First Periodic Evaluation

Groundwater Sustainability Plan for the Oxnard Subbasin

AUGUST 2024

Prepared for:

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Table of Contents

TABLES

FIGURES

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AF	acre-feet
AFY	acre-feet per year
AMI	advanced metering infrastructure
ASR	Aquifer Storage and Recovery
AWPF	Advanced Water Purification Facility
bgs	below ground surface
CMWD	Calleguas Municipal Water District
CWD	Camrosa Water District
CWRF	Camrosa Water District Water Reclamation Facility
DWR	California Department of Water Resources
EBB	Extraction Barrier Brackish
EOPMA	East Oxnard Plain Management Area
FCA	Fox Canyon Aquifer
FCGMA	Fox Canyon Groundwater Management Agency
GCA	Grimes Canyon Aquifer
GDE	groundwater-dependent ecosystem
GREAT	Groundwater Recovery Enhancement and Treatment
GRRP	Recycled Water/Groundwater Replenishment Reuse Project
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
LAS	Lower Aquifer System
LPVB	Las Posas Valley Basin
mg/L	milligrams per liter
msl	mean sea level
NBVC	Naval Base Ventura County
NNP	No New Projects
PEIR	Program Environmental Impact Report
PFAS	polyfluoroalkyl substances
PTP	Pumping Trough Pipeline
PVB	Pleasant Valley Basin
PVP	Pleasant Valley Pipeline
PVCWD	Pleasant Valley County Water District
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
State Water	State Water Project water
Subbasin	Oxnard Subbasin
SWP	State Water Project
TDS	total dissolved solids
UAS	Upper Aquifer System
UWCD	United Water Conservation District

Acronym/Abbreviation	Definition
VCWPD	Ventura County Watershed Protection District
VRGWFM	Ventura Regional Groundwater Flow Model
WLPMA	West Las Posas Management Area

Executive Summary

The Fox Canyon Groundwater Management Agency (FCGMA), the Groundwater Sustainability Agency (GSA) for the portions of the Oxnard Subbasin (Subbasin) within its jurisdictional boundaries, in coordination with the Camrosa Water District-Oxnard GSA and the Oxnard Outlying Areas GSA (County of Ventura), has prepared this first Periodic Evaluation of the Oxnard Subbasin Groundwater Sustainability Plan (GSP) in compliance with the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.)[1]. This first Periodic Evaluation of the GSP evaluates impacts of climate, water usage trends, and groundwater management decisions on groundwater conditions in the Subbasin between water year 2020[2] and water year 2024 and provides an assessment of whether GSP implementation is on track to achieve the sustainability goal of the Subbasin by 2040.

The GSP was submitted to the Department of Water Resources (DWR) on January 13, 2020, and was approved by DWR on November 18, 2021. The GSP reported on groundwater conditions through water year 2015. This evaluation includes an assessment of groundwater condition changes since the GSP was submitted. DWR's approval of the GSP included four recommended corrective actions, which FCGMA has worked to address over the past three years (Table ES-1, Recommended Corrective Actions and Corresponding FCGMA Activities).

Table ES-1. Recommended Corrective Actions and Corresponding FCGMA Activities

NO.	Summary of Recommended Corrective Action	Activities completed by FCGMA			Discussion of FCGMA Responses
		Technical Analysis or Study	New Project	Updated Monitoring Network	
1	Investigate the connectivity between surface water and groundwater	✓	✓	✓	Section 2.2.6
2	Discuss the impact of future seawater intrusion on beneficial uses and users	✓			Section 2.2.3
3	Incorporate periodic land subsidence monitoring into the GSP's monitoring plan			✓	Sections 2.2.5 and 7.2
4	Elaborate on the use of groundwater levels as a proxy for degraded water quality	✓	✓		Section 2.2.4

Additionally, since adopting the GSP, the FCGMA has been working to fill data gaps identified in the GSP, implement projects and management actions, and address legal actions taken in the Subbasin. FCGMA has undertaken these efforts in conjunction with other local agencies, and in consultation with interested parties in the Subbasin and the adjacent Pleasant Valley Basin (PVB) and Las Posas Valley Basins (LPVB). Targeted workshops were held during the development of this first Periodic Evaluation to solicit feedback and suggestions that have shaped the interpretations and recommendations presented in this document. The FCGMA Board of Directors remains committed to engaging with interested parties over the next periodic evaluation cycle.

[1] The GSAs that overlie that Oxnard Subbasin have not been modified since the GSP was submitted.
[2] A water year begins October 1 and ends September 30 to reflect the precipitation patterns in California. Under DWR's definition of a water year, water year 2024 began October 1, 2023, and ended September 30, 2024.

Current Groundwater Conditions

Five principal aquifers are present in the Subbasin: the Oxnard aquifer, Mugu aquifer, Hueneme aquifer, Fox Canyon aquifer (FCA), and Grimes Canyon aquifer (GCA) (FCGMA 2019). The Oxnard and Mugu aquifers compose the Upper Aquifer System (UAS), and the Hueneme, FCA, and GCA compose the Lower Aquifer System (LAS). Groundwater production for agricultural, municipal, and industrial use has induced seawater intrusion in both the UAS and LAS along the southwestern boundary of the Subbasin (FCGMA 2019). This first Periodic Evaluation of the GSP evaluates impacts of climate, water usage trends, and groundwater management decisions on groundwater conditions in the UAS and LAS between water year 2015 and water year 2024.

Between water year 2015 and 2022, the Subbasin experienced seven years of drier-than-average conditions[3]. Consequently, fall groundwater elevations in both the UAS and LAS declined between 2015 and 2022, even after FCGMA purchased 15,000 AF of supplemental State Water Project water for recharge in the Subbasin in water year 2019. The wetter than average 2023 and 2024 water years resulted in increased availability of Santa Clara River surface water diversions. These diversions supported groundwater elevation recoveries across the Subbasin over the past two water years. Groundwater elevations are currently higher than those measured in 2015.

While groundwater elevations are higher than they were in 2015, available groundwater quality and numerical modeling data indicate that the Subbasin experienced additional seawater intrusion over the evaluation period. The largest increases in chloride concentration associated with seawater intrusion were measured near Port Hueneme and Point Mugu. Near Port Hueneme, chloride concentration increases were largest in the UAS. Conversely, near Point Mugu, chloride concentration increases were largest in the LAS. As anticipated in the GSP, numerical modeling data suggests that since 2015, approximately 140,000 acre-feet of groundwater was added to the Subbasin, and 113,600 acre-feet of seawater has intruded into the Subbasin.

Relationship to the Sustainable Management Criteria

The GSP established minimum threshold and measurable objective groundwater elevations at 34 representative monitoring points, or “key wells”, in the Subbasin. As noted in the GSP, groundwater elevations below the minimum thresholds are likely to cause net seawater intrusion and landward migration of saline water. In 2015, groundwater elevations were lower than the minimum threshold groundwater elevations at all 34 key wells (FCGMA 2019).

The GSP acknowledged that groundwater elevation recoveries from 2015 conditions to the measurable objectives would require progressive implementation of projects and management actions over a 20-year period. To account for this, the GSP established interim milestones that serve as groundwater elevation targets through 2040. Under average climate conditions, the interim milestones targeted groundwater elevation recoveries that averaged approximately 14 feet in the UAS and approximately 22 feet in the LAS over the first five years of GSP implementation. The groundwater elevations measured in spring 2024 ranged from approximately 5 to 117 feet higher than those in spring 2015.

Importantly, groundwater elevations in spring 2024 were higher than the minimum thresholds in 21 of the 27 key based upon the available data. FCGMA anticipates that the general trend of rising groundwater elevations will continue through 2040 with continued implementation of the GSP.

[3] The Subbasin received higher than average precipitation in water years 2017 and 2019, but the precipitation and local surface water available for diversion was not sufficient for the Subbasin to recover from long-term drought conditions.

Water Supplies in the Subbasin

Water Supplies in the Subbasin consist of surface water, imported water, recycled water, and groundwater (Table ES-2, Historical and Current Water Supplies in the Oxnard Subbasin). Total water supplies since 2015 (2016-2022) were approximately 26% lower than the historical average, largely due to a reduction in the availability of Santa Clara River water during drought years. However, total groundwater usage and imported water reliance were also lower than the historical average. Total groundwater usage declined by approximately 6% since 2015, with production from the UAS decreasing by about 15%, and groundwater production from the LAS increasing by about 9% (Table ES-2). Groundwater production reductions were principally due to groundwater extraction allocation revisions implemented by FCGMA.

Since adoption of the GSP, agencies in the Subbasin, with support from FCGMA, have begun delivering recycled water for agricultural irrigation. This represents a new source of irrigation water supply in the Subbasin.

Table ES-2. Historical and Current Water Supplies in the Oxnard Subbasin

Water Source		Historical Average (1985 - 2015) [Acre-Feet per Year][a]	Current Average (2016 - 2022) [Acre-Feet per Year][a]
Groundwater	Upper Aquifer System	49,170	41,670
	Lower Aquifer System	31,250	33,940
	Subtotal	80,420	75,610
Surface Water	Conejo Creek	1,160	2,050
	Santa Clara River[b]	64,730	31,320
Imported Water		14,540	9,250
Recycled Water		0	1,320
	Total	**160,850**	**119,550**

a Rounded to the nearest ten (10) acre-feet.
b Includes Santa Clara River water recharged in the Oxnard Forebay

State of Overdraft

Historical overdraft in the Subbasin has resulted in seawater intrusion and the migration of saline water in the UAS and LAS, principally near the southern coastal area of the Subbasin. To better characterize the degree of overdraft currently occurring in the Subbasin, the sustainable yield was re-evaluated through multiple new future condition numerical groundwater flow modeling scenarios. In the event that no new projects are implemented in the Subbasin, the sustainable yield of the UAS is estimated to be 34,100 AFY, and the sustainable yield of the LAS is estimated to be 10,600 AFY[4]. Groundwater production from the UAS and LAS currently exceeds these estimates by approximately 7,600 AFY and 23,300 AFY, respectively. Actual overdraft may exceed this estimate due to uncertainty in the estimated sustainable yield.

[4] Due to uncertainty in the model-estimates of seawater flux into the Oxnard Subbasin, the sustainable yield of the UAS may range from 30,000 to 38,200 AFY, and the sustainable yield of the LAS may range from 7,000 to 14,200 AFY (FCGMA, 2019).

Future Groundwater Conditions

Under Future Baseline conditions, groundwater production is anticipated to exceed the sustainable yield of the UAS and LAS by 5,900 AFY and 17,700 AFY, respectively. To address this, FCGMA and other agencies in the Subbasin have made significant progress developing projects and management actions that mitigate overdraft and seawater intrusion by 2040. These include:

- The development and implementation of a fixed extraction allocation system that places an upper bound on the total allowable annual extractions available to each operator in the Subbasin.
- The development and implementation of projects, and policy, which expand availability and usage of recycled water.
- The development and implementation of projects that increase surface water diversions from Santa Clara River for recharge and delivery for use in lieu of groundwater.
- The development and evaluation of seawater intrusion barrier projects that create new water supplies and increase the sustainable yield of the Subbasin.

The benefits of future projects and management actions, and their ability to mitigate overdraft, were evaluated through numerical modeling (Table ES-3, Estimated Project-Related Future Sustainable Yield).

Table ES-3. Estimated Project-Related Future Sustainable Yield

Model Scenario Name	Projects Evaluated	Estimated Sustainable Yield (Acre-Feet per Year)[a]		Estimated Remaining Overdraft (Acre-Feet per Year)[b]	
		Upper Aquifer System	Lower Aquifer System	Upper Aquifer System	Lower Aquifer System
Projects	▪ Expansion of Santa Clara River water diversions. ▪ Voluntary temporary fallowing ▪ infrastructure improvements	36,100	13,300	3,900	15,000
Basin Optimization	▪ Redistribution of pumping	35,200	17,100	4,800	11,200
Future Baseline with EBB	▪ Extraction Barrier and Brackish Water Treatment Project (Seawater Intrusion Extraction Barrier)	40,000[c]	28,200	-	-

Notes: "-" indicates that Overdraft is addressed; WLPMA = West Las Posas Management Area of the Las Posas Valley Basin.
a Sustainable yield increases associated with each project may not be additive.
b Estimated based on the Future Baseline groundwater extraction rates, which are equal to the 2016 to 2022 average, adjusted for estimated Santa Clara River water availability.
c Excludes the 10,000 AFY of simulated brackish water extractions from the Subbasin via United Water Conservation District's Extraction Barrier and Brackish Water Treatment project extraction wells.

While the modeling suggests that future projects will play a critical role in mitigating overdraft and achieving the sustainability goal for the Subbasin, uncertainty remains surrounding the timing, feasibility, scale, and cost of each project. Additional numerical modeling would need to be conducted to characterize the individual, rather than collective, benefits of each project. FCGMA anticipates coordinating with agency-leads for each of these projects to integrate updated project understandings into the GSP as they evolve.

Importantly, over the next five years, United Water Conservation District will be developing and implementing Phase I of their Extraction Barrier and Brackish Water Treatment project. This project is intended to create a seawater intrusion barrier by extracting brackish water near Point Mugu and maintaining a pumping trough that helps prevent landward migration of saline water. This project is anticipated to both increase water supplies in the Subbasin, through delivery of treated brackish water, and increase the sustainable yield of the Subbasin. Results from Phase I of this project, which is anticipated to start in 2028, will inform the need to revise the sustainable management criteria for the Subbasin to allow for project-related groundwater elevation declines along the coast and provide operators with additional flexibility.

Assessment of Progress Towards Sustainability

The primary sustainability goal for the Subbasin is to "to increase groundwater elevations inland of the Pacific coast in the aquifers that compose the UAS [Upper Aquifer System] and the LAS [Lower Aquifer System] to elevations that will prevent the long-term, or climatic cycle net (net), landward migration of the 2015 saline water impact front; prevent net seawater intrusion in the UAS; and prevent net seawater intrusion in the LAS" (FCGMA 2019). GSP implementation, thus far, is on track to meet the sustainability goal set forth in the GSP. This has been accomplished through:

- Development of policy that allocates groundwater extractions in a manner consistent with the GSP and SGMA.
- Diversification of water supplies and reduction in groundwater production from the Subbasin.
- Ongoing groundwater elevation and quality monitoring.
- Implementation of projects that address data gaps,
- Development, evaluation, and implementation of projects that increase water supplies and the sustainable yield of the Subbasin.

The information collected through these activities has improved groundwater condition monitoring, the hydrogeologic conceptual model of the Subbasin, and the understanding of projects and management actions that are implementable and support sustainable groundwater management in the Subbasin. This has resulted in improved estimates of the sustainable yield of the Subbasin and potential improvements to the sustainable management criteria that will guide management over the next five years. Significantly, adjudication proceedings have been undertaken in the Subbasin. At this time, it is unclear what legal effect the adjudication action will have on FCGMA's continued ability to implement the GSP and sustainably manage the Subbasin. Over the next five-years, FCGMA will continue to work towards sustainability and will re-evaluate the impacts of climate, water usage, project implementation, and legal actions on groundwater conditions and groundwater management in the Subbasin in accordance with the ongoing GSP evaluation process and adaptive management approach outlined in SGMA.

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1 Significant New Information

Fox Canyon Groundwater Management Agency (FCGMA) and other agencies in the Oxnard Subbasin (Subbasin; California Department of Water Resources [DWR] Bulletin 118 Groundwater Basin 4-004.02) have designed, funded, and implemented a range of projects and management actions that facilitate implementation of the Groundwater Sustainability Plan (GSP) for the Subbasin. These have included: the development of policy that support management of groundwater extractions from the Subbasin in a manner consistent with the GSP; the implementation of technical studies that address data gaps and improve the hydrogeologic conceptual model of the Subbasin; and the implementation and development of larger capital projects that increase water supplies and decrease groundwater demands within the Subbasin. Additionally, there have been legal challenges filed against FCGMA's management of the Subbasin including a challenge to the GSP and request for a comprehensive adjudication. These activities are summarized in Table 1-1, Summary of New Information Since GSP, and are discussed in detail in Section 3, Status of Projects and Management Actions.

Table 1-1. Summary of New Information Since GSP

Significant New Information	Description	Aspects of Plan Affected	Warrant Changes to Any Aspects of the Plan
Legal Challenges			
OPV Coalition, et al. v. Fox Canyon Groundwater Management Agency, Santa Barbara Sup. Ct. Case No. VENCI00555357	In June 2021, the OPV Coalition filed a lawsuit against FCGMA, challenging the OPV (Oxnard and Pleasant Valley) GSPs, the ordinance that establishes extraction allocations (limits) for all users in the Basins, and requesting an adjudication of all groundwater rights in the Basins. At this time, it is unclear what legal effect the lawsuit, in particular the adjudication action, will have on FCGMA's continued ability to implement the OPV GSPs and sustainably manage the Basins.	Unknown	Unknown
City of Oxnard v. Fox Canyon Groundwater Management Agency, Los Angeles Sup. Ct. Case No. 20STCP00929	In December 2019, the City of Oxnard (City) filed a petition for writ of mandate challenging FCGMA's adoption of an ordinance intended to transition the Agency's current groundwater management programs to sustainable groundwater management under SGMA. FCGMA amended its ordinance in response to the court's August 2023 writ of mandate.	Unknown	Unknown
Monitoring Network Information			
New Monitoring Data	Two nested monitoring well clusters were installed within the Oxnard Pumping Depression Management	Monitoring Network	Yes

Table 1-1. Summary of New Information Since GSP

Significant New Information	Description	Aspects of Plan Affected	Warrant Changes to Any Aspects of the Plan
	Area, adjacent to the PVB, in 2019 and 2020.		
Interferometric Synthetic Aperture Radar (InSAR) Data	DWR InSAR data are now available to examine land subsidence in the Oxnard Subbasin.	Monitoring Network	Yes
Projects and Management Actions			
Management Actions			
Fixed Extraction Allocation System	In 2019, FCGMA adopted a fixed extraction allocation system, which placed an upper bound on the total allowable annual extractions available to each operator in the Subbasin. Since adoption of the GSP, FCGMA has adopted ordinance amendments and resolutions to facilitate transition to the new allocation system, provide policies and procedures for seeking variances, and made modifications required under a court order addressing a challenge to the ordinance.	Projects and Management Actions	Yes
In-lieu recycled water for agricultural irrigation program	In 2023, FCGMA adopted 23-02, which provides a "recycled water pumping allocation" to the City of Oxnard for delivery of recycled water from its Advanced Water Purification Facility to agricultural operators in the Saline Intrusion and Pumping Depression Management Areas for irrigation in lieu of pumping groundwater	Projects and Management Actions	Yes
Project Prioritization Process and Criteria	In 2023, FCGMA adopted a formal process for evaluating and prioritizing projects in the Subbasin. This process, which was developed with input from interested parties, provides other agencies and interested parties in the Subbasin to submit project information to FCGMA for consideration in future funding opportunities and GSP modeling.	Projects and Management Actions	No
Water Supply Projects			
Projects that are currently being implemented			
Advanced Water Purification Facility Improvements – Phase II	Expansion of the City of Oxnard's Advanced Water Purification Facility (AWPF) to generate an additional 4,500	Projects and Management Actions	Yes

Table 1-1. Summary of New Information Since GSP

Significant New Information	Description	Aspects of Plan Affected	Warrant Changes to Any Aspects of the Plan
	AFY of reclaimed water. (City of Oxnard 2022).		
Aquifer Storage and Recovery Program	Construction of additional aquifer storage and recovery (ASR) wells, and potentially above ground storage, to increase system capacity for the City of Oxnard (City of Oxnard 2022).	Projects and Management Actions	Yes
Extraction Barrier and Brackish Water Treatment Project	Extraction of brackish groundwater in the Oxnard, Mugu, and Fox Canyon aquifers near Point Mugu to help prevent landward migration of the saline water impact front (UWCD 2021b).	Projects and Management Actions	Yes
Freeman Diversion Expansion Project	Expansion of the existing intake, conveyance, and recharge facilities to divert surface water at higher flow rates and with higher sediment loads than is possible with UWCD's existing Freeman Diversion on the Santa Clara River (FCGMA 2022).	Projects and Management Actions	Yes
Ferro-Rose Artificial Recharge of Groundwater	Expansion and Extension of existing conveyance structures and connection to the Ferro-Rose recharge basin, to allow for more recharge and increase diversions, within the limits of UWCD's existing water right, from the Santa Clara River during high-flow events. This project is a component of the Freeman Diversion Expansion Project. (FCGMA 2022).	Projects and Management Actions	Yes
Future Projects			
Laguna Road Recycled Water Pipeline Interconnection	Construction of a new pipeline interconnection to allow conveyance of recycled water from Pleasant Valley County Water District's (PVCWD's) system to UWCD's Pumping Trough Pipeline (PTP) system. This will allow for full utilization of available recycled water (FCGMA 2022).	Projects and Management Actions	Yes
Nauman-Hueneme Road Recycled Water Pipeline Interconnection	Construction of a new pipeline interconnection to allow conveyance of recycled water from the City of Oxnard's AWPF system, at Hueneme Road, to UWCD's PTP system to allow full utilization of available recycled water. This project is a potential alternative to, or supplement for, the Laguna Road	Projects and Management Actions	Yes

Table 1-1. Summary of New Information Since GSP

Significant New Information	Description	Aspects of Plan Affected	Warrant Changes to Any Aspects of the Plan
	Recycled Water Pipeline interconnection (FCGMA 2022).		
Purchase of Supplemental State Water Project (SWP) Water	In years when SWP water is available in excess of UWCD's Table A allocation, it would be purchased and used for recharge in the Oxnard Subbasin and delivered to users on the PTP and PVCWD systems (FCGMA 2022).	Projects and Management Actions	Yes
Seawater Intrusion Injection Barrier	Potential use of AWPF water to create a seawater intrusion injection barrier to help prevent landward migration of the saline water impact front.	Projects and Management Actions	Yes
Destruction of Abandoned Wells	Identification and destruction of abandoned wells in the Oxnard Subbasin to reduce the cross-connection provided by wells screened across multiple aquifers (FCGMA 2022).	Projects and Management Actions	Yes
Projects to Address Data Gaps			
Installation of Additional Groundwater Monitoring Wells	This project proposes installation of multi-depth monitoring wells in the Oxnard Subbasin to assess groundwater conditions in the principal aquifers in areas of the Oxnard Subbasin that lack data (FCGMA 2022).	Projects and Management Actions	Yes
Installation of Additional Shallow Groundwater Monitoring Wells	This project proposes installation of shallow monitoring wells to assess groundwater conditions along the Revolon Slough, Calleguas Creek, and the Santa Clara River (FCGMA 2022).	Projects and Management Actions	Yes
Installation of Transducers in Monitoring Wells	This project proposes installation of transducers in key wells, or key wells, in the Subbasin to reduce the temporal data gaps that currently exist in the record of aquifer conditions (FCGMA 2022).	Projects and Management Actions	Yes

Notes: OPV = Oxnard and Pleasant Valley; N/A = Not Applicable; PVCWD = Pleasant Valley Count Water District; FCGMA = Fox Canyon Groundwater Management Agency; CWD = Camrosa Water District; CSD = Camarillo Sanitary District; UWCD = United Water Conservation District; WRP = Water Reclamation Plant.

2 Current Groundwater Conditions

2.1 Background

The Oxnard Subbasin of the Santa Clara River Valley Groundwater Basin (DWR Bulletin 118 Groundwater Basin 4-004.02) is a coastal alluvial groundwater subbasin, underlying the Oxnard Plain in Ventura County, California (Figure 2-1 Vicinity Map for the Oxnard Subbasin). The Subbasin is in hydrologic communication, to varying degrees, with the Las Posas Valley Basin (LPVB) and Pleasant Valley Basin (PVB) to the east, the Mound and Santa Paula Subbasins of the Santa Clara River Valley Basin to the north, and with the Pacific Ocean to the west and southwest (FCGMA 2019). The boundary between the Subbasin and the PVB is defined by a facies change[5] and the boundary between the Subbasin and the LPVB is a jurisdictional boundary that follows parcel lines. The contact between permeable alluvium and semi-permeable rocks of the Santa Monica Mountains defines the southeastern boundary of the Subbasin, and the Oak Ridge and McGrath faults form the northern boundary of the Subbasin (DWR 2018; FCGMA 2019).

Five principal aquifers are defined in the Subbasin: the Oxnard aquifer, Mugu aquifer, Hueneme aquifer, Fox Canyon aquifer (FCA), and Grimes Canyon aquifer (GCA) (FCGMA 2019). The Oxnard and Mugu aquifers compose the Upper Aquifer System (UAS), and the Hueneme, FCA, and GCA compose the Lower Aquifer System (LAS). Groundwater production for agricultural, municipal, and industrial use has induced seawater intrusion in both the UAS and LAS along the southwestern boundary of the Subbasin (FCGMA 2019).

The sustainability goal for the Subbasin established in the GSP is "to increase groundwater elevations inland of the Pacific coast in the aquifers that compose the UAS and the LAS to elevations that will prevent the long-term, or climatic cycle net (net), landward migration of the 2015 saline water impact front; prevent net seawater intrusion in the UAS; and prevent net seawater intrusion in the LAS" (FCGMA 2019). Groundwater elevation minimum thresholds and measurable objectives were established at representative monitoring points, referred to as "key wells" in the GSP (Figure 2-2, Representative Monitoring Points in the Oxnard Subbasin). The measurable objective water levels are "the water levels measured at each of the key wells throughout the Subbasin—at which there is neither seawater flow into nor freshwater flow out of the UAS or LAS" (FCGMA 2019). The minimum threshold water levels are water levels that minimize the landward migration of the 2015 saline water impact front and allow declines in groundwater elevations during periods of future drought to be offset by recoveries during future periods of above-average rainfall (FCGMA 2019).

Groundwater elevations at the key wells were below the minimum threshold groundwater elevations in 2015. Therefore, the GSP established interim milestone groundwater elevations as targets for groundwater elevation recoveries every five years between 2020 and 2040 (FCGMA 2019). The GSP established two sets of interim milestones, one for groundwater elevations to reach the minimum thresholds by 2040, and a second for groundwater elevations to reach the measurable objectives by 2040. These two sets of interim milestones were established to account for the climatic influence on groundwater elevations (FCGMA 2019). Under drought conditions, groundwater recovery is hampered by the lack of surface water available for recharge. Therefore, the GSP selected a drought condition recovery that would bring groundwater elevations to the minimum threshold by 2040. In contrast, under average climatic conditions, groundwater elevations are expected to recover to the

[5] A facies change is a change in the sediment characteristics. In this case, there is a lateral change from coarser grained sediments in the Subbasin to finer grained sediments in the PVB.

measurable objective groundwater elevation under average climatic conditions. Between October 1, 2019, and September 30, 2023, the Subbasin received an annual[6] average of 12.8 inches of precipitation. This is similar to, but approximately 9% lower than, than the long-term annual average precipitation of 14.1 inches. Therefore, for this five-year evaluation, groundwater elevations are compared to the interim milestones for average precipitation conditions.

The groundwater elevation minimum thresholds and measurable objectives selected to meet the sustainability goal for the Subbasin were used as a proxy for all other applicable sustainability indicators in the GSP (FCGMA 2019). These groundwater elevations are higher than the historical low groundwater elevations. Therefore, the minimum thresholds and measurable objective water levels will prevent chronic lowering of groundwater levels, significant and unreasonable reduction of groundwater storage, degraded water quality as a result of groundwater production, and land subsidence related to groundwater production (FCGMA 2019). Depletions of interconnected surface water that result in a significant and unreasonable loss of groundwater-dependent ecosystem (GDE) habitat have not occurred within the Subbasin because there is only minor (<31 AFY) production from the semi-perched aquifer, which is the source of the groundwater that supports GDEs in the Subbasin (FCGMA 2019). The semi-perched aquifer is not considered a principal aquifer in the Subbasin, and there are currently no plans to produce groundwater from this unit in the future (FCGMA 2019).

2.1.1 DWR Recommended Corrective Actions

DWR's assessment and approval of the GSP included four "recommended corrective actions" that should be considered for the first five-year GSP evaluation. These recommended corrective actions and the applicable sustainability indicators are:

RECOMMENDED CORRECTIVE ACTION 1

Investigate the hydraulic connectivity between the surface water bodies, semi-perched aquifer, and principal aquifers to improve the understanding of potential migration of impaired water, the reliance of two potential GDEs on the semi-perched aquifer, and depletion of interconnected surface water bodies. Also, identify specific locations of gaining and losing reaches of surface water bodies and quantify the depletion of interconnected surface water. Describe schedule and steps that will be taken to fill data gaps identified in the GSP related to shallow groundwater monitoring near surface water bodies and GDEs.

Recommended corrective action 1 applies to depletions of interconnected surface water.

RECOMMENDED CORRECTIVE ACTION 2

Under the dry climatic condition scenario, the groundwater levels will only reach minimum thresholds by 2040, which will limit seawater intrusion but not necessarily avoid the condition. Discuss the impact of further seawater intrusion and associated loss of storage on beneficial uses and users under the dry climatic condition scenario and the potential impacts to uses and users inland of the 2015 saline water impact area if landward migration of the saline water impact front continues.

[6] This is a water-year annual average, not a calendar year annual average.

Recommended corrective action 2 applies to seawater intrusion.

RECOMMENDED CORRECTIVE ACTION 3

Incorporate periodic subsidence monitoring into the GSP's monitoring plan that can be used to quantify whether land subsidence is occurring and whether the groundwater level proxy is avoiding undesirable results associated with land subsidence. As an option, the Department provides statewide InSAR data that can be used for monitoring land subsidence.

Recommended corrective action 3 applies to land subsidence.

RECOMMENDED CORRECTIVE ACTION 4

Elaborate how the Agency is planning to verify that the groundwater level thresholds are adequate to assess the groundwater quality conditions in the Subbasin. Discuss how the groundwater quality data from the existing monitoring network will be used for sustainable management of the Subbasin. Coordinate with the appropriate groundwater users, as identified in the GSP, and the appropriate water quality agencies in the Subbasin to evaluate how the Agency's current groundwater management strategy is affecting the groundwater quality in the Subbasin.

Recommended corrective action 4 applies to degraded water quality.

2.2 Current Conditions Related to Sustainability Indicators

The following sections discuss the current groundwater conditions related to each of the sustainability indicators in the Subbasin. The groundwater levels relative to the GSP-defined sustainable management criteria (SMC) are discussed in Section 2.2.1, Chronic Lowering of Groundwater Levels, along with a discussion of undesirable results related to groundwater levels, DWR recommended corrective actions related to groundwater levels, and progress toward achieving sustainability. Sections 2.2.2, Reduction of Groundwater in Storage, through 2.2.6, Depletion of Interconnected Surface Waters, focus on the undesirable results, DWR recommended corrective actions, and the progress toward achieving sustainability for each sustainability indicator.

Changes to the SMCs, where recommended, are discussed relative to each sustainability indicator.

