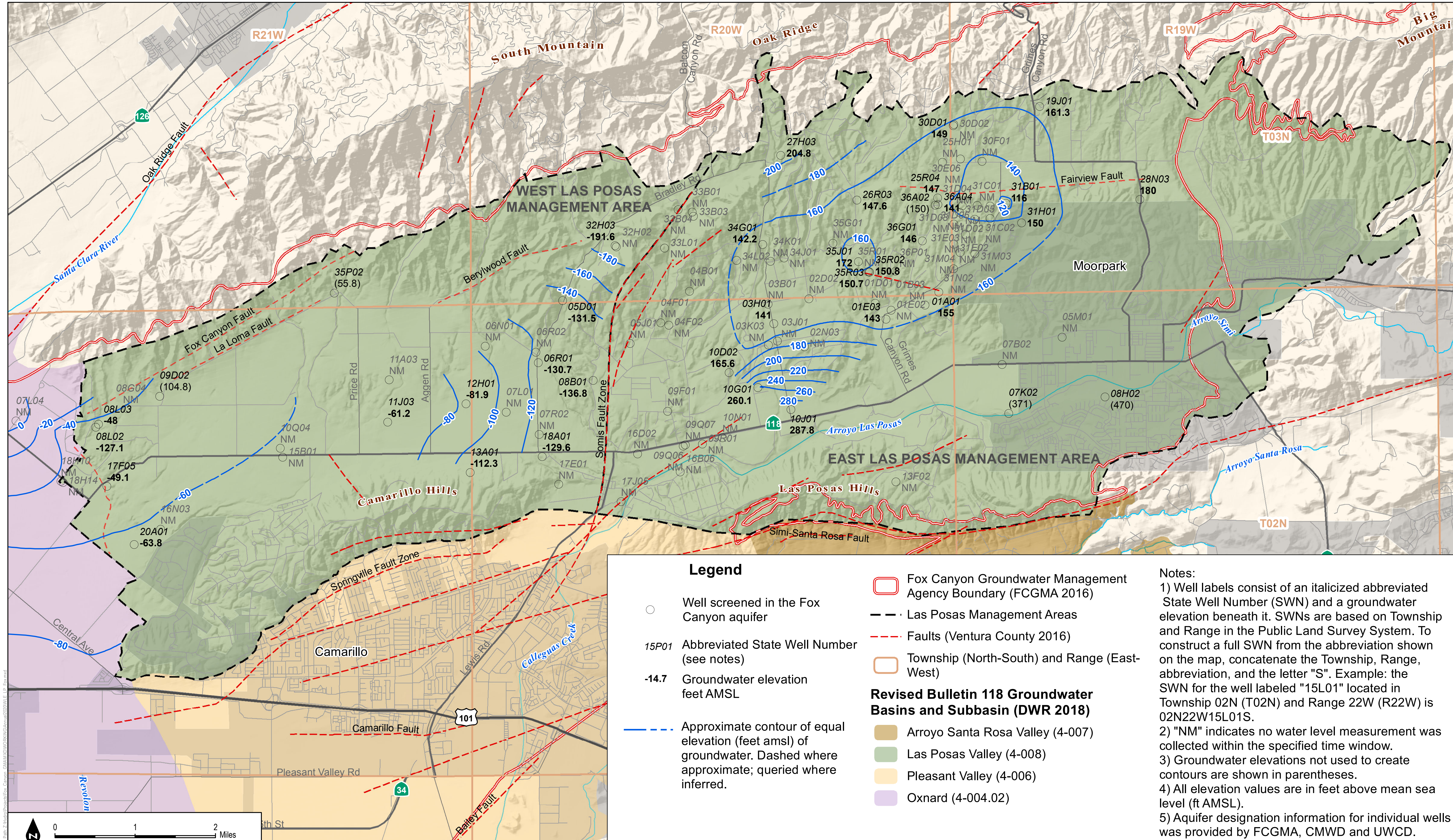


SOURCE: DWR; Ventura County; UWCD; CMWD

DUDEK

FIGURE 2-23

Groundwater Elevation Contours in the Fox Canyon Aquifer, October 2-29, 2016

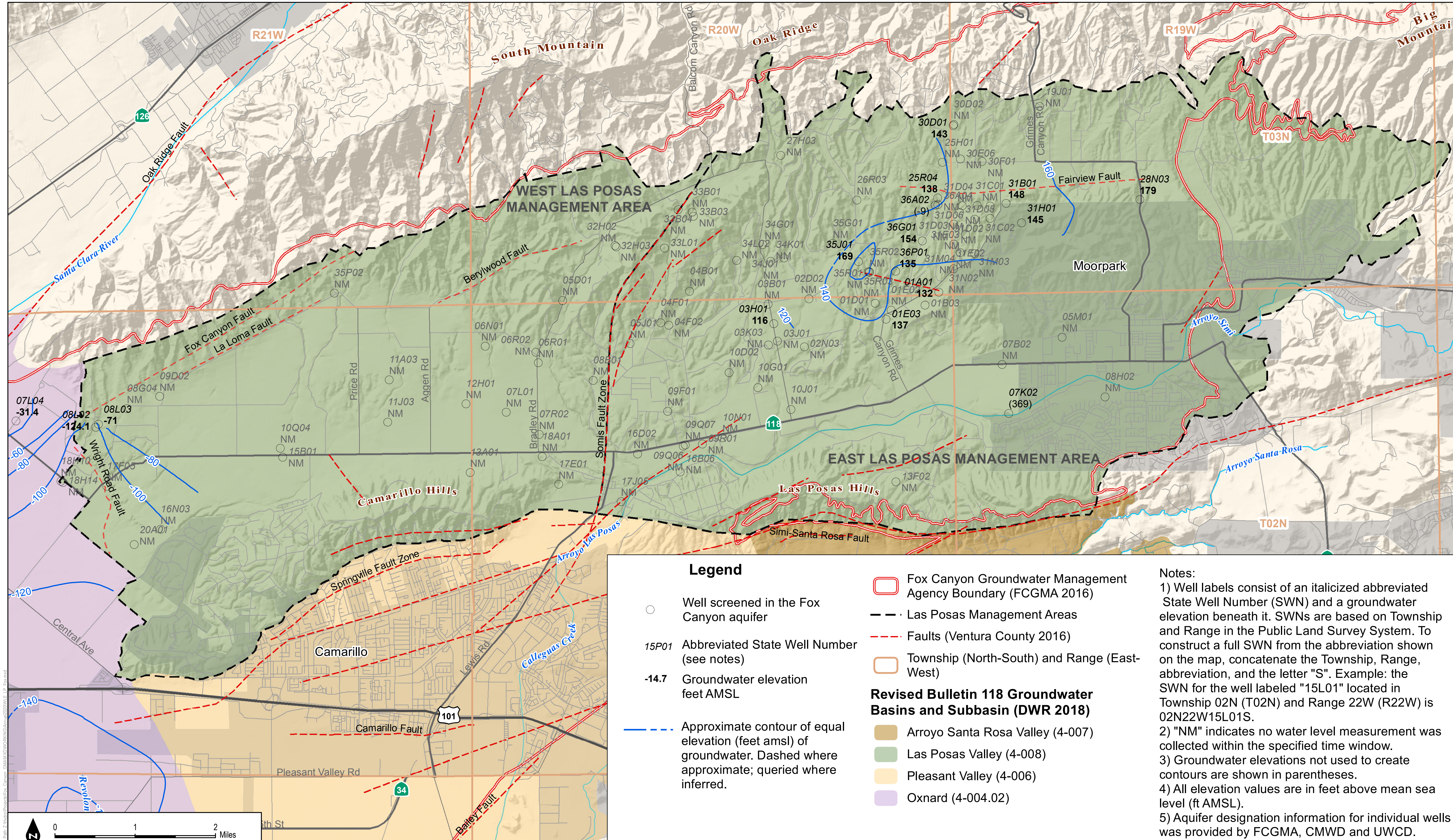


SOURCE: DWR; Ventura County; UWCD; CMWD

DUDEK

FIGURE 2-24

Groundwater Elevation Contours in the Fox Canyon Aquifer, March 2-29, 2017



Legend

Well screened in the Fox Canyon aquifer

15P01 Abbreviated State Well Number (see notes)

-14.7 Groundwater elevation feet AMSL

Approximate contour of equal elevation (feet amsl) 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 2018)

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 above mean sea level (ft AMSL).

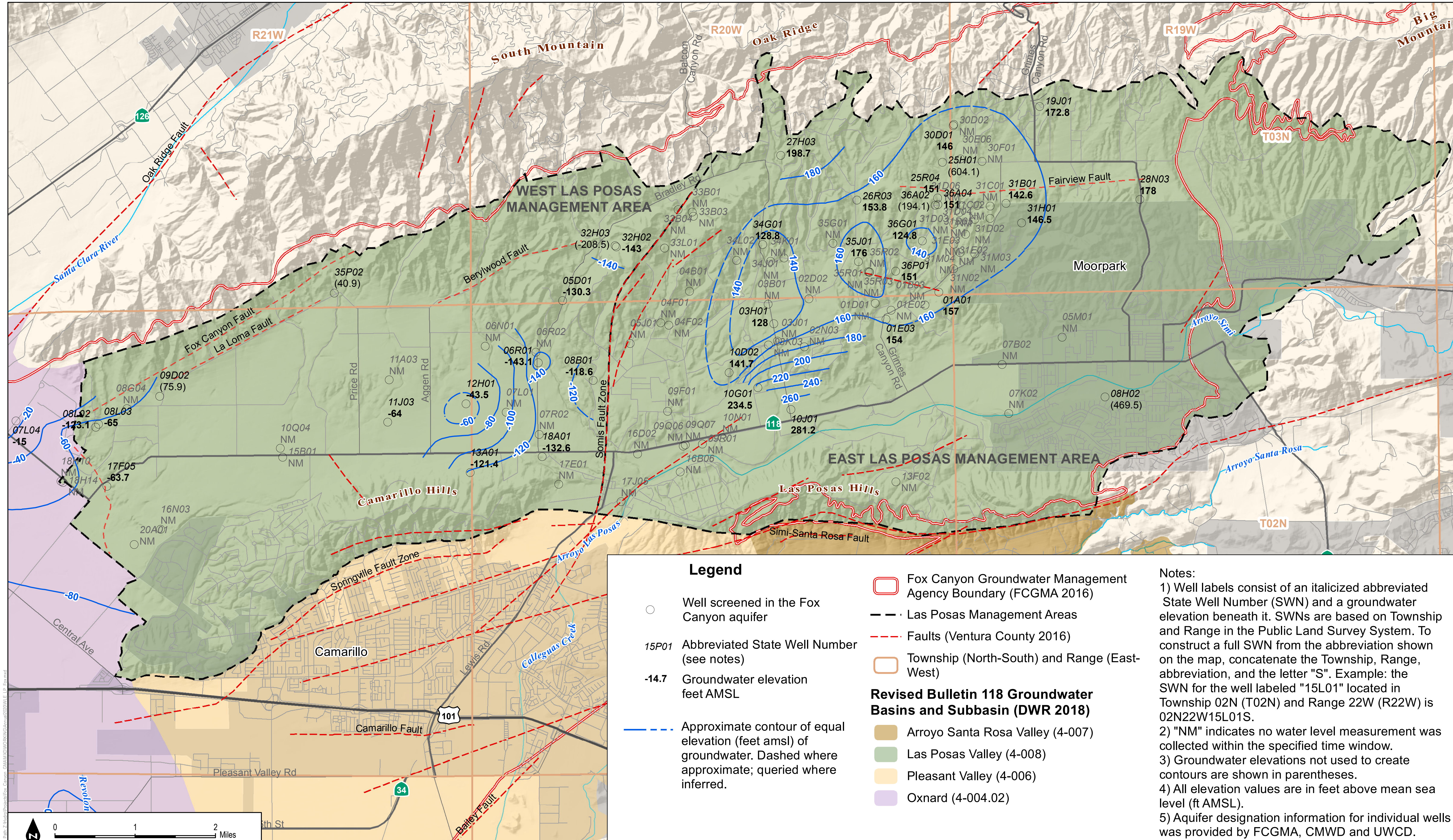
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-25