2.2.1 Chronic Lowering of Groundwater Levels

This section summarizes current (i.e., water year 2024) groundwater elevations in the Subbasin and their relation to the SMCs established in the GSP. Additionally, this section reviews groundwater elevation changes between:

- The end of the GSP reporting period (i.e., calendar year 2015) and the current water year.
- Water year 2020 and water year 2024, which is the evaluation period for this first periodic evaluation of the GSP.

Water year groundwater elevations are characterized using seasonal low and seasonal high measurements. Seasonal low groundwater elevations are defined in the GSP as groundwater elevations measured between

October 2 and October 29 and seasonal high groundwater elevations are defined in the GSP as groundwater elevations measured between March 2 and March 29.

In fall 2023 and spring 2024, measured groundwater elevations were available for 27 of the 34 key wells established in the GSP (Table 2-1, Water Year 2024 Groundwater Elevations at Key Wells in the Oxnard Subbasin; Figure 2-3, Fall 2023 Water Levels Relative to the Minimum Thresholds and Measurable Objectives; Figure 2-4, Spring 2024 Water Levels Relative to the Minimum Thresholds and Measurable Objectives).

2.2.1.1 DWR Recommended Corrective Actions

DWR did not issue a recommended corrective action specific to chronic lowering of groundwater levels, although two of the recommended corrective actions issued by DWR are related to groundwater levels (DWR 2021). These two recommended corrective actions are discussed in more detail in Sections 2.4, Seawater Intrusion, and 2.5, Groundwater Quality.

2.2.1.2 Groundwater Elevation Changes in the Subbasin

Groundwater elevations in the Subbasin generally respond to climatic conditions and the availability of Santa Clara River water for recharge and delivery for use in lieu of groundwater. Since 2015, climate in the Subbasin has varied, with drier-than-average conditions persisting through water year 2022, and wetter-than-average conditions occurring in water years 2023 and 2024. In response to this, between fall 2015 and fall 2022, groundwater elevations in the Subbasin declined by an average of approximately 19 feet in the UAS and 46 AF in the LAS. The wetter-than-average hydrology in water years 2023 and 2024 resulted in increased availability of Santa Clara River water, which supported groundwater elevation recoveries across the Subbasin. Groundwater elevations are currently higher than those measured in 2015. The sections below summarize the net groundwater elevation change in each principal aquifer over this period.

2.2.1.2.1 Upper Aquifer System

Oxnard Aquifer

The GSP reported on groundwater conditions through fall and spring of 2015. Since 2015, fall groundwater elevations in the Oxnard aquifer have increased across the Subbasin. Groundwater elevations exhibited the largest increases in the Forebay Management Area, where United Water Conservation District's (UWCD) recharge operations supported recoveries of up to approximately 110 feet (Figure 2-5, Oxnard Aquifer - Groundwater Elevation Changes from Fall 2015 to 2023). In the Oxnard Pumping Depression Management Area, fall groundwater elevations increased by approximately 20 to 40 feet between 2015 and 2023, and in the Saline Intrusion Management Area, groundwater elevations increased by approximately 3 to 20 feet (Figure 2-5). Groundwater elevations in the UAS exhibited similar recoveries between spring 2015 and spring 2024 (Figure 2-6, Oxnard Aquifer - Groundwater Elevation Changes from Spring 2015 to 2024).

Since 2019, the start of the evaluation period, fall groundwater elevations in the Oxnard aquifer have increased by approximately 9 to 20 feet (Table 2-1).

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Table 2-1. Water Year 2024 Groundwater Elevations at Key Wells in the Oxnard Subbasin

State Well Number	Aquifer	Management Area	Fall Groundwater Elevations			Spring Groundwater Elevations			Minimum Threshold	Measurable Objective	2025 Interim Milestone (Average Climate)
			2023 (ft MSL)	Change from 2019 (ft)	Change from 2015 (ft)	2024 (ft MSL)	Change from 2020 (ft)	Change from 2015 (ft)			
01N21W32Q06S	Oxnard	Saline Intrusion	-5.79	9.03	14.45	4.86	15.68	17.59	2	17	-15
01N22W20J08S	Oxnard	Saline Intrusion	6.22	19.99	20.41	18.13	26.8	25.7	7	17	-7
01N22W26J04S	Oxnard	Saline Intrusion	-1.09	17.85	22.22	12.94	25.95	27.28	2	17	-15
01N22W27C03S	Oxnard	Saline Intrusion	4.76	19.64	19.59	7.68	16.16	16.71	7	17	-7
01N23W01C05S	Oxnard	West Oxnard Plain	7.16	8.65	8.08	12.24	10.73	11.06	7	17	4
02N22W36E06S	Oxnard	West Oxnard Plain	NM	—	—	NM	—	—	12	37	-10
01N21W32Q05S	Mugu	Saline Intrusion	-47.63	17.22	50.11	-17.87	39.66	42.86	2	17	-78
01N21W32Q07S	Mugu	Saline Intrusion	-31.15	14.09	33.87	-10.21	28.33	31.00	2	17	-52
01N22W20J07S	Mugu	Saline Intrusion	5.30	21.79	20.26	17.55	27.16	26.64	7	17	-7
01N22W26J03S	Mugu	Saline Intrusion	NM	—	—	NM	—	—	2	17	-30
01N22W27C02S	Mugu	Saline Intrusion	-0.65	20.40	21.92	14.47	27.44	28.79	7	17	-15
02N21W07L06S	Mugu	Forebay	126.12	92.4	138.2	125.85	82.64	117.65	27	62	8
02N22W23B07S	Mugu	Forebay	45.72	80.45	76.53	62.85	62.07	83.57	17	47	-11
02N22W36E05S	Mugu	West Oxnard Plain	NM	—	—	NM	—	—	12	37	-6
01N22W20J05S	Hueneme	Saline Intrusion	-0.40	28.16	27.28	13.51	32.67	33.42	2	17	-18
01N23W01C03S	Hueneme	West Oxnard Plain	-1.71	32.91	28.24	11.20	33.46	34.44	7	22	-17
01N23W01C04S	Hueneme	West Oxnard Plain	5.15	35.64	31.67	21.09	39.92	41.12	7	22	-17
02N22W23B04S	Hueneme	Forebay	-36.85	47.41	49.92	-15.79	47.76	59.80	-3	17	-67
02N22W23B05S	Hueneme	Forebay	-19.34	54.86	56.50	1.91	53.00	67.44	-3	17	-60
02N22W23B06S	Hueneme	Forebay	41.78	81.48	78.21	57.35	61.25	80.55	17	47	-15
02N22W36E03S	Hueneme	West Oxnard Plain	NM	—	—	NM	—	—	12	37	-28
02N22W36E04S	Hueneme	West Oxnard Plain	NM	—	—	NM	—	—	12	37	-13
01N21W32Q04S	FCA	Saline Intrusion	-51.95	18.09	53.43	-22.21	40.60	44.09	-23	2	-86
01N22W20J04S	FCA	Saline Intrusion	-9.13	28.5	28.0	5.96	33.18	34.08	2	17	-26[b]
01N22W26K03S	FCA	Saline Intrusion	-59.60	0.76	-	-6.82	36.92	58.81	-18	2	-52
01N23W01C02S	FCA	West Oxnard Plain	-12.67	26.88	21.67	-2.20	26.27	27.11	7	22	-25
02N21W07L04S	FCA	Forebay	52.33	67.37	84.35	61.64	55.65	57.76	17	42	-12
02N22W23B03S	FCA	Forebay	-35.13	50.39	48.42	-15.46	48.18	61.54	-3	17	-67
01N21W32Q02S	GCA	Saline Intrusion	-50.33	18.30	52.87	-18.91	42.15	45.79	-23	2	-86
01N21W32Q03S	GCA	Saline Intrusion	-61.09	17.31	53.08	-31.61	40.76	43.95	-23	2	-93
01N21W07J02S	Multiple	Oxnard Pumping Depression	NM	—	—	NM	—	—	-38	2	-105
01N21W21H02S	Multiple	Oxnard Pumping Depression	NM	—	—	NM	—	—	-68	-8	-103
02N21W07L03S	Multiple	Forebay	42.19	53.06	66.78	48.66	50.17	46.82	17	37	-10
02N21W07L05S	Multiple	Forebay	117.77	90.04	119.17	118.53	76.19	118.53	27	57	11

Notes: NM = "Not Measured", "-" indicates that one or more measurements during the analysis window were not collected.

[a] Positive values indicate that groundwater elevations at the key well have increased. Negative values indicate that groundwater elevations at the key well have declined.

[b] The Interim Milestone for this well was erroneously reported in the GSP as 42 ft. mean sea level, which is higher than the measurable objective. The interim milestone for this well was corrected as part of this periodic evaluation.

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Mugu Aquifer

Like the Oxnard aquifer, fall groundwater elevations in the Mugu aquifer have increased since 2015. Groundwater elevations exhibited the largest increases in the Forebay Management Area, where UWCD's recharge operations supported recoveries of up to approximately 120 feet (Figure 2-7, Mugu Aquifer - Groundwater Elevation Changes from Fall 2015 to 2023). In the Oxnard Pumping Depression Management Area, fall groundwater elevations increased by approximately 15 to 40 feet between 2015 and 2023, and in the Saline Intrusion Management Area, groundwater elevations increased by approximately 20 to 50 feet (Figure 2-7). Groundwater elevations in the UAS exhibited similar recoveries between spring 2015 and spring 2024 (Figure 2-8, Mugu Aquifer - Groundwater Elevation Changes from Spring 2015 to 2024).

Since 2019, the start of the evaluation period, fall groundwater elevations in the Mugu aquifer have increased by approximately 14 to 80 feet (Table 2-1). The largest fall groundwater elevation increases in the Mugu were measured in the Forebay Management Area. Within the Saline Intrusion Management Area, fall groundwater elevations in the Mugu increased by an average of approximately 18 feet (Table 2-1).

2.2.1.2.2 Lower Aquifer System

Hueneme Aquifer

Fall groundwater elevations in the Hueneme aquifer in the Forebay Management Area increased by 50 to 100 feet (Figure 2-9, Hueneme Aquifer – Groundwater Elevation Changes from Fall 2015 to 2023). Over the same period, along the coast and near Port Hueneme, groundwater elevations increased by approximately 20 to 25 feet (Figure 2-9). Between spring 2015 and 2024, groundwater elevations in the Forebay Management Area increased by approximately 60 to 90 feet, and groundwater elevations near Port Hueneme increased by approximately 25 to 30 feet (Figure 2-10, Hueneme Aquifer – Groundwater Elevation Changes from Spring 2015 to 2024)

Since 2019, the start of the evaluation period, fall groundwater elevations in the Hueneme aquifer have increased by up to 82 feet (Table 2-1).

Fox Canyon Aquifer

Fall groundwater elevations in the FCA within the Forebay Management Area increased by 48 to 84 feet between 2015 and 2023 (Figure 2-11, Fox Canyon Aquifer – Groundwater Elevation Changes from Fall 2015 to 2023). Over the same period within the Saline Intrusion Management Area, groundwater elevations increased by approximately 25 to 60 feet (Figure 2-11). Between spring 2015 and 2024, groundwater elevations in the Forebay Management Area increased by approximately 45 to 60 feet, and groundwater elevations in the Saline Intrusion Management Area increased by approximately 30 to 60 feet (Figure 2-12, Fox Canyon Aquifer – Groundwater Elevation Changes from Spring 2015 to 2024)

Since 2019, the start of the evaluation period, fall groundwater elevations in the FCA have increased by up to 67 feet (Table 2-1). Over the evaluation period, spring high groundwater elevation recoveries in the Saline Intrusion Management Area were larger than fall low groundwater elevation recoveries (Table 2-1).

Grimes Canyon Aquifer

GCA fall groundwater elevations in the Saline Intrusion Management Area, increased by 20 to 50 feet between 2015 and 2023 (Figure 2-13, Grimes Canyon Aquifer – Groundwater Elevation Changes from Fall 2015 to 2023). GCA groundwater elevations recoveries between spring 2015 and 2024 were similar to the fall groundwater elevation recoveries (Figure 2-14, Grimes Canyon Aquifer – Groundwater Elevation Changes from Spring 2015 to 2024)

Since 2019, fall groundwater elevations in the GCA have increased by approximately 18 feet (Table 2-1). Spring 2024 groundwater elevations were approximately 40 feet higher than they were in spring 2020 (Table 2-1).

2.2.1.3 Sustainable Management Criteria

2.2.1.3.1 Measurable Objectives

In 2015, the end of the GSP reporting period, groundwater elevations in the Subbasin were lower than the measurable objective groundwater elevations. Under average climate conditions, the GSP establishing the goal of increasing groundwater elevation to the measurable objectives by 2040. Fall 2023 groundwater elevations were above the measurable objectives at 4 of 34 key wells in the Subbasin (Table 2-1; Figure 2-3 and Figures 2-15 through 2-19). Spring 2024 groundwater elevations were above the measurable objective groundwater elevations at 8 of the 34 key wells in the Subbasin (Table 2-1; Figure 2-4 and Figures 2-15 through 2-19).

Groundwater elevations the Subbasin are influenced by water year type and the availability of surface water for recharge and use in lieu of groundwater. Because of this, there may be periods of declining groundwater elevations during dry water years. Despite this, FCGMA anticipates that the general trend of rising groundwater elevations will continue through 2040 with continued implementation of projects and management actions.

2.2.1.3.2 Minimum Thresholds

In 2015, groundwater elevations in the Subbasin were lower than the minimum threshold groundwater elevations. Fall 2023 groundwater elevations were above the minimum thresholds at 7 of the key wells in the Subbasin (Table 2-1; Figure 2-3 and Figures 2-15 through 2-19). Spring 2024 groundwater elevations were above the minimum thresholds at 21 of the key wells in the Subbasin (Table 2-1; Figure 2-4 and Figures 2-15 through 2-19). Of the six wells with spring groundwater elevations below the minimum threshold, three are screened in the UAS, and three are screened in the LAS. Geographically, these wells are distributed in the Saline Intrusion Management Area, the Forebay Management Area, and the West Oxnard Plain Management Area (Table 2-1).

2.2.1.3.3 Interim Milestones

Fall 2023 groundwater elevations were above the 2025 interim milestones at 26 of the key wells in the Subbasin (Table 2-1; Figure 2-3 and Figures 2-15 through 2-19). Spring 2024 groundwater elevations were above the 2025 interim milestones at all 27 key wells with available measurements in the Subbasin (Table 2-1; Figure 2-4 and Figures 2-15 through 2-19).

2.2.1.4 Undesirable Results

The GSP defined undesirable results for the both the UAS and LAS. The UAS is expected to experience undesirable results if:

- In any single monitoring event, water levels in 6 of the 14 key wells are below their respective minimum threshold[7].
- The groundwater elevation at any individual key well is below the historical low water level[8] for that well; or
- The groundwater elevation in any individual key well is below the minimum threshold for either three consecutive monitoring events or three of five consecutive monitoring events, where monitoring events are scheduled to occur in the spring and fall of each year.

Similarly, the LAS is expected to experience undesirable results if:

- In any single monitoring event, water levels in 8 of the 19 key wells are below their respective minimum threshold.
- The groundwater elevation at any individual key well is below the historical low water level[9] for that well.
- The groundwater elevation in any individual key well is below the minimum threshold for either three consecutive monitoring events or three of five consecutive monitoring events, where monitoring events are scheduled to occur in the spring and fall of each year.

During the evaluation period, groundwater elevations occurred below the historical low groundwater elevations at 9 of the 15 key wells screened in the UAS and 11 of the 19 key wells screened in the LAS (Figures 2-15 through 2-19). Additionally, groundwater elevations at all key wells in the Subbasin were below the minimum thresholds between spring 2015 and fall 2022 (Figures 2-15 through 2-19). These conditions indicate that undesirable results occurred in both the UAS and LAS between spring 2015 and fall 2022.

Importantly, fall 2023 groundwater levels were higher than they were in 2019 in all 27 key wells that were measured, and 26 were higher than the interim milestones. Therefore, management of the Subbasin under the adopted GSP, along with climate conditions that allowed for groundwater recharge in the Oxnard Forebay, has resulted in groundwater levels that are progressing toward sustainable levels that will prevent the further inland migration of the saline water impact front by 2040.

2.2.1.5 Progress Toward Achieving Sustainability

Spring 2024 groundwater elevations were higher than the spring 2020 groundwater elevations at all 11 key wells in the UAS, and all 16 of the key wells in the LAS (Table 2-1). Additionally, groundwater elevations in spring 2024 were higher than the average climate interim milestones at all 27 key wells measured in the Subbasin. These groundwater elevations reflect management decisions by the FCGMA, projects that have been implemented, UWCD's recharge operations, and the influence of two water years with above average precipitation in the Subbasin. GSP implementation has been effective thus far in progressing toward groundwater sustainability by 2040.

[7] 15 wells were referenced in the GSP. However, only 14 key wells are screened in the UAS.
[8] Historical low water levels were defined using groundwater elevations measured prior to December 31, 2015.
[9] Historical low water levels were defined using groundwater elevations measured prior to December 31, 2015.

Since 2020, groundwater production in the Subbasin averaged approximately 75,000 AFY[10], which was 900 AFY lower than the average groundwater production between 2015 and 2020. This reduction in groundwater production was due to FCGMA management actions, principally implementation of a new groundwater extraction allocation system, supported by use of new recycled water supplies provided to agricultural operators for use in lieu of groundwater. Additionally, in water year 2023, UWCD diverted approximately 111,000 (acre-feet) AF of water from the Santa Clara River for recharge in the Subbasin, which was the third largest volume of Santa Clara River water recharged in the Forebay since 1985 (FCGMA 2019). The introduction of new recycled water supplies, reduction in groundwater pumping, and historically high recharge have reversed the downward trend in groundwater elevations in the Subbasin.

2.2.1.6 Adaptive Management Approaches

FCGMA has taken several steps to adaptively manage the Subbasin since adoption of the GSP. These include:

- Purchase of 15,000 AF of supplemental State Water Project (SWP) water in 2019 to support recharge in the Forebay and conjunctive use within the Subbasin.
- Development and implementation of a new extraction allocation system with fixed allocations for all pumpers which facilitates groundwater extraction reporting and management in a manner consistent with the Sustainable Groundwater Management Act (SGMA).
- Development of project evaluation criteria and process to prioritize water supply and infrastructure projects that support groundwater sustainability in the Subbasin.
- Initial investigation of basin optimization scenarios that consider differential pumping adjustments by management area within the Subbasin.

2.2.1.7 Impacts to Beneficial Uses and Users of Groundwater

Beneficial uses and users of groundwater within the Subbasin include environmental, agricultural, domestic, and municipal and industrial users (FCGMA 2019). Groundwater elevations that remain above the minimum thresholds are anticipated to improve beneficial uses of the Subbasin by limiting seawater intrusion and chronic lowering of groundwater levels. Under average climate conditions, such as those experienced over the evaluation period, the GSP targeted raising groundwater elevations above the measurable objectives by 2040. The fact that groundwater elevations across the Subbasin are currently higher than the measurable objectives in several key wells and are above the minimum threshold groundwater elevations in both the UAS and LAS indicates that GSP implementation has positively impacted beneficial uses and users of groundwater in the Subbasin.

2.2.1.8 Changes to Sustainable Management Criteria

The minimum threshold and measurable objective groundwater elevations established in the GSP were based on results from future scenario modeling using the Ventura Regional Groundwater Flow Model (VRGWFM) (UWCD 2018; FCGMA 2019). Future scenario modeling was updated as part of this Periodic GSP evaluation. Two simulations were identified that minimize seawater intrusion and maximize total groundwater production from the Subbasin, PVB, and West Las Posas Management Area (WLPMA). These simulations are: No New Projects (NNP) 3 and Future Baseline with UWCD's Extraction Barrier and Brackish (EBB) Water Treatment project (Section 5.2,

10 Estimated using extraction data from water years 2021 and 2022. Water year 2020 was not included in the calculation because 2020 was a transitional reporting year.

Future Scenario Water Budgets and Sustainable Yield). The simulated groundwater elevations from the NNP 3 scenario were used to develop recommended revisions to SMCs for the Subbasin.

Minimum Thresholds

Based on the updated simulations, revisions are recommended to 9 minimum threshold groundwater elevations established in the GSP (Table 2-2, Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin). Eight of the recommended revisions are for wells located within the Saline Intrusion and Oxnard Pumping Depression management areas and one is for a well located in the Forebay Management Area (Table 2-2).

In the UAS, revisions to the minimum threshold groundwater elevations are recommended for three wells in the Mugu aquifer. The recommended minimum thresholds for these wells are approximately 7 feet lower than the minimum thresholds established in the GSP (Table 2-2). In the LAS, the recommended minimum thresholds are approximately 13 feet higher than those established in the GSP (Table 2-2). The recommended minimum thresholds for three wells screened across multiple aquifers, range from 7 feet lower than the GSP minimum threshold to 38 feet higher than the GSP minimum threshold (Table 2-2).

Measurable Objectives

Revised measurable objective groundwater elevations are recommended at 11 key wells. Six of these are wells screened in the UAS and five are screened in the LAS (Table 2-2).

In the UAS, revisions to the measurable objectives are recommended for one well in the Oxnard aquifer five are in the Mugu aquifer. In the Oxnard aquifer, the recommended measurable objective is seven feet lower than the GSP. In the Mugu aquifer, the recommended measurable objectives are, on average, 10 feet lower than the GSP. In the Forebay Management Area of the Mugu aquifer, the recommended measurable objective groundwater elevations range from 12 feet lower than the GSP to 13 feet higher than the GSP (Table 2-2).

In the LAS, the recommended measurable objectives at five key wells range from 8 to 43 feet higher than the GSP measurable objectives (Table 2-2).

Consideration of UWCD's EBB Projects

UWCD's EBB Water Treatment project is intended to create a seawater intrusion barrier, near Point Mugu, by extracting brackish groundwater in the Oxnard and Mugu aquifers near the coast and maintaining a pumping trough that helps prevent landward migration of seawater. The project will cause groundwater elevations along the coast to decline below current elevations. To account for this as part of the successful implementation of the project, the SMCs in the Subbasin may need to be lowered to provide sufficient operational flexibility for the project and operators in the Subbasin. Potential revisions to the SMCs if UWCD's EBB project is implemented are described in Section 6.3, Potential Sustainable Management Criteria with Implementation of EBB.

Table 2-2. Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin

SWN	Management Area	Aquifer	Historical Low (ft msl) and Date Measured		Minimum Thresholds and Measurable Objectives Defined in the GSP[c]		Recommended Minimum Thresholds and Measurable Objectives[c]	
					MT (ft msl)	MO (ft msl)	MT (ft msl)	MO (ft msl)
01N21W32Q06S	Saline Intrusion Management Area	Oxnard	-25.8	11/22/1991	2	17	2	10
01N22W20J08S	Saline Intrusion Management Area	Oxnard	-14.8	9/28/1991	7	17	7	17
01N22W26J04S	Saline Intrusion Management Area	Oxnard	-28.3	10/26/1990	2	17	2	17
01N22W27C03S	Saline Intrusion Management Area	Oxnard	-18.6	12/13/1990	7	17	7	17
01N23W01C05S	West Oxnard Plain Management Area	Oxnard	-6.9	11/18/1991	7	17	7	17
02N22W36E06S	West Oxnard Plain Management Area	Oxnard	-25	10/28/2015	12	37	12	37
01N21W32Q05S	Saline Intrusion Management Area	Mugu	-107.4	11/30/2015	2	17	-5	5
01N21W32Q07S	Saline Intrusion Management Area	Mugu	-72.5	11/30/2015	2	17	-5	5
01N22W20J07S	Saline Intrusion Management Area	Mugu	-16.5	11/13/1991	7	17	7	17
~~01N22W26J03S~~	~~Saline Intrusion Management Area~~	~~Mugu~~	~~-52.6~~	~~10/26/1990~~	~~2~~	~~17~~	-	-
01N22W27C02S	Saline Intrusion Management Area	Mugu	-27.3	12/13/1990	7	17	0	10
02N21W07L06S	Forebay Management Area	Mugu	-12.2	12/3/2015	27	62	27	75
02N22W23B07S	Forebay Management Area	Mugu	-40.8	12/15/1992	17	47	17	60
02N22W36E05S	West Oxnard Plain Management Area	Mugu	-21	11/4/2015	12	37	12	37
01N22W20J05S	Saline Intrusion Management Area	Hueneme	-29.9	11/30/2015	2	17	2	17
01N23W01C03S	West Oxnard Plain Management Area	Hueneme	-39.7	1/7/1991	7	22	7	22
01N23W01C04S	West Oxnard Plain Management Area	Hueneme	-34.9	1/7/1991	7	22	7	22
02N22W23B04S	Forebay Management Area	Hueneme	-147.1	10/28/2014	-3	17	-3	17
02N22W23B05S	Forebay Management Area	Hueneme	-121	10/12/1991	-3	17	-3	17
02N22W23B06S	Forebay Management Area	Hueneme	-41.7	2/3/1993	17	47	17	60
02N22W36E03S	West Oxnard Plain Management Area	Hueneme	-51.8	12/3/2014	12	37	12	37
02N22W36E04S	West Oxnard Plain Management Area	Hueneme	-32.11	11/4/2015	12	37	12	37
01N21W32Q04S	Saline Intrusion Management Area	FCA	-116.9	11/30/2015	-23	2	-10	2
01N22W20J04S	Saline Intrusion Management Area	FCA	-40.7	11/30/2015	2	17	2	17
01N22W26K03S	Saline Intrusion Management Area	FCA	-71.8	6/16/2015	-18	2	-18	2
01N23W01C02S	West Oxnard Plain Management Area	FCA	-50.4	1/7/1991	7	22	7	22

Table 2-2. Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin

SWN	Management Area	Aquifer	Historical Low (ft msl) and Date Measured		Minimum Thresholds and Measurable Objectives Defined in the GSP[c]		Recommended Minimum Thresholds and Measurable Objectives[c]	
					MT (ft msl)	MO (ft msl)	MT (ft msl)	MO (ft msl)
02N21W07L04S	Forebay Management Area	FCA	-32	10/14/2015	17	42	17	55
02N22W23B03S	Forebay Management Area	FCA	-128.7	2/28/1991	-3	17	-3	17
01N21W32Q02S	Saline Intrusion Management Area	GCA	-115.2	11/30/2015	-23	2	-10	2
01N21W32Q03S	Saline Intrusion Management Area	GCA	-125.8	11/30/2015	-23	2	-10	2
01N21W07J02S	Oxnard Pumping Depression Management Area	Multiple	-145.4	10/21/2014	-38	2	-25	2
01N21W21H02S	Oxnard Pumping Depression Management Area	Multiple	-149.4	10/20/2014	-68	-8	-30	0
02N21W07L03S	Forebay Management Area	Multiple	-24.6	10/15/2015	17	37	10	50
02N21W07L05S	Forebay Management Area	Multiple	-7.4	12/30/2015	27	57	27	75

Notes: FCA= Fox Canyon Aquifer, GCA = Grimes Canyon Aquifer; MT = minimum threshold; MO = measurable objective; ft. msl = feet mean sea level. Strikethrough indicates well was removed from the key well network.

[a] Bolded where different from the GSP (FCGMA 2019).

2.2.2 Reduction of Groundwater in Storage

2.2.2.1 DWR Recommended Corrective Actions

DWR did not issue a recommended corrective action specific to reduction of groundwater in storage, although two of the recommended corrective actions issued by DWR are related to groundwater levels and storage (DWR 2021). These two recommended corrective actions are discussed in more detail in Sections 2.2.3, Seawater Intrusion, and 2.2.4, Degraded Water Quality.

2.2.2.2 Groundwater in Storage Changes

Since adoption of the GSP, FCGMA has estimated the change in groundwater in storage in the Subbasin annually using a series of linear regression models that relate measured groundwater elevations to simulated values of change in storage (FCGMA 2020, 2021, 2022, 2023a, 2024). The linear regressions utilized results from the VRGWFM for the historical period from 1985 through 2015 (UWCD 2018). UWCD has updated the VRGWFM to improve the hydrogeologic conceptual model along the coastline and simulate groundwater conditions through September 30, 2022 (Section 4.1, Hydrogeologic Conceptual Model, and Section 5.1, Model Updates).

The change in storage values summarized below are based on the model results from the updated VRGWFM (Table 2-3a, Groundwater Recharge and Discharge from the Upper Aquifer System (Acre-Feet), and Table 2-3b, Groundwater Recharge and Discharge from the Lower Aquifer System (Acre-Feet)). Because the updated VRGWFM does not simulate water years 2023 and 2024, the change in storage for the last two years of the evaluation period were estimated using model results from water years with similar starting and ending measured groundwater elevations. Groundwater elevations in fall 2021 were similar to those measured in fall 1991 and groundwater elevations in spring 2024 were similar to those measured in the spring of 1995 (Figures 2-15 through 2-19). Because of this, the simulated change in groundwater in storage for the period from water year 1992 through 1995 is used as a proxy for the change in storage during the 2023 and 2024 water years.

2.2.2.2.1 Upper Aquifer System

The GSP reported on the change in groundwater in storage in the Subbasin through the end of calendar year 2015. Between January 1, 2016, and September 30, 2022, the VRGWFM estimates that groundwater in storage in the UAS decreased by approximately 11,400 AF. Over this same period, the model estimates that approximately 41,700 AF of seawater intruded into the UAS. Between water years 1992 and 1995, the VRGWFM estimates that groundwater in storage in the UAS increased by approximately 135,200 AF. During this period, the VRGWFM estimates that approximately 15,600 AF of seawater intruded into the UAS.

Adding the 2016 to 2022 results to the 1992 to 1995 results, used as a proxy for water years 2023 and 2024, suggests that since 2016, groundwater in storage in the UAS has increased by approximately 123,800 AF. However, over this same time period, approximately 57,300 AF of seawater has intruded into the UAS.

Table 2-3a. Groundwater Recharge and Discharge from the Upper Aquifer System (Acre-Feet)

Water Year	Stream Leakage	Volcanic Outcrops	Recharge	Subsurface Inflow from Pleasant Valley Basin	Unincorporated Areas	Subsurface Inflow from the Semi-Perched Aquifer	Subsurface Inflow from Santa Paula Basin	Sum of Coastal Flux into the Oxnard Subbasin[a]				Subsurface Inflow from the Mound Basin	*Total Outflow*	Pumping	Subsurface Outflow to LAS	Subsurface Outflow to West Las Posas Basin	*Total Outflow*	Change in Groundwater In Storage[b]
								North of Channel Islands Harbor	Channel Islands Harbor to Perkins Road	Perkins Road to Arnold Road	Arnold Road to Point Mugu							
2016[c]	1,233	3	4,144	3,063	101	14,752	1,931	2,620	1,453	926	2,566	2,946	*35,738*	-27,532	-17,274	-1,282	*-46,087*	-10,349
2017	11,133	17	13,064	3,964	132	21,317	2,526	3,557	1,976	1,218	3,283	2,950	*65,136*	-38,274	-22,014	-2,378	*-62,666*	2,470
2018	1,902	6	4,958	4,138	133	19,870	2,596	3,869	2,131	1,309	3,493	4,525	*48,930*	-42,979	-21,367	-1,940	*-66,286*	-17,356
2019	18,992	14	39,148	4,131	123	20,299	2,372	3,590	2,031	1,204	3,195	1,147	*96,246*	-40,631	-19,613	-3,545	*-63,790*	32,457
2020	10,894	12	30,780	3,136	119	17,053	2,303	2,836	1,689	1,058	2,863	1,390	*74,134*	-41,288	-18,986	-3,837	*-64,111*	10,023
2021	736	1	14,057	2,683	116	14,646	2,477	2,854	1,649	1,050	2,818	3,095	*46,181*	-43,478	-18,378	-2,780	*-64,637*	-18,456
2022	4,228	10	13,993	3,008	120	16,459	2,545	3,199	1,787	1,090	2,919	3,553	*52,912*	-42,229	-18,492	-2,388	*-63,109*	-10,197
Average	**7,017**	**9**	**17,163**	**3,446**	**120**	**17,771**	**2,393**	**3,218**	**1,816**	**1,122**	**3,020**	**2,801**	***59,897***	**-39,487**	**-19,446**	**-2,593**	***-61,527***	**-1,630**

Notes:
a Coastal flux south of Channel Islands Harbor is associated with seawater intrusion into the Oxnard Subbasin.
b Negative (-) values denote a reduction of groundwater in storage. Positive (+) values denote an increase in groundwater in storage.
c Represents the nine-month period from January 1, 2016 through September 30, 2022.

Table 2-3b. Groundwater Recharge and Discharge from the Lower Aquifer System (Acre-Feet)

Water Year	Subsurface Inflow from Pleasant Valley Basin	Subsurface Inflow from the UAS	Unincorporated Areas	Subsurface Inflow from Santa Paula Basin	Subsurface Inflow from West Las Posas Basin	Sum of Coastal Flux into the Oxnard Subbasin[a]				Subsurface Inflow from the Mound Basin	*Total Inflow*	Pumping	Subsurface Outflow to West Las Posas Basin	*Total Outflow*	Change in Groundwater In Storage[b]
						North of Channel Islands Harbor	Channel Islands Harbor to Perkins Road	Perkins Road to Arnold Road	Arnold Road to Point Mugu						
2016[c]	1,230	17,274	1	21	2,453	2,475	1,969	1,304	1,257	2,886	*30,869*	-31,621	0	*-31,621*	-752
2017	1,730	22,014	2	28	2,763	3,219	2,548	1,662	1,637	3,759	*39,362*	-39,041	0	*-39,041*	321
2018	1,038	21,367	2	28	2,388	3,303	2,631	1,767	1,718	3,421	*37,662*	-37,060	0	*-37,060*	602
2019	1,290	19,613	1	27	754	3,024	2,404	1,596	1,534	2,686	*32,931*	-31,536	0	*-31,536*	1,395
2020	1,001	18,986	1	26	0	2,651	2,173	1,493	1,370	2,638	*30,338*	-27,673	-134	*-27,807*	2,531
2021	391	18,378	1	26	169	2,597	2,087	1,505	1,392	3,269	*29,816*	-31,037	0	*-31,037*	-1,220
2022	362	18,492	1	27	472	2,731	2,160	1,502	1,413	3,554	*30,715*	-31,603	0	*-31,603*	-888
Average	**1,006**	**19,446**	**1**	**26**	**1,286**	**2,857**	**2,282**	**1,547**	**1,474**	**3,173**	***33,099***	**-32,796**	**-19**	***-32,815***	**284**

Notes:
a Coastal flux south of Channel Islands Harbor is associated with seawater intrusion into the Oxnard Subbasin.
b Negative (-) values denote a reduction of groundwater in storage. Positive (+) values denote an increase in groundwater in storage.
c Represents the nine-month period from January 1, 2016 through September 30, 2022.

2.2.2.2.2 Lower Aquifer System

Between January 1, 2016, and September 30, 2022, the VRGWFM estimates that groundwater in storage in the LAS increased by approximately 2,000 AF. Over this same period, the model also estimates that approximately 37,100 AF of seawater intruded into the LAS. During the 1992 through 1995 period, the VRGWFM estimates that groundwater in storage in the LAS increased by approximately 14,200 AF. During this period, the VRGWFM estimates that approximately 19,200 AF of seawater intruded into the LAS.

Adding 2016 to 2022 results to the 1992 to 1995, used as a proxy for water year 2023 and 2024, results suggests that groundwater in storage in the LAS has increased by approximately 16,200 AF since 2016. Additionally, the VRGWFM suggests that since 2016 approximately 56,300 AF of seawater has intruded into the LAS of the Subbasin.

2.2.2.3 Undesirable Results

Groundwater levels are used as a proxy for undesirable results associated with loss of groundwater in storage. Groundwater elevations in both the UAS and LAS were below the minimum threshold groundwater elevations between January 2016 and the end of water year 2022. During this period, the VRGWFM suggests that approximately 79,000 AF of seawater intruded into the Subbasin and groundwater in storage declined by approximately 9,400 AF. These data indicate that the Subbasin experienced undesirable results related to loss of fresh groundwater in storage through the end of water year 2022.

The wet 2023 and 2024 water years facilitated groundwater elevation recoveries across the Subbasin. Over these last two years of the evaluation period, results from the VRGWFM suggest that groundwater in storage in the Subbasin increased by approximately 149,400 AF.

2.2.2.4 Progress Toward Achieving Sustainability

As described in Section 2.2.1.5, GSP implementation has been effective thus far in achieving the sustainability goal for the Subbasin by 2040.

2.2.2.5 Adaptive Management Approaches

FCGMA's approach to adaptive management is described in Section 2.2.1.6.

2.2.2.6 Impacts to Beneficial Uses and Users of Groundwater

The benefits of GSP implementation on beneficial uses and users of groundwater in the Subbasin are described in Section 2.2.1.7.

2.2.2.7 Changes to Sustainable Management Criteria

Groundwater levels are used as a proxy for groundwater in storage. Proposed revisions for a subset of the minimum thresholds and measurable objectives are presented in Section 2.2.1.8.

2.2.3 Seawater Intrusion

2.2.3.1 DWR Recommended Corrective Actions

DWR issued a recommended corrective action related to seawater intrusion (DWR 2021). This recommended corrective action states:

> "Under the dry climatic condition scenario, the groundwater levels will only reach minimum thresholds by 2040, which will limit seawater intrusion but not necessarily avoid the condition. Discuss the impact of further seawater intrusion and associated loss of storage on beneficial uses and users under the dry climatic condition scenario and the potential impacts to uses and users inland of the 2015 saline water impact area if landward migration of the saline water impact front continues."

Impacts of Dry Climate Interim Milestones

To estimate the loss of groundwater in storage associated with seawater intrusion during the 2025 to 2040 implementation period, a linear relationship was developed between the average simulated groundwater elevation within the Saline Intrusion Management Area and simulated coastal flux (i.e., seawater intrusion) into the Saline Intrusion Management Area. Based on this linear regression, it is estimated that under the average climate scenario, approximately 87,000 AF of seawater will intrude into the Subbasin between 2025 and 2040. Under the dry climate scenario, it is estimated that approximately 128,000 AF of seawater will intrude into the Subbasin over the same period. Between 70% and 75% of this estimated seawater intrusion would occur in the LAS.

The additional loss of groundwater in storage associated with seawater intrusion would impact operators in the Saline Intrusion Management Area. Over the 2016 to 2022 period, approximately 4,600 AFY of groundwater was pumped from the LAS in the Saline Intrusion Management Area. Groundwater pumped from the LAS in this part of the Subbasin supports agricultural operations and accounted for approximately 15% of the average annual production from the LAS and approximately 6% of the average annual production from the Subbasin as a whole. FCGMA and other interested parties in the Subbasin are currently evaluating projects to offset and reduce pumping within this region, which would minimize the impact of additional seawater intrusion under the dry climate scenario.

2.2.3.2 Seawater Intrusion Changes

In 2015, the known extent of saline water intrusion in the UAS and LAS generally occurred near and southeast of Port Hueneme and in the area surrounding Mugu Lagoon (FCGMA 2019). This understanding was based on UWCD's interpretation of the 100 milligrams per liter (mg/L) chloride concentration contour, developed using chloride concentrations in groundwater samples collected from coastal groundwater wells (UWCD 2016). Since adoption of the GSP, UWCD has continued to sample a network of wells along the coastline to evaluate the progression of saline intrusion in the Subbasin. In 2021, UWCD published an updated interpretation of saline water impact in the Subbasin. The updated interpretation is based on chloride concentrations measured in groundwater in 2019 and new solute transport modeling results (UWCD 2021a).

UWCD's updated interpretation indicates that the saline water impact front has migrated landward since 2015. The largest changes are in the UAS near Port Hueneme, where the 100 mg/L contour now extends north of Hueneme Road as far east as Arnold Road (UWCD 2021a). Directly adjacent to Port Hueneme, chloride concentrations increased by as much as 4,400 mg/L in the UAS between 2015 and 2020 (UWCD 2021a). In the LAS near Port

Hueneme, landward migration of saline water has caused the 100 mg/L contour to extend south of the previously mapped extent; in 2020, the 100 mg/L concentration contour extended north of Hueneme Road as far east as Surfside Drive (UWCD 2021a). Farther south in the UAS, near Mugu Lagoon, chloride concentrations increased by as much as approximately 1,800 mg/L (UWCD 2021a) and the saline water impact front is interpreted to have migrated approximately 0.25 miles inland from the 2015 extent. In this same part of the Subbasin in the LAS, chloride concentrations increased by as much as 1,000 mg/L (UWCD 2021a).

The landward migration of the saline water impact front since 2016 is consistent with the prolonged period between 2016 and 2022 where groundwater elevations in both the UAS and LAS occurred below the minimum threshold groundwater elevations (Figures 2-15 through 2-19). This period corresponded to a period of extended drought, where surface water available for recharge and use in lieu of groundwater was limited.

2.2.3.3 Undesirable Results

The GSP defines undesirable results associated with seawater intrusion as, "…seawater intrusion that results in a net landward migration of the 2015 saline water impact front beyond the already impacted area west of Highway 1 and south of Hueneme Road from 2040 through 2069" (FCGMA 2019). Between water years 2019 and 2023, groundwater levels were below the minimum thresholds in the majority of the key wells in the Subbasin and the saline water impact front migrated landward (Sections 2.1 and 2.2.3). Some landward migration of the saline water impact front is expected between 2020 and 2040 as the FCGMA Board and interested parties in the Subbasin undertake necessary projects and management actions toward achieving groundwater sustainability by 2040.

2.2.3.4 Progress Toward Achieving Sustainability

As described in Section 2.2.1.5, GSP implementation has been effective thus far in achieving the sustainability goal for the Subbasin by 2040.

2.2.3.5 Adaptive Management Approaches

FCGMA's approach to adaptive management is described in Section 2.2.1.6.

2.2.3.6 Impacts to Beneficial Uses and Users of Groundwater

The benefits of GSP implementation on beneficial uses and users of groundwater in the Subbasin are described in Section 2.2.1.7.

2.2.3.7 Changes to Sustainable Management Criteria

For the GSP, the extent of saline water impact front in each principal aquifer of the Subbasin was evaluated based on the interpreted 100 mg/L chloride concentration isocontour. To better reflect the extent of brackish water in the Subbasin, the extent of saline water impact has been updated based on the interpreted 500 mg/L chloride concentration isocontour.

Groundwater levels are used as a proxy for seawater intrusion. Proposed revisions for a subset of the minimum thresholds and measurable objectives are presented in Section 2.2.1.8.

2.2.4 Degraded Water Quality

This section summarizes current groundwater quality conditions in the Subbasin and the relation to groundwater quality conditions at the end of the GSP reporting period. Due to the variation in groundwater quality monitoring schedules across the Subbasin, groundwater quality is characterized using the most recent groundwater samples collected over a 5-year window. For the GSP, groundwater quality conditions were characterized using the most recent groundwater sample collected during the period from 2011 through 2015. Groundwater quality conditions over the evaluation period were characterized using measurements collected during the period from 2019 through 2023.

The FCGMA adopted Basin Management Objectives for nitrate, chloride, and total dissolved solids (TDS) in the Subbasin as part of its 2007 Groundwater Management Plan (FCGMA 2007). Additionally, the Water Quality Control Plan: Los Angeles Region (Basin Plan) specifies water quality objectives for TDS, chloride, nitrate, sulfate, and boron (LARWQCB 2013). While the GSP only defines undesirable results for TDS and chloride (FCGMA 2019), the change in groundwater quality concentrations related to each constituent relative to the 2011 to 2015 period is summarized below.

2.2.4.1 DWR Recommended Corrective Actions

DWR issued a recommended corrective action related to groundwater quality (DWR, 2021). This recommended corrective action states:

> "Elaborate how the Agency is planning to verify that the groundwater level thresholds are adequate to assess the groundwater quality conditions in the Subbasin. Discuss how the groundwater quality data from the existing monitoring network will be used for sustainable management of the Subbasin. Coordinate with the appropriate groundwater users, as identified in the GSP, and the appropriate water quality agencies in the Subbasin to evaluate how the Agency's current groundwater management strategy is affecting the groundwater quality in the Subbasin."

The GSP defines undesirable results for TDS and chloride. These undesirable results are associated with seawater intrusion as well as the release of connate water from fine-grained lenses, downward migration of brines from improperly abandoned wells, and upward migration of brines from deeper geologic formations (FCGMA 2019). As described in Section 2.2.4.2, Groundwater Quality Changes in the Subbasin, TDS and chloride concentrations generally increased over the evaluation period. These increasing TDS and chloride concentrations are consistent with the prolonged period of groundwater elevations below the minimum thresholds (Section 2.1). These data support continued use of groundwater levels as a proxy for undesirable results associated with degraded groundwater quality. However, FCGMA anticipates continuing to evaluate the relationship between groundwater quality and groundwater elevations as part of the periodic evaluation process to assess whether groundwater levels continue to be an appropriate proxy for groundwater quality.

UWCD, in support of their EBB project, developed a solute-transport model for the Subbasin (UWCD 2021b). The new solute-transport model, developed using the USGS MODFLOW-USG software, is based on the same hydrogeologic conceptual model as the VRGWFM, but provides a direct simulation of chloride concentrations associated with seawater intrusion in the Subbasin, further constraining the relationship between pumping, groundwater levels, and degraded water quality. FCGMA anticipates re-evaluating the new model's use in groundwater sustainability planning as new data are integrated into the model to better constrain simulation results.

2.2.4.2 Groundwater Quality Changes in the Subbasin

2.2.4.2.1 Total Dissolved Solids

Over the 2019 to 2023 period, TDS concentrations were highest near Port Hueneme and Mugu Lagoon (Figure 2-20, Upper Aquifer System – Most Recent TDS (mg/L) Measured 2019 – 2023, through Figure 2-22, Lower Aquifer System – Most Recent TDS (mg/L) Measured 2019 – 2023). Near Port Hueneme, TDS concentrations ranged from approximately 800 to 13,400 mg/L in the UAS and 690 to 18,800 mg/L in the LAS. TDS concentrations in this part of the Subbasin were generally higher than 2011-2015 concentrations in the UAS and LAS (Figure 2-23, Change in TDS Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023, through Figure 2-25, Change in TDS Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023).

Near Mugu Lagoon, TDS concentrations ranged from 1,800 to 31,700 mg/L in the UAS and 960 to 36,100 mg/L in the LAS during the 2019-2023 period. Like the UAS, TDS concentrations in this part of the Subbasin were generally higher than they were between 2011 and 2015 (Figure 2-23 through Figure 2-25).

2.2.4.2.2 Chloride

Between 2019 and 2023, chloride concentrations were highest near Port Hueneme and Mugu Lagoon (Figure 2-26, Upper Aquifer System – Most Recent Chloride (mg/L) Measured 2019-2023, through Figure 2-28, Upper Aquifer System – Most Recent Chloride (mg/L) Measured 2019-2023). Near Port Hueneme, chloride concentrations ranged from approximately 210 to 7,200 mg/L in the UAS (Figure 2-26) and approximately 40 to 7,900 mg/L in the LAS (Figure 2-28). Since the 2011 to 2015 period, chloride concentrations near Port Hueneme have increased by as much as approximately 3,400 mg/L in the UAS and 1,000 mg/L in the LAS (Figure 2-29, Change in Chloride Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023, through Figure 2-31, Change in Chloride Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023).

Near Mugu Lagoon, chloride concentrations ranged from approximately 630 to 17,000 mg/L in the UAS and approximately 5,400 to 16,400 mg/L in the LAS (Figures 2-26 and 2-28). Since the 2011 to 2015 period, chloride concentrations near Mugu Lagoon have increased by as much as 1,030 mg/L in the UAS and 3,040 mg/L in the LAS (Figures 2-29 through 2-31).

2.2.4.2.3 Nitrate

Between 2019 and 2023, nitrate concentrations were highest in the Forebay Management Area, where elevated nitrate concentrations are likely a legacy of historical septic discharges and agricultural fertilizer application practices (FCGMA 2019; Figure 2-32, Upper Aquifer System – Most Recent Nitrate (mg/L) Measured 2019-2023, through Figure 2-34, Lower Aquifer System – Most Recent Nitrate (mg/L) Measured 2019-2023). In this part of the Subbasin, nitrate concentrations ranged from a low of approximately 0.4 mg/L to a high of approximately 115 mg/L in the UAS (Figure 2-32 and Figure 2-33, Upper Aquifer System, Forebay Area – Most Recent Nitrate (mg/L) Measured 2019 - 2023). In the LAS, nitrate concentrations in groundwater were less than 10 mg/L (Figure 2-34). Nitrate concentrations across the Subbasin have either remained stable or decreased since the 2011-2015 period (Figure 2-35, Change in Nitrate Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023, through Figure 2-37, Change in Nitrate Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023).

2.2.4.2.4 Sulfate

Between 2019 and 2023, sulfate concentrations generally ranged from 300 – 600 mg/L in the UAS (Figure 2-38, Upper Aquifer System – Most Recent Sulfate (mg/L) Measured 2019-2023, and Figure 2-39, Upper Aquifer System, Forebay Area – Most Recent Sulfate (mg/L) Measured 2019-2023) and were lower than 600 mg/L in the LAS (Figure 2-40, Lower Aquifer System - Most Recent Sulfate (mg/L) Measured 2019-2023). These concentrations are generally equal to or lower than the Regional Water Quality Control Board's water quality objectives for sulfate of 600 mg/L (LARWQCB 2013). Locally, however, sulfate concentrations exceeded these general ranges. For example, in the UAS, sulfate concentrations near Mugu Lagoon were measured as high as 2,520 mg/L and near Port Hueneme were measured as high as 1,030 mg/L (Figure 2-38). In the LAS, sulfate was measured at concentrations that exceed 2,000 mg/L at one well in the Forebay Management Area and one well near Mugu Lagoon (Figure 2-40).

In the UAS within the Forebay Management Area, sulfate concentrations in the 2019 to 2023 period ranged from approximately 450 mg/L lower than the 2011 to 2015 period, to approximately 300 mg/L higher than the 2011 to 2015 period (Figure 2-41, Change in Sulfate Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023, and Figure 2-42, Change in Sulfate Concentration (mg/L) in the UAS, Forebay Area, between 2011-2015 and 2019-2023). Near the coast, sulfate concentrations have increased since the 2011 to 2015 period. The largest increases in sulfate concentration are measured near Port Hueneme and Mugu Lagoon (Figure 2-41). In the LAS concentrations in groundwater were within 200 mg/L of the 2011 to 2015 concentrations (Figure 2-43, Change in Sulfate Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023).

2.2.4.2.5 Boron

Between 2019 and 2023, boron concentrations were generally lower than 1 mg/L, which is the Regional Water Quality Control Board's water quality objective for boron (Figure 2-44, Upper Aquifer System – Most Recent Boron (mg/L) Measured 2019-2023, through Figure 2-46, Lower Aquifer System – Most Recent Boron (mg/L) Measured 2019-2023). These concentrations are similar to the concentrations of boron measured in groundwater during the 2011 to 2015 period (Figure 2-47, Change in Boron Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023, through Figure 2-49, Change in Boron Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023).

2.2.4.3 Undesirable Results

Groundwater levels measured at the key wells in the Subbasin are used as a proxy for undesirable results associated with degraded water quality. The GSP defines undesirable results for two constituents: TDS and chloride. Based on this, the criteria used to define undesirable results for degraded water quality is the migration of the 2015 saline water impact front during the 2040 to 2069 sustaining period (FCGMA 2019).

As described in Section 2.1, prior to water year 2023, groundwater levels during the evaluation period were below the minimum threshold groundwater elevations in the majority of the key wells in the Subbasin and the saline water impact front migrated landward over the evaluation period. The landward migration of the saline water impact front has caused TDS and chloride concentrations near Port Hueneme and Mugu Lagoon to increase since 2015. Some landward migration of the saline water impact front is expected between 2020 and 2040 as the FCGMA Board and interested parties in the Subbasin undertake necessary projects and management actions toward achieving groundwater sustainability in 2040.

However, groundwater elevations have generally increased since 2015. Therefore, management of the Subbasin under the adopted GSP, along with climate conditions that allowed for groundwater recharge in the Oxnard Forebay, has resulted in groundwater levels that are progressing toward sustainable levels that will prevent the further inland migration of the saline water impact front by 2040.

2.2.4.4 Progress Toward Achieving Sustainability

As described in Section 2.2.1.5, GSP implementation has been effective thus far in achieving the sustainability goal for the Subbasin by 2040.

2.2.4.5 Adaptive Management Approaches

FCGMA's approach to adaptive management is described in Section 2.2.1.6.

2.2.4.6 Impacts to Beneficial Uses and Users of Groundwater

The benefits of GSP implementation on beneficial uses and users of groundwater in the Subbasin are described in Section 2.2.1.7.

2.2.4.7 Changes to Sustainable Management Criteria

Groundwater levels are used as a proxy for degraded water quality. Proposed revisions for a subset of the minimum thresholds and measurable objectives are presented in Section 2.2.1.8.

2.2.5 Land Subsidence

2.2.5.1 DWR Recommended Corrective Actions

DWR issued a recommended corrective action related to land subsidence (DWR 2021). This recommended corrective action states:

> "Incorporate periodic subsidence monitoring into the GSP's monitoring plan that can be used to quantify whether land subsidence is occurring and whether the groundwater level proxy is avoiding undesirable results associated with land subsidence. As an option, the Department provides statewide InSAR data that can be used for monitoring land subsidence."

The established, and recommended, minimum threshold and measurable objective groundwater levels in the Subbasin are higher than historical low groundwater elevations. Because of this, groundwater management under the GSP is not anticipated to cause land subsidence, related to groundwater production, that would significantly impact land uses and critical infrastructure. To monitor these conditions in the future, FCGMA has incorporated periodic subsidence monitoring into the GSP monitoring network. Subsidence monitoring will be performed using DWR's statewide InSAR datasets (Section 7.4, Functionality of Additional Monitoring Network).

2.2.5.2 Land Subsidence Changes

Since 2015, DWR's InSAR data indicate that land surface elevations have changed by less than approximately 2 inches (Figure 2-50). No impacts to land uses or critical infrastructure resulting from subsidence within the Subbasin have been reported.

2.2.5.3 Undesirable Results

The GSP defines undesirable results associated with land subsidence as, "…subsidence that substantially interferes with surface land uses" (FCGMA 2019). As noted above, the Subbasin did not experience subsidence, associated with groundwater production, that substantially interfered with surface land uses. Therefore, while groundwater elevations were below the minimum thresholds through the majority of the evaluation period, they were above the historical low groundwater elevation, and undesirable results associated with land subsidence did not occur.

2.2.5.4 Progress Toward Achieving Sustainability

As described in Section 2.2.1.5, GSP implementation has been effective thus far in achieving the sustainability goal of the Subbasin by 2040.

2.2.5.5 Adaptive Management Approaches

FCGMA's approach to adaptive management is described in Section 2.2.1.6.

2.2.5.6 Impacts to Beneficial Uses and Users of Groundwater

The benefits of GSP implementation on beneficial uses and users of groundwater in the Subbasin are described in Section 2.2.1.7.

2.2.5.7 Changes to Sustainable Management Criteria

Groundwater levels are used as a proxy for land subsidence. Proposed revisions for a subset of the minimum thresholds and measurable objectives are presented in Section 2.2.1.8.

2.2.6 Depletions of Interconnected Surface Water

2.2.6.1 DWR Recommended Corrective Actions

DWR issued a recommended corrective action related to groundwater-surface water connections (DWR 2021). This recommended corrective action states:

> "Investigate the hydraulic connectivity between the surface water bodies, semi-perched aquifer, and principal aquifers to improve the understanding of potential migration of impaired water, the reliance of two potential GDEs on the semi-perched aquifer, and depletion of interconnected surface water bodies. Also, identify specific locations of gaining and losing reaches of surface water bodies and quantify the depletion of interconnected surface water. Describe schedule and steps

that will be taken to fill data gaps identified in the GSP related to shallow groundwater monitoring near surface water bodies and GDEs."

In 2022, FCGMA was awarded grant funds through DWR's Sustainable Groundwater Management Grant Program to support implementation of projects developed during the GSP and through subsequent discussions with interested parties. One component of this grant project is the construction of shallow and multi-depth monitoring wells in the Subbasin to address groundwater elevation data gaps identified in the GSP. Two shallow monitoring wells funded through this program are planned along Revolon Slough and Calleguas Creek, within the Oxnard Pumping Depression Management Area, and one is planned along the southern portion of Santa Clara River, within the West Oxnard Plain Management Area. FCGMA anticipates completing construction of these shallow wells in the 2024 calendar year and integrating these data into the GSP starting in water year 2025. Data collected through these new wells will be used to improve understanding of the connectivity between surface water bodies, the semi-perched aquifer, and the principal aquifers within the Subbasin.

Additionally, FCGMA anticipates using these data to evaluate the VRGWFM's representation of interconnected surface water, shallow groundwater conditions, and the connection between the semi-perched and principal aquifers within the Subbasin. UWCD has recently evaluated the connection between the semi-perched and principal aquifers near Mugu Lagoon based on additional hydrogeologic data, in support of the design and operation of their EBB project (Section 4.1). The new data collected from the shallow wells constructed along Revolon Slough and Santa Clara River will provide additional constraint on the representation of surface water bodies in the model and the influence of groundwater pumping on their depletions.

2.2.6.2 Undesirable Results

The undesirable results associated with depletion of interconnected surface water in the Subbasin is loss of GDE habitat. The primary cause of groundwater conditions in the Subbasin that would lead to loss of GDE habitat would be groundwater production from the semi-perched aquifer, which is not a principal aquifer of the Subbasin. Over the evaluation period, less than 30 AFY of groundwater was produced from the semi-perched aquifer, consistent with historical usage from this aquifer (FCGMA 2019; Table 2-3c, Groundwater Recharge and Discharge from the Semi-Perched aquifer (Acre-Feet)). In addition, satellite-based estimates of habitat health at the four GDEs identified in the GSP indicate that habitat conditions have either remained stable, or improved, since 2016 (TNC 2024). These data suggest that undesirable results associated with depletion of interconnected surface water and GDEs has not occurred during the evaluation period.

Table 2-3c. Groundwater Recharge and Discharge from the Semi-Perched Aquifer (Acre-Feet)

WY	Stre-am Leak-age	Rechar-ge	Subsurface Inflow from Pleasant Valley Basin	Sum of Coastal Flux into the Oxnard Subbasin				GHB[a]	Total Inflow	Pumping	Tile Drains	Subsurface Outflow to UAS	ET	Unincorpo-rated Areas	Sum of Coastal Flux into the Oxnard Subbasin				Subsurface Outflow to Mound Basin	Total Outflow	CHANGE IN GROUND-WATER STORAGE[b]
				North of Channel Islands Harbor	Channel Islands Harbor to Perkins Road	Perkins Road to Arnold Road	Arnold Road to Point Mugu								North of Channel Islands Harbor	Channel Islands Harbor to Perkins Road	Perkins Road to Arnold Road	Arnold Road to Point Mugu			
2016[c]	916	12,229	1,645	0	0	137	598	312	*15,838*	0	-2,330	-14,752	-4,399	-37	-492	-302	0	0	-318	*-22,631*	-6,793
2017	4,362	25,433	2,202	0	0	159	747	415	*33,318*	0	-4,479	-21,317	-6,377	-49	-615	-300	0	0	-701	*-33,838*	-520
2018	1,306	16,737	2,122	0	0	159	783	436	*21,543*	0	-2,725	-19,870	-5,102	-50	-470	-185	0	0	-350	*-28,752*	-7,209
2019	6,578	22,202	2,144	0	0	157	747	438	*32,266*	-100	-3,552	-20,299	-6,098	-48	-412	-97	0	0	-816	*-31,421*	845
2020	3,726	18,775	2,065	0	0	173	769	446	*25,954*	-252	-3,197	-17,053	-5,443	-36	-420	-43	0	0	-680	*-27,124*	-1,170
2021	1,005	12,874	1,701	0	0	190	807	457	*17,035*	-263	-2,030	-14,646	-4,541	-39	-339	-18	0	0	-343	*-22,218*	-5,184
2022	2,330	18,140	1,626	0	0	180	778	450	*23,504*	-195	-2,490	-16,459	-4,979	-38	-314	-18	0	0	-382	*-24,877*	-1,372
Average	2,889	18,056	1,930	0	0	165	747	422	*24,208*	-116	-2,972	-17,771	-5,277	-43	-437	-138	0	0	-513	*-27,266*	-3,058

Notes:

a GHB = General Head Boundary Condition, which represents recharge to the semi-perched aquifer through Channel Island Harbor, Port Hueneme, and Duck Ponds north of Naval Base Ventura County at Point Mugu.

b Negative (-) values denote a reduction of groundwater in storage. Positive (+) values denote an increase in groundwater in storage.

c Represents the nine-month period from January 1, 2016 through September 30, 2022.

2.2.6.3 Progress Toward Achieving Sustainability

Groundwater levels are used as a proxy for depletion of interconnected surface waters and GDEs. Results from the numerical modeling for the GSP indicate that groundwater elevations in the semi-perched aquifer, which support GDEs in the Subbasin, will be supported by the minimum threshold and measurable objective groundwater elevations.

The groundwater elevation recoveries measured over the evaluation period suggest that groundwater conditions in the semi-perched aquifer did not negatively impact interconnected surface waters and GDEs in the Subbasin. FCGMA will further evaluation these conditions as data are collected in the shallow monitoring wells planned along Revolon Slough, Calleguas Creek, and Santa Clara River.

2.2.6.4 Adaptive Management Approaches

FCGMA's approach to adaptive management is described in Section 2.2.1.6.

2.2.6.5 Impacts to Beneficial Uses and Users of Groundwater

Satellite-based estimates of habitat health suggest that GSP implementation, and the wetter-than-average hydrology encountered in 2023 and 2024, has positively impacted interconnected surface waters and GDEs in the Subbasin (TNC 2024).