Groundwater Elevation Contours in the Fox Canyon Aquifer, October 2-29, 2017

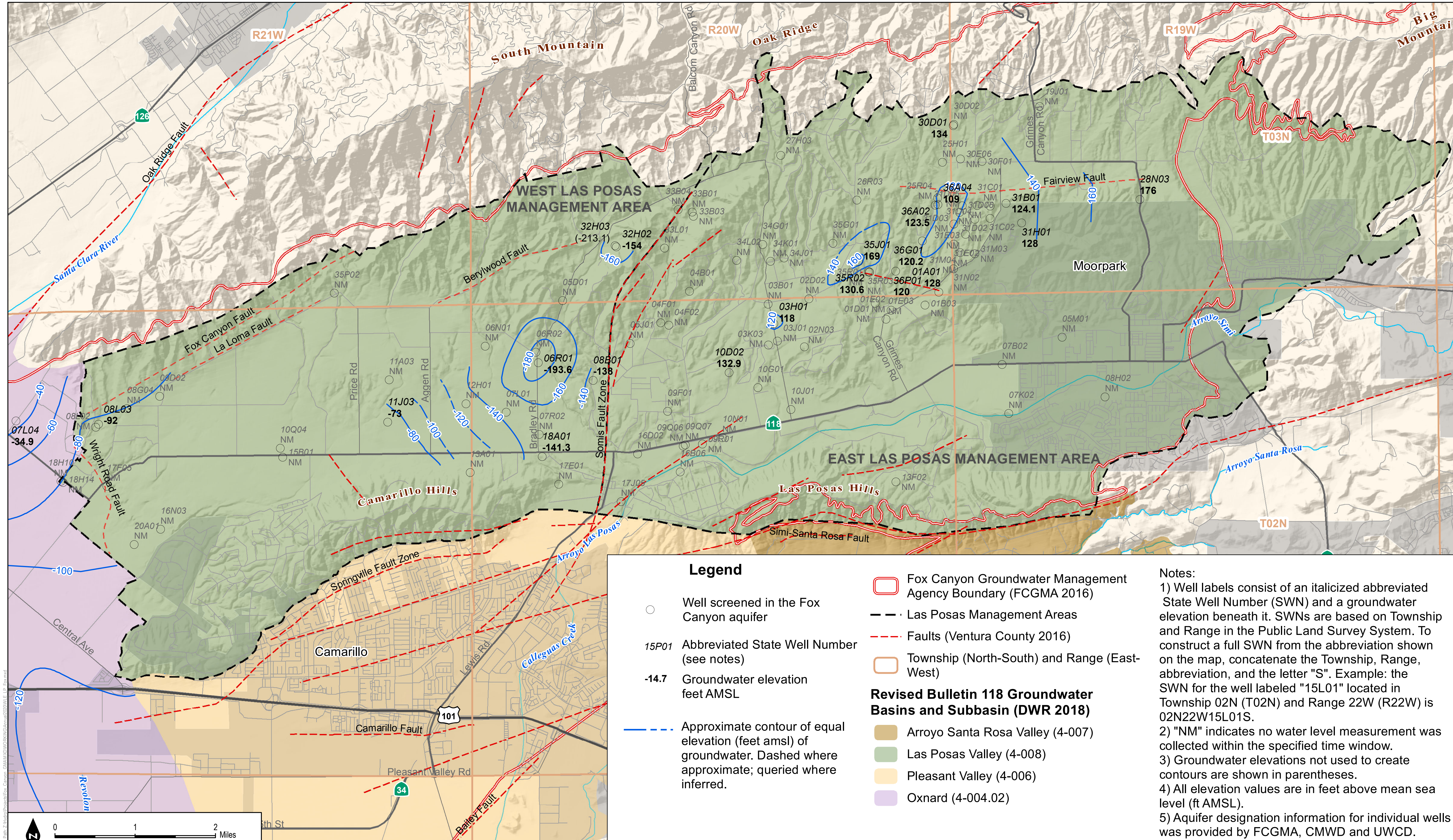


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-26

Groundwater Elevation Contours in the Fox Canyon Aquifer, March 2-29, 2018

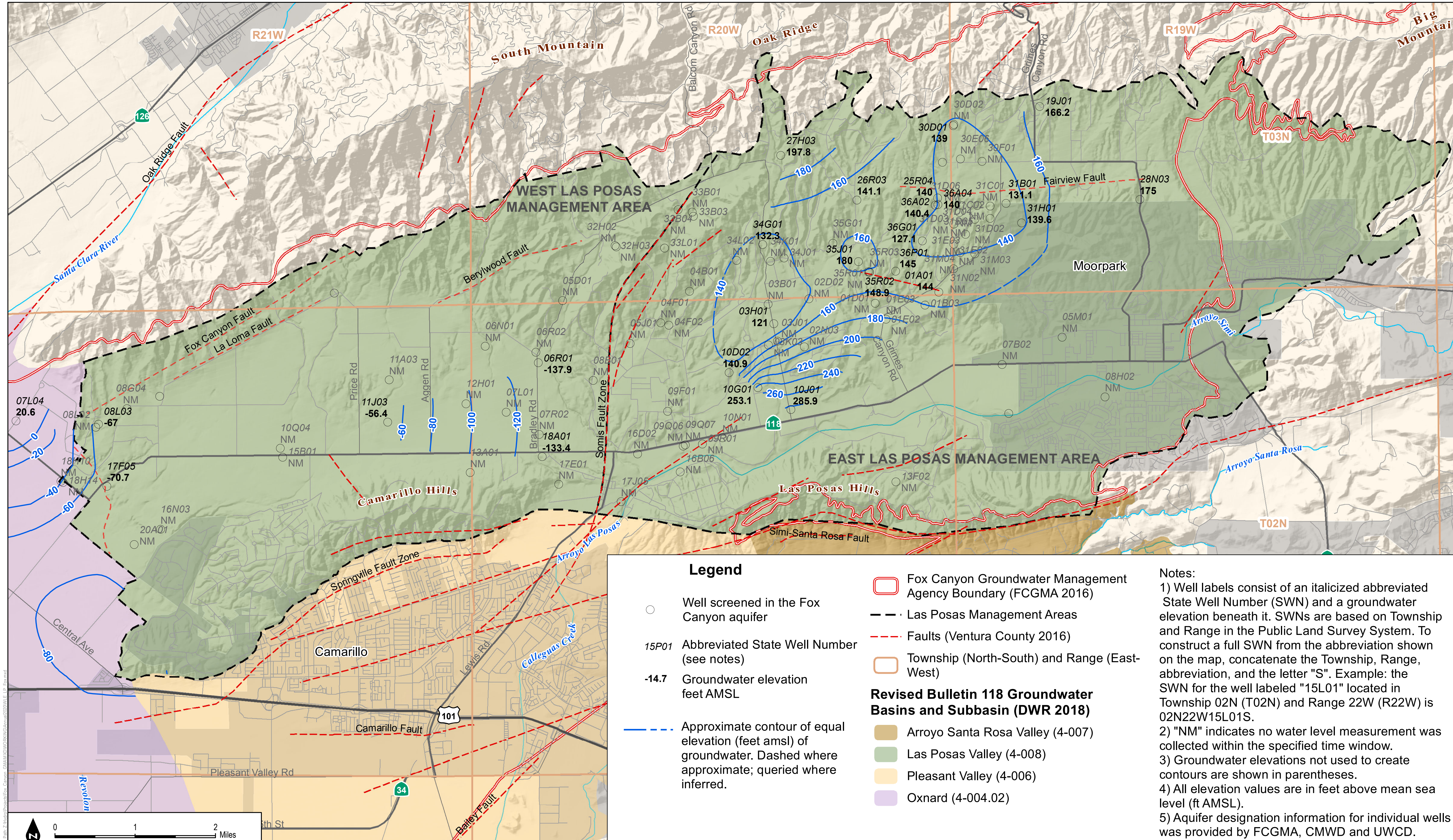


SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-27

Groundwater Elevation Contours in the Fox Canyon Aquifer, October 2-29, 2018

DUDEK

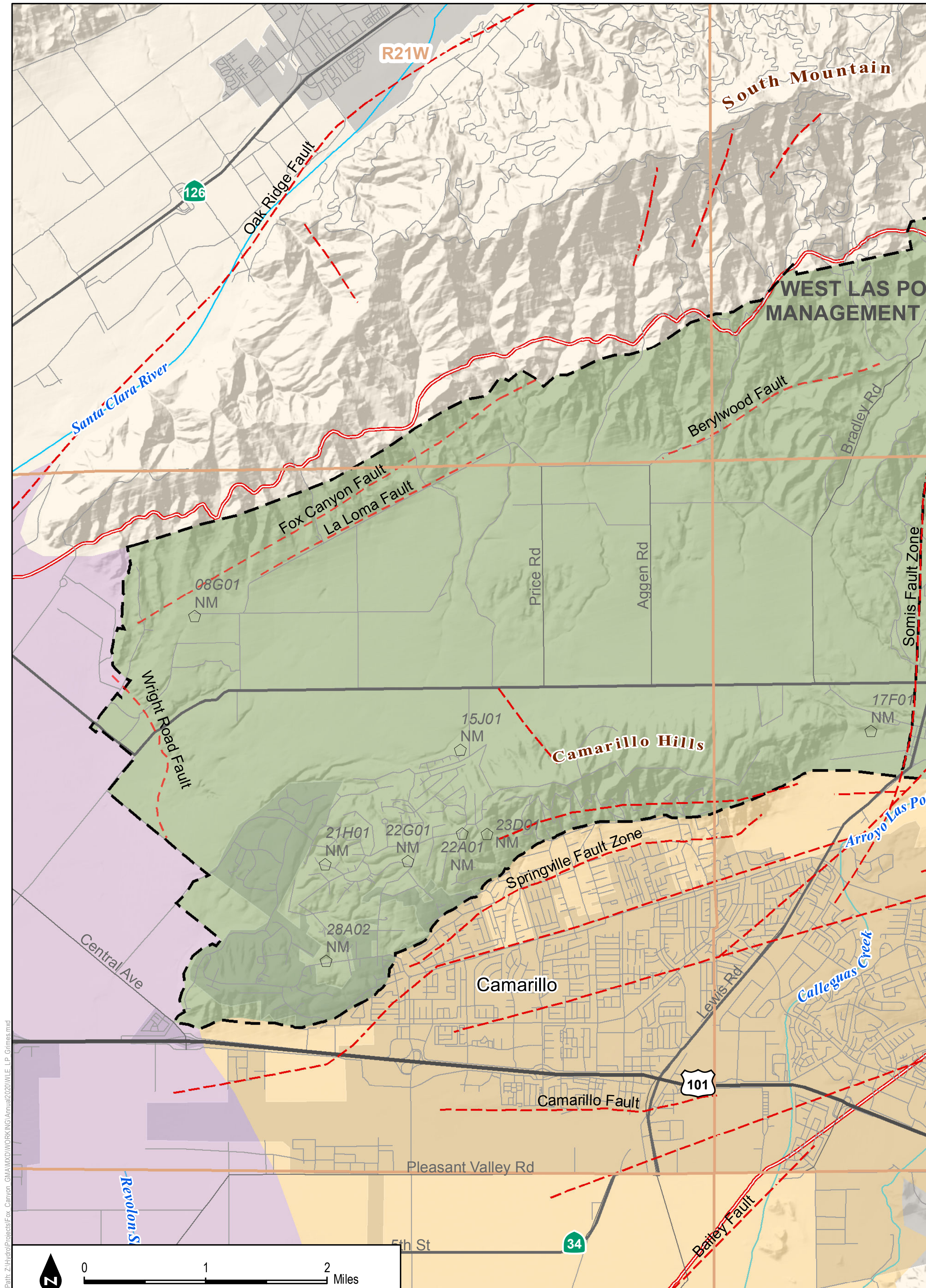


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-28

Groundwater Elevation Contours in the Fox Canyon Aquifer, March 2-29, 2019



Legend

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

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

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

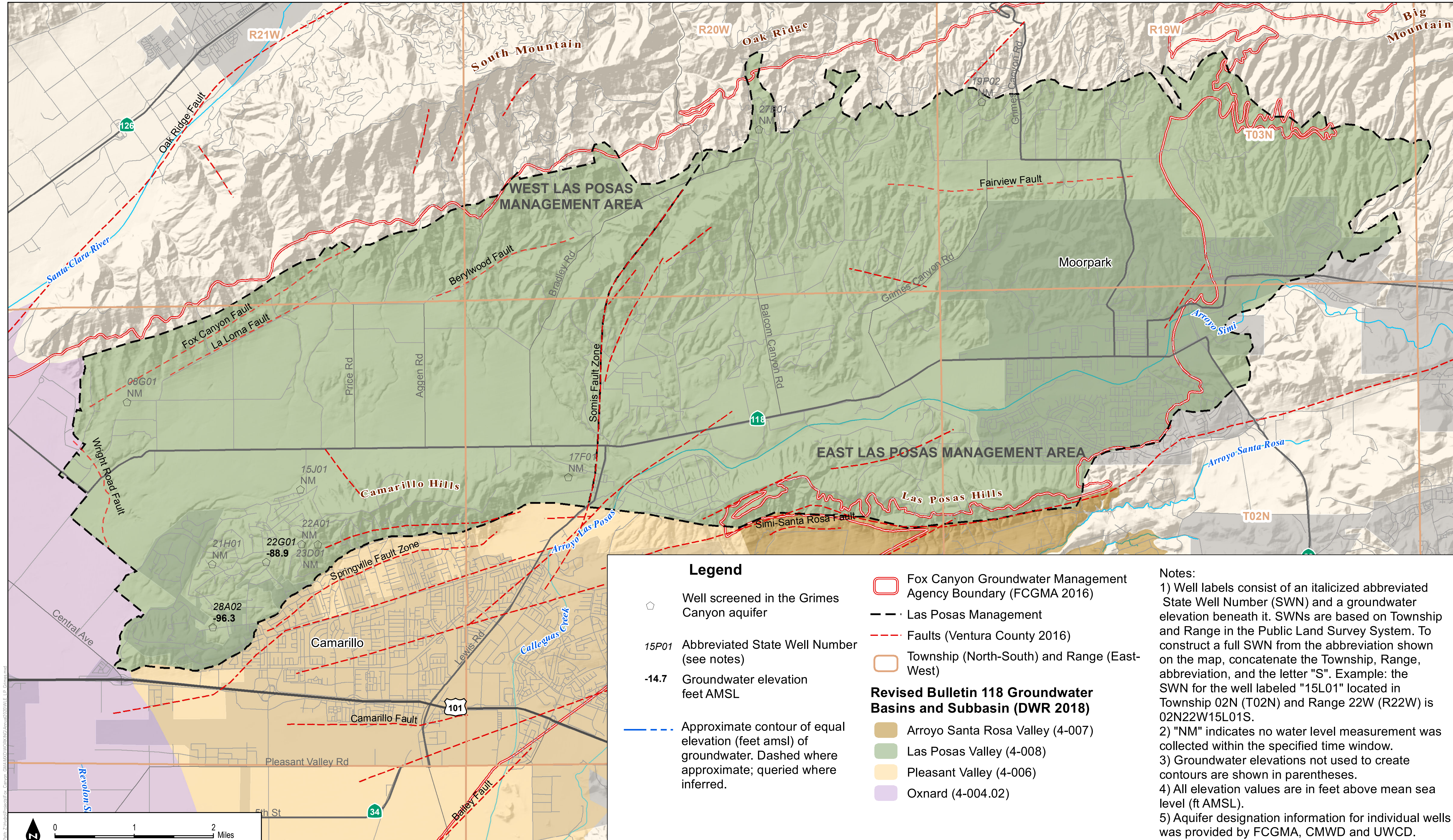
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, 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 above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-29