2.2.6.6 Changes to Sustainable Management Criteria

Groundwater levels are used as a proxy for depletions of interconnected surface waters. Proposed revisions for a subset of the minimum thresholds and measurable objectives are presented in Section 2.2.1.8.

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3 Status of Projects and Management Actions

The GSP identified five (5) projects and two (2) management actions that support implementation of the GSP and groundwater sustainability in the Subbasin (FCGMA 2019). Projects identified in the GSP were: two projects that increased the delivery of the recycled water, produced at the City of Oxnard's Advanced Water Purification Facility (AWPF), to agricultural operators in the Subbasin; development of the Riverpark-Saticoy Groundwater Replenishment and Reuse Recycled Water Project; the Freeman Diversion Expansion Project; and a Voluntary Temporary Land Fallowing Project. Management actions identified in the GSP included reduction in groundwater production, and a water market pilot program. Since adoption of the GSP, FCGMA and other agencies in the Subbasin have identified, designed, funded, and implemented a broader range of projects that increase water supplies and reduce groundwater demands within the Subbasin.

This section provides an assessment of the projects and management actions identified in the GSP, summarizes all new projects that have been identified in the Subbasin that support GSP implementation, and describes the process for public notice and engagement throughout the implementation of projects and management actions in the Subbasin.

3.1 Evaluation of Projects and Management Actions Identified in the GSP

3.1.1 Management Actions

In 2019, FCGMA adopted an ordinance to establish a new fixed extraction allocation system that supports managing groundwater demand in the Subbasin in a manner consistent with SGMA and the GSP. Since adoption of the GSP, FCGMA has adopted ordinance amendments and resolutions to facilitate transition to the new ordinance, provide policies and procedures for seeking variances, and made modifications required under a court order addressing a challenge to the ordinance. Additionally, FCGMA adopted resolutions increasing tiered groundwater surcharge rates for extractions that exceed allocation. The surcharge provides an economic disincentive to extract groundwater exceeding allocation.

The new extraction allocation system supports FCGMA's implementation of the two management actions identified in the GSP. Activities accomplished associated with each management action to date are summarized in Table 3-1, Status of Projects and Management Actions Identified in the GSP.

Table 3-1. Status of Projects and Management Actions Identified in the GSP

Number	Name	Description	Status	Expected Schedule	Benefits Observed to Date	Estimated Accrued Benefits at Completion
Management Actions						
1	Reduction in Groundwater Production	Reduce Groundwater production by monitoring and imposing quantitative limits on pumpers; with governing authority from the FCGMA Board.	Not implemented	Not defined	Establishment of a fixed groundwater extraction allocation system.	Mitigation of seawater intrusion and the landward migration of saline water throughout the Subbasin.
2	Water Market Pilot Program	Pilot Program to evaluate a water market, through which agricultural operators may buy, sell, or transfer extraction allocations.	Pilot program was extended through 2021 and is no longer operational	Not defined	N/A	Increased flexibility for operators in the Subbasin to adapt to reduced extraction allocations
Projects						
1	AWPF	Advanced Water Purification Facility – production and use of recycled water in lieu of groundwater.	Ongoing	Ongoing	900 AFY of in-lieu deliveries	Not Defined
2	AWPF Facility Improvements	Expansion of AWPF to produce an additional 4,500 AFY for groundwater recharge and/or deliver of new water to users in the Subbasin.	Preliminary Design	Not defined	N/A	7,000 – 10,000 AFY of additional in lieu deliveries
3	Riverpark-Saticoy GRRP	Extend recycled water pipeline 3 miles to UWCD groundwater recharge facilities.	Inactive	Not Defined	N/A	N/A
4	Freeman Diversion Expansion	Construct new facilities at Freeman Diversion to capture surface water at higher flow rates and sediment loads than currently possible; recharge groundwater	Initial phases under construction	3 to 15 years	Infrastructure improvements to increase recharge at the Ferro-Rose basin	Up to 10,000 AFY of additional diversions for recharge and delivery via PTP and PVP

Table 3-1. Status of Projects and Management Actions Identified in the GSP

Number	Name	Description	Status	Expected Schedule	Benefits Observed to Date	Estimated Accrued Benefits at Completion
5	Voluntary Temporary Fallowing	Utilize replenishment fees to lease and temporarily fallow agricultural land	Not implemented	Not defined	N/A	Up to 500 AFY groundwater demand reduction

3.1.2 Projects

3.1.2.1 Project No. 1: Advanced Water Purification Facility

3.1.2.1.1 Description of Project No. 1

The City of Oxnard's AWPF provides a source of reclaimed water that can be used for landscape irrigation, agricultural irrigation, industrial process water, and groundwater recharge. The AWPF is designed to initially treat approximately 8 to 9 million gallons per day of secondary effluent from the Oxnard Wastewater Treatment Plant and produce 6.25 million gallons per day of product water for reclaimed water uses. This is equivalent to 7,000 acre-feet per year (AFY) of product water. AWPF water was first delivered to agricultural operators in 2016.

Project No. 1 uses the existing monitoring network to evaluate improved groundwater conditions.

3.1.2.1.2 Benefits and Impacts of Project No. 1

Realized Benefits

Since 2016, the City of Oxnard has delivered an average of approximately 900 AFY of AWPF water to agricultural operators in the Subbasin and to Pleasant Valley County Water District (PVCWD), for subsequent delivery within their service area. The largest delivery of AWPF water occurred in 2018, when the City of Oxnard delivered approximately 2,400 AF of AWPF water for agricultural irrigation. This additional water increases groundwater levels in the Subbasin by providing water that would otherwise be pumped from the Subbasin.

Expected Benefits

At the time of GSP development, it was understood that the City of Oxnard would deliver 4,600 AFY of AWPF water to agricultural operators in the Subbasin and the adjacent PVB. This assumption was updated, in consultation with the City of Oxnard, as part of this periodic GSP evaluation. For planning purposes, it is presently assumed that the City of Oxnard will provide an average of 1,500 AFY of AWPF water for agricultural uses through this project. This delivery estimate may change in the future as the City of Oxnard continues to evaluate projects that could rely on AWPF water as a source of water supply. These deliveries would be made under FCGMA Resolution 2023-02.

Impacts to beneficial uses and users

Delivery of AWPF may increase the sustainable yield of the Subbasin by reducing groundwater demands in the areas that have a greater influence on seawater intrusion and the migration of saline water in the coastal area of the Subbasin. Therefore, delivery and use of this water will have a positive impact on beneficial uses and users.

3.1.2.2 Project No. 2: AWPF Facility Improvements Phase II

3.1.2.2.1 Description of Project No. 2

The purpose of the AWPF Expansion Project is to increase the production of high-quality recycled water within the City of Oxnard, the Subbasin, and the PVB. This project may provide additional reclaimed water for Subbasin recharge. The AWPF Expansion Project is predicated on the availability of secondary effluent from the Oxnard Wastewater Treatment Plant or other available and appropriate source water. The main project components include purchase and installation of additional microfiltration, reverse osmosis, and ultraviolet/advanced oxidation equipment. Additionally, the project will require construction of influent flow equalization facilities. The AWPF Expansion Project could occur in phases, which would be dictated by the availability of source water, recycled water uses and needs, and project funding.

The City of Oxnard is seeking to expand the AWPF to produce a total of approximately 14,000 AFY of water that can be delivered through existing infrastructure. These improvements will fully utilize available recycled water to provide supply resiliency and cost stabilization for the future. Additionally, this expansion will support the regional water management actions to increase the sustainable yield of the Subbasin.

Project No. 2 will use the existing monitoring network to evaluate improved groundwater conditions.

3.1.2.2.2 Benefits and Impacts of Project No. 2

Realized Benefits

This project is currently in preliminary design; thus, benefits have not yet been realized.

Expected Benefits

The current capacity of the AWPF is for 7,000 AFY of product water that can be delivered through existing infrastructure. The AWPF Facility improvements will increase capacity by 7,000 AFY to a total of 14,000 AFY of product water. The City of Oxnard is evaluating projects, and their benefits, that could rely on this water as a source of water supply.

Impacts to beneficial uses and users

The AWPF Facility Improvements Phase II would provide additional recycled water and may increase sustainable yield in the Subbasin if utilized in lieu of groundwater extraction in the Saline Intrusion and Pumping Depression management areas, and thus have a positive impact on beneficial uses and users.

3.1.2.3 Project No. 3: Riverpark-Saticoy GRRP Recycled Water

3.1.2.3.1 Description of Project No. 3

The Riverpark–Saticoy Groundwater Replenishment and Reuse Project (GRRP) Recycled Water Project would convey water produced by the AWPF (see Section 3.1.2) to the Saticoy Groundwater Recharge Facility and El Rio Groundwater Recharge Facility operated by UWCD (FCGMA 2018). In 2016, the City of Oxnard completed the northernmost portion of its 9.5-mile north–south Recycled Water Backbone Pipeline, which terminates at the Riverpark development adjacent to the Santa Clara River, north of Highway 101. This pipeline does not currently reach UWCD's groundwater recharge facilities. Under the GRRP Recycled Water Project, the Recycled Water Backbone Pipeline would be extended by 3 miles to convey water from the AWPF Expansion Project to UWCD groundwater recharge facilities. The 3-mile pipeline extension is called the Riverpark–Saticoy Pipeline. Up to 4,800 AFY of water would be conveyed to the UWCD recharge facilities via the Recycled Water Backbone and Riverpark–Saticoy Pipelines. It should be noted that this project does not provide water in addition to Project No. 2; rather, it provides the infrastructure to deliver the Groundwater Recovery Enhancement and Treatment (GREAT) AWPF expansion water to the Saticoy Spreading Grounds.

Project No. 3 would use the existing monitoring network to evaluate improved groundwater conditions.

3.1.2.3.2 Benefits and Impacts of Project No. 3

Realized Benefits

Since adoption of the GSP, the project proponents have not actively developed this project.

Expected Benefits

As described in the GSP, the Riverpark–Saticoy GRRP Recycled Water Project is expected to benefit the Subbasin by providing the infrastructure to take recycled wastewater from the AWPF and for groundwater recharge (FCGMA 2018). Currently, this water is being discharged to the Pacific Ocean. The Riverpark–Saticoy Pipeline and the GRRP will help ensure that excess flows from the AWPF will be used for groundwater recharge. In addition, the product water from the AWPF is of higher quality than groundwater in the Oxnard Forebay. Therefore, by using this water to recharge groundwater in the Forebay, implementation of the GRRP Recycled Water Project is expected to improve groundwater quality in the Forebay (FCGMA 2018).

Impacts to beneficial uses and users

The Riverpark–Saticoy GRRP would increase sustainable yield in the Subbasin by increasing groundwater recharge, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.1.2.4 Project No. 4: Freeman Diversion Expansion Project

3.1.2.4.1 Description of Project No. 4

UWCD currently operates the Freeman Diversion on the Santa Clara River, which diverts surface water flows from the river into groundwater recharge facilities in the Oxnard Forebay and directs surface-water deliveries to growers via UWCD's and PVCWD's pipelines. In recent years, more restrictive environmental regulations have lessened the amount of Santa Clara River surface water available that can be diverted at the Freeman Diversion. The Freeman Diversion Expansion Project proposes to construct facilities capable of diverting surface water at higher flow rates and with higher sediment loads than currently possible. Use of flows with higher sediment loads, which are less conducive to fish migration, has been encouraged by both regulatory agencies and non-governmental organizations (FCGMA 2019). The expansion project has advanced since the GSP was submitted to DWR. This project description reflects the updated understanding of the project based on work that was completed since 2018.

This project requires expansion of the existing intake, conveyance, and recharge facilities associated with Freeman Diversion and, in a subsequent phase, an associated increase in UWCD's right to divert surface water from the Santa Clara River from 375 cubic feet per second to 750 cubic feet per second instantaneous flow during periods of peak flow in the river. When constructed, this project will result in additional recharge and conjunctive use of flood/storm flows in both Oxnard and Pleasant Valley Basins. UWCD will improve fish passage and implement a new Multi-Species Habitat Conservation Plan, concurrent with this project.

Increased volume of diverted water will be used for artificial recharge and conjunctive use via the Pumping Trough Pipeline (PTP) in the Subbasin. Benefits will include higher groundwater levels, more groundwater in storage, reduced potential for seawater intrusion and land subsidence, and improved groundwater quality. The project will improve groundwater quality in the Forebay because the diverted surface water is of higher chemical quality (i.e., lower TDS) than the groundwater. Historical data show a direct relationship between diversion and recharge rates with groundwater quality at several water-supply wells in the Forebay. The areas served by the PTP and Pleasant Valley Pipeline (PVP) will receive additional surface-water deliveries for conjunctive use, reducing pumping and increasing groundwater elevations. Higher groundwater elevations will reduce the potential for subsidence related to groundwater production in the Subbasin.

Some components of this project have been designed or are constructed already. Next-step project components include expansion of existing conveyance structures (inverted siphon, 3-barrel culvert, and extension of the conveyance system to connect to UWCD's new Ferro-Rose spreading basin via a new undercrossing at Vineyard Ave.

Project No. 4 uses the existing monitoring network to evaluate improved groundwater conditions.

3.1.2.4.2 Benefits And Impacts of Project No. 4

Realized Benefits

UWCD is currently expanding and extending existing conveyance structures and connections to the Ferro-Rose recharge basin to allow for more recharge and increase diversions, within their existing water rights, from the Santa Clara River. This construction is a key component of the Freeman Diversion Expansion Project and is described in more detail in Section 3.2.1.

Expected Benefits

Increased volume of diverted water will be used for artificial recharge and conjunctive use via the PTP in the Subbasin. Benefits will include higher groundwater levels, more groundwater in storage, reduced potential for seawater intrusion and land subsidence, and improved groundwater quality. The project will improve groundwater quality in the Forebay because the diverted surface water is of higher chemical quality (i.e., lower TDS) than the groundwater. Historical data show a direct relationship between diversion and recharge rates with groundwater quality at several water-supply wells in the Forebay. The areas served by the PTP and PVP will receive additional surface-water deliveries for conjunctive use, reducing pumping and increasing groundwater elevations. Higher groundwater elevations will reduce the potential for subsidence related to groundwater production in the Subbasin.

Impacts to beneficial uses and users

The Freeman Diversion Expansion Project will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users.

3.1.2.5 Project No. 5: Voluntary Temporary Agricultural Land Fallowing

3.1.2.5.1 Description of Project No. 5

The Voluntary Temporary Agricultural Land Fallowing Project would use replenishment fees to temporarily fallow agricultural land (FCGMA 2018). This would result in decreased groundwater production on the parcels or ranches that are fallowed, and an overall reduction in groundwater demand in the Subbasin. Parcels or ranches in areas susceptible to seawater intrusion would be targeted with this project (FCGMA 2018).

Project No. 5 would use the existing monitoring network to evaluate improved groundwater conditions.

3.1.2.5.2 Benefits and Impacts of Project No. 5

Realized Benefits

This project is conceptual; thus, benefits have not yet been realized.

Expected Benefits

Temporary fallowing is a quick way to reduce demand with no capital costs or infrastructure needed. Because it is inexpensive, it is envisioned that voluntary temporary fallowing could be implemented, while other long-term solutions are investigated and implemented. The Voluntary Temporary Agricultural Land Fallowing Project will benefit the Subbasin by mitigating seawater intrusion in the Subbasin. This project would be utilized in conjunction with other projects and management actions to reduce the groundwater demand in the Subbasin.

Impacts to beneficial uses and users

Voluntary Temporary Agricultural Land Fallowing will increase groundwater elevations in the Subbasin, and thus have a positive impact on beneficial uses and users.

3.2 Newly Identified Projects and Management Actions

FCGMA and other agencies in the Subbasin have undertaken significant efforts to identify, evaluate, fund, and implement additional projects in the Subbasin that increase water supplies in the Subbasin and support GSP implementation. These projects were not included in the GSP. A portion of these projects were incorporated into the GSP list of projects for grant eligibility through the 2021 GSP Annual Report for the Subbasin (FCGMA 2022), and a portion of these projects were identified through FCGMA's new project evaluation process. These projects are summarized below and in Table 3-2, Summary of New Projects and Management Actions.

3.2.1 Project No. 6: Ferro-Rose Artificial Recharge of Groundwater

3.2.1.1 Description of Project No. 6

Project No. 6 is a key component of the Freeman Expansion Project. It involves expansion and extension of existing conveyance structures (inverted siphon and 3-barrel culvert) and connection to Ferro-Rose basin (Vineyard Ave. crossing) to allow for more recharge and to increase diversions, within the limits of UWCD's existing water right, from the Santa Clara River during high-flow events when suspended sediment concentrations are high.

Increased volume of diverted water will be used for artificial recharge and conjunctive use via the PTP in Subbasin, and a smaller amount for conjunctive use via the PVP in PVB.

Project No. 6 uses the existing monitoring network to evaluate improved groundwater conditions.

Table 3-2. Summary of New Projects and Management Actions

Number	Name	Description	Status	Expected Schedule	Benefits Observed to Date	Estimated Accrued Benefits at Completion
Projects						
6	Ferro-Rose Artificial Recharge of Groundwater	Expansion and extension of conveyance structures to allow for increased diversion of Santa Clara River water	Under Construction	Completion by end of 2024	N/A	Increase in sustainable yield by approximately 2,000 – 3,000 AFY.
7	Laguna Road Recycled Water Pipeline Interconnection	New pipeline interconnection to convey recycled water from PVCWD's system to UWCD's PTP	Under construction	▪ Phase 1 completion 2024. ▪ Phase 2 completion 2027	N/A	Increase in sustainable yield of Oxnard Subbasin by approximately 1,500 AFY. Reduced energy consumption for pumpers.
8	Extraction Barrier and Brackish Water Treatment	Seawater intrusion barrier formed by extracting brackish near Point Mugu	Preliminary design in project	▪ Phase 1 completion 2028. ▪ Phase 2 completion 2031	N/A	Potential increase in sustainable yield of the Oxnard Subbasin by more than 10,000 AFY.
9	Purchase of Supplemental State Water Project Water	Purchase supplemental SWP water for recharge in the Oxnard Subbasin and delivery to users via the PTP and PVP	Ongoing	Immediate	25,000 AF of imported water between 2019 and 2021	Increase in combined sustainable yield of the Oxnard Subbasin and PVB by 6,000 AFY. Reduced energy consumption for pumpers.
10	Destruction of Abandoned Wells	Destroy abandoned wells to reduce cross-connection and contamination across multiple aquifers	Conceptual	First phase, 2027	N/A	Improved groundwater quality

Table 3-2. Summary of New Projects and Management Actions

Number	Name	Description	Status	Expected Schedule	Benefits Observed to Date	Estimated Accrued Benefits at Completion
Projects						
11	Seawater Injection Barrier Feasibility Study	Feasibility study to evaluate potential benefits of freshwater injection wells installed in targeted areas of the Oxnard coastline	Conceptual	Not Defined	N/A	N/A
12	Installation of Transducers in Groundwater Monitoring Wells	Improved data collected and characterization of groundwater conditions at key wells	Preliminary design in process	Not defined	N/A	Improved data collection and understanding of groundwater conditions, resulting in improved management of the Subbasin.
13	Naumann-Hueneme Road Recycled Water Pipeline Interconnection	New pipeline interconnection to allow conveyance of recycled water from PVCWD's system to UWCD's PTP. Alternative to, or supplement for, Laguna Road Recycled Water Pipeline interconnection.	Preliminary design in process	2028-2029	N/A	Increased sustainable yield of Oxnard Subbasin by 1,500 AFY. Reduced energy consumption for pumpers.
14	Installation of Multi-Depth Monitoring Wells	Installation of monitoring wells in the Subbasin to assess groundwater conditions in areas that lack data.	Ongoing	Completion by the end of 2024	Two wells installed along Revolon Slough in the Oxnard Pumping Depression Management Area. Additional monitoring wells	Improved data collection and understanding of groundwater conditions, resulting in improved management of the Subbasin.

Table 3-2. Summary of New Projects and Management Actions

Number	Name	Description	Status	Expected Schedule	Benefits Observed to Date	Estimated Accrued Benefits at Completion
Projects						
					planned for construction near boundary with LPVB and in the EOPMA	
15	Installation of 3 Shallow Monitoring Wells	Installation of monitoring wells along the Revolon Slough, Calleguas Creek, and Santa Clara River.	Ongoing	Ongoing	Two shallow monitoring wells planned for completion in 2024 along Santa Clara River and Revolon Slough.	Improved data collection and understanding of groundwater conditions, resulting in improved management GDEs in the Subbasin.
16	ASR Wells and Recycled Water Storage	The design and construction of multiple ASR wells for injection/extraction and the storage of AWPF water.	Initial feasibility study complete and pilot program under development.	Estimated completion by 2033.	N/A	Increase in the sustainable yield of the Subbasin, dependent on additional projects that utilized AWPF water.
17	Recycled Water Seawater Injection Barrier	The design and construction of seawater injection barrier wells that would be used as part of the City of Oxnard's proposed ASR program.	This project is conceptual.	Not defined.	N/A	Increase in the sustainable yield of the Subbasin; dependent on additional projects that utilized AWPF water
18	Optimization of Groundwater Pumping Distribution Feasibility Study	Feasibility study to evaluate the benefits, and infrastructure requirements, to shift pumping out of the	This project is conceptual	Not defined.	N/A	Additional information to support the evaluation of projects that shift pumping across the Subbasin in

Table 3-2. Summary of New Projects and Management Actions

Number	Name	Description	Status	Expected Schedule	Benefits Observed to Date	Estimated Accrued Benefits at Completion
Projects						
		Saline Intrusion and Oxnard Pumping Depression management areas				an effort to mitigate seawater intrusion and maximize sustainable yield.

Notes: AFY = acre-feet per year; AF = acre-feet; GDE = Groundwater Dependent Ecosystem; SWP = State Water Project; PVCWD = Pleasant Valley County Water District; UWCD = United Water Conservation District; PTP = Pumping Trough Pipeline; PVP = Pleasant Valley Pipeline; ASR = Aquifer Storage and Recovery; AWPF = Advanced Water Purification Facility

3.2.1.2 Benefits and Impacts of Project No. 6

Realized Benefits

UWCD received funding to begin infrastructure improvements for the Ferro-Rose recharge basin through DWR's Sustainable Groundwater Management Grant Program's. Construction will be completed in 2024.

Expected Benefits

Expected benefits include higher groundwater levels, additional groundwater in storage, improved groundwater quality, which occurs as a result of the higher quality surface water used for recharge, and reduced potential for seawater intrusion or land subsidence in both the Subbasin and the PVB.

Impacts to beneficial uses and users

Ferro-Rose Artificial Recharge of Groundwater will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.2.2 Project No. 7: Laguna Road Recycled Water Pipeline Interconnection

3.2.2.1 Description of Project No. 7

The Laguna Road Recycled Water Pipeline Interconnection is a new pipeline interconnection to allow conveyance of recycled water from PVCWD's system to UWCD's PTP system to allow full utilization of available recycled water.

Project No. 7 uses the existing monitoring network to evaluate improved groundwater conditions.

3.2.2.2 Benefits and Impacts of Project No. 7

Realized Benefits

This project is currently under construction; thus, benefits have not yet been realized.

Expected Benefits

Benefits of using more recycled water in the PTP system will include higher groundwater levels, more groundwater in storage, improved groundwater quality, and reduced potential for seawater intrusion or land subsidence in the Subbasin. This project will reduce pumping and the potential for migration of high-TDS water into the aquifers. The PTP area will receive additional recycled water for agricultural use, reducing pumping in those areas, which will increase groundwater elevations and improve groundwater quality, while reducing potential for subsidence. The PTP area will receive the most direct and immediate benefit.

Impacts to beneficial uses and users

The Laguna Road Recycled Water Pipeline Interconnection will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.2.3 Project No. 8 Extraction Barrier and Brackish Water Treatment

3.2.3.1 Description Of Project No. 8

This project is intended to create a seawater intrusion barrier in the Subbasin, near Point Mugu, by extracting brackish groundwater in the Oxnard and Mugu aquifers near the coast and maintaining a pumping trough that helps prevent landward migration of seawater. Creation of a barrier to seawater intrusion will increase the sustainable yield of the Subbasin and may influence water levels in the adjacent PVB. In addition, this project will (1) produce treated brackish water for municipal and industrial use, agricultural use, and/or artificial recharge from currently unusable portions of the aquifers and (2) reduce the area and volume of the aquifers that are currently contaminated with seawater, thereby increasing storage capacity for fresh water.

Project components include construction of: (1) extraction barrier wells near Mugu Lagoon, (2) a reverse-osmosis treatment plant, and (3) a conveyance system for distribution of treated water. The brackish groundwater extracted in the Point Mugu area will be treated for beneficial use, including artificial recharge and/or direct delivery to water users (e.g., PTP, PVP). Benefits will include limiting further seawater intrusion, reversing the impacts of seawater intrusion in localized areas, increasing the groundwater storage capacity, raising groundwater elevations (primarily, but not exclusively, in the LAS), and areas where the treated water is provided, such as coastal areas, the Forebay, PVP, and PTP.

The project is envisioned to be advanced in multiple phases. The first phase of the project includes construction of monitoring well clusters and data collection in the vicinity of the proposed project site to aid in optimizing the project design. The monitoring well clusters will be used to collect groundwater quality and level data from the aquifers that will be pumped as part of the extraction barrier, as well as the semi-perched aquifer. The data collected from these wells will be used to: 1) refine understanding of horizontal and vertical conductivity of the aquifers and confining layers, to aid in design of the extraction wellfield; 2) provide additional data regarding geochemistry of the aquifers that will be pumped as part of the extraction; and 3) assess whether contaminants in some shallow portions of the semi-perched aquifer are likely to migrate toward the extraction wells, now or in the future. Additionally, Phase 1 will include construction and operation of approximately 10 groundwater extraction wells that operate at an average annual production rate of approximately 3,500 AFY.

The second phase of the project includes design and construction of ten (10) additional extraction wells, design and construction of the treatment plant, and the conveyance system for treated water distribution and a connection to Calleguas Salinity Management Pipeline for reverse osmosis brine discharge. Full build-out of the EBB project is designed to pump and treat 10,000 AFY of brackish water from the Subbasin.

Other supporting activities include additional groundwater modeling (e.g., of barrier concepts for the Port Hueneme area), geophysical studies, and operation of a pilot-scale extraction/treatment system that will help refine the extent of extraction and treatment needs.

An additional monitoring network and monitoring plan is currently under development for Project No. 8.

3.2.3.2 Benefits And Impacts of Project No. 8

Realized Benefits

This project is currently in design and permitting; thus, benefits have not yet been realized.

Expected Benefits

This project should aid with achievement of measurable objectives and minimum thresholds for four out of six sustainability criteria by blocking seawater intrusion near the coast, raising groundwater elevations in the Forebay, improving groundwater quality, and increasing fresh groundwater in storage in the aquifers (replacing the existing intruded seawater). The project anticipates increasing the combined annual sustainable yield of the Subbasin and PVB, considering both the quantity of treated brackish water supplied by the project and the effects on sustainable yield resulting from mitigating existing and future seawater intrusion.

Impacts to beneficial uses and users

The Extraction Barrier and Brackish Water Treatment Project will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.2.4 Project No. 9: Purchase of Supplemental State Water Project Water

3.2.4.1 Description Of Project No. 9

This project proposes purchasing supplemental State Water Project (State Water) water for recharge in the Subbasin and delivery to users on PTP and PVCWD systems in years when the State Water is available and willing participants can be found to execute a water transfer. “Supplemental” refers to State Water purchased, exchanged, or transferred for use in the Subbasin and PVB, in excess of UWCD’s Table A allocation, which is 3,150 AFY (in an average year, only about 60 percent of allocated State Water is actually delivered by DWR). The annual volume of State Water transfers that can be purchased will depend on the volume available and the price that UWCD and other Ventura County agencies are willing to pay. UWCD anticipates that over the long-term approximately 6,000 AFY of supplemental State Water imports will be available at the Freeman Diversion for use within the Subbasin and PVB.

Project No. 9 uses the existing monitoring network to evaluate improved groundwater conditions.

3.2.4.2 Benefits And Impacts of Project No. 9

Realized Benefits

Importation of supplemental State Water has already begun. In 2019, FCGMA funded UWCD’s purchase of 15,000 AF of supplemental State Water for recharge in the Subbasin. Between 2019 and 2021, UWCD purchased an additional 10,000 AF of supplemental State Water for recharge and delivery in the Subbasin and PVB. Realized benefits are an increase in groundwater elevations as a result of recharge in the Forebay and a reduction in groundwater pumping as a result of surface water deliveries for use in-lieu of groundwater.

Expected Benefits

This project anticipates increasing the combined sustainable yield of the Subbasin and the PVB by approximately 6,000 AFY.

Impacts to beneficial uses and users

The Purchase of Supplemental State Water Project Water will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.2.5 Project No. 10: Destruction of Abandoned Wells

3.2.5.1 Description of Project No. 10

This project proposes identifying and destroying abandoned wells in the Subbasin to reduce the cross-connection provided by wells screened across multiple aquifers. There are three primary concerns with these wells. First, inland from the Point Mugu, abandoned private wells may act as a conduit for seawater that has intruded the units of the UAS to migrate downward into the LAS. Second, abandoned wells in the semi-perched aquifer may provide pathways for groundwater with high chloride concentrations to migrate into the UAS and negatively impact the water quality of the Oxnard and Mugu aquifers. Third, the GSP determined that groundwater elevations that are higher than the minimum threshold groundwater elevations in the UAS and LAS adjacent to the coast may result in a return to artesian conditions in the confined aquifers. Abandoned wells can act as conduits for flow from the aquifer systems to land surface.

Because of the existing impacts to groundwater quality and the potential future impacts to infrastructure from abandoned wells, these wells need to be destroyed properly to achieve sustainable management of the groundwater conditions in the Subbasin. The initial phase of this project would address private wells inland from the Point Mugu. Subsequent phases would identify and address coastal wells and wells that allow leakage from the semi-perched aquifer to the UAS.

Project No. 10 would use the existing monitoring network to evaluate improved groundwater conditions.

3.2.5.2 Benefits and Impacts of Project No. 10

Realized Benefits

This project is currently in the planning stage; thus, benefits have not yet been realized.

Expected Benefits

The quantifiable benefits of this project will be in improved water quality in the LAS in the vicinity of Point Mugu, by preventing migration of poor-quality groundwater from the UAS to the LAS. Secondarily, the project will provide an improved understanding of groundwater conditions in each of the principal aquifers by limiting vertical migration of groundwater. Later phases of this project will help limit future infrastructure expenditures to resolve issues that may arise when the groundwater levels in the confined aquifers recover to elevations that will restore artesian conditions on the Oxnard Plain.

Impacts to beneficial uses and users

The Destruction of Abandoned Wells Project will reduce inter-aquifer flow and improve water quality for beneficial uses and users. Project impacts are intended to improve water quality for all users.

3.2.6 Project No. 11 Seawater Injection Barrier Feasibility Study

3.2.6.1 Description of Project No. 11

Seawater intrusion, which primarily occurs in the vicinity of Point Mugu and Port Hueneme, is the primary sustainability indicator that causes undesirable results in the Subbasin. This project would prevent seawater intrusion in these targeted areas of the Oxnard coastline through installation of a network of injection wells to increase groundwater elevations at the coastline and reverse the landward gradient in the lower aquifer system by creating a ridge of freshwater within the affected aquifers. This project is in the early stages of development, though preliminary groundwater modelling suggests that in the LAS, installation of 5 to 10 injection wells landward of the eastern edge of the existing seawater intrusion front, injecting a total of 2,400 AFY, has the potential to eliminate any further inland migration of seawater in the FCA. This type of seawater barrier has been used, successfully, to prevent seawater intrusion in the West Coast Basin and the Orange County Groundwater Basin. Water supplied to the injection wells in these areas comes from a combination of advanced treated recycled water and imported water. Additional modeling needs to be done to assess: (1) the feasibility of an injection barrier in the LAS, (2) the potential volume and sources of water available to inject, (3) the volume of injected water that would be recovered by inland wells, (4) the feasibility of implementing this project along with the seawater extraction barrier project proposed for the Point Mugu area, and (5) the infrastructure requirements, cost, and feasibility of constructing the project and delivering water to stakeholders west of injection barrier.

This project will be evaluated concurrently with Project No. 17, Recycled Water Seawater Intrusion Barrier. Project No. 11 uses the existing monitoring network to evaluate improved groundwater conditions.

3.2.6.2 Benefits and Impacts of Project No. 11

Realized Benefits

This project is a feasibility study and has not been initiated.

Expected Benefits

This project is a feasibility study so expected benefits are a greater understanding of (1) the feasibility of an injection barrier in the LAS, (2) the potential volume and sources of water available to inject, (3) the volume of injected water that would be recovered by inland wells, (4) the feasibility of implementing this project along with the seawater extraction barrier project proposed for the Point Mugu area, and (5) the infrastructure requirements, cost, and feasibility of constructing the project and delivering water to stakeholders west of injection barrier.

If this project is found to be feasible and is constructed, groundwater elevations will rise in the vicinity of the injection barrier and the minimum thresholds defined in the GSP will be re-evaluated and may be changed to reflect the new groundwater conditions under which the Subbasin could be managed sustainably.

Impacts to beneficial uses and users

The Seawater Injection Barrier Feasibility Study is a paper study, so the impacts to beneficial uses and users will be neutral. If the project is found to be feasible and is constructed, it will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.2.7 Project No. 12: Installation of Transducers in Groundwater Monitoring Wells

3.2.7.1 Description of Project No. 12

This project proposes installation of transducers in key wells, which may include the need to modify wellheads and install sounding tubes below the turbine pump bowls. The GSP determined that there were often 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. The temporal data gaps have persisted in reporting groundwater levels in storage for the annual reports prepared after the GSP was submitted to DWR. Additionally, as most key wells are agricultural irrigation wells, transducers will help assure that measured water levels are actual static water levels unaffected by recovery or potential well interference. The addition of transducers will help ensure that spring high and fall low water levels are collected from the key wells 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 a better comparison for annual change in storage estimates and will facilitate better management of the Subbasin.

Project No. 12 is an improvement to the existing monitoring network.

3.2.7.2 Benefits and Impacts of Project No. 12

Realized Benefits

This project has not been implemented.

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 water-level measurements. The data collected can be used to make better management decisions depending on the observed groundwater conditions.

Impacts to beneficial uses and users

This project does not have a direct impact on beneficial uses and users. It will, however, provide data that can be used to help evaluate and potentially revise the measurable objectives in the future.

3.2.8 Project No. 13: Nauman-Hueneme Road Recycled Water Pipeline Interconnection

3.2.8.1 Description of Project No. 13

This project is a new pipeline interconnection to allow conveyance of recycled water from Oxnard's AWPF system, at Hueneme Road, to UWCD's Pumping Trough Pipeline (PTP) system to allow full utilization of available recycled water. This project is a potential alternative to, or supplement for, the Laguna Road Recycled Water Pipeline interconnection (Project No. 7). The PTP area is expected to receive the most direct and immediate benefit from this project. Benefits of using more recycled water in the PTP system include higher groundwater levels, more groundwater in storage, improved groundwater quality, and reduced potential for seawater intrusion or land subsidence in the Subbasin.

Project No. 14 uses the existing monitoring network to evaluate improved groundwater conditions.

3.2.8.2 Benefits and Impacts of Project No. 13

Realized Benefits

This project is currently in preliminary design. Thus, project benefits have not yet been realized.

Expected Benefits

This project should aid with achievement of measurable objectives and minimum thresholds for five out of six sustainability indicators. This project will help raise groundwater levels, which will reduce the landward gradient that induces seawater intrusion near the coast, increase the volume of groundwater in storage, improve groundwater quality, and reduce the potential for land subsidence related to groundwater withdrawals. Higher groundwater levels will also reduce pump lift, and therefore energy consumption, for municipal and agricultural pumpers. The project anticipates increasing the annual sustainable yield of the Subbasin by approximately 1,500 AFY on average. The additional yield to the Subbasin will not double if both the Nauman-Hueneme Road and the Laguna Road Pipeline projects are both implemented, however building both projects may provide some supplemental yield over building just one of the two.

Impacts to beneficial uses and users

The Nauman-Hueneme Road Recycled Water Pipeline Interconnection will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.2.9 Project No. 14: Installation of Multi-Depth Monitoring Wells

3.2.9.1 Description of Project No.14

This project proposes installation of multi-depth monitoring wells in the Subbasin to assess groundwater conditions in the principal aquifers in areas of the Subbasin that lack data. The GSP determined that there were spatial data gaps in the understanding of aquifer conditions and identified 11 potential new well locations that would help fill the gaps identified. High-priority potential new well locations are located near the boundary with the LPVB, along the boundary with PVB, and in the West Oxnard Plain Management Area (FCGMA 2019).

In addition, a new well in the East Oxnard Plain Management Area (EOPMA) will help define conditions in an area of the Subbasin that does not currently have any monitoring wells. Groundwater levels to the west of the Bailey Fault are currently used as a proxy for conditions to the east of the fault. The addition of multi-depth monitoring wells, completed in each of the principal aquifers in this location, will help refine the understanding of groundwater flow directions and vertical gradients in the EOPMA.

3.2.9.2 Benefits and Impacts of Project No.14

Realized Benefits

Since the GSP was submitted to DWR, a multi-depth monitoring well cluster was installed adjacent to the Revolon Slough, within the Oxnard Pumping Depression Management Area. This well was installed through the DWR Technical Support Services program. This well helps to address a high priority data gap identified in the GSP and was completed to monitor all five principal aquifers. In addition, with support from DWR through their Sustainable Groundwater Management grant program, FCGMA is currently constructing nested monitoring wells near the boundary with the LPVB and in the Pumping Depression Management Area. These wells are anticipated to be completed in the 2024 calendar year.

Expected Benefits

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

Impacts to beneficial uses and users

The installation of multi-depth monitoring wells will improve data collection and management of groundwater resources for beneficial uses and users. Projects impacts are intended to benefit all users.

3.2.10 Project No.15: Installation of 3 Shallow Monitoring Wells

3.2.10.1 Description of Project No.15

This project proposes installation of shallow monitoring wells to assess groundwater conditions along the Revolon Slough, Calleguas Creek, and the Santa Clara River. The GSP determined that there was a data gap in the understanding of how surface water and shallow groundwater interact with the deeper primary aquifers in the Subbasin. DWR also identified "investigation of the hydraulic connectivity of the surface water bodies to the shallow aquifer and principal aquifers" as a recommended corrective action that should be addressed before the periodic evaluation of the Subbasin GSP. Shallow groundwater monitoring wells will be used to help understand the relationship between surface water and groundwater along the stream courses. Data from the construction of the wells will help define aquifer properties in the semi-perched aquifer and Oxnard aquifer, and data on groundwater conditions in these wells will be used to help assess groundwater gradients that may influence the source of water for GDEs.

3.2.10.2 Benefits and Impacts of Project No.15

Realized Benefits

FCGMA, with support from DWR through their Sustainable Groundwater Management grant program, is currently constructing three shallow monitoring wells in the Subbasin: one near Santa Clara River, one near Revolon Slough, and one near Calleguas Creek. These wells are anticipated for completion in the 2024 calendar year.

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 Subbasin. Such refinement may result in reevaluation and adjustment of the minimum thresholds or measurable objectives associated with GDEs.

Impacts to beneficial uses and users

The installation of shallow monitoring wells will improve data collection and management of groundwater resources for beneficial uses and users. Projects impacts are intended to benefit all users.

3.2.11 Project No.16: ASR Wells and Recycled Water Storage

3.2.11.1 Description of Project No.16

The Aquifer Storage and Recovery (ASR) Expansion Project proposed by the City of Oxnard is a Seawater Intrusion Barrier generally located along a northwest to southeast alignment in the vicinity of Hueneme Road and Pacific Coast Highway. This project was considered as part of Phase 2 of the AWPF Expansion Project and was included in the Program Environmental Impact Report (PEIR) developed by CH2MHill for the City in 2004. The PEIR contains detailed descriptions and analyses of AWPF Program Phases 1 and 2. Section 2.4.4 of the PEIR Volume 1 includes an overall description of the Project, and Sections 4.6.3.1.2 and 4.6.3.3.2 describe the modeling and proposed operation respectively. Recycled water would be conveyed to the ASR wells via the recycled water delivery system along Hueneme Road and a new ASR well Conveyance Pipeline constructed along Pacific Coast Highway. Individual Coastal ASR Well Laterals would be constructed from the main conveyance pipelines to distribute water to each well. Water injected into the coastal aquifers would act as a focused seawater intrusion barrier, create a new water supply for the basin to mitigate overdraft conditions and would generate groundwater storage that could be extracted from the Oxnard Forebay. Stored water generated from the Project would be pumped for potable use from the north Oxnard Plain using City wells.

3.2.11.2 Benefits and Impacts of Project No.16

Realized Benefits

The City of Oxnard is currently designing a pilot study of the proposed ASR project. Benefits of the project have not yet been realized.

Expected Benefits

Modeling results from the PEIR suggests the likelihood of "very large increases in groundwater elevations along the coastal injection wells" and that the project would "significantly help to decrease the severe overdraft conditions…". This project would operate as part of Project No. 2, AWPF Facility Improvements Phase II.

Impacts to beneficial uses and users

Increases in groundwater elevations associated with implementation of this project is expected to benefit all groundwater uses and users in the Subbasin.

3.2.12 Project No.17: Recycled Water Seawater Injection Barrier Project

3.2.12.1 Description of Project No.17

The Oxnard Recycled Water Seawater Injection Barrier Project proposed by the City of Oxnard is a Seawater Intrusion Barrier generally located along a northwest to southeast alignment in the vicinity of Hueneme Road and Pacific Coast Highway. This project was considered as part of Phase 2 of the GREAT program and was included in the PEIR developed by CH2MHill for the City of Oxnard in 2004. The PEIR contains detailed descriptions and analyses of GREAT Program Phases 1 and 2. Section 2.4.4 of the PEIR Volume 1 includes an overall description of the Project and Section 4.6.3.1.2 and 4.6.3.3.2 describe the modeling and proposed operation respectively. Recycled water would be conveyed to the ASR wells via the recycled water delivery system along Hueneme Road and a new ASR well Conveyance Pipeline constructed along Pacific Coast Highway. Individual Coastal ASR Well Laterals would be constructed from the main conveyance pipelines to distribute water to each well. Water injected into the coastal aquifers would act as a focused seawater intrusion barrier, create a new water supply for the basin to mitigate overdraft conditions and would generate groundwater storage that could be extracted from the Oxnard Forebay. Stored water generated from the project would be pumped for potable use from the north Oxnard Plain using City wells.

3.2.12.2 Benefits and Impacts of Project No. 17

Realized Benefits

This project is conceptual – benefits have not been realized.

Expected Benefits

Modeling results from the PEIR suggests the likelihood of "very large increases in groundwater elevations along the coastal injection wells" and that the project would "significantly help to decrease the severe overdraft conditions." This project would operate as part of Project No. 2, AWPF Facility Improvements Phase II.

Impacts to beneficial uses and users

Increases in groundwater elevations associated with implementation of this project is expected to benefit all groundwater uses and users in the Subbasin.

3.2.13 Project No. 18 Optimization of Groundwater Pumping Distribution Feasibility Study

3.2.13.1 Description of Project No. 18

Results from numerical modeling performed during GSP implementation, and as part of this periodic evaluation, indicate that the sustainable yield of the Subbasin, PVB, and WLPMA could be increased by shifting pumping out of the Saline Intrusion and Oxnard Pumping Depression Management Areas to the Forebay and/or West Oxnard Plain Management Areas (see Section 5.2). Additional analysis needs to be done to assess: (1) the feasibility of implementing this project alongside other large capital projects proposed in the Subbasin, and (2) the infrastructure and costs required to deliver water to users in the Subbasin that are impacted by localized pumping reductions.

3.2.13.2 Benefits and Impacts of Project No. 18

Realized Benefits

This project is a feasibility study and has not been initiated.

Expected Benefits

This project is a feasibility study so expected benefits are a greater understanding of (1) the sustainable yield increase associated with re-distributing groundwater pumping, (2) the feasibility of, and need for, implementing this alongside other large capital projects in the Subbasin, and (3) the infrastructure and cost requirements to deliver water to those impacted by local pumping reductions.

Impacts to beneficial uses and users

The Optimization of Groundwater Pumping Distribution Feasibility Study is a paper study, so the impacts to beneficial uses and users will be neutral. If the project is found to be feasible and is constructed, it will increase sustainable yield in the Subbasin, and thus have a positive impact on beneficial uses and users. Project impacts are intended to increase sustainable yield for all users.

3.3 Process for Public Notice and Engagement

To facilitate funding, implementation, and integration into the GSP modeling, FCGMA developed a formal process for evaluating, ranking, and prioritizing projects within the Subbasin. This project evaluation process was developed under the guidance of the FCGMA Board of Directors' Operations Committee, with participation by other agencies and interested in the Subbasin. The project evaluation process includes set of evaluation criteria, guidelines, and policies for vetting, adding, and prioritizing projects. FCGMA adopted the project prioritization process and solicited the first found of project information from agencies in the Subbasin in September 2023. The adoption of this process provides interested parties and other agencies in the Subbasin with the opportunity to submit new or updated project information for consideration in the GSP to FCGMA on an annual basis.

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4 Basin Setting Review

This section of the report evaluates the Basin Setting described in the GSP, including the Hydrogeologic Conceptual Model (Section 4.1); and water supplies, land uses, and water budgets over the evaluation period (Section 4.2).

4.1 Hydrogeologic Conceptual Model

Groundwater in the Subbasin occurs in six aquifers: the semi-perched aquifer, and the Oxnard, Mugu, Hueneme, Fox Canyon, and Grimes Canyon aquifers. Five of these six aquifers are principal aquifers and are grouped into a UAS and Lower Aquifer System (LAS). The UAS comprises the Oxnard and Mugu aquifers, which consist of recent to upper Pleistocene- and Holocene-age alluvial deposits. The LAS comprises of the Hueneme, Fox Canyon, and Grimes Canyon aquifers, which consist of middle to lower Pleistocene-age marine and nonmarine sediments. Groundwater production from the Subbasin has induced seawater intrusion in both the UAS and LAS.

Since adoption of the GSP, FCGMA and other agencies in the Subbasin have designed, scoped, and implemented new hydrogeologic investigations, projects, and technical studies that improve understanding of the hydrogeologic conceptual model of the Subbasin. These investigations have focused on improving understanding of the relationship between groundwater extractions, groundwater levels, and seawater intrusion. This section summarizes: (i) new information and data gathered from these projects and studies, and (ii) the improved understanding of local hydrogeologic conditions within the Subbasin.

4.1.1 New Information and Data

4.1.1.1 Hydrostratigraphic Information

United Water Conservation District (UWCD) maintains the three-dimensional (3D) hydrostratigraphic model of the Subbasin. This 3D hydrostratigraphic model maps the lateral extents, thicknesses, and properties of the six regional water-bearing aquifers in the Subbasin. The 3D model was designed during development of the VRGWFM and integrates geophysical logs (e-logs) and lithologic data from approximately 575 wells with structural geologic information into a 3D model developed using the Rockworks software (UWCD 2018). Since adoption of the GSP, UWCD has continued development of the 3D hydrostratigraphic model of the region. UWCD has focused their hydrostratigraphic model updates to the areas underlying the Naval Base Ventura County (NBVC) installations at Point Mugu and Port Hueneme, where groundwater is impacted by seawater intrusion.

NBVC Point Mugu

NBVC staff provided UWCD with e-logs, borehole lithologic data, and cone penetrometer test data at approximately 50 locations on the base. These data provide information on subsurface conditions underlying the base to depths of approximately 150 ft below ground surface (bgs). UWCD integrated these data into their hydrostratigraphic model to update the interpreted thicknesses of the semi-perched aquifer, Oxnard aquifer, Mugu aquifer, and the aquitards that separate these three water-bearing units.

NBVC Port Hueneme

While revising the hydrostratigraphic mapping underlying NBVC Point Mugu, UWCD re-evaluated the hydrostratigraphy of the Subbasin underlying NBVC Port Hueneme. To do this, UWCD developed new cross sections using e-log data, onshore seismic-reflection profiles, and sea-floor seismic-reflection profiles that were not analyzed during development of the VRGWFM (Johnson et al. 2012; UWCD 2021c). These data were used to update aquifer thicknesses and lateral extents to depths of approximately 850 ft bgs, with a focus on refining the interpreted thickness and extent of the Hueneme aquifer.

4.1.1.2 Depth-Discrete Groundwater Elevation Data

In 2019 and 2020, DWR installed a nested monitoring well cluster for FCGMA under DWR's Technical Support Services program adjacent to Revolon Slough within the Oxnard Pumping Depression Management Area. The new well consists of shallow and deep well clusters that improves characterization of vertical gradients between the principal aquifers and addresses a data gap in the spatial distribution of depth-discrete groundwater elevation measurements identified in the GSP.

The shallow well cluster, which was completed on November 22, 2019, contains three monitoring wells individually screened within the Oxnard, Mugu, and Hueneme aquifers. The deep well cluster, which was completed on March 19, 2020, contains three monitoring wells individually screened within the upper and basal zones of the FCA and the GCA. These new depth-discrete monitoring wells are measured quarterly using an electronic sounder and are sampled to characterize local groundwater quality conditions. Data collected at these wells have been used to improve groundwater elevation contouring and interpretation of aquifer-specific conditions since March 2020 and have been included in the GSP annual reports covering water years 2020 through 2023.

4.1.1.3 Numerical Modeling Studies

Effects of Management Area Pumping on Seawater Intrusion

To support effective management and meet the sustainability goal for the Subbasin by 2040, the GSP established five management areas: the Forebay Management Area, the West Oxnard Plain Management Area, the Oxnard Pumping Depression Management Area, the Saline Intrusion Management Area, and the East Oxnard Plain Management Area (FCGMA 2019). The relative influence of pumping within each management area on seawater intrusion into the Subbasin was identified as a data gap in the GSP.

To improve understanding of the influence of pumping within each management area on seawater intrusion, FCGMA initiated a numerical modeling study of the Subbasin that used the VRGWFM to evaluate the impacts of re-distributed pumping on historical seawater intrusion to the Subbasin. The study evaluated five (5) different pumping redistribution scenarios that simulated a 10% shift in historical pumping between management areas. The estimate of coastal flux into the Saline Intrusion Management Area, which represents the approximate lateral extent of seawater intrusion in the Subbasin, was used to quantify the relative impacts of pumping within each management area on seawater intrusion (Section 4.1.2.3).

4.1.2 Improvements to the Hydrogeologic Conceptual Model

4.1.2.1 Hydrostratigraphic Information

Semi-Perched Aquifer

Geophysical and lithologic data collected across the Subbasin suggests that the semi-perched aquifer extends from land surface to depths of approximately 140 ft. bgs (UWCD 2021c), except for in the Forebay Management Area where the semi-perched aquifer is not present. Near NBVC Point Mugu, the semi-perched aquifer gradually increases in thickness from northwest to southeast. On the northwestern portion of the base, the semi-perched aquifer is interpreted to range in thickness from 20 to 30 feet. Near Mugu Lagoon and Calleguas Creek, the semi-perched aquifer ranges in thickness from approximately 80 to 100 feet.

These new data result in similar interpretations of the semi-perched aquifer thickness in the northwestern portion of the base (UWCD 2018, UWCD 2021c). Near Mugu Lagoon, these data suggest that that the semi-perched aquifer is approximately 20 to 50 feet thinner than previously interpreted (UWCD 2018, UWCD 2021c).

Clay Cap

The semi-perched aquifer is separated from the underlying Oxnard aquifer of the UAS by a laterally continuous clay cap[11]. Geophysical and lithologic data collected across the Subbasin suggests that the clay cap ranges in thickness from approximately 10 to 100 feet, except in the Forebay Management Area, where the clay cap is not present.

Data collected from NBVC Point Mugu suggests that the thickness of the clay cap varies across the base. On the northwestern portion of the base, the clay cap is interpreted to range from 50 to 80 feet thick (UWCD 2021c). Near Mugu Lagoon and Calleguas Creek, the clay cap ranges in thickness from approximately 10 to 30 feet. These new data suggest that the clay cap is up to approximately 30 feet thinner than previously interpreted in the northeastern portion of the base and is approximately 15 to 30 feet thicker than previously interpreted in the southwestern portion of the base (UWCD 2018, UWCD 2021c).

Upper Aquifer System

As previously described, the UAS comprises the Oxnard and Mugu aquifers. Within the NBVC Point Mugu boundaries, the Oxnard aquifer lithology is variable and consists of fine- to coarse-grained sand, with interbeds of clay, silt, and gravel. The Mugu aquifer is composed of sands and gravels, with silt and clay interbeds, but it is generally finer grained than the Oxnard aquifer. The Oxnard and Mugu aquifers are separated by a 10 to 40-foot-thick aquitard within the NBVC Point Mugu area.

In the NBVC Point Mugu area, the UAS ranges in thickness from approximately 200 to 300 feet (UWCD 2021c). The UAS is thickest in the northern part of the base, and generally thins towards Mugu Lagoon. This interpretation is consistent with previous interpretations of the northern part of the base and southeastern parts of the base. In the central part of the base, underlying Point Mugu Game Reserve, the NBVC data indicate that the UAS is up to 50-feet thinner than previously interpreted.

11 The semi-perched and underlying confining clay are not present within the Forebay Management Area of the Subbasin.

Hueneme Aquifer

The Hueneme aquifer is present across the majority of the Subbasin, except underlying NBVC Point Mugu, where uplift has eroded the Hueneme aquifer, and the Mugu aquifer sits unconformably on the FCA (FCGMA 2019). The geophysical data and seismic refraction data analyzed as part of the hydrogeologic conceptual model update indicates that in the NBVC Port Hueneme area, the Hueneme aquifer rapidly thins from approximately 500 feet on the northwestern part of the base, to less than 10 feet south of Hueneme Road (UWCD 2021c). While this interpretation is generally consistent with previous interpretations of the extent of the Hueneme aquifer, the data indicate that the Hueneme aquifer may be up to 50 feet thinner than previously interpreted (UWCD 2021c).

4.1.2.2 Depth-Discrete Groundwater Elevation Data

Groundwater elevations measured at the new depth-discrete monitoring located near Revolon Slough were used to characterize seasonal high and low groundwater elevations starting in water year 2021 (Section 7.2). Improvements to the understanding of groundwater conditions in the UAS and LAS based on these measurements are discussed in detail in the 2022, 2023, and 2024 GSP annual reports for the Subbasin and are summarized below.

Upper Aquifer System

The nested well cluster located near Revolon Slough contains two completions within the UAS:

- Well 01N21W16P07S is screened 140 to 180 ft. bgs in the Oxnard aquifer.
- Well, 01N21W16P06S is screened 340 to 460 ft. bgs in the Mugu aquifer.

Groundwater elevations measured at these wells have improved characterization of groundwater conditions within the UAS within the Oxnard Pumping Depression Management Area.

Oxnard Aquifer

Seasonal low groundwater elevations between water year 2021 and 2023 at well 01N21W16P07S ranged from a low of approximately -5 ft. mean sea level (msl) (measured in fall 2021) to a high of approximately -0.5 ft. msl (measured in fall 2020). Throughout the 2021 to 2023 water year period, groundwater elevations measured at well 01N21W16P07S were higher than groundwater elevations measured farther west within the Oxnard Pumping Depression Management Area and along the coastline (FCGMA 2022, FCGMA 2023, FCGMA 2024).

Mugu Aquifer

Seasonal low groundwater elevations between water year 2021 and 2023 at well 01N21W16P06S ranged from a low of approximately -86 ft. msl (measured in fall 2022) to a high of approximately -61 ft. msl (measured in fall 2020). Throughout the 2021 to 2023 water year period, groundwater elevations measured at well 01N21W16P06S were consistent with previous groundwater elevation interpretations, which suggest that groundwater elevations in the Mugu aquifer are lowest near the intersection of Hueneme Road and Highway 1 (FCGMA 2022, FCGMA 2023, FCGMA 2024).

Vertical Gradients within the UAS

Groundwater elevations measured at wells 01N21W16P07S and 01N21W16P06S indicate that within the Oxnard Pumping Depression Management Area, there is a downward vertical gradient between the Oxnard and Mugu aquifers. Over the 2021 to 2023 water years, the downward vertical gradient ranged from approximately 0.2 to 0.3 feet per foot.

Lower Aquifer System

The nested well cluster located near Revolon Slough contains four completions within the LAS:

- Well 01N21W16P05S is screened 510 to 640 ft bgs in the Hueneme aquifer.
- Well 01N21W16P10S is screened 710 to 860 ft bgs in the upper FCA.
- Well 01N21W16P09S is screened 960 to 1050 ft bgs in the basal FCA.
- Well 01N21W16P08S is screened 1,130 to 1,180 ft. bgs in the GCA.

Groundwater elevations measured at these wells help improve characterization of groundwater conditions within the LAS of the Oxnard Pumping Depression Management Area.

Hueneme Aquifer

Seasonal low groundwater elevations between water year 2021 and 2023 at well 01N21W16P05S ranged from a low of approximately -129 ft. msl (measured in fall 2022) to a high of approximately -88 ft. msl (measured in fall 2020). Throughout the 2021 to 2023 water year period, groundwater elevations measured at well 01N21W16P05S corresponded to the regional low groundwater elevations within the Hueneme aquifer (FCGMA 2022, FCGMA 2023, FCGMA 2024).

Fox Canyon Aquifer

Between water year 2021 and 2023 fall groundwater elevations in the upper FCA ranged from a low of approximately -125 ft. msl (measured in fall 2022) to a high of approximately -88 ft. msl (measured in fall 2020). Over this same period in the basal FCA, fall groundwater elevations ranged from a low of -129 ft. msl (measured in fall 2022) to a high of approximately -89 ft. msl (measured in fall 2020). Throughout the 2021 to 2023 water year period, groundwater elevations measured at well 01N21W16P10S were approximately 20 to 45 feet higher than the regional low groundwater elevations in the FCA, which occurred along the boundary with the PVB (FCGMA 2022, FCGMA 2023a, FCGMA 2024). Over this period, groundwater elevations in the basal FCA were approximately 0.5 to 5 feet lower than the upper FCA.

Grimes Canyon Aquifer

Seasonal low groundwater elevations between water year 2021 and 2023 at well 01N21W16P08S ranged from a low of approximately -125 ft. msl (measured in fall 2022) to a high of approximately -88 ft. msl (measured in fall 2020). Throughout the 2021 to 2023 water year period, groundwater elevations measured at well 01N21W16P08S were the lowest regional low groundwater elevations within the GCA (FCGMA 2022, FCGMA 2023, FCGMA 2024). Over this period, groundwater elevations in the GCA were approximately 0.5 to 4 feet higher than the basal FCA groundwater elevations measured at this location.

Vertical Gradients within the LAS

Groundwater elevations measured at wells 01N21W16P05S and 01N21W16P09S indicate that within the Oxnard Pumping Depression Management Area, there is a limited vertical gradient between the Hueneme aquifer, FCA, and GCA. Over the 2021 to 2023 water years, the vertical gradient measured at these two wells ranged from approximately 0.001 to 0.01 feet per foot between the Hueneme aquifer and the FCA. The vertical gradient between the FCA and GCA also ranged from approximately 0.001 to 0.01 feet per foot over this same period.

Vertical Gradients between the UAS and LAS

Groundwater elevations measured at wells 01N21W16P10S through -05S indicate that within the Oxnard Pumping Depression Management Area, there is a downward vertical gradient between the UAS and LAS. Over the 2021 to 2023 water years, the downward vertical gradient ranged from approximately 0.15 to 0.25 feet/foot. The downward gradient between the UAS and LAS is one to two orders-of-magnitude higher than the vertical gradients between the Hueneme aquifer, FCA, and GCA.

4.1.2.3 Numerical Modeling Studies

Effects of Management Area Pumping on Seawater Intrusion

The numerical modeling evaluation performed by FCGMA in 2022 indicated that shifting production out of the more impacted management areas may increase the sustainable yield of the Subbasin. The numerical modeling evaluation provided three key take-aways:

- Shifting pumping out of the Saline Intrusion Management Area reduces seawater intrusion by approximately 20% of the transferred pumping volume.
- Shifting pumping from the Forebay or West Oxnard Plain management areas into the Oxnard Pumping Depression Management Area increases seawater intrusion by approximately 10% of the transferred pumping volume.
- Shifting pumping from the Forebay Management Area to the West Oxnard Plain Management Area increases the coastal flux north of Channel Island Harbor by approximately 6% of the shifted pumping but has little impact on seawater flux into the Saline Intrusion Management Area. Seawater intrusion has not been observed on the coast north of Channel Islands Harbor.

These results were used to inform the future scenario modeling performed as part of this periodic GSP evaluation (Section 5.2, Future Scenario Water Budgets and Sustainable Yield).

4.1.2.4 Potential Recharge Areas

To evaluate potential future recharge areas within, and surrounding, the Subbasin, soil types were obtained from the Web Soil Survey, available online at https://websoilsurvey.nrcs.usda.gov/ (USDA 2019). Soil Ksat rates (saturated hydraulic conductivity rates) for soils of 92 micrometers per second or greater were plotted (Figure 4-1, Potential Recharge Areas). In addition to this, areas where the FCA outcrops at land surface act as potential recharge areas for the Subbasin.

4.1.3 Data Gaps

The GSP identified data gaps in the hydrogeologic conceptual model of the Subbasin that create uncertainty in the understanding of the impacts of groundwater production on water-level changes and seawater intrusion (FCGMA 2019). These data gaps are summarized in Table 4-1, Summary of Actions Taken to Address Data Gaps Identified in the GSP. Since adoption of the GSP, FCGMA and other agencies in the Subbasin have begun to address these data gaps. A summary of the actions taken by FCGMA and other agencies in the Subbasin is included in Table 4-1.