Groundwater Elevation Contours in the Grimes Canyon Aquifer, March 2-29, 2016

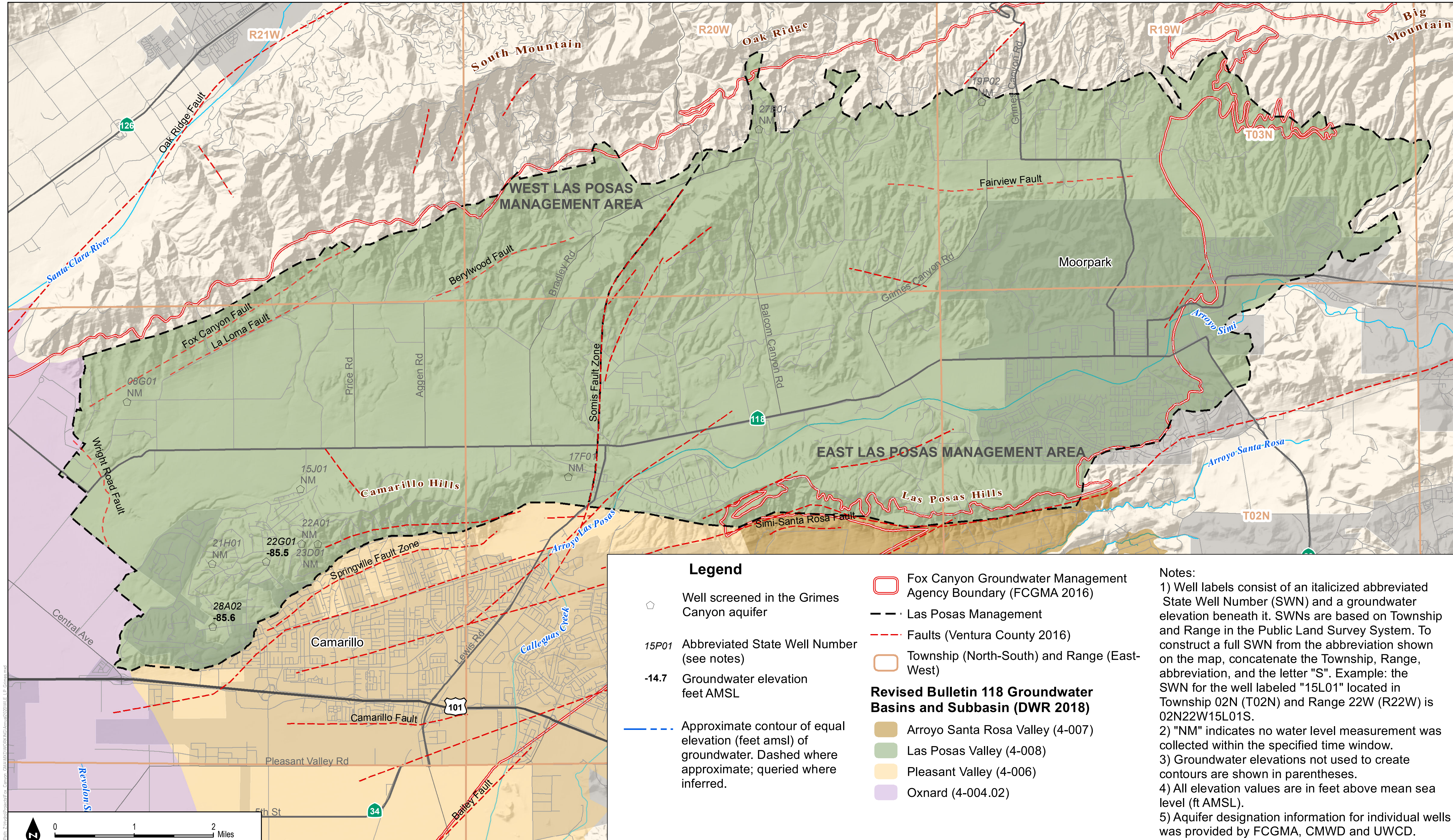


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-30

Groundwater Elevation Contours in the Grimes Canyon Aquifer, October 2-29, 2016

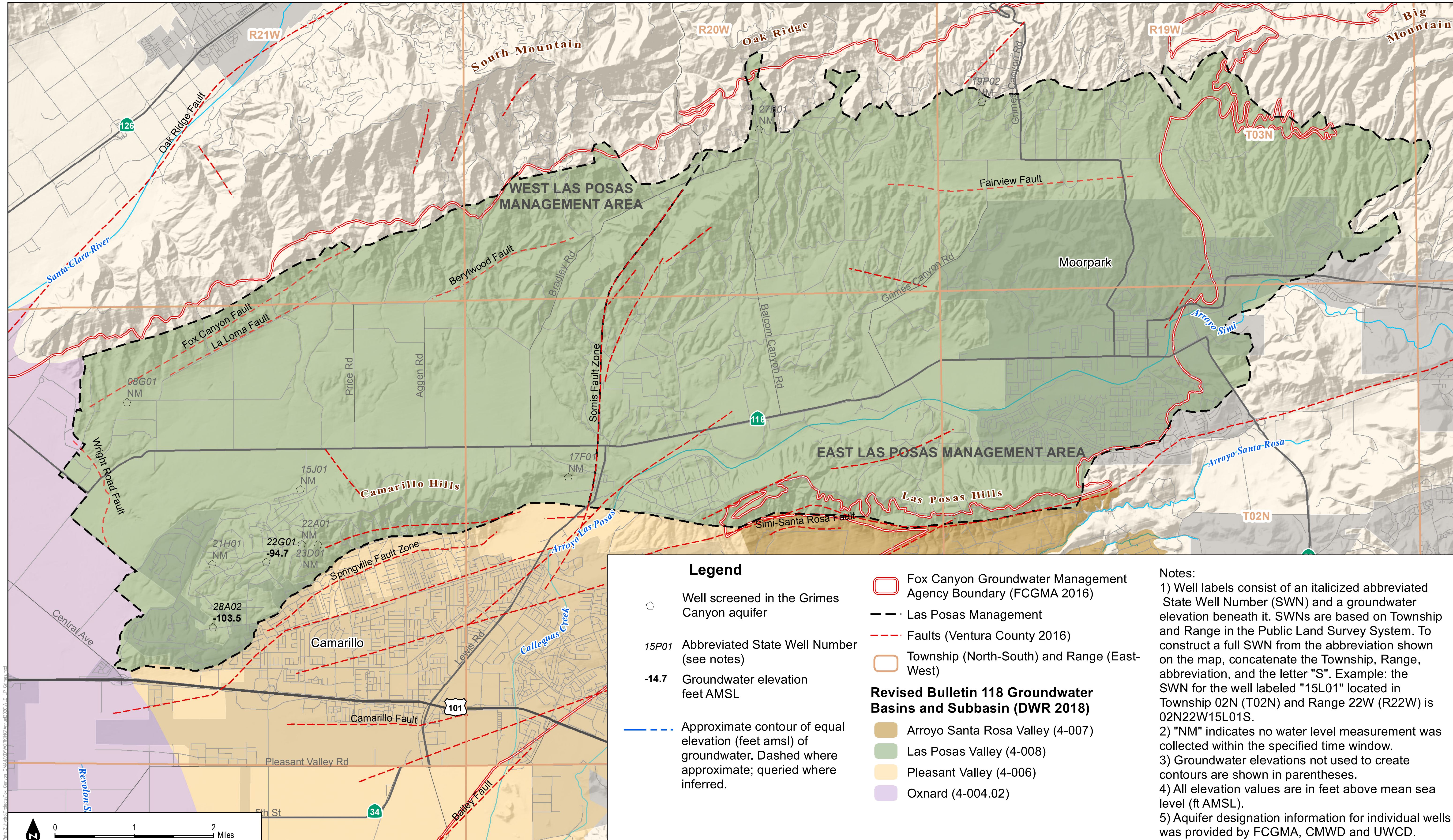


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-31

Groundwater Elevation Contours in the Grimes Canyon Aquifer, March 2-29, 2017



Legend

Well screened in the Grimes Canyon aquifer

15P01 Abbreviated State Well Number (see notes)

-14.7 Groundwater elevation feet AMSL

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

Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)

Las Posas Management

Faults (Ventura County 2016)

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

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

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 above mean sea level (ft AMSL).

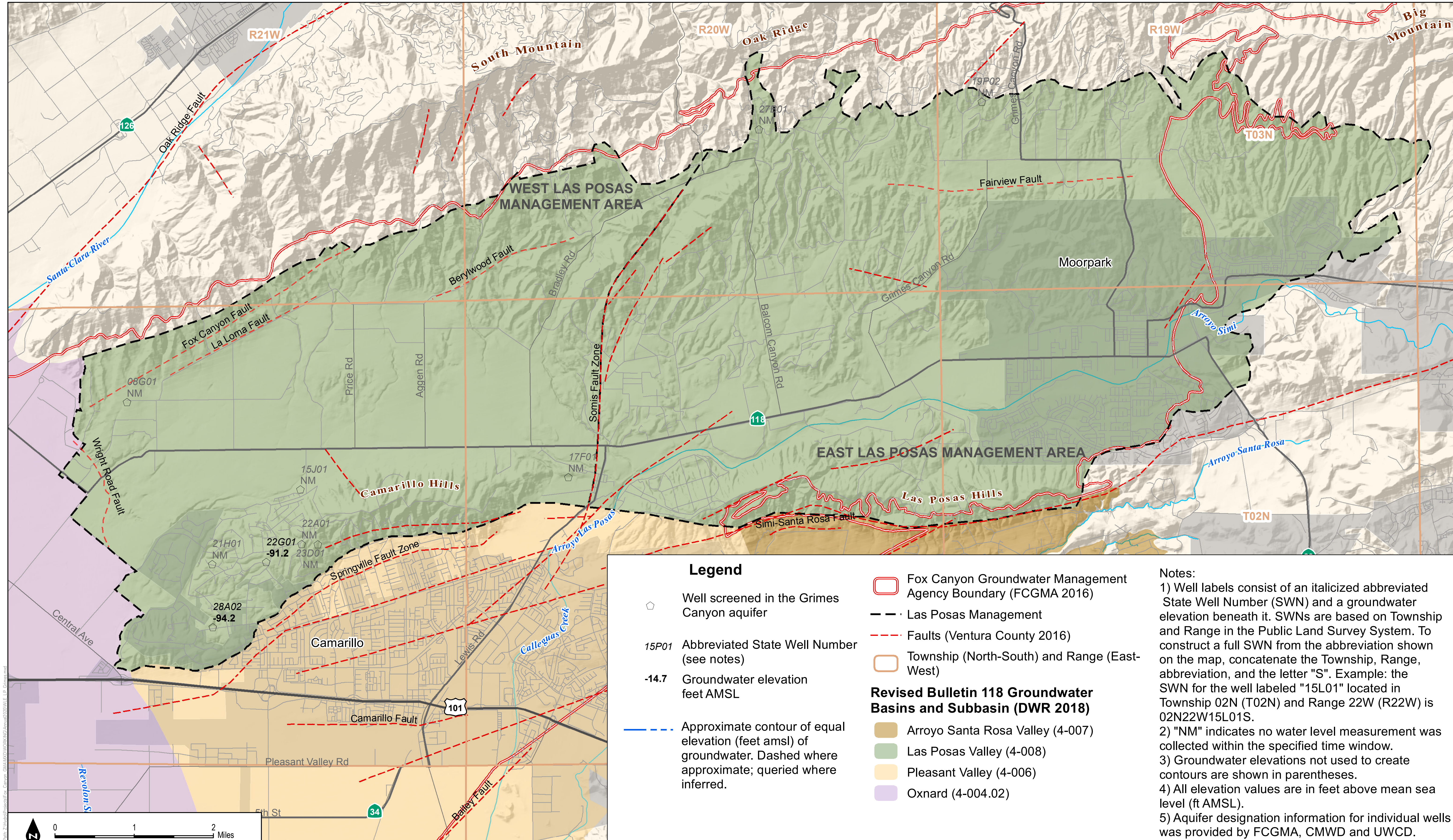
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-32

Groundwater Elevation Contours in the Grimes Canyon Aquifer, October 2-29, 2017



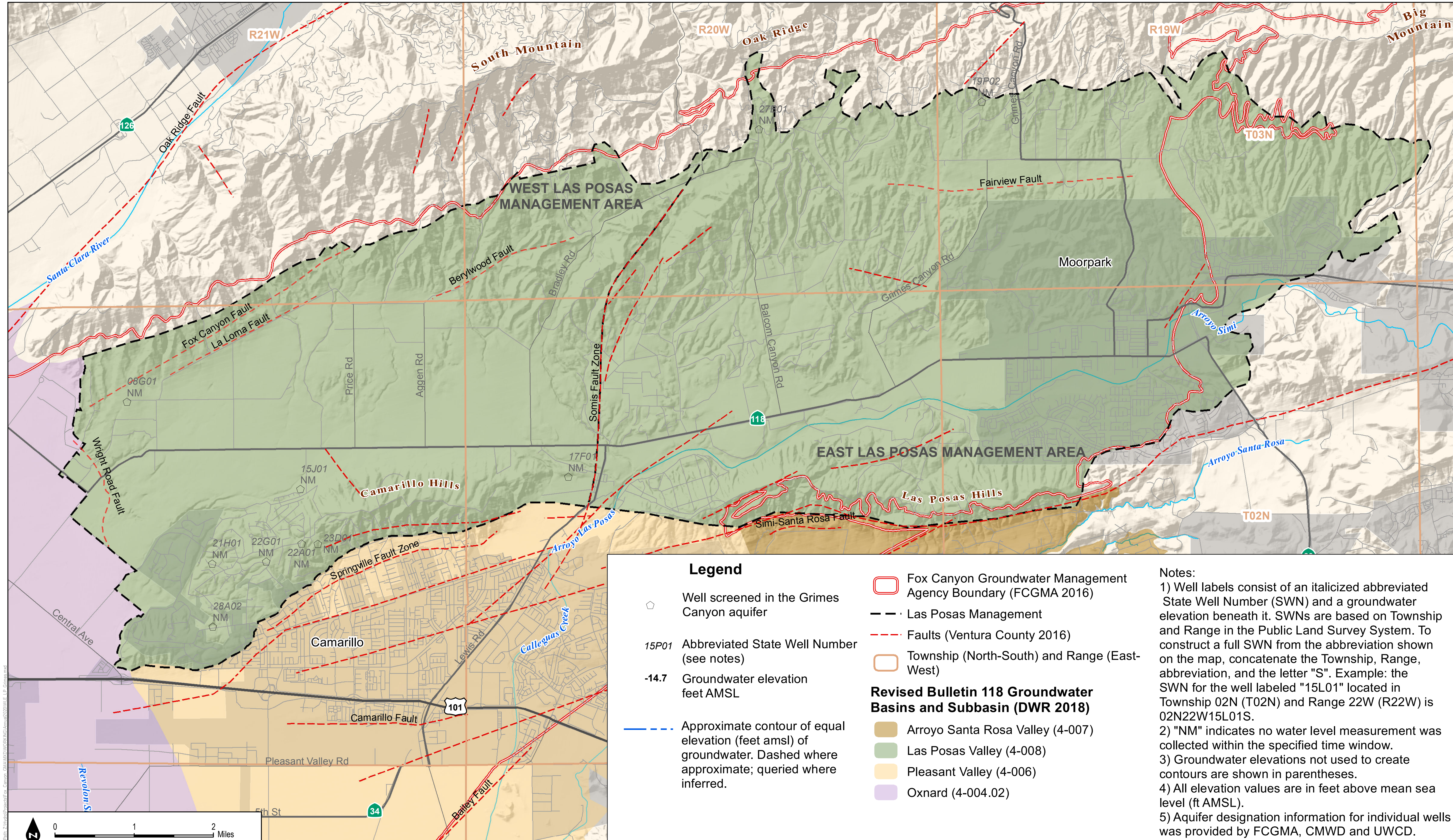
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, 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 above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-33