While FCGMA and other agencies in the Subbasin have begun to address data gaps, some remain. To help prioritize projects that address these remaining data gaps, FCGMA has developed a project evaluation process that formalized a set of criteria used to weigh project benefits and costs and quantitatively rank projects in the Subbasin. The ranking system is intended to prioritize projects for future funding. FCGMA anticipates the using this process to identify, rank, fund, and implement projects in the Subbasin, annually. Projects that address data gaps will be included in this process.

Table 4-1. Summary of Actions Taken to Address Data Gaps Identified in the GSP

Data Gap Identified in the GSP		
No.	Description	Actions Taken
1	Distributed measurements of aquifer properties	▪ FCGMA has collected geophysical and lithologic data from the new monitoring wells constructed in the Oxnard Subbasin. These data help to improve understanding of local aquifer thickness and characteristics.
2	Distributed measurements of groundwater quality	▪ VCWPD and UWCD continue to sample a network of groundwater wells that characterize aquifer-specific groundwater quality conditions in the Subbasin. UWCD and VCWPD added 13 new wells to the groundwater quality monitoring network, 11 are screened within a single aquifer in the Subbasin.
3	Measurements of groundwater quality that distinguish the sources of high TDS in the FCA and GCA	▪ FCGMA and other agencies in the Subbasin have not initiated new technical studies that distinguish the sources of high TDS in the FCA and GCA.
4	Temporal limitations on groundwater elevation data	▪ UWCD added four wells to their existing groundwater elevation monitoring network that are equipped with pressure transducers. These wells are in the Forebay Management Area, WOPMA, and Oxnard PDMA. ▪ In 2022, FCGMA was awarded grant funds under DWR's SGM funding opportunity. As part of this, FCGMA will be constructing up to two new nested well clusters in the Subbasin. FCGMA anticipates equipping these wells with pressure transducers. FCGMA anticipates completing construction in the 2024 calendar year.
6	Relative impacts of groundwater production from specific areas within the Subbasin on seawater intrusion	▪ In 2022, FCGMA conducted a numerical modeling study to evaluate the impacts of pumping within each management area on seawater intrusion into the Subbasin. These results were used to constrain future scenario modeling for this periodic GSP evaluation. A summary of this study is included in Section 4.1.
7	Connection between the semi-perched aquifer and potential GDEs	▪ In 2022, FCGMA was awarded grant funds under DWR's SGM funding opportunity. As part of this, FCGMA will be constructing three new shallow monitoring wells located near Calleguas Creek, Revolon Slough and Santa Clara River. These monitoring wells will be completed within the semi-perched aquifer; data collected from these wells will help address this data gap. FCGMA anticipates completing construction in the 2024 calendar year.
8	Potential impacts of increased production in the semi-perched aquifer	▪ FCGMA and other agencies in the Subbasin have not undertaken new technical studies to evaluate the potential impacts of increased production in the semi-perched. However, as noted in the GSP, the semi-perched aquifer is not a principal aquifer and, currently, there are no plans to expand production in the semi-perched in the future.

Notes: UWCD = United Water Conservation District; VCWPD = Ventura County Watershed Protection District; SGM = Sustainable Groundwater Management; WOPMA = West Oxnard Plain Management Area; PDMA = Pumping Depression Management Area

4.1.3.1 Newly Identified Data Gaps

Emerging Contaminants

On April 10, 2024, the U. S. Environmental Protection Agency announced final drinking water regulations for six per- and polyfluoroalkyl substances (PFAS) (U.S. EPA 2024; Table 4-2, Final MCLGs and MCLs for PFAS). Under the final ruling:

- Public water systems must monitor for regulated PFAS. Initial monitoring must be completed by 2027, followed by ongoing compliance monitoring. Starting in 2027, public water systems must also provide the public with information on the level of PFAS in their drinking water.
- Public water systems must, by 2029, implement solutions to reduce PFAS if concentrations exceed the final maximum contaminant levels.
- Beginning in 2029, public water systems that have PFAS in drinking water which violates the maximum contaminant levels must take action to reduce these PFAS levels and provide public notification of the violation.

At the time of GSP adoption, PFAS was not regulated under State or Federal guidelines.

Table 4-2. Final MCLGs and MCLs for PFAS

Compound	Final MCLG	Final MCL
PFOA	Zero	4.0 ppt
PFOS	Zero	4.0 ppt
PFHxS	10 ppt	10 ppt
PFNA	10 ppt	10 ppt
HFPO-DA (commonly known as GenX Chemicals)	10 ppt	10 ppt
Mixtures containing two or more PFHxS, PFNA, HFPO-DA, and PFBS	1 (unitless) Hazard Index	1 (unitless) Hazard Index

Notes: MCLG = Maximum Contaminant Level Goal; MCL = Maximum Contaminant Level; ppt = parts per trillion, also expressed as nano-grams per liter (ng/L)

Public water suppliers in the Subbasin are currently performing baseline monitoring to evaluate concentrations, if prevalent, of PFAS in their water supplies (Figure 4-2, Public Water System Wells Currently Monitoring PFAS Concentrations in Groundwater). As noted above, public water suppliers are not required to complete baseline monitoring until 2027.

4.2 Water Uses during the Evaluation Period

The GSP characterized historical land uses and water supplies in the Subbasin through December 31, 2015. Since 2015, FCGMA and other agencies in the Subbasin have implemented projects that have diversified water supplies in the Subbasin and supported ongoing conjunctive use of surface water, recycled water, and groundwater. This section summarizes the water supplies in the Subbasin since 2015. Land use changes in the Subbasin since 2015 are provided for context.

4.2.1 Land Use Changes in the Oxnard Subbasin

Land use change in the Subbasin was evaluated using DWR's statewide land use data for 2014[12] and 2022. Land uses were grouped into three categories: agriculture, urban, and idle/unclassified (Table 4-3, Land Use Change 2014-2022). The largest changes in land use over the 2014 to 2022 period occurred within the urban sector. Agricultural land uses in 2022 were similar to those in 2014. The total land area of the Subbasin in DWR's published land use varies by 1,418 acres between 2014 and 2022 pointing to uncertainty in the data which should be considered when evaluating the land-use changes.

Table 4-3. Land Use Change 2014-2022

Land Use	2014 (Acres)	2022 (Acres)	Difference (Acres)	Percent Change
Agriculture	22,873	22,516	-357	-2%
Urban	18,603	19,952	1,349	7%
Idle/Unclassified	101	527	426	422%

Source: DWR 2024.
Notes: In 2014, mapped land use totaled 41,577 acres. In 2022, mapped land use totaled 42,995 acres. The difference in total mapped acreage reflects uncertainty in the land use mapping and does not represent a change in the areal extent of the Subbasin.

4.2.2 Water Supplies during the Evaluation Period

Water supplies in the Subbasin consist of surface water, imported water, recycled water, and groundwater. This section of the GSP evaluation summarizes the total water supplies in the Subbasin and provides a comparison to historical availability. Because the GSP provides data on water supplies through 2015, water supply data are summarized here for water years 2016 through 2023. However, water-use trends over the evaluation period are characterized using data for the period of water year 2020 through 2023[13]. Data for water year 2024 were not available at the time of reporting.

4.2.2.1 Groundwater

On October 23, 2019, the FCGMA Board of Directors adopted an Ordinance to Establish an Allocation System for the Oxnard and Pleasant Valley Groundwater Basins, effective October 1, 2020. The prior system provided an efficiency allocation to agricultural pumpers based on the crop type, number of acres planted, and water-year type. This enabled increased groundwater extractions if more water-intensive crops were planted, or additional acres were brought into production. The new system established fixed extraction allocations assigned to each production well, a change that was needed to sustainably manage the Subbasin. The ordinance additionally transitioned extraction reporting from calendar year to water year.

Historically, groundwater extractions in the FCGMA have been reported semiannually. Because groundwater extractions were not reported monthly, groundwater production prior to 2020 cannot be reported on a water year

12 Because land use data was not published for 2015, the 2014 data are used here.
13 Groundwater extraction trends for the evaluation period are summarized using data from two years: water year 2021 and 2022. Water year 2020 was not included because this was a transitional reporting year. Water year 2023 was not included because, at the time of reporting, FCGMA had only received and/or processed extraction reports for approximately 80% of the operators in the Subbasin.

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Table 4-4. Groundwater Extractions in the Oxnard Subbasin by Aquifer System and Water Use Sector

Year	Extraction Reporting Complete / Estimated Percentage Complete (%)[a]	Upper Aquifer System (Acre-Feet)				Lower Aquifer System (Acre-Feet)				Wells in multiple or unassigned aquifer systems (Acre-Feet)				TOTAL (Acre-Feet)
		AG	Dom	M&I	Sub-Total	AG	Dom	M&I	Sub-Total	AG	Dom	M&I	Sub- Total	
CY 2016	Yes	15,710	65	12,681	28,455	31,366	24	10,623	42,013	8,315	110	584	9,009	79,477
CY 2017	Yes	15,841	59	14,785	30,685	29,248	27	8,613	37,888	9,922	45	418	10,385	78,959
CY 2018	Yes	15,097	58	16,936	32,091	26,596	24	6,601	33,222	9,735	20	309	10,064	75,376
CY 2019	Yes	13,112	58	17,820	30,990	22,473	27	6,413	28,913	9,394	36	544	9,974	69,877
2020[c]	Yes	9,333	48	14,782	24,163	14,389	9	5,079	19,478	7,183	46	529	7,758	51,399
WY 2021	Yes	13,782	66	20,981	34,829	23,407	6	7,782	31,196	8,980	29	754	9,763	75,788
WY 2022[d]	Yes	12,398	52	18,966	31,416	23,250	14	7,148	30,412	9,452	27	2,898	12,377	74,205
WY 2023[e]	No/80%	7,445	31	12,710	20,186	14,925	11	11,583	26,519	4,580	13	471	5,064	51,769
2016-2022 Average[f]		**14,323**	**60**	**17,028**	**31,411**	**26,057**	**20**	**7,863**	**33,940**	**9,300**	**44**	**918**	**10,262**	**75,613**
2021 - 2022 Average[f,g]		**13,090**	**59**	**19,974**	**33,123**	**23,329**	**10**	**7,465**	**30,804**	**9,216**	**28**	**1,826**	**11,070**	**74,996**

Notes: CY = Calendar Year; WY = Water Year; AG = Agriculture; Dom = domestic; M&I = Municipal and Industrial. Groundwater extraction data updated based on additional review of Automated Metering Infrastructure data.

a Qualifier indicates whether extraction reporting is complete for the given year. "Yes" indicates no additional reporting is anticipated. "No" indicates that additional reporting is anticipated. The percentage included after the "No" qualifier represents the estimated total percentage of operators who have reported extractions as of January 26, 2024.

b Total pumping in 2016 includes 4 acre-feet of groundwater production from the semi-perched aquifer that were used by the M&I sector.

c Groundwater extraction reporting is from January 1, 2020, through September 30, 2020, due to transition to water year reporting.

d Groundwater extractions updated upon receipt of additional reporting.

e Groundwater extractions are preliminary and will be updated during preparation of the 2025 GSP Annual report based on receipt of additional reporting.

f Excludes 2020 because this was a transitional reporting year in which only nine (9) months of extractions were reported to FCGMA.

g Excludes 2023 from the average because, as of January 26, 2024, approximately 20% of the extraction reports are outstanding.

basis. Therefore, for 2016 through 2019 reported in Table 4-4, Groundwater Extractions in the Oxnard Subbasin by Aquifer System and Water Use Sector, follow the historical precedent and represent calendar year extractions. Due to the transition from calendar year to water year reporting in 2020, groundwater extractions reported for 2020 represent extractions for the nine-month period from January 1, 2020, through September 30, 2020 (Table 4-4).

The water year 2023 extractions presented in Table 4-4 represent the extractions reported to FCGMA as of January 26, 2024, and do not include estimates of extractions for wells that had not yet been reported. As of January 26, 2024, FCGMA had received reporting from approximately 80% of the operators in the Subbasin. In water year 2022, extractions from operators with missing 2023 reports accounted for approximately 10% of the total extractions from the Subbasin.

Comparison to Historical Groundwater Supplies

During the 1985 to 2015 period, an average of approximately 80,500 AFY of groundwater was extracted from the Subbasin (FCGMA 2019). Approximately 65% was used for agriculture, 35% was used for municipal supply, and less than 1% was used for domestic purposes. Available data characterizing groundwater extractions in water years 2021 and 2022 indicate that groundwater extractions from the Subbasin averaged approximately 75,000 AFY (Table 4-4), or 7% lower than the 1985 to 2015 average. In water years 2021 and 2022, approximately 61% of the pumped groundwater was used for agriculture, 39% was used for municipal supply, and less than 1% was used for domestic purposes.

Additionally, data from 2016 through 2022 indicate that groundwater extractions from the UAS increased in the Subbasin while extractions from the LAS decreased (Table 4-4).

Comparison to Projected Groundwater Supplies

Future projections of groundwater extractions were updated as part of this periodic GSP evaluation (Section 5.2). Under baseline conditions, groundwater extractions from the Subbasin are projected to average approximately 67,300 AFY. This is approximately 7,700 AFY lower than the average annual groundwater extraction from the Subbasin in water years 2021 and 2022. The difference between groundwater extractions over the 2021 and 2022 water years and the projected groundwater extraction rates is associated with long-term availability of surface and recycled water for use in lieu of groundwater (Section 5.2.1).

4.2.2.2 Surface Water

The primary source of surface water supply in the Subbasin is the Santa Clara River. UWCD operates the Freeman Diversion, which allows UWCD to divert surface water from the Santa Clara River for recharge in the Forebay and delivery to agricultural operators in the Subbasin and adjacent PVB via their Pumping Trough Pipeline (PTP) and Pleasant Valley Pipeline (PVP). Surface water diverted by UWCD includes imported SWP water. In 2019, FCGMA and UWCD entered into an agreement that funded UWCD’s purchase of 15,000 AF of surplus SWP water for delivery and recharge in the Subbasin.

In addition to the Santa Clara River, a portion of the Conejo Creek surface water diverted by Camrosa Water District (CWD) is supplied to PVCWD for agricultural irrigation within the Subbasin. Santa Clara River water and Conejo Creek water used in the Subbasin over the evaluation period is summarized in Table 4-5, Surface Water Supplies in the Subbasin.

Table 4-5. Surface Water Supplies in the Subbasin

Water Year	PVCWD	UWCD			Total (acre-feet)
	Conejo Creek Flows Delivered by CWD to PVCWD[a] (acre-feet)	Diversions of Santa Clara River Water			
		PTP deliveries (acre-feet)	PVP deliveries[b] (acre-feet)	Recharge to UWCD Spreading Basins (acre-feet)	
2016	1,038	0	0	2,209	3,247
2017	1,774	0	0	10,297	12,071
2018	1,854	0	0	3,126	4,980
2019	2,795	1,059	309	36,768	40,931
2020	2,310	2,494	966	28,327	34,097
2021	2,035	3,823	1,049	12,820	19,727
2022	2,392	1,905	425	11,448	16,170
2023	2,225	3,558	2,285	111,254	119,322
2016 – 2023 Average	**2,053**	**1,605**	**629**	**27,031**	**31,318**
2020 – 2023 Average	**2,241**	**2,945**	**1,181**	**40,962**	**47,329**

Notes:
Acronyms: PVCWD = Pleasant Valley County Water District; UWCD = United Water Conservation District; CWD = Camrosa Water District; PTP = Pumping Trough Pipeline; PVP = Pleasant Valley Pipeline.

[a] Estimated by using 56% of the total Conejo Creek water delivered by CWD to PVCWD. This division is based on the fraction of PVCWD's service area that overlies the Subbasin.

[b] Estimated by using 56% of the total Santa Clara River Water deliveries to the PVP. This division is based on the fraction of PVCWD's service area that overlies the Subbasin.

During the 2020 to 2023 period, PVCWD delivered an average of approximately 2,200 AFY of Conejo Creek water to agricultural users within the Subbasin. UWCD delivered an average of approximately 4,100 AFY of Santa Clara River water to users on the PTP and to PVCWD via the PVP. In water years 2020, 2021, and 2022, UWCD recharged an average of approximately 18,000 AFY of Santa Clara River water to the Subbasin. In water year 2023, a wet water year, UWCD recharged approximately 111,000 AF of Santa Clara River water.

Comparison to Historical Surface Water Supplies

CWD began delivering Conejo Creek Project water to PVCWD in 2002 (FCGMA 2019). Between 2002 and 2015, CWD delivered an average of approximately 2,600 AFY of Conejo Creek Project water to PVCWD for agricultural uses (FCGMA 2019). CWD's average annual delivery of Conejo Creek water to PVCWD during the 2020 to 2023 period is approximately 15% lower than the historical delivery volumes (Table 4-5).

UWCD constructed the PVP[14] in 1959 to deliver surface water diverted from the Santa Clara River to PVCWD, which delivers this water to agricultural customers in both the Subbasin and the PVP. The PTP was jointly constructed in 1986 by UWCD, the County of Ventura, and FCGMA, to deliver surface water from the Santa Clara River to agricultural customers in the pumping depression to reduce pumping in the UAS. UWCD delivers surface water

[14] Deliveries via the PVP consist exclusively of Santa Clara River water.

diverted from the Santa Clara River and groundwater pumped from the LAS to agricultural operators in the Subbasin. Between 1985 and 2015, UWCD delivered an average of approximately 9,800 AFY of Santa Clara River water to users on the PVP and PTP (FCGMA 2019). Between water years 2020 and 2023, UWCD's deliveries on the PVP and PTP were approximately 60% lower than the 1985 to 2015 average (Table 4-5). The reduction in PVP and PTP deliveries over this time reflects the drought conditions experienced in the Subbasin during the first three years of the evaluation period.

UWCD began recharging Santa Clara River water in the Forebay in the mid-1950s. Over the 1985 to 2015 period, UWCD recharged an average of approximately 48,300 AFY of Santa Clara River water in the Forebay (FCGMA 2019). During the first three-years of the evaluation period, UWCD recharged an average of approximately 17,500 AFY, which is approximately 65% lower than the 1985 to 2015 average. In the wet 2023 water year, UWCD recharged approximately 111,000 AF of Santa Clara River water in the Forebay - this was the third largest volume of Santa Clara River water recharged in a single year by UWCD since 1985.

Comparison to Projected Surface Water Supplies

Future projections of surface water availability in the Subbasin were updated as part of this periodic GSP evaluation (Section 5.2). Under baseline conditions, UWCD anticipates being able to divert an average of approximately 62,000 AFY from the Santa Clara River. UWCD's average annual Santa Clara River water diversions during the evaluation period were approximately 25% lower than projected, which reflects the drier-than-average hydrology experienced between water years 2019 through 2022. Additionally, UWCD is constructing projects to provide additional flexibility in in diverting Santa Clara River water. CWD anticipates delivering approximately 4,000 AFY of Conejo Creek Project water to PVCWD, approximately 2,240 AFY[15] of which would be served in the Subbasin. CWD's delivery of Conejo Creek Project water to PVCWD during the evaluation period is approximately equal to their future projections.

4.2.2.3 Imported Water

Calleguas Municipal Water District (CMWD) provides imported potable water to the City of Oxnard and Port Hueneme Water Agency for municipal use. Sales and use of imported water supplied by CMWD is summarized in Table 4-6, Sales and Use of Imported Water Supplied by CMWD. Additionally, SWP water imported by UWCD is delivered through Lake Piru and diverted at the Freeman diversion. UWCD's importations are included in the sum of PTP, PVP, and recharge volumes shown in Table 4-6.

Table 4-6. Sales and Use of Imported Water Supplied by CMWD

Water Year	Delivered and Used by the City of Oxnard for M&I (acre-feet)	Delivered and Used by the PHWA for M&I (acre-feet)	Total Imported Water (acre-feet)
2016	10,854	459	11,313
2017	10,179	561	10,740
2018	11,382	789	12,171
2019	9,418	580	9,998
2020	8,729	983	9,712
2021	9,435	654	10,089

15 Calculated by multiplying CWD's projections for Conejo Creek deliveries to PVCWD by the percentage of PVCWD's service area that overlies the Subbasin.

Table 4-6. Sales and Use of Imported Water Supplied by CMWD

Water Year	Delivered and Used by the City of Oxnard for M&I (acre-feet)	Delivered and Used by the PHWA for M&I (acre-feet)	Total Imported Water (acre-feet)
2022	7,770	735	8,505
2023	6,207	408	6,615
2016 – 2023 Average	**9,247**	**646**	**9,247**
2020 – 2023 Average	**8,035**	**695**	**8,730**

Notes:
Acronyms: M&I = Municipal and Industrial; PHWA = Port Hueneme Water Agency

Over the 2020 to 2023 period, CMWD delivered an average of approximately 8,700 AFY of imported water for municipal and industrial uses within the Subbasin. Approximately 92% of this was for municipal use by the City of Oxnard (Table 4-6).

Comparison to Historical Imported Water Supplies

CMWD delivered an average of approximately 14,500 AFY of imported water between 1985 and 2015. Over the last decade, imported water supplied by CMWD in the Subbasin has declined from a maximum of approximately 18,000 AF in 2013 to a minimum of approximately 6,600 AF in 2023 (FCGMA 2019; Table 4-6). The average annual volume of imported water supplied by CMWD in the Subbasin during the evaluation period is approximately 40% lower than the 1985 to 2015 average.

Comparison to Projected Imported Water Supplies

In their 2015 and 2020 Urban Water Management Plans, CMWD included projections for the City of Oxnard's and Port Hueneme Water Agency's combined imported water demands. Over the 2020 to 2025 period, these projections average approximately 16,400 AFY (CMWD 2016; CMWD 2021). Under normal, single year dry, and multi-year dry scenarios, CMWD does not anticipate experiencing water supply shortages that would impact their ability to meet these demands (CMWD 2016; CMWD 2021).

Over the 2020 to 2023 period, the City of Oxnard's and Port Hueneme Water Agency's combined imported-water demand was approximately 50% lower than the projections included in CMWD's 2015 and 2020 Urban Water Management Plans.

4.2.2.4 Recycled Water

Recycled water provides a source of agricultural water supply within the Subbasin. Recycled water used in the Subbasin originates from three sources: the City of Oxnard's AWPF, the Camarillo Sanitary District Water Reclamation Plant, and CWD's Water Reclamation Facility (CWRF; Table 4-7 Recycled Water Supplied and Used within the Subbasin).

In 2016, the City of Oxnard began delivering AWPF water to both PVCWD and agricultural operators within the Subbasin. The City of Oxnard delivers recycled water to PVCWD and agricultural operators for use in lieu of groundwater and accrues one acre-foot of Recycled Water Pumping Allocation for each acre-foot of recycled water delivered (FCGMA 2023b). In 2019, CWD began delivering recycled water produced at the Camarillo Sanitary District Water Reclamation Plant and CWRF to PVCWD for agricultural use.

Table 4-7. Recycled Water Supplied and Used within the Subbasin

Water Year	Recycled Water Served in PVCWD (acre-feet) [a]			AWPF served directly to AG operators in the Subbasin (acre-feet)	Total (acre-feet)
	CamSan	CWRF	AWPF		
2016	0	0	234	43	276
2017	0	0	776	110	886
2018	0	0	1,146	370	1,516
2019	0	0	849	145	993
2020	619	376	0	63	1,058
2021	826	292	0	109	1,227
2022	663	191	7	404	1,266
2023	702	485	113	419	1,719
2016 – 2023 Average	**351**	**168**	**391**	**208**	**1,118**
2020 – 2023 Average	**702**	**336**	**30**	**249**	**1,317**

Notes:
Acronyms: PVCWD = Pleasant Valley County Water District; AWPF = Advanced Water Purification Facility; CamSan WRP = Camarillo Sanitary District's Water Reclamation Plant; CWRF = Camrosa Water Reclamation Facility.
[a] Estimated by using 56% of the total volume of recycled water delivered to PVCWD. This division is based on the fraction of PVCWD's service area that overlies the Subbasin.

Comparison to Historical Recycled Water Supplies

The recycled water produced at the AWPF, Camarillo Sanitary District's Water Reclamation Plant, and CWRF is a new source of water supply in the Subbasin. Over the 2020 to 2023 period, agricultural operators within the Subbasin used an average of approximately 1,300 AFY of recycled water for irrigation (Table 4-7). Approximately 80% of this was used within the PVCWD service area which spans both the Subbasin and PVB.

Comparison to Projected Recycled Water Supplies

Future projections of recycled water availability in the Subbasin were updated as part of this periodic GSP evaluation (Section 5.2). Under baseline conditions, the City of Oxnard anticipates delivering an average of approximately 1,500 AFY of recycled water to PVCWD and agricultural operators in the Subbasin. The City of Camarillo anticipates delivering an average of approximately 1,400 AFY of Camarillo Sanitary District Water Reclamation Plant water to PVCWD, and CWD anticipates delivering an average of approximately 2,300 AFY of CWRF water for agriculture, a portion of which will be provided to PVCWD. In total, recycled water supplies in the Subbasin are projected to average approximately 3,100 AFY. Over the evaluation period, recycled water supplies were approximately 1,800 AFY lower than projected.

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5 Updated Numerical Modeling

5.1 Model Updates

UWCD actively maintains the VRGWFM to support regional groundwater management. The version of the VRGWFM used during development of the GSP covered the entirety of the Oxnard and Mound subbasins and the majority of the WLPMA and PVB (UWCD 2018). Following adoption of the GSP, UWCD expanded the VRGWFM to cover the entirety of WLPMA and PVB and to include the Santa Paula, Piru, and Fillmore subbasins (UWCD 2021d). As part of the VRGWFM expansion and update, UWCD updated the hydrogeologic conceptual model of the Oxnard, Santa Paula, Piru, and Fillmore subbasins to improve representation of local hydrogeologic conditions and, in the Oxnard Subbasin, better represent groundwater elevations along the coast and their influence on seawater intrusion.

Due to the complexity of simulating the effects of Santa Clara River flows on groundwater conditions in the Santa Paula, Piru, and Fillmore subbasins, with a daily timestep, UWCD maintains a version of the VRGWFM that excludes the upper basins and uses a monthly timestep. This branch-off of the VRGWFM is informally referred to as the Coastal Plain Model and covers the entirety of the Subbasin, PVB, WLPMA, and Mound Subbasin. Consistent with the GSP modeling, the Coastal Plain Model represents interactions between the Subbasin and the upgradient Santa Paula Subbasin using a general head boundary condition (FCGMA 2018). While the Coastal Plain Model is distinct from the VRGWFM, the model design and structure are consistent with the model used during development of the GSP. Therefore, the Coastal Plain Model is considered an update to the GSP model and was used for the periodic GSP evaluation modeling.

Improvements to the Coastal Plain Model compared to the GSP model include revised estimates of subsurface exchanges with the Santa Paula Subbasin (Basin No. 4-004.04), and updated hydrostratigraphy in the vicinity of Port Hueneme and Point Mugu (Section 4.1.1.1 Hydrostratigraphic Information). Additionally, as part of this GSP evaluation, UWCD extended the Coastal Plain Model to simulate groundwater conditions in the Subbasin through water year 2022. Updates are summarized below and will be detailed in a technical memorandum prepared by UWCD[16].

5.1.1 Underflows from the Santa Paula Subbasin

The Coastal Plain Model includes improved estimates of underflows between the Santa Paula and Oxnard subbasins. These estimates were informed by UWCD's regional modeling efforts with the VRGWFM, which was calibrated to groundwater elevations measured in the Santa Paula, Fillmore, and Piru subbasins, and provides direct simulation of the underflows between each basin. Results from the VRGWFM simulations were used to update the north-eastern general head boundary condition in the Coastal Plain Model, which controls underflows between the Oxnard and Santa Paula subbasins.

5.1.2 Port Hueneme and Point Mugu

As described in Section 4.1.1, in 2020, UWCD updated the hydrogeologic conceptual model of the Subbasin in the vicinity of Port Hueneme and Point Mugu based on newly available geophysical and borehole data. UWCD

16 UWCD anticipates publishing the Coastal Plain Model update technical memorandum in fall 2024.

incorporated the revised hydrostratigraphic mapping into the Coastal Plain Model to better represent hydrogeologic conditions along the coastline. Revisions to the interpreted aquifer thicknesses are summarized in Section 4.1.2. Importantly, these revisions provide an improved representation of hydrogeologic connectivity between the UAS and FCA near Point Mugu.

5.1.3 Model Extension and Recalibration

As part of this periodic evaluation, UWCD extended the Coastal Plain Model to simulate groundwater conditions in the Subbasin through the end of water year 2022 (i.e., September 30, 2022). During the model update and extension process, UWCD recalibrated the Coastal Plain Model. This recalibration effort involved incremental adjustments to local hydraulic conductivity, storativity, and boundary conductance values which resulted in better simulation of groundwater conditions along the coastline (details to be included in UWCD's Coastal Plain Model update technical memorandum).

5.2 Future Scenario Water Budgets and Sustainable Yield

Future scenario modeling was updated as part of this periodic GSP evaluation to better reflect current groundwater usage trends within the Subbasin; update the future hydrology; and expand the suite of projects included in the simulation of future groundwater conditions. In addition, the future modeling time-period was updated to account for the extension in the historical modeling period. Results from the updated future model scenarios were used to evaluate the estimated sustainable yield of the Subbasin under different project and management scenarios.

Revisions to the simulation time-period, baseline extractions, future hydrology, and suite of projects considered in the future scenarios are described in Section 5.2.1, Updated Future Scenario Assumptions. The suite of future scenarios, and associated model results, are summarized in Section 5.2.2, Projected Water Budgets. Resulting revisions to the estimates of the future sustainable yield of the Subbasin are summarized in Section 5.2.3, Estimates of the Future Sustainable Yield.

5.2.1 Updated Future Scenario Assumptions

This section describes the set of assumptions used for the updated modeling and provides a comparison to the assumptions used for the GSP.

5.2.1.1 Updated Simulation Time Period

The future scenarios developed for this periodic evaluation simulate groundwater conditions in the Subbasin over the 47-year period from October 1, 2022, through September 30, 2069 (i.e., water year 2023 through 2069). This simulation period, combined with the 2020, 2021, and 2022 water-year simulation results, provides a 50-year GSP projection horizon as required under SGMA (23 CCR §354.18[17]).

[17] 23 CCR §354.18 - California Code of Regulations Title 23 Waters, Division 2 Department of Water Resources, Chapter 1.5 Groundwater Management, Subchapter 2 Groundwater Sustainability Plans, Section 354.18 Water Budget

Comparison to the GSP Modeling

The future scenarios developed for the GSP simulated groundwater conditions in the Subbasin over the 50-year period from January 1, 2020, through December 31, 2069 (FCGMA 2019). Because water years 2020, 2021, and 2022 were incorporated into the historical modeling, the future scenarios were updated to begin in water year 2023.