Groundwater Elevation Contours in the Grimes Canyon Aquifer, March 2-29, 2018



Legend

Well screened in the Grimes Canyon aquifer

15P01 Abbreviated State Well Number (see notes)

-14.7 Groundwater elevation feet AMSL

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

Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)

Las Posas Management

Faults (Ventura County 2016)

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

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

Arroyo Santa Rosa Valley (4-007)

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Pleasant Valley (4-006)

Oxnard (4-004.02)

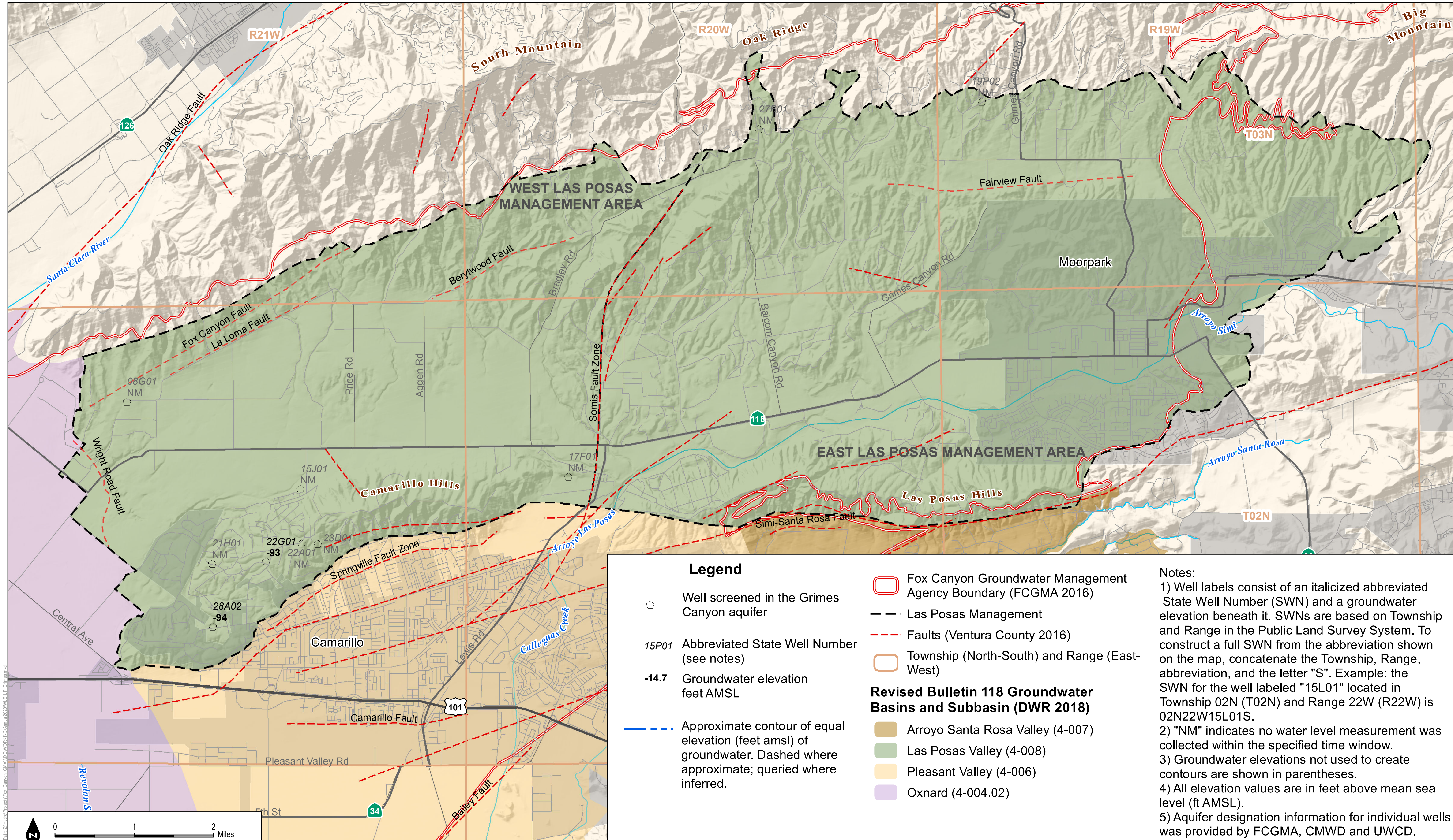
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a groundwater elevation beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, 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 above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-34

Groundwater Elevation Contours in the Grimes Canyon Aquifer, October 2-29, 2018



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 above mean sea level (ft AMSL).
5) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-35

Groundwater Elevation Contours in the Grimes Canyon Aquifer, March 2-29, 2019

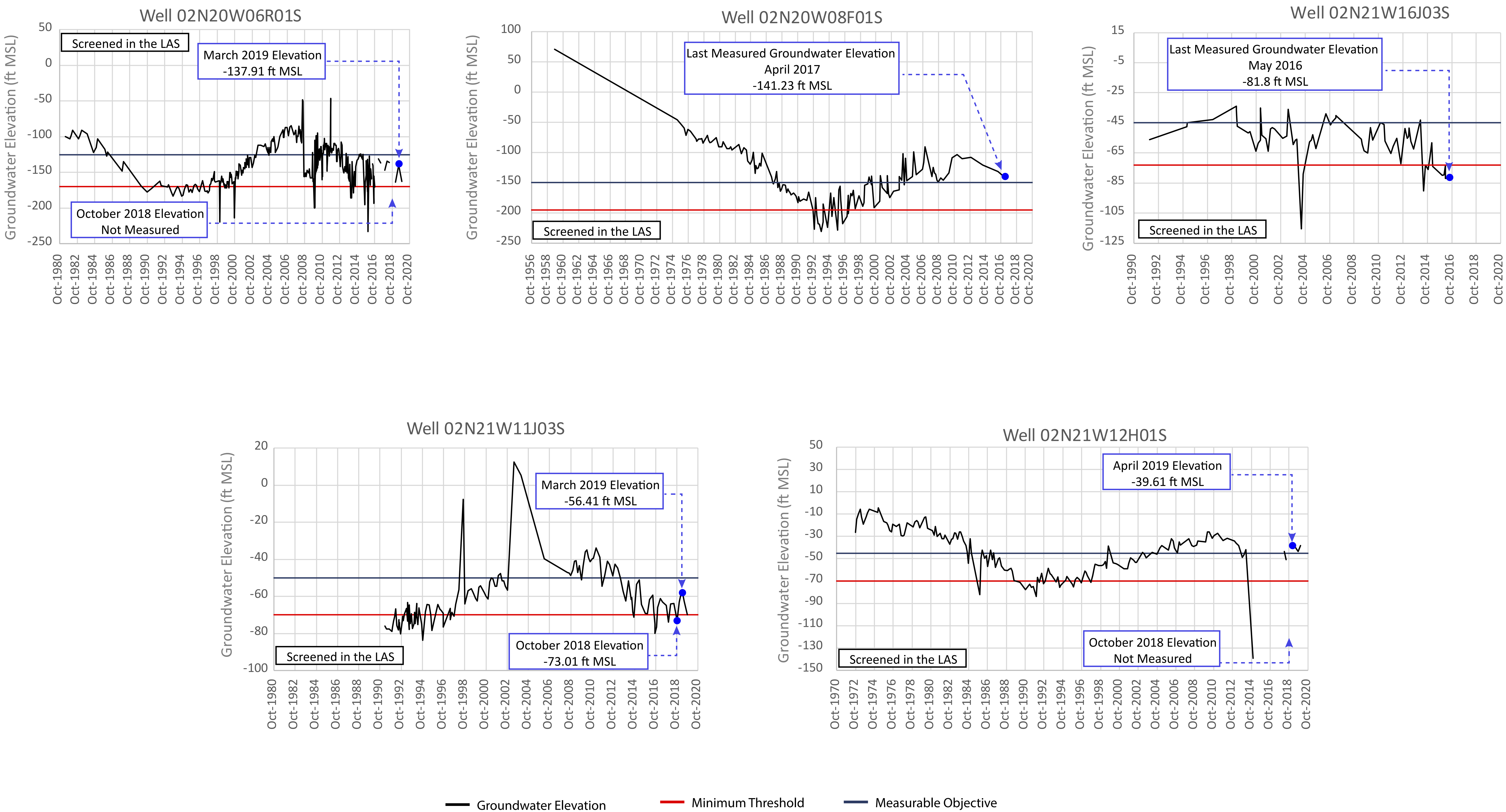


FIGURE 2-36

Groundwater Elevation Hydrographs for Representative Wells in the WLPMA

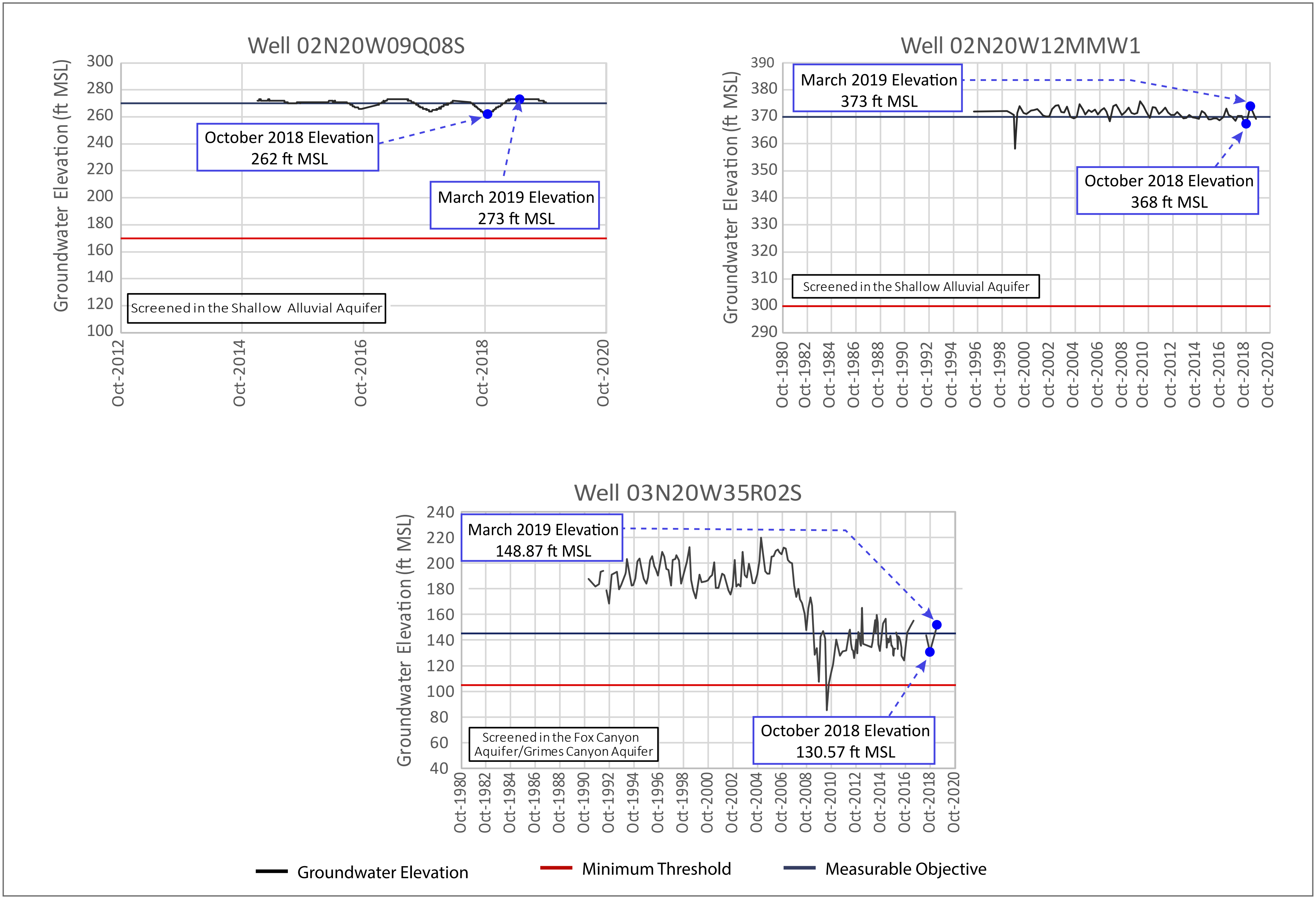


FIGURE 2-37a

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

DUDEK

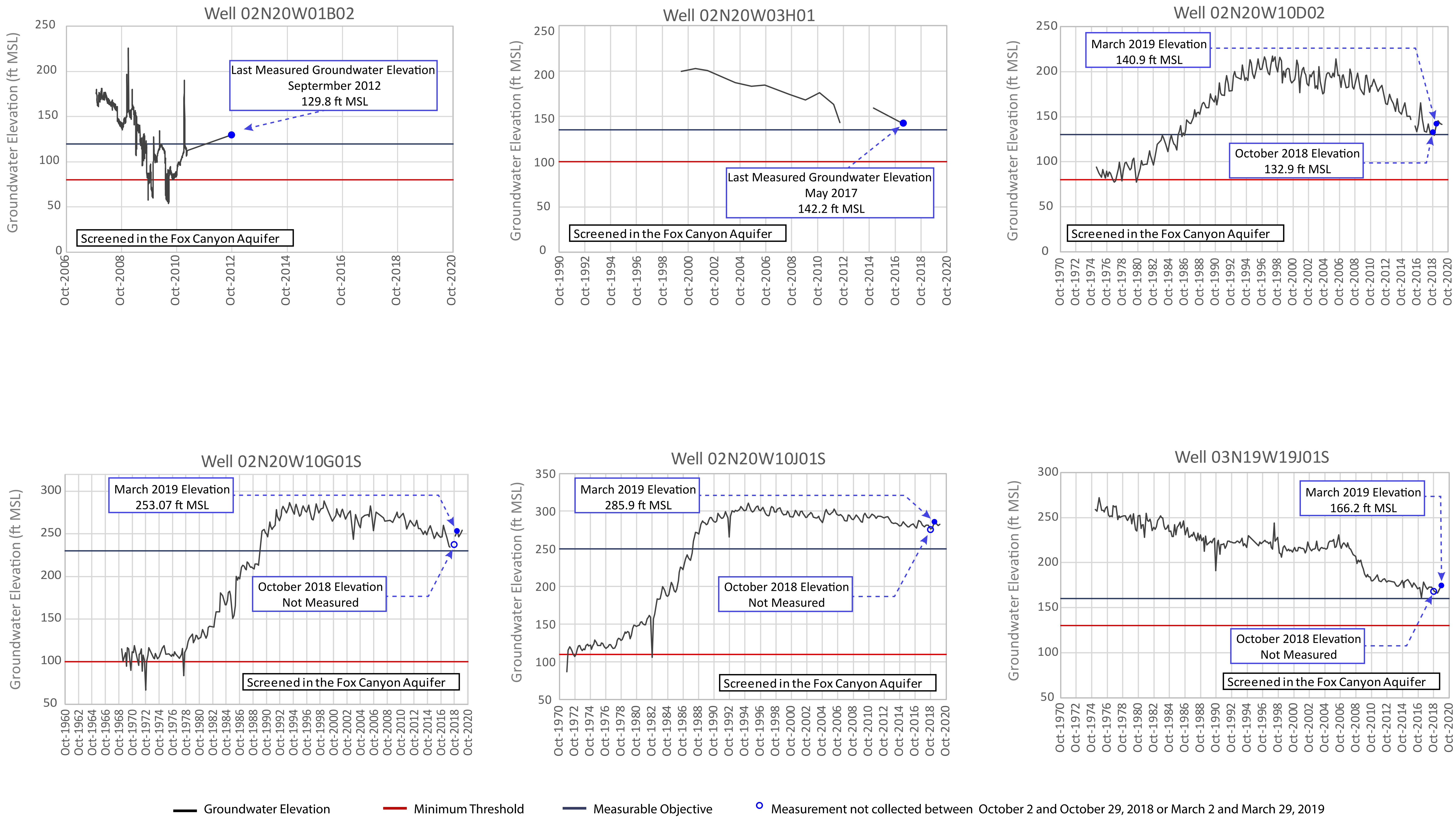


FIGURE 2-37b

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

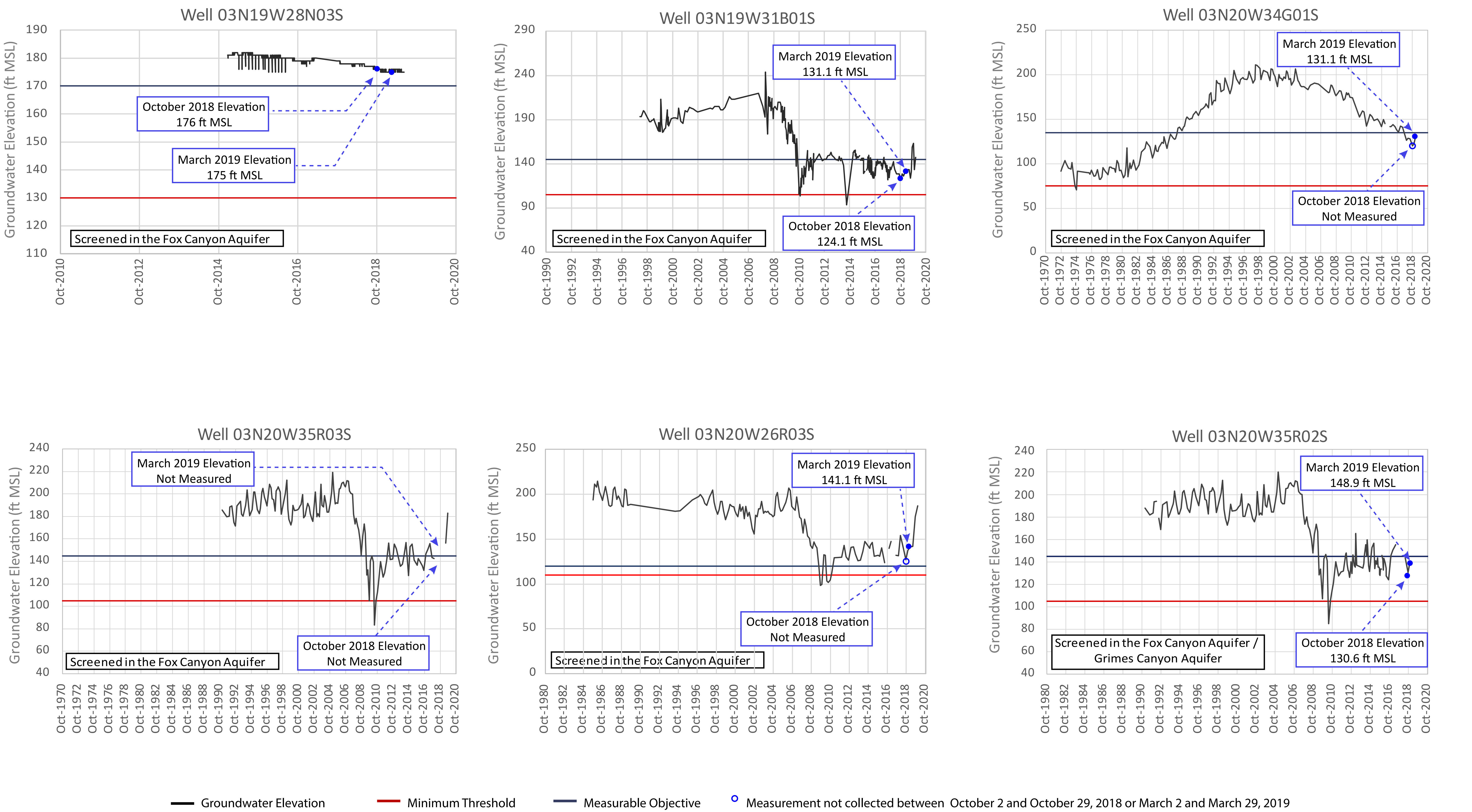


FIGURE 2-37c

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

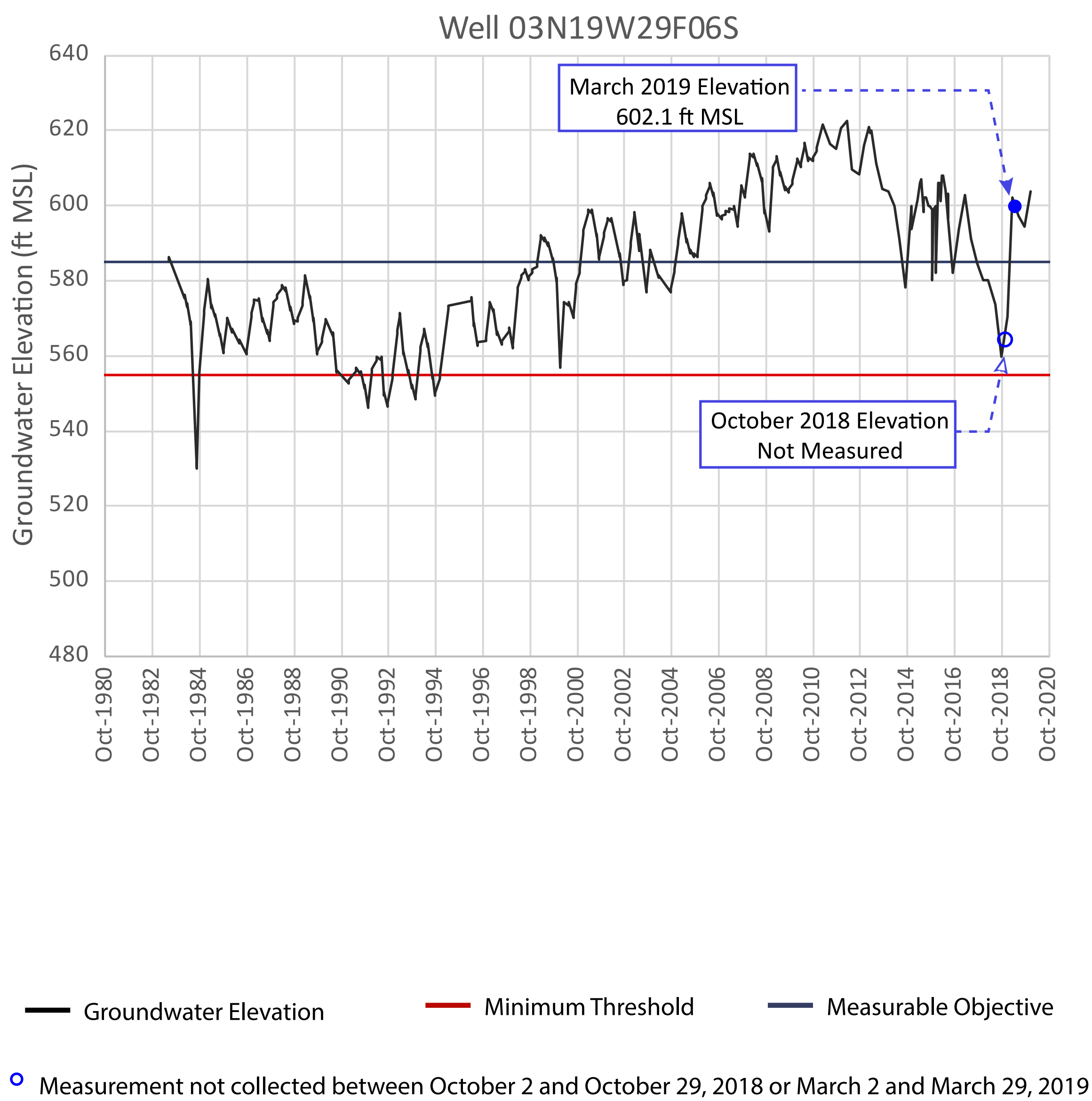


FIGURE 2-38

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

Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report

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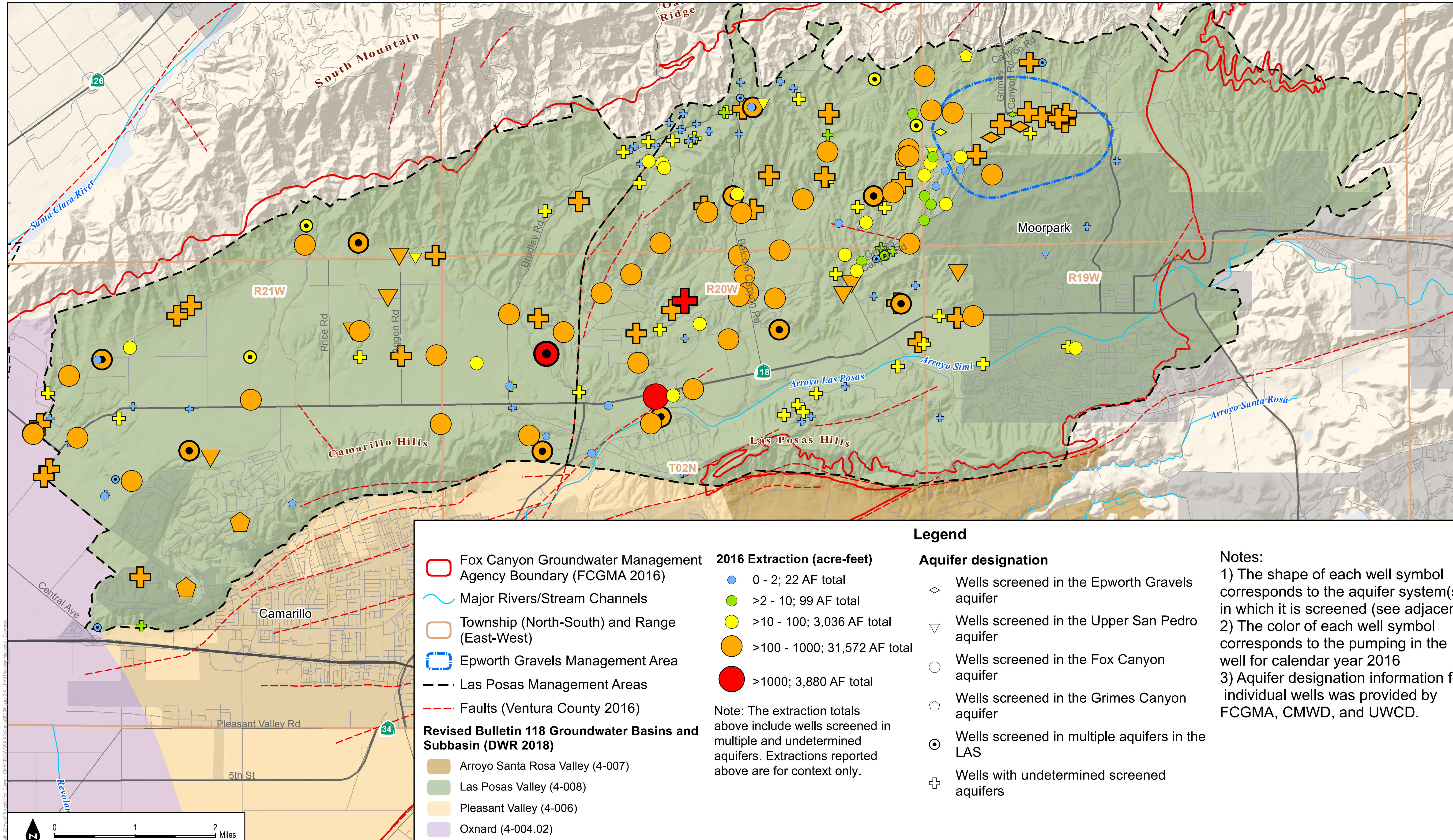