5.2.1.2 Updated Baseline Extraction Rates

The future baseline groundwater extraction rates used for periodic evaluation modeling are equal to the 2016 to 2022 average[18], adjusted monthly by estimates of future surface water, imported water, and recycled water availability. Groundwater extractions over this period consist of both reported and estimated extractions. Estimated extractions were based on available automated metering infrastructure (AMI) data for wells with missing extraction reports (for example, see FCGMA 2023). The 2016 to 2022 average groundwater extraction rates reflect current usage trends in the Subbasin, which have been impacted by the availability of new sources of recycled water, availability of Santa Clara River water, and the implementation of FCGMA's new fixed extraction allocation system (Section 4.2.2.1, Section 3.1).

Comparison to the GSP Modeling

For the GSP, the future baseline extraction rates were equal to the average 2015 to 2017 extraction rates, adjusted by estimates of future surface water, imported water, and recycled water availability. During the 2015 to 2017 period, surface water supplies in the Subbasin consisted exclusively of Conejo Creek Project water delivered by CWD to PVCWD (FCGMA 2019). Santa Clara River water, which historically provided an average of approximately 9,800 AFY for use in lieu of groundwater, was not available during this period due to drought conditions. The updated Future Baseline groundwater extractions for the Subbasin averaged approximately 68,300 AFY, or approximately 300 AFY higher than the Future Baseline extraction rates used in the GSP.

5.2.1.3 Updated Hydrology

The future hydrology used for this periodic evaluation modeling is the 1933 through 1979 hydrology, adjusted by DWR's 2070 central tendency climate change factors, with the noted exception that water year 1933 hydrology was replaced with water year 1978 hydrology.

Water year 1933 hydrology was approximately 15% drier than the long-term historical average. Conversely, precipitation measured in water year 2023 in the Subbasin was approximately 65% higher than the long-term historical average, and the volume of Santa Clara River water diverted for recharge in the Forebay Management Area was approximately 230% of the long-term historical average (Section 4.2.2). To represent the wet 2023 water year in the future projections, the hydrologic record for water year 1933 was replaced with the hydrologic record for water year 1978. Water year 1978 was selected because flows available for diversion from the Santa Clara River were similar to those in water year 2023.

18 Water year 2020 was not included in the calculation. FCGMA transitioned extraction reporting from calendar year to water year in 2020; therefore 2020 extraction reporting only spanned 9 months (January 1 through September 30).

The resulting 47-year hydrologic record includes drier-than-average periods (e.g., 1944 through 1951) as well as wetter-than-average periods (e.g. 1933 through 1939). The average annual precipitation during this period is similar to the long-term historical average annual precipitation measured in the Subbasin.

Comparison to the GSP Modeling

The future scenarios developed for the GSP used hydrology measured during the 1930 to 1979 period, adjusted by DWR's 2070 central tendency climate change factors. This hydrology represented the future hydrology for the period from January 1, 2020, through December 31, 2069 (FCGMA 2019). The hydrology used for this periodic evaluation modeling is consistent with the hydrology used for the GSP, with the noted exception that water year 1933 hydrology was replaced with water year 1978 hydrology.

5.2.1.4 Future Projects and Water Supply

In 2023, FCGMA adopted a process for evaluating water supply and infrastructure projects in the Subbasin. As part of this process, FCGMA solicited project information from project proponents to evaluate, rank, and prioritize projects for funding and incorporation into the GSP modeling. A full summary of project information solicited through this process is included in Section 3, Status of Projects and Management Actions.

The suite of projects incorporated into the future scenario modeling is summarized in Table 5-1, Projected Future Water Supplies and Projects in the Subbasin, Pleasant Valley Basin, and West Las Posas Management Area of the Las Posas Valley Basin and in Section 5.2.2. Because the VRGWFM spans the entirety of the Subbasin, PVB, and WLPMA, Table 5-1 includes existing and planned projects applicable to each basin. Similarly, the water supply estimates shown in Table 5-1 include each project's anticipated total water supply, a portion of which may be used in the Subbasin.

Table 5-1. Projected Future Water Supplies and Projects in the Subbasin, Pleasant Valley Basin, and West Las Posas Management Area of the Las Posas Valley Basin

	Existing Projects and Programs				Planned Water Supply Projects			
Source of Future Water Supply	Description	Project Proponent	Applicable Basin(s)	Projected Future Water Supply / In Lieu Delivery (AFY)	Project Name or Description	Project Proponent	Applicable Basin(s)	Projected Future Water Supply / In Lieu Delivery (AFY)
Santa Clara River	MAR	UWCD	Ox	50,000				
	PTP	UWCD	Ox	5,000				
	PVP	UWCD	Ox, PV	5,100				
					Freeman Expansion	UWCD	Ox, PV	6,800
Imported Water	CMWD Deliveries	CMWD	PV	8,700				
		CMWD	Ox	13,900				
	Groundwater Pumped from ASRV and Used in PVB	CWD	PV	1,600				
	Groundwater Pumped from Tierra Rejada and Used in PVB	CWD	PV	200				
					Purchase of Imported water from CMWD for Basin Replenishment	—	WLPMA	2,262
State Water Project	Supplemental State Water Project Purchase	UWCD	Ox, PV	6,000				
City of Oxnard AWPF	Deliveries to AG Operators[a]	City of Oxnard	Ox, PV	1,500				
	Laguna Road Recycled Water Interconnect	UWCD	Ox, PV	Unknown[b]				
					AWPF Expansion[c]	City of Oxnard	Ox, PV	7,500 - 10,000
					Aquifer Storage and Recovery Program	City of Oxnard	Ox	Unknown[b]
					Injection Barrier	City of Oxnard	Ox	Unknown[b]
Conejo Creek	Conejo Creek Project	CWD	Ox, PV	4,000				
	CWD Deliveries	CWD	PV	2,900				
Camrosa Water Reclamation Facility	CWD Deliveries to AG & M&I Operators	CWD	Ox, PV	2,600				
Camarillo Sanitary District Water Reclamation Plant	Recycled Water Deliveries to PVCWD	City of Camarillo	Ox, PV	1,500				
	Recycled Water Deliveries to AG and M&I within the City of Camarillo	City of Camarillo	PV	2,300				
Treated Brackish Water					Extraction Barrier Brackish Water Treatment Project (EBB)	UWCD	Ox, PV	5,000
	North Pleasant Valley Desalter Project	City of Camarillo	PV	-4,500[d]				
Santa Rosa Subbasin	CWD Importation and delivery to AG & M&I Operators	CWD	PV	1,600				
Tierra Rejada Subbasin	CWD Importation and delivery to AG & M&I Operators	CWD	PV	200				
Demand Reduction	Water Delivery Infrastructure Improvements	ZMWC	WLPMA	500				
					Temporary Voluntary Fallowing	FCGMA	Ox	504[e]
						FCGMA	PV	2,407[e]
	Total Anticipated Water Supply from Existing Projects (AFY)			**103,100**	**Total Anticipated Water Supply from Future Projects (AFY)**			**24,473 – 26,973**

Notes: UWCD = United Water Conservation District; CMWD = Calleguas Municipal Water District; CWD = Camrosa Water District; FCGMA = Fox Canyon Groundwater Management Agency; ZMWC = Zone Mutual Water Company; PTP = Pumping Trough Pipeline; PVP = Pleasant Valley Pipeline; AWPF = Advanced Water Purification Facility; ASR = Aquifer Storage and Recovery; AG = Agricultural; M&I = Municipal and Industrial; Ox = Oxnard Subbasin; PV = Pleasant Valley Basin; WLPMA = West Las Posas Management Area of the Las Posas Valley Basin

[a] Under existing FCGMA program (Resolution 23-02).

[b] Project is designed to extract 4,500 AFY of brackish groundwater from the northern portion of PVB. The City of Camarillo intends to treat and serve this water in lieu of imported water.

[c] Represents temporary demand reduction, not a temporary increase in water supply.

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5.2.2 Projected Water Budgets

Five model scenarios were developed for this periodic evaluation in accordance with the SGMA guidelines, and consistent with the GSP, to evaluate the future sustainable yield of the Subbasin. These scenarios are:

- Future Baseline Scenario
- NNP Scenario
- Projects Scenario
- Basin Optimization Scenario
- EBB Water Treatment Project Scenario

Each scenario covers the 47-year period from October 1, 2022, through September 30, 2069 (i.e., water year 2023 through water year 2069). Consistent with the GSP, the period from 2023 through 2039 is referred to as the "implementation period" and the period from 2040 to 2069 is referred to as the "sustaining period." The sustainable yield was evaluated using the model runs that resulted in: (1) no net flux of seawater into either the UAS or LAS, and (2) no landward migration of the saline water impact front. Both metrics were evaluated over the 30-year sustaining period, with consideration of the uncertainty in Coastal Plain Model's predictions (FCGMA 2019).

Because the Subbasin is hydrogeologically connected to the PVB and the WLPMA, the sustainable yield of the Subbasin is influenced by groundwater conditions in these adjacent basins. The Coastal Plain Model includes both the PVB and the WLPMA in the model domain, and the modeling assumptions associated with each scenario discussed below include the assumptions made for these adjacent basins.

5.2.2.1 Evaluation Metrics

A total of eight (8) model runs were completed under the five scenarios referenced above. Results from each model run were analyzed to characterize the effects of different pumping distributions, projects, and management actions on seawater flux into the Subbasin, the landward migration of the saline water impact front, and groundwater conditions in the adjacent basins. The methods for calculating seawater flux, landward migration of the saline water impact front, and impacts to adjacent basins are summarized below.

5.2.2.1.1 Seawater Flux and Landward Migration of the Saline Water Impact Front

The VRGFWM provides an estimate of the volume of water entering and leaving the Subbasin along the coastline on a monthly timescale. This estimate was evaluated along four coastal segments: (1) from the northern boundary of the Subbasin, south to Channel Islands Harbor, (2) Channel Islands Harbor to Perkins Road, which is south of Port Hueneme, (3) Perkins Road to Arnold Road, and (4) Arnold Road to Point Mugu (Figure 5-1, Modeled Seawater Flux Coastal Segments). The combined flow from Channel Islands Harbor to Point Mugu (segments 2 through 4) represents the approximate coastal boundary of the Saline Intrusion Management Area and the portion of the Subbasin that has historically been impacted by seawater intrusion (FCGMA 2019).

Net seawater flux for each model run was calculated by averaging the annual flow of seawater into the Subbasin south of Channel Islands Harbor during the sustaining period. Net seawater flux was calculated separately for both the UAS and LAS to develop an estimate of sustainable yield by aquifer system.

The landward migration of the saline water impact front was characterized using particle tracking for a subset of the model runs. Initial particle positions were set along the current interpretation of the 2020 saline water impact front in each aquifer. The particles were released at the start of the model simulation to provide a 50-year trajectory of the saline water migration throughout the Subbasin.

Particle tracks were analyzed concurrently with the estimates of seawater flux to characterize the likelihood of ongoing landward migration of saline water and seawater intrusion over the 30-year sustaining period.

Scenarios with UWCD's EBB Project

The approach for evaluating seawater intrusion in the Subbasin differs between the scenarios that do and do not include UWCD's EBB project. This approach is described in detail in Section 5.2.2.6, Extraction Barrier and Brackish Water Treatment Scenario.

5.2.2.1.2 Impacts of Pleasant Valley Basin and West Las Posas Management Area on Seawater Intrusion in the Oxnard Subbasin

The Coastal Plain Model simulates underflows between the Subbasin, PVB, and WLPMA. Results from the Coastal Plain Model were used to calculate the average underflows across each boundary, and by aquifer system, during the 30-year sustaining period to characterize the impacts of pumping, projects, and management actions implemented in one basin on groundwater conditions in an adjacent basin.

5.2.2.2 Future Baseline Model Scenario

SGMA requires that the GSP include an assessment of "future baseline" conditions. The Future Baseline scenario developed for this periodic evaluation built on the GSP modeling and was designed to assess whether current groundwater extractions from the Subbasin, PVB, and WLPMA of the LPVB are sustainable. To do this, the average annual 2016 to 2022 extraction rates, adjusted by surface water and recycled deliveries, were simulated. Future surface water deliveries were estimated by UWCD using their Surface Water Distribution Model (UWCD 2021e) with the GSP evaluation hydrology (Section 5.2.1.3). Estimates of recycled water available for use in lieu of groundwater were provided by the City of Camarillo, CWD, and the City of Oxnard. In addition, the Future Baseline Scenario included all existing projects that are either funded or currently under construction in the Subbasin (Table 5-1).

Adjusting the 2016 to 2022 average groundwater extractions by projected surface water and recycled water supplies leads to an average annual groundwater extraction rate over the sustaining period of approximately 68,300 AFY in the Subbasin, 13,900 AFY in the PVB, and 13,500 AFY in the WLPMA.

5.2.2.2.1 Future Baseline Model Assumptions

The Future Baseline model simulation assumptions included the following:

- Average annual extractions from the Subbasin equal to the 2016 to 2022 average, adjusted by surface water, imported water, and recycled water availability.
- Starting groundwater levels equal to the September 30, 2022, groundwater levels from the Coastal Plain Model.
- Precipitation and streamflow for the 1933 to 1979 period, adjusted by DWR's 2070 central tendency climate change factors, with 1933 hydrology replaced by 1978 hydrology (Section 5.2.1.3).

- Estimates of surface water availability for diversion prepared by UWCD using the periodic GSP evaluation hydrology and calculated using their Surface Water Distribution Model.
- Estimates of recycled water availability provided by the City of Oxnard, City of Camarillo, and CWD.
- Inflows to PVB along Arroyo Las Posas extracted from the East Las Posas Management Area model.

In addition to these assumptions, all existing projects in the Subbasin were included in the Future Baseline model scenario (Table 5-1).

5.2.2.2.2 Future Baseline Model Results

Both the modeled seawater flux into the Saline Intrusion Management Area and the particle tracks from the Future Baseline Scenario indicate that groundwater pumping at the average 2016 to 2022 rate would cause ongoing seawater intrusion to the Subbasin and landward migration of the current saline water impact front (Table 5-2, Summary of Future Scenarios; Figures 5-2 through 5-9). The average annual seawater flux into the UAS and LAS was approximately 2,100 AFY and 3,200 AFY, respectively (Table 5-2). In the UAS and LAS, particle tracks indicate that current saline water impact front would migrate landward (Figures 5-3 through 5-8). Based on these factors, the current areal and aquifer-system distribution of groundwater production at the 2016 to 2022 extraction rates was determined not to be sustainable.

Under the Future Baseline conditions, approximately 1,200 AFY of underflows from PVB recharged the Subbasin. Conversely, approximately 4,400 AFY of underflows from the Subbasin recharged the WLPMA (Table 5-2).

Table 5-2. Summary of Future Scenarios

Future Scenario Scenario		Average Annual Rate Over the Sustaining Period (2040 – 2069; AFY)[a]							
		Future Baseline	No New Projects			Basin Optimization	Projects	EBB	
			NNP1	NNP2	NNP3			Baseline	Projects
Groundwater Extractions[b]	UAS	-40,000	-32,300	-35,200	-34,100	-35,200	-39,500	-50,000	-49,400
	LAS	-28,300	-6,800	-2,600[c]	-10,600	-17,100	-26,600	-28,200	-26,400
	Total	**-68,300**	**-39,100**	**-37,800**	**-44,700**	**-52,300**	**-66,100**	**-78,200**	**-75,800**
Seawater Flux into the Subbasin[d]	UAS	2,100	-1,000	-1,100	-600	-400	1,300	6,900	6,200
	LAS	3,400	500	200	1,000	1,100	2,900	4,000	3,400
	Total	**5,500**	**-500**	**-900**	**400**	**700**	**4,200**	**10,900**	**9,600**
Flux across the Current Saline Water Impact Front in the Subbasin[e]	UAS	—	—	—	—	—	—	3,200	3,800
	LAS	—	—	—	—	—	—	500	600
	Total	**—**	**—**	**—**	**—**	**—**	**—**	**3,700**	**4,200**
Underflows from PVB to the Subbasin	UAS	900	700	600	700	900	1,600	1,100	1,800
	LAS	300	-1,200	-2,000	-1,000	-1,000	600	500	900
	Total	**1,200**	**-500**	**-1,400**	**-300**	**-100**	**2,200**	**1,600**	**2,700**
Underflows from WLPMA to the Subbasin	UAS	-4,900	-4,400	-4,500	-4600	-4500	-4,400	-5,000	-4,500
	LAS	500	-1,000	-1,800	-700	300	700	500	800
	Total	**-4,400**	**-5,400**	**-6,300**	**-5,300**	**-4,200**	**-3,700**	**-4,500**	**-3,700**

Notes: NNP = No New Projects; AFY = Acre-Feet per Year; PVB = Pleasant Valley Basin; WLPMA = West Las Posas Management Area of the Las Posas Valley Basin

[a] Negative (-) values denote discharges, or outflows, from the Subbasin. Positive (+) values denote recharge, or inflows, to the Subbasin.

[b] Represents groundwater production from the Oxnard Subbasin.

[c] In the NNP2 scenario, groundwater production from the LAS of the Oxnard Subbasin was reduced by 100%. The 2,600 AFY in groundwater production shown here represents pumping from wells screened across both the UAS and LAS – pumping from these wells was reduced by 20%, consistent with the simulated UAS reductions.

[d] Represents the average annual simulated seawater flux across the coastline south of Channel Islands Harbor.

[e] Represents sum of fluxes across the interpreted 500 mg/L chloride concentration contour in each principal aquifer. Positive (+) values indicate that fresh groundwater is migrating towards the coast and UWCD's EBB extraction wells. Results are shown only for the EBB scenarios because seawater flux across the coastline in all other scenarios is an indication of ongoing seawater intrusion.

5.2.2.3 No New Projects Model Scenario

The NNP scenario was designed to provide a direct simulation of the areal and aquifer-system groundwater pumping distributions that limit seawater flux into the Subbasin and the landward migration of the 2020 saline water impact front. Three separate model runs were conducted under the NNP scenario: NNP1, NNP2, and NNP3. Each model run incorporated all the assumptions included in the Future Baseline scenario (Section 5.2.2.2) but used different sets of assumptions for groundwater production.

The NNP Scenario model runs evaluated different pumping distributions and reductions to provide the FCGMA Board of Directors information to evaluate potential future management actions. While the simulated pumping reductions provide an estimate of the sustainable yield of the Subbasin, operation within the estimated sustainable yield likely will require development of additional projects and policies that equitably distribute impacts across operators in the Subbasin. Additionally, and importantly, FCGMA and other agencies in the Subbasin are actively pursuing the development of water supply projects aimed at increasing the sustainable yield of the Subbasin.

5.2.2.3.1 No New Projects Scenario Assumptions

As described above, the NNP Scenario included all the assumptions from the Future Baseline Scenario, except for the distribution of groundwater production. Groundwater production distributions were adjusted by basin and aquifer system in each of the three model runs. The specific distributions used in each model run are described below.

No New Projects 1

The NNP1 model run incorporated a 20% reduction in pumping in the UAS of the Subbasin, an 80% reduction in pumping in the LAS of the Subbasin, and a 20% reduction in pumping from both aquifer systems in the PVB and WLPMA of the LPVB (Table 5-2). This reduction in groundwater production, adjusted by surface and recycled water availability, results in an average annual groundwater production rate of approximately 39,100 AFY in the Subbasin, 13,200 AFY in the PVB, and 10,800 AFY in the WLPMA. The NNP1 pumping distribution is equal to the estimates of future sustainable yield presented in the GSP, adjusted by surface and recycled water availability (FCGMA 2019).

No New Projects 2

The NNP2 model run was designed to evaluate the impacts of pumping in the PVB and WLPMA on seawater flux in the LAS of the Subbasin. To do this, a 10% reduction in pumping was implemented in the UAS of the Subbasin, a 100% reduction in pumping was implemented in the LAS of the Subbasin, and no pumping reductions were implemented in the PVB and WLPMA of the LPVB. Implementing this reduction in groundwater production results in an average annual groundwater production rate of approximately 37,800 AFY in the Subbasin, 14,000 AFY in the PVB, and 13,500 AFY in the WLPMA.

No New Projects 3

The NNP3 model run was designed to evaluate future groundwater conditions in the Subbasin if pumping was reduced to a revised estimate of the sustainable yield of the Subbasin. The NNP3 scenario incorporated a 15% reduction in pumping in the UAS of the Subbasin, a 65% reduction in pumping in the LAS of the Subbasin, and a 15% reduction in pumping in both aquifer systems of the PVB and WLPMA (Table 5-2). Implementing this reduction in groundwater production results in an average annual groundwater production rate of approximately 44,700 AFY in the Subbasin, 13,400 AFY in the PVB, and 11,400 AFY in the WLPMA.

5.2.2.3.2 No New Projects Scenario Model Results

No New Projects 1

In the NNP1 scenario, approximately 1,000 AFY of groundwater discharged to the Pacific Ocean through the UAS south of Channel Islands Harbor, and approximately 500 AFY of seawater entered the Subbasin through the LAS south of Channel Islands Harbor (Table 5-2, Figures 5-2, Seawater Flux in the LAS: Future Model Scenarios without UWCD's EBB Project, and 5-3, Seawater Flux in the LAS: Future Model Scenarios without UWCD's EBB Project). Particle tracks were not conducted for this model run.

The NNP1 pumping distribution resulted in approximately 2,200 AFY of underflows from the LAS of the Subbasin to the LPVB and PVB (Table 5-2). This is a change in both the direction and magnitude of LAS underflows, compared to the Future Baseline Scenario. This represents a loss of approximately 3,000 AFY in LAS underflow recharge to the Subbasin, compared to the Future Baseline Scenario. In the UAS, the NNP1 pumping distribution resulted in a reduction in underflows of approximately 200 AFY from the PVB and a reduction in underflows to the LPVB of approximately 500 AFY, resulting in a net gain in fresh groundwater in storage in the UAS of approximately 300 AFY. The change in underflows in the UAS were less than those simulated in the LAS.

No New Projects 2

The NNP1 model simulation indicates that pumping in the PVB and LPVB influences seawater flux into the Subbasin by capturing underflows that would otherwise be recharging the Subbasin. The effects of this are more pronounced in the LAS, where differential reductions in pumping between the Subbasin, PVB, and WLPMA result in a change in the direction and magnitude of underflows between basins. To better characterize this process, the NNP2 simulation included a complete reduction in pumping in the LAS of the Subbasin while maintaining groundwater production in the PVB and WLPMA at the Future Baseline rates.

The NNP2 pumping distribution resulted in approximately 3,800 AFY of underflows from the LAS of the Subbasin to the WLPMA and PVB (Table 5-2). This represents a loss of approximately 4,600 AFY in underflow recharge to the LAS of the Subbasin compared to the Future Baseline scenario. Additionally, the NNP2 pumping distribution resulted in a 70% increase in the volume of underflows from the LAS of the Subbasin to the WLPMA and PVB, compared to the NNP1 scenario. In the UAS, the NNP2 pumping distribution results in a net increase in fresh groundwater in storage in the UAS of approximately 100 AFY (Table 5-2).

In the NNP2 simulation, approximately 1,100 AFY of groundwater discharged to the Pacific Ocean through the UAS south of Channel Islands Harbor and approximately 200 AFY of seawater entered the Subbasin through the LAS south of Channel Islands Harbor (Table 5-2; Figures 5-2 and 5-3). Particle tracks were not conducted for this model run.

No New Projects 3

In the NNP3 model run, approximately 600 AFY of groundwater discharged to the Pacific Ocean through the UAS south of Channel Islands Harbor and approximately 1,000 AFY of seawater entered the Subbasin through the LAS south of Channel Islands Harbor (Table 5-2; Figures 5-2 and 5-3). Compared to the NNP1 simulation, this represents a 40% reduction in the volume of groundwater lost to the Pacific Ocean through the UAS and provides a similar estimate of seawater flux into the LAS, given the uncertainty in the Coastal Plain Model predictions (FCGMA 2019).

Particle tracks indicate that the NNP3 pumping distribution results in a recession of the saline water impact front in the Oxnard aquifer (Figure 5-10, UWCD Model Particle Tracks, Oxnard Aquifer, NNP3). Similarly, south of Casper Road, particle tracks show no landward migration of the saline water impact front in the Mugu aquifer (Figure 5-11). In the northern portion of the saline water impact front in the Mugu aquifer, the NNP3 pumping distribution reduced saline water migration by approximately 50% (Figure 5-11, UWCD Model Particle Tracks, Mugu Aquifer, NNP3).

In the LAS, the NNP3 pumping distribution does not fully mitigate the landward migration of the saline water impact front, except in the GCA. In the Hueneme aquifer, particle tracks show ongoing landward migration over the entire 47-year simulation period; however, the particle trajectories in the NNP3 scenario are approximately 40% shorter than the Future Baseline Scenario (Figures 5-11 and 5-6, UWCD Model Particle Tracks, Hueneme Aquifer, Future Baseline). In the upper and basal FCA, the 2020 saline water impact front migrated landward by approximately 0.1-miles. This is an approximately 80% reduction in the saline water impact front migration within the FCA, and within the model uncertainty (Figures 5-13, 5-14, 5-7, and 5-8).

These particle track and seawater flux results indicate that NNP3 pumping rate and distribution is sustainable, within the uncertainty of the VRGWFM.

The NNP3 pumping distribution resulted in approximately 1,700 AFY of underflows from the LAS of the Subbasin to the WLPMA and PVB (Table 5-2). This represents a loss of approximately 2,500 AFY in underflow recharge to the Subbasin compared to the Future Baseline scenario. However, the reduction in underflows to the Subbasin was approximately 15% and 45% lower than the NNP1 and NNP2 model runs, respectively (Table 5-2). In the UAS, the NNP3 pumping distribution results in a net increase in fresh groundwater in storage in the UAS of approximately 100 AFY (Table 5-2).

5.2.2.4 Basin Optimization Model Scenario

To support effective management of the Subbasin, the GSP established five separate management areas: the Forebay Management Area, the West Oxnard Plain Management Area, the Oxnard Pumping Depression Management Area, the Saline Intrusion Management Area, and the East Oxnard Plain Management Area (Figure 2-2). Results from an initial investigation of the pumping impacts within each management area on seawater flux indicated that the sustainable yield of the Subbasin could be increased by shifting pumping out of the Saline Intrusion and Oxnard Pumping Depression management areas into the West Oxnard Plain and Forebay management areas (Section 4.1.2.3). The Basin Optimization Scenario was developed to integrate these results into the future scenario modeling for the GSP, with the goal of increasing total groundwater production from the Subbasin, PVB, and WLPMA, while maintaining similar estimates of seawater flux and landward migration of the saline water impact front as the NNP3 model run.

The pumping distribution evaluated as part of this Basin Optimization scenario neither represents a commitment by FCGMA to implement a reduction and/or shift in groundwater production. While the simulated pumping scenario provides the foundation on which additional basin optimization strategies can be developed and evaluated, implementing management actions consistent with this scenario would require the development of additional projects that equitably distribute impacts across operators in the Subbasin. Additionally, and importantly, FCGMA and other agencies in the Subbasin are actively pursuing the development of water supply and treatment projects aimed at increasing the sustainable yield of the Subbasin. These projects should be considered in future evaluations of basin optimization strategies.

5.2.2.4.1 Basin Optimization Scenario Assumptions

As described above, the Basin Optimization Scenario included all the assumptions from the Future Baseline Scenario, except for the distribution of groundwater production. Using the results from the Future Baseline Scenario and NNP Scenario, along with the results from FCGMA's initial investigation of management area impacts (Section 4.1.2), the Basin Optimization Scenario implemented:

- A 10% reduction in groundwater production from the UAS of the Subbasin
- A 40% reduction in groundwater production from the LAS of the Subbasin
- A 10% reduction in groundwater production from both aquifer systems of the PVB
- A 10% reduction in groundwater production from both aquifer systems of the LPVB

Importantly, during the sustaining period, all pumping that would have occurred in the Saline Intrusion Management Area and 40% of the pumping that would have occurred in the Oxnard Pumping Depression Management Area, was moved to the West Oxnard Plain Management Area. Implementing this reduction and shift in groundwater production resulted in an average annual groundwater production rate of approximately 52,300 AFY in the Subbasin, 13,800 AFY in the PVB, and 12,200 AFY in the WLPMA.

This scenario did not include any changes to existing land uses in the Subbasin. Therefore, this modeling scenario assumes that implementing pumping shifts across the Subbasin would occur concurrently with the development of infrastructure projects that would deliver water to operators directly impacted by pumping reductions.

5.2.2.4.2 Basin Optimization Scenario Results

In the Basin Optimization Scenario, approximately 400 AFY of groundwater discharged to the Pacific Ocean through the UAS and approximately 1,100 AFY of seawater entered the Subbasin through the LAS (Table 5-2, Figures 5-1, Modeled Seawater Flux Coastal Segments, and 5-2, Seawater Flux in the UAS: Future Model Scenarios without UWCD's EBB Project). These estimates are similar to the seawater flux values estimated in the NNP3 simulation and are within the quantitative uncertainty of the VRGWFM.

Particle tracks show a similar recession of the saline water impact front in the Oxnard aquifer (5-16, UWCD Model Particle Tracks, Oxnard Aquifer, Basin Optimization). In the Mugu aquifer, the Basin Optimization Scenario pumping distribution reduced the landward migration of the saline water impact front compared to the NNP3 simulation (Figure 5-17, UWCD Model Particle Tracks, Mugu Aquifer, Basin Optimization). In the Hueneme aquifer, FCA, and GCA, particle tracks show similar trajectories of the saline water impact fronts within each aquifer (Figures 5-18 through 6-22). Therefore, the particle tracks and simulated seawater flux values indicate that an average annual production rate of approximately 52,300, under the Basin Optimization distribution, is sustainable.

The Basin Optimization Scenario pumping distribution resulted in approximately 1,000 AFY of underflows from the LAS of the Subbasin to the PVB. Underflows from the LAS of the WLPMA to the Subbasin were approximately 200 AFY less than the Future Baseline Scenario. The combined underflows in the LAS represent a loss of approximately 900 AFY in the volume of fresh groundwater in storage compared to the Future Baseline scenario. This is approximately 45% lower than the NNP3 simulation (Table 5-2). Recharge from underflows in the UAS increased by approximately 400 AFY (Table 5-2).

5.2.2.5 Projects Scenario

Modeling of future conditions in the Projects Scenario included all the assumptions incorporated in the Future Baseline Scenario, and also included UWCD's Freeman Expansion project, FCGMA's Voluntary Temporary Fallowing Project, and in-lieu delivery and infrastructure improvement projects in the WLPMA (Table 5-2). Due to uncertainty in the planned use of the future AWPF water, the City of Oxnard's AWPF Expansion project was not incorporated into the Projects Scenario. Additionally, UWCD's EBB Water Treatment project was not included in the Projects Scenario, but rather, was evaluated in a separate scenario to account for the impacts of this project on groundwater elevations and seawater flux along the coast (Section 5.2.2.6 Extraction Barrier and Brackish Water Treatment Scenario).