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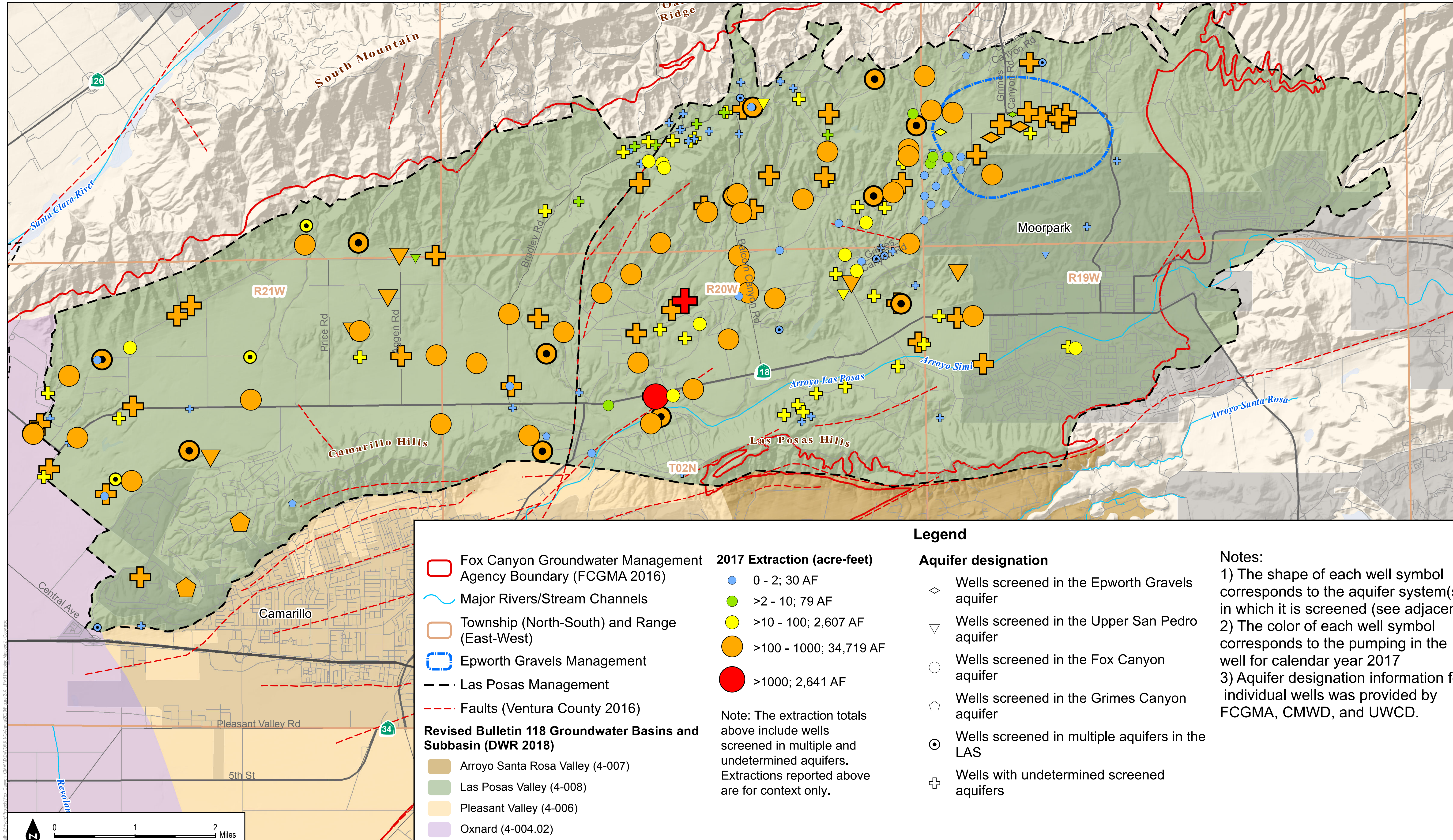
SOURCE: DWR, FCGMA, VCWPD, UWCD, CMWD

FIGURE 2-39

Groundwater Production (Acre-feet) in the Las Posas Valley Basin in Calendar Year 2016

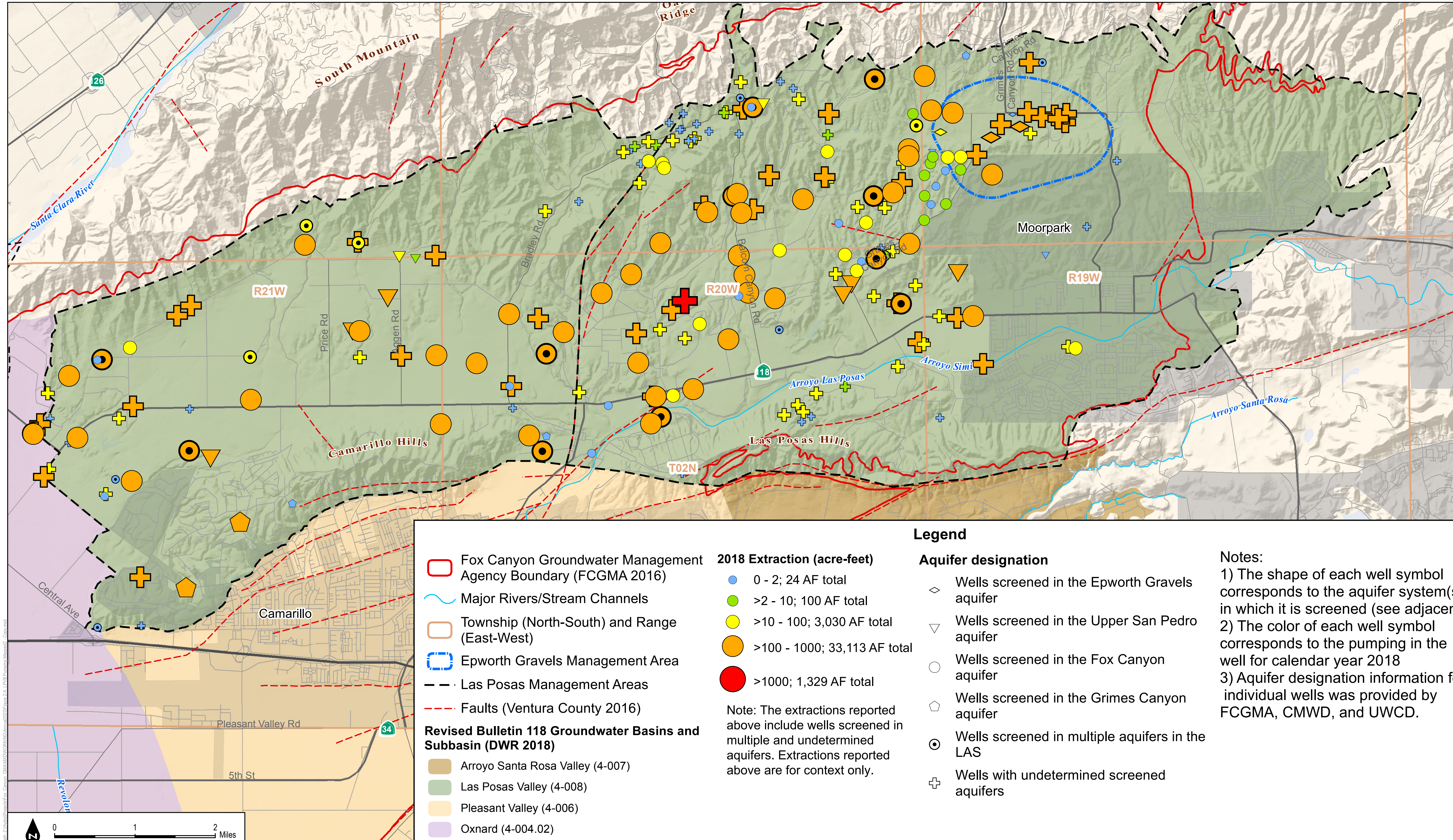


DUDEK

SOURCE: DWR, FCGMA, VCWPD, UWCD, CMWD

FIGURE 2-40

Groundwater Production (Acre-feet) in the Las Posas Valley Basin in Calendar Year 2017



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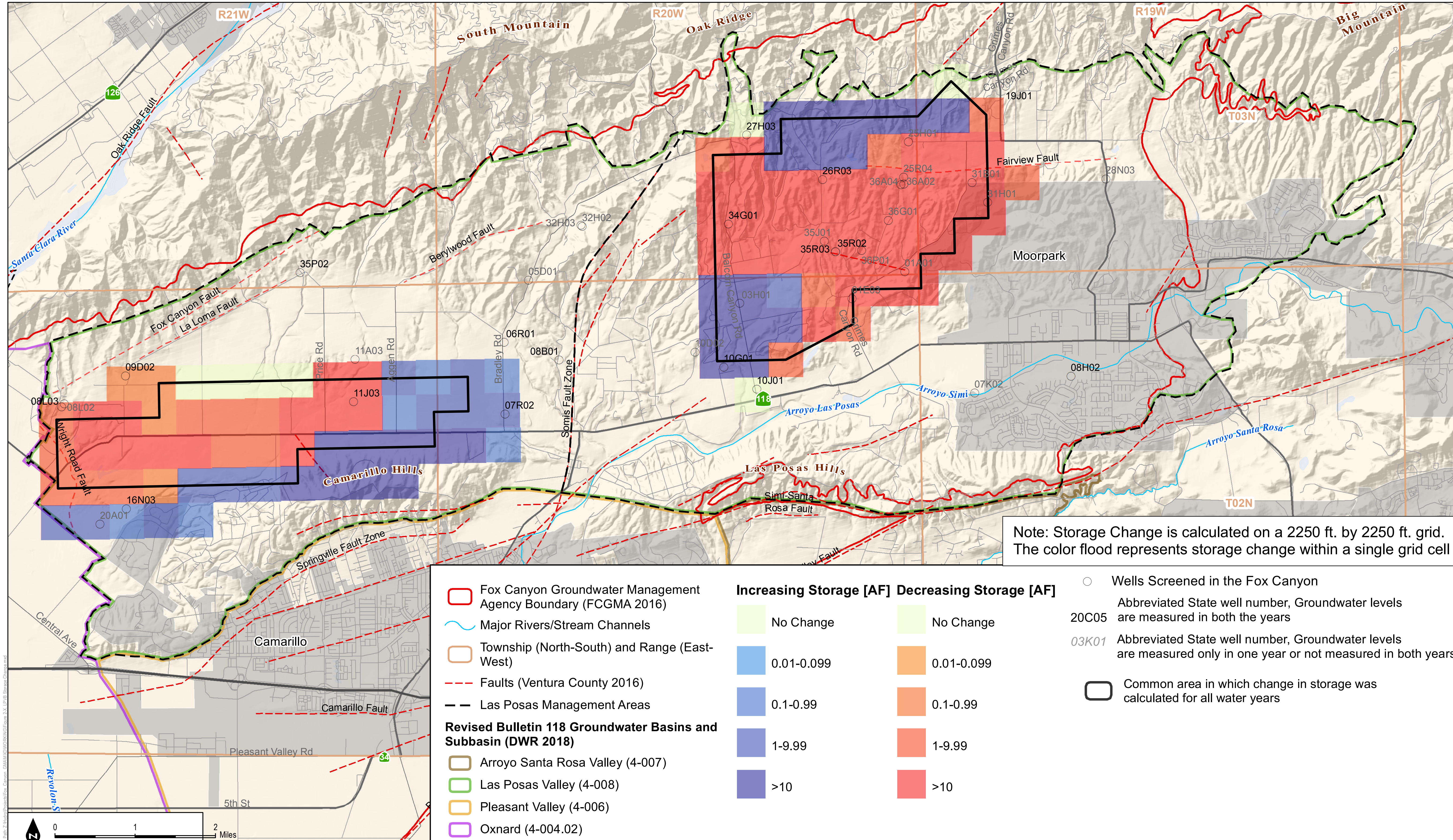
SOURCE: DWR, FCGMA, VCWPD, UWCD, CMWD

FIGURE 2-41

Groundwater Production (Acre-feet) in the Las Posas Valley Basin in Calendar Year 2018

Las Posas Valley Basin Groundwater Sustainability Plan 2020 Annual Report



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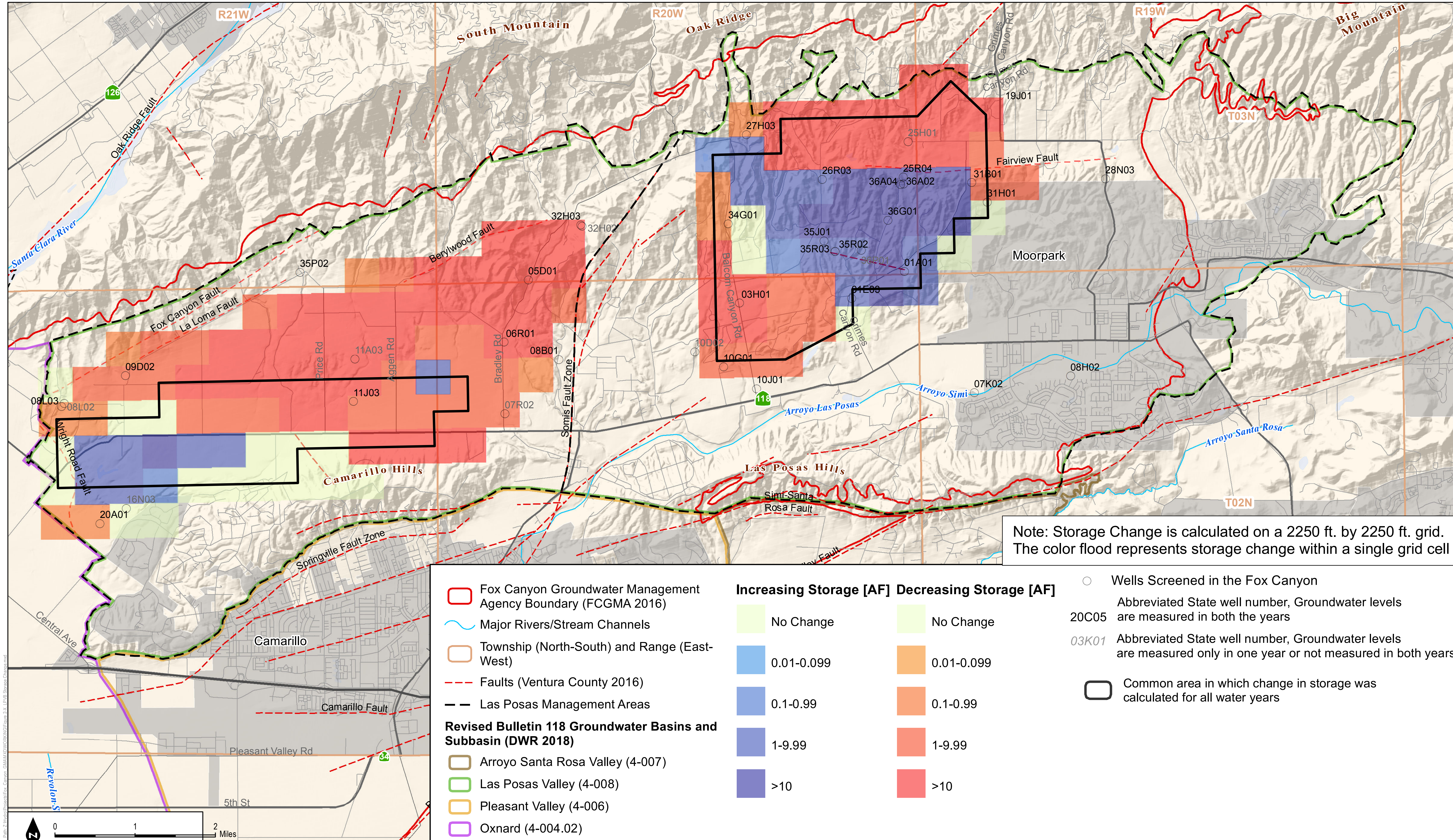
SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-42

Change in Storage in the Fox Canyon Aquifer: Spring 2015 to Spring 2016



SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

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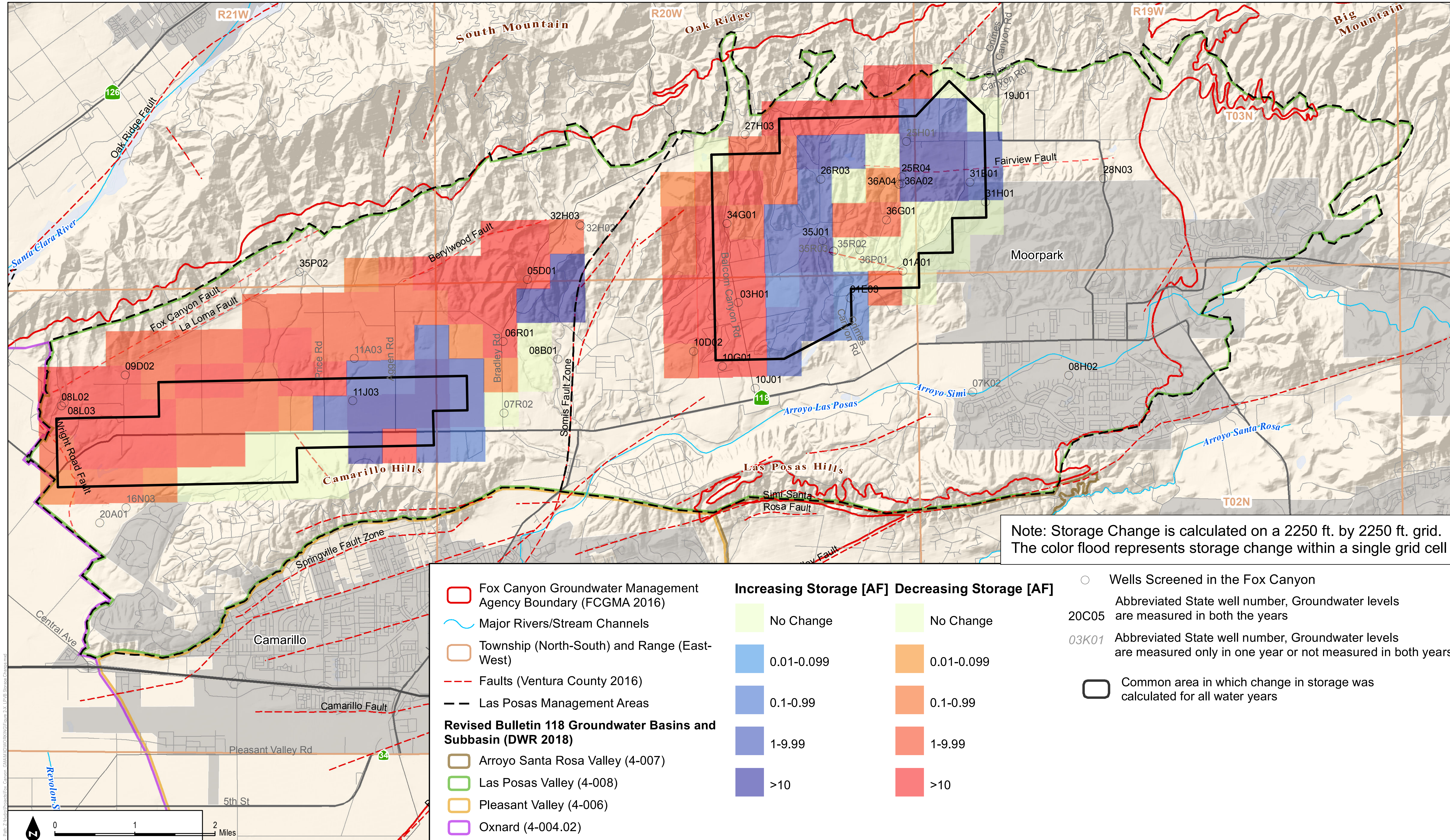
FIGURE 2-43

Change in Storage in the Fox Canyon Aquifer: Spring 2016 to Spring 2017



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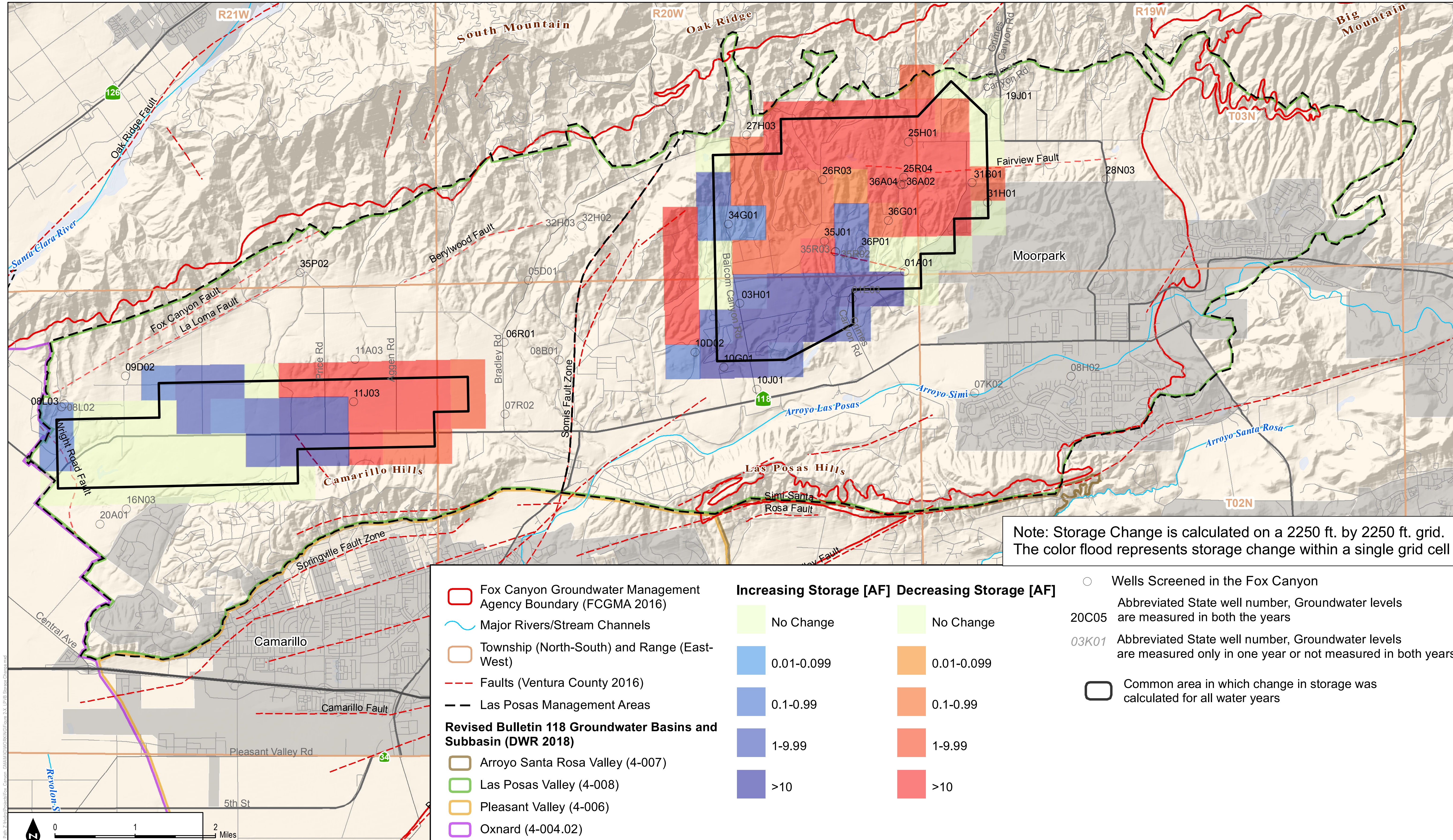
SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-44

Change in Storage in the Fox Canyon Aquifer: Spring 2017 to Spring 2018



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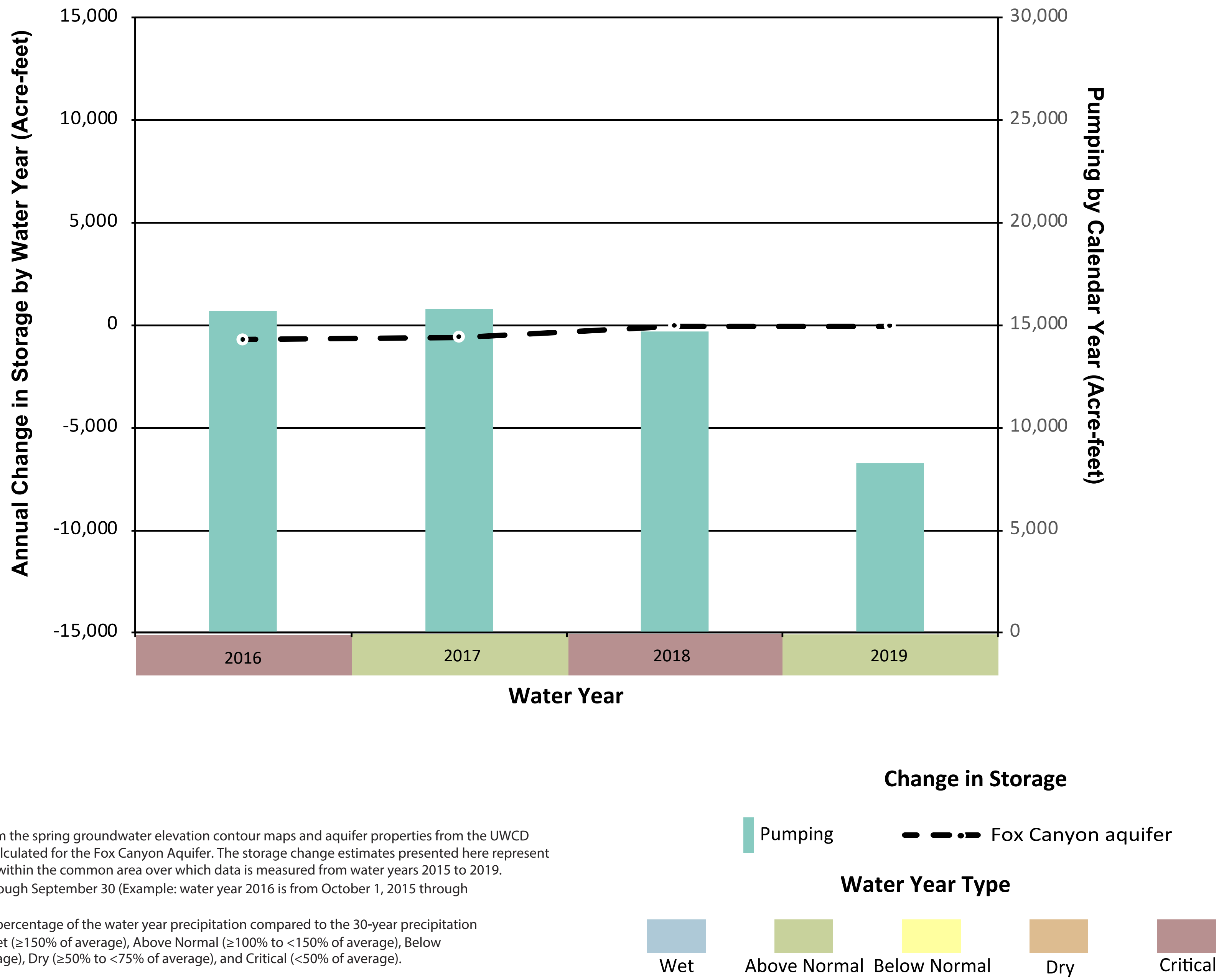
SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-45

Change in Storage in the Fox Canyon Aquifer: Spring 2018 to Spring 2019



Notes:

1) Storage change is estimated from the spring groundwater elevation contour maps and aquifer properties from the UWCD model. Storage change is only calculated for the Fox Canyon Aquifer. The storage change estimates presented here represent change in groundwater storage within the common area over which data is measured from water years 2015 to 2019.
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 2-46

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

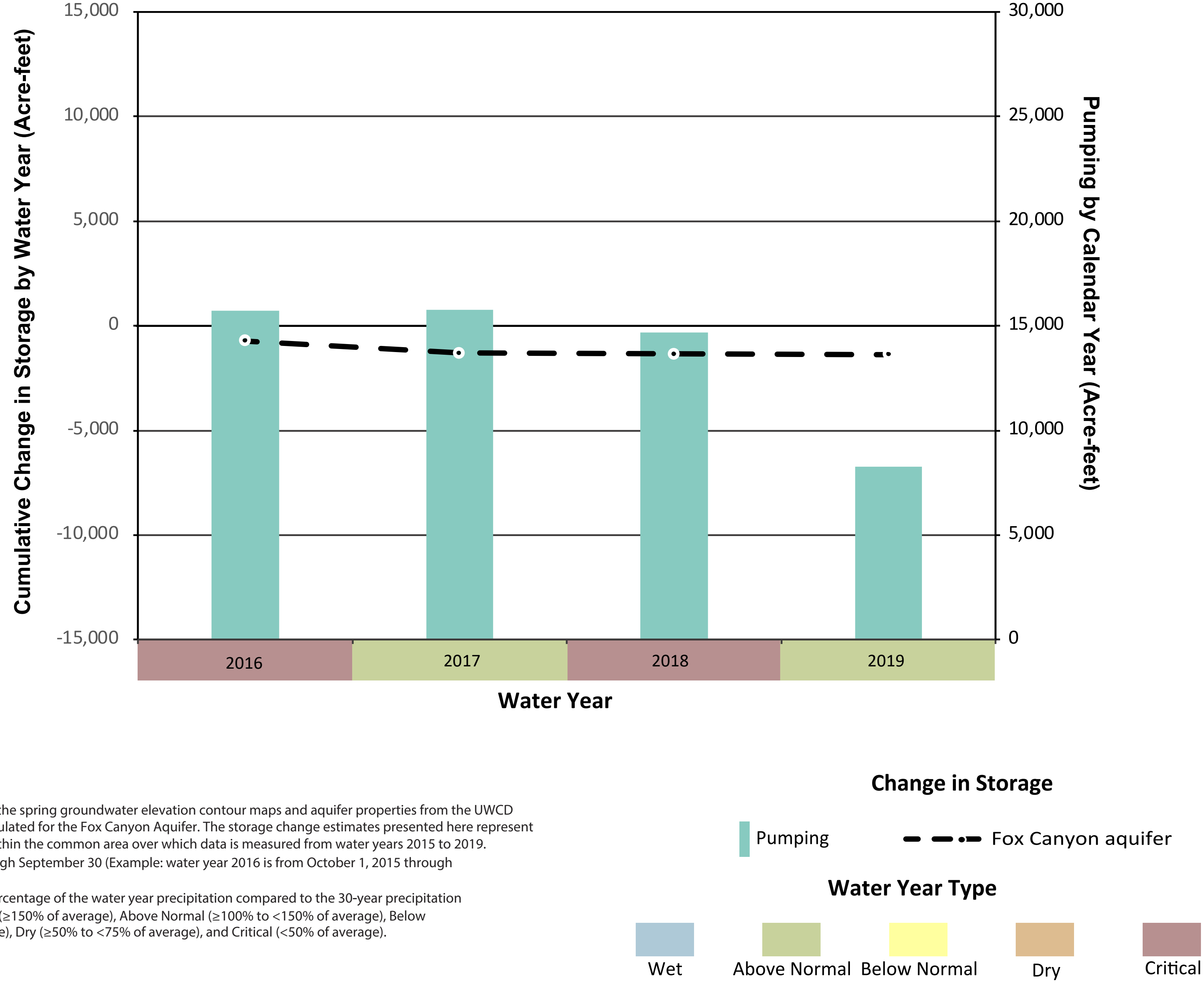


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FIGURE 2-47

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

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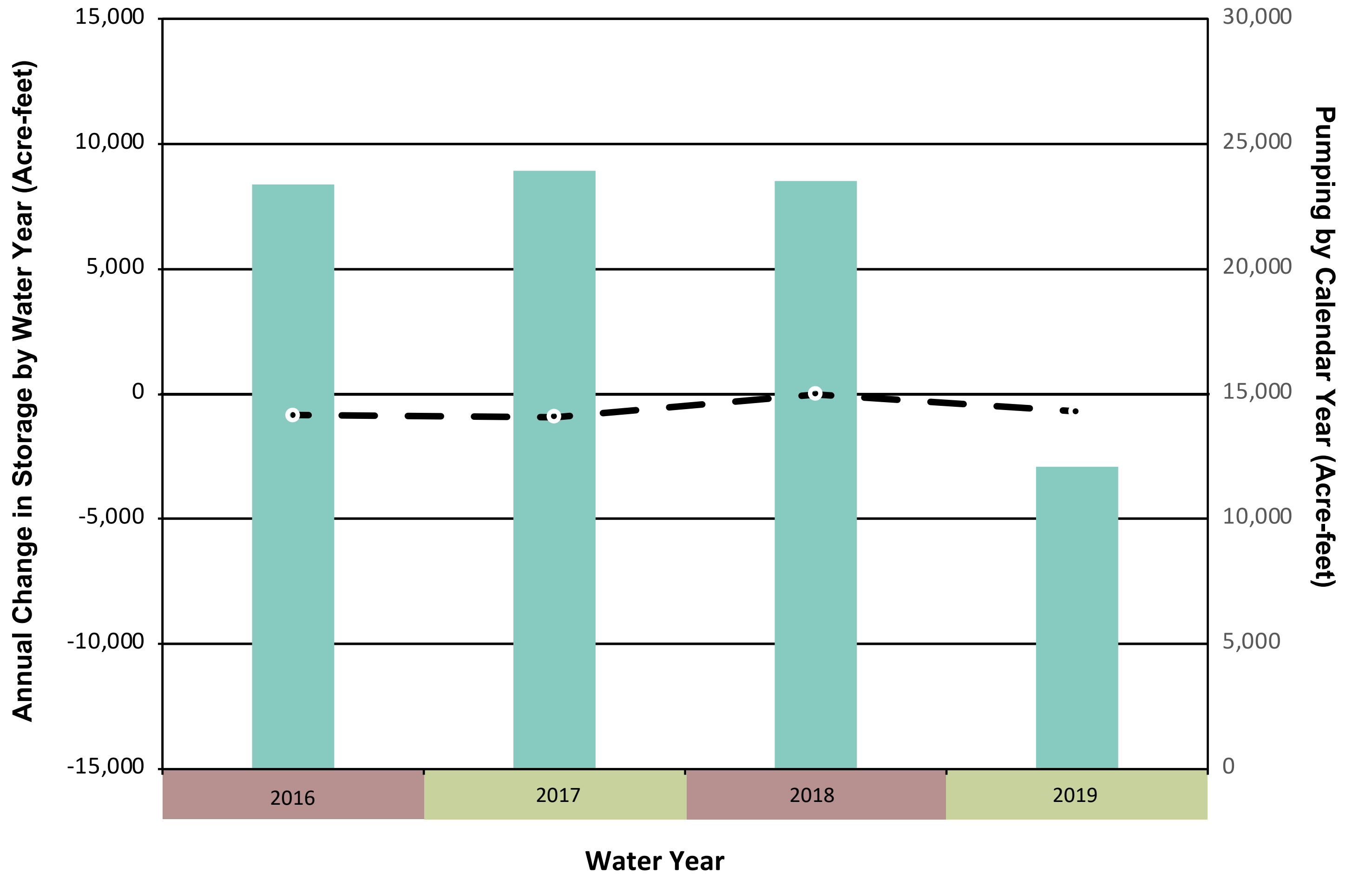

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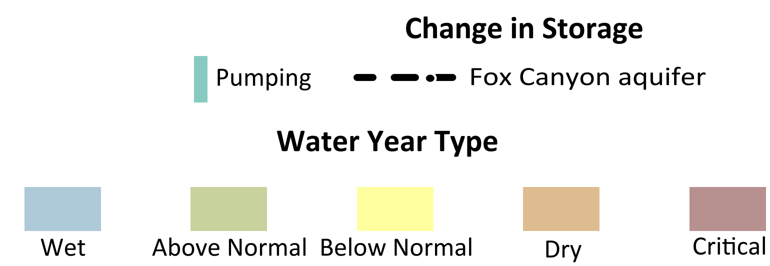

FIGURE 2-48

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

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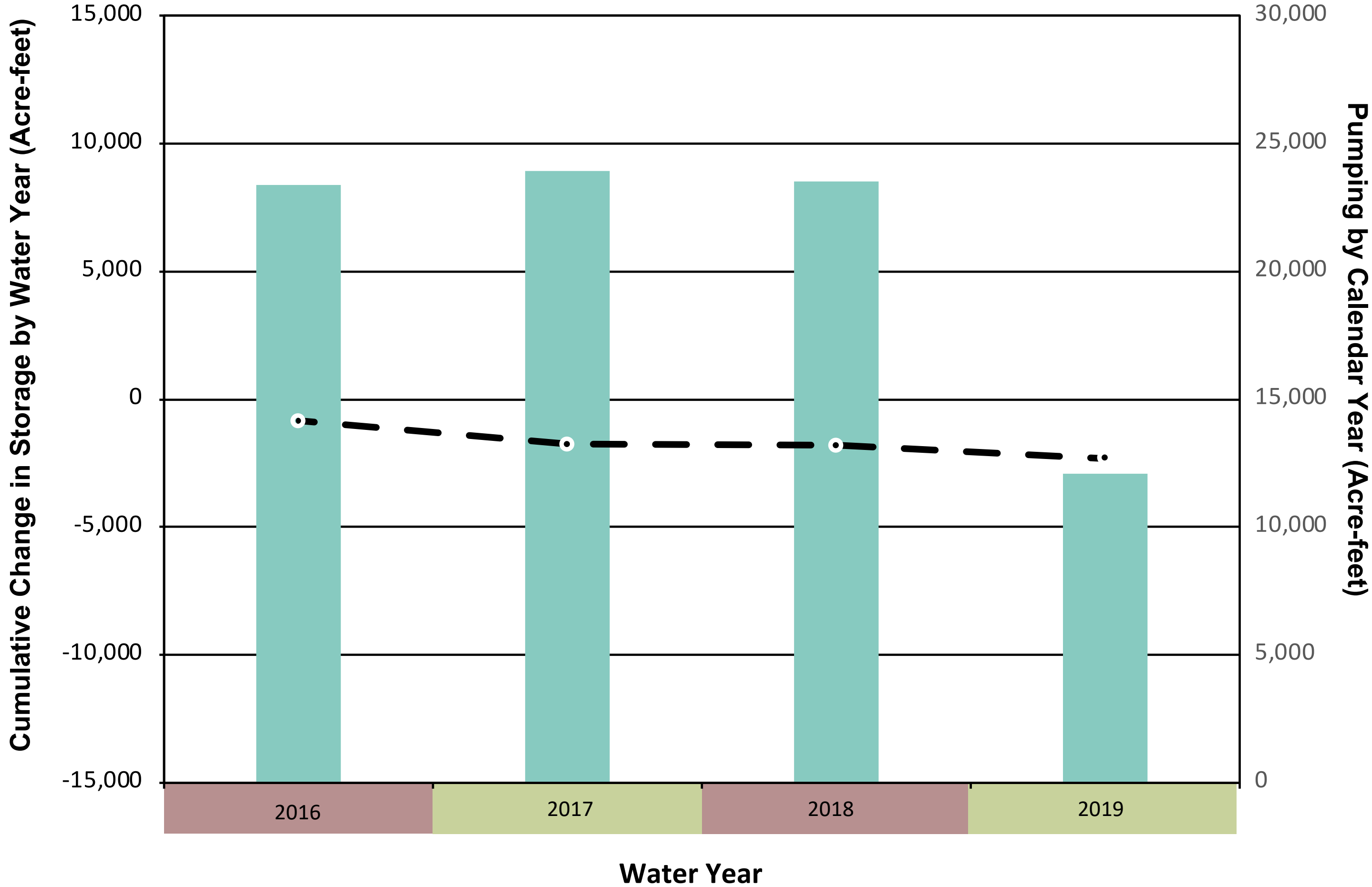

Notes:

1) Storage change is estimated from the spring groundwater elevation contour maps and aquifer properties from the CMWD model. Storage change is calculated for only for the Fox Canyon Aquifer. The storage change estimates presented here represent change in groundwater storage within the common area over which data is measured from water years 2015 to 2019.
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Change in Storage

Pumping — Fox Canyon aquifer

Water Year Type

Wet | Above Normal | Below Normal | Dry | Critical

FIGURE 2-49

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

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