Incorporation of the potential future projects in the Projects Scenario neither represents a commitment by FCGMA to impose pumping reductions nor a commitment to move forward with each project included in the future model scenario.

5.2.2.5.1 Projects Scenario Assumptions

In the Subbasin, simulated future projects included UWCD's Freeman Diversion Expansion project, which, under the projected future hydrology, would increase Santa Clara River water diversions by approximately 6,800 AFY compared to Future Baseline conditions. UWCD anticipates delivering a portion of this water to users on their pipelines and recharging a portion of this water in the Forebay (Table 5-2). The timing and volume of pipeline deliveries and recharge was determined by UWCD using their Surface Water Distribution Model.

Two voluntary temporary fallowing projects were modeled in the Projects Scenario. In the Subbasin, a 504 AFY reduction of pumping was simulated. In the PVCWD service area, a voluntary temporary fallowing program was simulated using a 2,407 AFY reduction in agricultural water demands, which consists of both surface water, recycled water, and groundwater. To do this, agricultural water demands were reduced uniformly and proportionally in the PVCWD service area, and UWCD's Surface Water Distribution Model was used to estimate the resulting reduction in groundwater pumping. These projects are discussed in detail in Section 3.1.

In the WLPMA, future projects included the purchase of 1,762 AFY of water to be delivered to the eastern portion of the WLPMA in lieu of groundwater extraction and infrastructure improvements to Zone Mutual Water Company's distribution network, which are anticipated to reduce groundwater demands by approximately 500 AFY. The combination of these projects results in a reduction in pumping of 2,262 AFY. Simulated pumping was reduced uniformly and proportionally at Zone Mutual Water Company and Ventura County Waterworks District-19 wells located in the WLPMA.

After incorporating the potential future projects, the average groundwater production rate for the UAS in the Subbasin was 39,500 AFY and the average groundwater production rate for the LAS in the Subbasin was 26,600 AFY for the Projects Scenario. In the PVB, the average groundwater production rate was 4,100 AFY in the UAS and 8,900 AFY in the LAS. In the WLPMA, the average production rate in the LAS was 11,400 AFY.

5.2.2.5.2 Projects Scenario Results

In the Projects Scenario, groundwater production from the Subbasin at a rate of approximately 66,100 AFY resulted in seawater flux into both the UAS and LAS of the Subbasin (Table 5-2). In the UAS, the seawater flux averaged approximately 1,300 AFY over the sustaining period, and in the LAS, the seawater flux averaged approximately 2,100 AFY over the sustaining period. These results indicate that implementation of UWCD's Freeman Expansion Project, FCGMA's temporary voluntary fallowing project, and ZMWC's infrastructure improvement and in-lieu delivery project would result in a 20% decrease in total seawater flux, compared to the Future Baseline Scenario. The majority of these benefits would occur in the UAS (Table 5-2).

Implementation of these three projects in the Subbasin, PVB, and WLPMA, without any additional demand reduction actions, results in an increase in underflows from the PVB and WLPMA. In the LAS, underflows from the PVB and WLPMA increased by approximately 500 AFY (Table 5-2). In the UAS, underflows from the WLPMA and PVB increased by approximately 1,200 AFY (Table 5-2). These underflows help to reduce the seawater flux into the Subbasin.

5.2.2.6 Extraction Barrier and Brackish Water Treatment Scenario

UWCD is designing and implementing an EBB Water Treatment Project to create a seawater intrusion barrier at NBVC Point Mugu. UWCD intends to operate the project by extracting brackish groundwater from the Oxnard and Mugu aquifers near the coast, creating a pumping trough that helps prevent landward migration of saline water throughout the Subbasin. Because successful implementation and operation of this project will intentionally lower groundwater elevations along the coastline, thereby inducing seawater flux along the coast, a separate set of model simulations were conducted to evaluate this project.

Two model runs were conducted under this scenario:

- Future Baseline with EBB
- Projects with EBB

The assumptions used for each model run are described below. The pumping distributions evaluated in the EBB Water Treatment Scenario neither represent a commitment by FCGMA to impose pumping reductions or projects nor a commitment to move forward with specific pumping reduction scenarios or projects.

5.2.2.6.1 EBB Water Treatment Scenario Assumptions

Simulation of UWCD's EBB Water Treatment project included the following:

- A total of ten (10) EBB extraction wells screened in the Oxnard aquifer, pumping at a combined rate of approximately 5,000 AFY over the 30-yr sustaining period.
- A total of ten (10) EBB extraction wells screened in the Mugu aquifer, pumping at a combined rate of approximately 5,000 AFY over the 30-year sustaining period.

Consistent with the current project understanding (Section 3.1.1), implementation of the EBB Water Treatment Project occurred in two phases:

- **Phase I (Water Year 2028 through Water Year 2030):** 2,500 AFY of production from 5 wells screened in the Oxnard aquifer, and 1,000 AFY of production from 2 wells screened in the Mugu aquifer.

- **Phase I (Water Year 2031 through Water Year 2069):** 5,000 AFY of production from 10 wells screened in the Oxnard aquifer, and 5,000 AFY of production from 10 wells screened in the Mugu aquifer.

Based on the current project understanding, it was assumed that 50% of the brackish water treated as part of the EBB project would be made available for delivery and use in the Subbasin. Of this, UWCD anticipates delivering approximately 1,500 AFY to NBVC and delivering the remaining 3,500 AFY either to operators in the Subbasin or to the Forebay for additional recharge. For simplicity in both the Future Baseline with EBB and Projects with EBB scenario, it was assumed that the 3,500 AFY of treated EBB water was recharged in the Forebay Management Area. The addition of a consistent source of recharge to the Forebay through this project resulted in an increase in the availability of Santa Clara River water for delivery to users on the PTP and PVP.

Future Baseline with EBB Model Simulation

The Future Baseline with EBB simulation included all the assumptions from the Future Baseline Scenario, and also included the full implementation of UWCD's EBB Water Treatment Project. Including UWCD's EBB Water Treatment Project resulted in a total groundwater production rate of 78,200 AFY in the Subbasin (10,000 AFY of which are from UWCD's EBB extraction wells), 13,800 AFY from the PVB, and 13,500 AFY from the WLPMA.

Projects with EBB Model Simulation

The Projects with EBB simulation included all the assumptions from the Projects Scenario, and also included the full implementation of UWCD's EBB Water Treatment Project. The net effects of UWCD's EBB Water Treatment Project, Freeman Diversion Expansion Project, Voluntary Temporary Fallowing Project, and In-Lieu and infrastructure improvement projects in WLPMA resulted in a total groundwater production rate of 75,800 AFY from the Subbasin (10,000 AFY of which are from UWCD's EBB extraction wells), 13,000 AFY from the PVB, and 11,400 AFY from the WLPMA.

5.2.2.6.2 EBB Water Treatment Scenario Model Results

Because UWCD's EBB project is designed to increase seawater flux into the Subbasin, groundwater sustainability was evaluated by calculating the simulated flows across the current inland extent of saline water impact in the UAS and LAS of the Subbasin. The average annual flows across these boundaries for the 30-year sustaining period were used to characterize the pumping rates, projects, and management actions that would result in no net landward movement of the current saline water extents.

Like some of the scenarios that do not include UWCD's EBB projects, the net flow estimates were analyzed concurrently with particle tracks to characterize the trajectory of the saline water impact front over the sustaining period.

Future Baseline with EBB

In the Future Baseline with EBB scenario, approximately 3,200 AFY of groundwater flowed across the current inland extent of saline water impact in the UAS, towards the coast. This flow direction indicates that, under Future Baseline conditions, operation of UWCD's EBB project did not result in a net landward migration of saline water throughout the UAS over the 30-year sustaining period. Particle tracks show a recession in the saline water impact front in the UAS, and corresponding capture of groundwater that migrates towards the coast by UWCD's EBB extraction wells (Figures 5-21, UWCD Model Particle Tracks, Grimes Canyon Aquifer, Basin Optimization, and 5-22, UWCD Model Particle Tracks, Oxnard Aquifer, Future Baseline with EBB).

Over the sustaining period, approximately 500 AFY of groundwater flowed across the current inland extent of saline water impact in the LAS, towards the coast (Table 5-2). This suggests that, under the Future Baseline conditions, while UWCD's EBB project does not include any dedicated extraction wells in the LAS, operation of the UAS extraction wells limit the landward migration of saline water throughout the LAS. This interpretation is consistent with particle tracks that shows a recession of the saline water impact front, particularly near Point Mugu (Figures 5-23, UWCD Model Particle Tracks, Mugu Aquifer, Future Baseline with EBB; and 5-26, UWCD Model Particle Tracks, Basal Fox Canyon Aquifer, Future Baseline with EBB). Particle tracks suggest some inland migration in the Hueneme aquifer near Port Hueneme (Figure 5-24, UWCD Model Particle Tracks, Hueneme Aquifer, Future Baseline with EBB). Presently, there are no wells in this vicinity to monitor the actual saline front. Although modeled particle tracks indicate inland migration of approximately 0.75 miles over the 30-year sustaining period, the closest wells screened across the Hueneme aquifer are still more than 1.5 miles from the modeled inland saline intrusion extent.

These results indicate that groundwater production at the average 2016 to 2022 rates in the Subbasin, PVB, and WLPMA may be sustainable if UWCD's EBB project is implemented at a 10,000 AFY production scale.

Projects with EBB

In the Projects with EBB scenario, approximately 3,800 AFY of groundwater flowed across the current inland extent of saline water impact in the UAS, towards the coast. This is an increase in the coastward flow of approximately 20% compared to the Future Baseline with EBB simulation. Like the Future Baseline with EBB simulation, this indicates that operation of UWCD's EBB project will limit the landward migration of saline water throughout the UAS over the 30-year sustaining period. This is consistent with particle tracks that show a recession in the saline water impact front in the UAS, and corresponding capture at UWCD's EBB extraction wells (Figures 5-27, Future Baseline with EBB Scenario, Grimes Canyon Aquifer; and 5-28, UWCD Model Particle Tracks, Oxnard Aquifer, Projects with EBB).

Over the sustaining period, approximately 600 AFY of groundwater will flow across the current inland extent of saline water impact in the LAS, towards the coast. Like the Future Baseline with EBB scenario, this suggests that, while UWCD's EBB project does not include any dedicated extraction wells in the LAS, operation of the UAS extraction wells will result in the vertical migration of flow from the LAS to UAS, limiting the landward migration of saline water throughout the LAS. This interpretation is consistent with particle tracks that shows a recession of the saline water impact front, particularly near Point Mugu (Figures 5-29 through 5-32). The one exception to this is in the Hueneme aquifer near Port Hueneme, where the particle trajectories under the Projects with EBB scenario were similar to those in the Future Baseline with EBB scenario.

5.2.3 Estimates Of the Future Sustainable Yield

The primary sustainability goal of the Subbasin is to increase groundwater elevations to elevations that will prevent long-term, or climatic-cycle net, landward migration of the saline water impact front and prevent net seawater intrusion into the UAS and LAS (FCGMA 2019). To ensure that the Subbasin is managed under conditions that will achieve and maintain this goal, the sustainable yield for the Subbasin was estimated by examining the modeled flux of seawater into the Subbasin, south of Channel Islands Harbor, over the 30-year sustaining period. The sustaining period was assessed because SGMA recognizes that undesirable results may occur during the 20-year implementation period, as basins move toward sustainable groundwater management. In addition to the flux of seawater, particle tracks from the model runs were analyzed to evaluate the potential migration of the current extent of saline water impact in the UAS and the LAS. As described in Section 5.2.2.1, the particles were placed along the approximate inland extent of the zone of saline water impact in 2020. Scenarios that minimize the net flux of seawater into the Subbasin and the landward migration of the saline water impact front over the 30-year sustaining period are sustainable for the Subbasin, while those that allow for net seawater intrusion and landward migration of the saline water impact front are not. Estimates of sustainable yield are summarized by aquifer system, rather than for the Subbasin as a whole, because the aquifer systems experience different levels of overdraft.

Sustainable Yield without Future Projects

All three simulations performed under the NNP Scenario reduced seawater intrusion in the LAS during the 30-year sustaining period and resulted in net freshwater loss from the UAS to the Pacific Ocean. Therefore, the simulation with the highest overall production rate, that also minimized impacts from adjacent basins, was identified as the best estimate of the sustainable yield of the Subbasin, in the event that no new future projects are implemented in the Subbasin. The simulation with the highest total groundwater production rate from this scenario was NNP3 – under this simulation, an average of approximately 34,100 AFY of groundwater was pumped from the UAS (Section 5.2.2.3). This estimate of the sustainable yield is approximately 2,100 AFY higher than the estimate presented in the GSP for the UAS (FCGMA 2019). Applying the estimate of sustainable yield uncertainty calculated during development of the GSP for the sustaining period suggests that the sustainable yield of the UAS may be as high as 38,200 AFY or as low as 30,000 AFY (FCGMA 2019).

In the NNP3 simulation, a total of 10,600 AFY of groundwater was pumped from the LAS. This estimate of the sustainable yield for the LAS from NNP3 is approximately 3,600 AFY higher than the estimate presented in the GSP for the LAS (FCGMA). Applying the estimate of sustainable yield uncertainty calculated during development of the GSP for the sustaining period suggests that the sustainable yield of the LAS may be as high as 14,200 AFY or as low as 7,000 AFY (FCGMA 2019).

Over the 2021 to 2022 period, groundwater extractions from the UAS averaged approximately 44,200 AFY (Table 4-4)[19]. This is approximately 6,000 AFY higher than the upper end estimate of sustainable yield for the UAS. Over the 2021 to 2022 period, groundwater extractions from the LAS averaged approximately 30,800 AFY, which is approximately 16,600 AFY higher than the upper end estimate of sustainable yield for the LAS (Table 4-4).

Sustainable Yield with Future Projects

FCGMA and other agencies in the Subbasin have identified, and anticipate implementing, as feasible, additional projects in the Subbasin, PVB, and WLPMA that increase the sustainable yield, provide supplemental water, and/or reduce demand in each basin. In the Projects Scenario, implementation of the suite of projects described above reduced seawater flux into the Subbasin by approximately 800 AFY, or 40%, in the UAS and 300 AFY, or 10%, in the LAS. Based on the relationship between pumping and seawater intrusion in the Future Baseline and NNP scenarios, this may translate into a 2,000 AFY increase in the sustainable yield of the UAS and a 2,700 AFY increase in the sustainable yield of the LAS. Under this scenario, the sustainable yield of the UAS may be as high as 40,200 AFY or as low as 32,000 AFY. Similarly, the sustainable yield of the LAS may be as high as 16,900 AFY or as low as 9,700 AFY.

The Basin Optimization Model Scenario indicates that a project designed to shift pumping in the Subbasin away from the Saline Intrusion and Oxnard Pumping Depression management areas to the West Oxnard Plain Management Area may increase the sustainable yield of the UAS and LAS by approximately 1,100 AFY and 6,500

19 Results from the Coastal Plain Model indicate that the majority of groundwater withdrawal from wells screened in multiple or unassigned aquifer occurs through the UAS. Because of this, the pumping from wells screened in multiple or unassigned aquifers was added to the groundwater extractions from wells screened exclusively within the UAS.

AFY, respectively. Under this scenario, the sustainable yield of the UAS may be as high as 39,300 AFY or as low as 31,100 AFY. Similarly, the sustainable yield of the LAS may be as high as 20,700 AFY or as low as 13,500 AFY. Additional modeling would be required to evaluate whether or not these benefits are additive to the sustainable yield increases associated with projects that were evaluated in the Projects Scenario.

Sustainable Yield with UWCD's EBB Water Treatment Project

Both simulations conducted under the EBB Water Treatment Scenario limited the landward migration of saline water in the Oxnard aquifer, Mugu aquifer, FCA, and GCA. Because of this, the simulation with the highest overall production rate was used as the estimate of sustainable yield of the Subbasin if UWCD's EBB Water Treatment project is successfully implemented as described in Section 5.2.2.6, Extraction Barrier and Brackish Water Treatment Scenario. The simulation with the highest total groundwater production rate from this scenario was the Future Baseline with EBB simulation – under this simulation, and excluding the extractions from UWCD's EBB extraction wells, an average of approximately 40,000 AFY of groundwater was pumped from the UAS and 28,200 AFY of groundwater was pumped from the LAS (Section 5.2.2.6, Extraction Barrier and Brackish Water Treatment Scenario). This would represent an increase in the sustainable yield of approximately 5,900 AFY in the UAS and 17,600 AFY in the LAS, compared to the scenario in which no new projects are implemented in the Subbasin.

Additional Considerations

Particle tracks from the 5-year GSP evaluation modeling indicate that none of the scenarios fully mitigate seawater intrusion in the Hueneme aquifer near Port Hueneme. However, the NNP3, Basin Optimization, and Future Baseline with EBB scenarios were considered sustainable because the particle tracks suggest that the saline water migration would not impact beneficial uses and users of groundwater in the Hueneme aquifer. Over the 47-year period, these three scenarios suggest that the saline water impact front may migrate approximately 0.5 miles inland; the nearest groundwater wells are approximately 1 to 2 miles away from the estimated saline water impact front in 2070 (Figures 5-4 through 5-33).

FCGMA and other agencies will continue to monitor saline water impact in this part of the Subbasin. As necessary and appropriate, FCGMA will evaluate the need to implement new projects and technical studies if beneficial uses and users of groundwater are likely to be impacted by future seawater intrusion in the Hueneme aquifer.

6 Revisions to the Sustainable Management Criteria

The GSP established minimum threshold and measurable objective groundwater elevations that minimize seawater intrusion in the Subbasin after 2040. These SMCs were established based on simulation results from the VRGWFM. As noted in Section 5.2, Future Scenario modeling was updated as part of this periodic GSP evaluation. Two model runs were found to be sustainable: the NNP3 model run and Future Baseline with EBB model run.

Phase I of UWCD's EBB project is anticipated to start in water year 2028 and operate for approximately 3 years (Section 3). Data collected during Phase I operation will inform project efficacy and impacts. Full scale implementation of the EBB project will require demonstration that the local increase in extractions from the UAS does not induce vertical migration of contaminants from the semi-perched aquifer down into the drinking water aquifers of the Subbasin. Because full-scale implementation of the EBB project will depend on results from Phase I of the project, the minimum thresholds and measurable objectives recommended for the next 5-years of GSP implementation are the SMC that do not account for implementation of UWCD's EBB project.

Recommendations for SMCs that account for EBB are discussed in Section 6.3. These SMCs are included to provide a framework for future management objectives in the event that EBB is successfully implemented in the Subbasin. FCGMA and other agencies in the PVB will evaluate appropriateness of managing towards these criteria as Phase I of the EBB project is implemented.

6.1 Minimum Thresholds

Consistent with the GSP, the minimum threshold groundwater elevations were evaluated by comparing the GSP-defined minimum threshold groundwater elevations to the lowest simulated groundwater elevation after 2040 from the NNP 3 simulation. Groundwater elevation minimum thresholds were recommended for revision if the simulated lows in the updated scenarios were more than 5-feet different than the minimum threshold established in the GSP. This 5-foot criterion was selected based on the uncertainty in the modeled relationship between seawater flux and average groundwater elevation within the Saline Intrusion Management Area. Lastly, consistent with the GSP, the minimum thresholds recommended for revision were rounded down to the nearest 5-foot interval (Figures 6-1b through 6-6)[20].

Nine minimum threshold groundwater elevations are recommended for revision, three of which are for wells screened in the UAS and the remaining are for wells screened in the LAS (Table 6-1, Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin). Eight of the recommended revisions are for wells located within the Saline Intrusion and Oxnard Pumping Depression management areas and one is for a well located in the Forebay Management Area (Table 6-1).

In the UAS, revisions to the minimum threshold groundwater elevations are recommended for three wells in the Mugu aquifer. The recommended minimum thresholds for these wells are an average of approximately 7 feet lower

20 For the GSP, 2-feet was added to each SMC to account for future sea level rise (FCGMA 2019). The numerical modeling for this periodic GSP evaluation accounts for future sea level rise by simulating sea level rise projected by NASA (2023). Because of this, 2-feet was not added to the recommended revised SMC.

Table 6-1. Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin

SWN	Aquifer	Management Area	Historical Low (ft msl) and Date Measured		Minimum Thresholds and Measurable Objectives Defined in the GSP[c]		Recommended Minimum Thresholds and Measurable Objectives[c]	
					MT (ft msl)	MO (ft msl)	MT (ft msl)	MO (ft msl)
01N21W32Q06S	Saline Intrusion Management Area	Oxnard	-25.8	11/22/1991	2	17	2	10
01N22W20J08S	Saline Intrusion Management Area	Oxnard	-14.8	9/28/1991	7	17	7	17
01N22W26J04S	Saline Intrusion Management Area	Oxnard	-28.3	10/26/1990	2	17	2	17
01N22W27C03S	Saline Intrusion Management Area	Oxnard	-18.6	12/13/1990	7	17	7	17
01N23W01C05S	West Oxnard Plain Management Area	Oxnard	-6.9	11/18/1991	7	17	7	17
02N22W36E06S	West Oxnard Plain Management Area	Oxnard	-25	10/28/2015	12	37	12	37
01N21W32Q05S	Saline Intrusion Management Area	Mugu	-107.4	11/30/2015	2	17	-5	5
01N21W32Q07S	Saline Intrusion Management Area	Mugu	-72.5	11/30/2015	2	17	-5	5
01N22W20J07S	Saline Intrusion Management Area	Mugu	-16.5	11/13/1991	7	17	7	17
~~01N22W26J03S~~[21]	~~Saline Intrusion Management Area~~	~~Mugu~~	~~-52.6~~	~~10/26/1990~~	~~2~~	~~17~~	–	–
01N22W27C02S	Saline Intrusion Management Area	Mugu	-27.3	12/13/1990	7	17	0	10
02N21W07L06S	Forebay Management Area	Mugu	-12.2	12/3/2015	27	62	27	75
02N22W23B07S	Forebay Management Area	Mugu	-40.8	12/15/1992	17	47	17	60
02N22W36E05S	West Oxnard Plain Management Area	Mugu	-21	11/4/2015	12	37	12	37
01N22W20J05S	Saline Intrusion Management Area	Hueneme	-29.9	11/30/2015	2	17	2	17
01N23W01C03S	West Oxnard Plain Management Area	Hueneme	-39.7	1/7/1991	7	22	7	22
01N23W01C04S	West Oxnard Plain Management Area	Hueneme	-34.9	1/7/1991	7	22	7	22
02N22W23B04S	Forebay Management Area	Hueneme	-147.1	10/28/2014	-3	17	-3	17
02N22W23B05S	Forebay Management Area	Hueneme	-121	10/12/1991	-3	17	-3	17
02N22W23B06S	Forebay Management Area	Hueneme	-41.7	2/3/1993	17	47	17	60

[21] Since 2016, an obstruction in the well head has prevented manual depth to water measurements at well 01N22W26J03S. This well has been removed from the monitoring network.0

Table 6-1. Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin

SWN	Aquifer	Management Area	Historical Low (ft msl) and Date Measured		Minimum Thresholds and Measurable Objectives Defined in the GSP[c]		Recommended Minimum Thresholds and Measurable Objectives[c]	
					MT (ft msl)	MO (ft msl)	MT (ft msl)	MO (ft msl)
02N22W36E03S	West Oxnard Plain Management Area	Hueneme	-51.8	12/3/2014	12	37	12	37
02N22W36E04S	West Oxnard Plain Management Area	Hueneme	-32.11	11/4/2015	12	37	12	37
01N21W32Q04S	Saline Intrusion Management Area	FCA	-116.9	11/30/2015	-23	2	**-10**	2
01N22W20J04S	Saline Intrusion Management Area	FCA	-40.7	11/30/2015	2	17	2	17
01N22W26K03S	Saline Intrusion Management Area	FCA	-71.8	6/16/2015	-18	2	-18	2
01N23W01C02S	West Oxnard Plain Management Area	FCA	-50.4	1/7/1991	7	22	7	22
02N21W07L04S	Forebay Management Area	FCA	-32	10/14/2015	17	42	17	**55**
02N22W23B03S	Forebay Management Area	FCA	-128.7	2/28/1991	-3	17	-3	17
01N21W32Q02S	Saline Intrusion Management Area	GCA	-115.2	11/30/2015	-23	2	**-10**	2
01N21W32Q03S	Saline Intrusion Management Area	GCA	-125.8	11/30/2015	-23	2	**-10**	2
01N21W07J02S	Oxnard Pumping Depression Management Area	Multiple	-145.4	10/21/2014	-38	2	**-25**	2
01N21W21H02S	Oxnard Pumping Depression Management Area	Multiple	-149.4	10/20/2014	-68	-8	**-30**	**0**
02N21W07L03S	Forebay Management Area	Multiple	-24.6	10/15/2015	17	37	**10**	**50**
02N21W07L05S	Forebay Management Area	Multiple	-7.4	12/30/2015	27	57	27	**75**

Notes: FCA= Fox Canyon Aquifer, GCA = Grimes Canyon Aquifer; MT = minimum threshold; MO = measurable objective; ft. msl = feet mean sea level. Strikethrough indicates well was removed from the key well network.

a Bolded and underlined where different than the GSP (FCGMA 2019).

than the minimum thresholds established in the GSP. In the FCA and GCA, the recommended minimum thresholds are approximately 13 feet higher than the GSP. The recommended minimum thresholds for both wells located in the Oxnard Pumping Depression Management Area, and screened across multiple aquifers, are an average of approximately 25 feet higher than the GSP. The recommended minimum threshold for the one well in the Forebay Management Area is seven feet lower than the minimum threshold established in the GSP.

6.2 Measurable Objectives

Consistent with the GSP, the measurable objective groundwater elevations were evaluated by comparing the GSP-defined measurable objective groundwater elevations to the median simulated groundwater elevation after 2040 from the NNP3 simulation. Measurable objectives were recommended for revision if the median groundwater elevations in the updated scenarios were more than 5-feet different than the measurable objectives established in the GSP. This 5-foot criterion was selected based on the uncertainty in the modeled relationship between seawater flux and average groundwater elevation within the Saline Intrusion Management Area. Lastly, consistent with the GSP, the measurable objectives recommended for revision were rounded down to the nearest 5-foot interval.

Eleven (11) measurable objective groundwater elevations are recommended for revision, six of which are for wells screened in the UAS and five of which are for wells screened in the LAS (Table 6-1).

In the UAS, revisions to the measurable objectives are recommended for one well in the Oxnard aquifer and three four wells in the Mugu aquifer. In the Oxnard aquifer, the recommended measurable objective is seven feet lower than the GSP. In the Mugu aquifer, the recommended measurable objectives are, on average, 10 feet lower than the GSP. In the Forebay Management Area of the Mugu aquifer, the recommended measurable objectives are 13 feet higher than the GSP (Table 6-1).

In the LAS, the recommended measurable objectives at five key wells are, on average, 13 feet higher than the GSP (Table 6-1).

6.3 Potential Sustainable Management Criteria with Implementation of EBB

Implementation of UWCD's EBB project will require minimum threshold groundwater elevations in the Saline Intrusion Management Area to be lower than the GSP minimum thresholds to provide sufficient flexibility for project operation. In addition, successful implementation of UWCD's EBB project is anticipated to allow for the lowering of minimum thresholds and measurable objectives throughout the remainder of the Subbasin without causing additional seawater intrusion (Figures 6-7a through 6-12).

6.3.1 Minimum Thresholds

Based on the Future Baseline with EBB simulation results, minimum thresholds in the UAS of the Saline Intrusion Management Area may need to be lowered by an average of approximately 30 and 60 feet in the Oxnard and Mugu aquifers, respectively. In the LAS of the Saline Intrusion Management Area, the minimum threshold groundwater elevations may need to be lowered by an average of approximately 22, 45, and 57 feet in the Hueneme aquifer, FCA, and GCA, respectively (Table 6-2, Potential Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin with EBB).

Table 6-2. Potential Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin with EBB

SWN	Aquifer	Management Area	Historical Low (ft msl) and Date Measured		Minimum Thresholds and Measurable Objectives Defined in the GSP[c]		Potential Minimum Thresholds and Measurable Objectives[c]	
					MT (ft msl)	MO (ft msl)	MT (ft msl)	MO (ft msl)
01N21W32Q06S	Saline Intrusion Management Area	Oxnard	-25.8	11/22/1991	2	17	-45	-30
01N22W20J08S	Saline Intrusion Management Area	Oxnard	-14.8	9/28/1991	7	17	-10	5
01N22W26J04S	Saline Intrusion Management Area	Oxnard	-28.3	10/26/1990	2	17	-25	-10
01N22W27C03S	Saline Intrusion Management Area	Oxnard	-18.6	12/13/1990	7	17	-15	0
01N23W01C05S	West Oxnard Plain Management Area	Oxnard	-6.9	11/18/1991	7	17	-10	10
02N22W36E06S	West Oxnard Plain Management Area	Oxnard	-25	10/28/2015	12	37	-5	25
01N21W32Q05S	Saline Intrusion Management Area	Mugu	-107.4	11/30/2015	2	17	-100	-80
01N21W32Q07S	Saline Intrusion Management Area	Mugu	-72.5	11/30/2015	2	17	-100	-80
01N22W20J07S	Saline Intrusion Management Area	Mugu	-16.5	11/13/1991	7	17	-10	5
~~01N22W26J03S~~[22]	~~Saline Intrusion Management Area~~	~~Mugu~~	~~-52.6~~	~~10/26/1990~~	~~2~~	~~17~~	—	—
01N22W27C02S	Saline Intrusion Management Area	Mugu	-27.3	12/13/1990	7	17	-25	-10
02N21W07L06S	Forebay Management Area	Mugu	-12.2	12/3/2015	27	62	5	55
02N22W23B07S	Forebay Management Area	Mugu	-40.8	12/15/1992	17	47	0	47
02N22W36E05S	West Oxnard Plain Management Area	Mugu	-21	11/4/2015	12	37	-5	25
01N22W20J05S	Saline Intrusion Management Area	Hueneme	-29.9	11/30/2015	2	17	-20	-5
01N23W01C03S	West Oxnard Plain Management Area	Hueneme	-39.7	1/7/1991	7	22	-10	5
01N23W01C04S	West Oxnard Plain Management Area	Hueneme	-34.9	1/7/1991	7	22	-10	5
02N22W23B04S	Forebay Management Area	Hueneme	-147.1	10/28/2014	-3	17	-50	-25
02N22W23B05S	Forebay Management Area	Hueneme	-121	10/12/1991	-3	17	-50	-25
02N22W23B06S	Forebay Management Area	Hueneme	-41.7	2/3/1993	17	47	0	47
02N22W36E03S	West Oxnard Plain Management Area	Hueneme	-51.8	12/3/2014	12	37	-5	25
02N22W36E04S	West Oxnard Plain Management Area	Hueneme	-32.11	11/4/2015	12	37	-5	25
01N21W32Q04S	Saline Intrusion Management Area	FCA	-116.9	11/30/2015	-23	2	-80	-60
01N22W20J04S	Saline Intrusion Management Area	FCA	-40.7	11/30/2015	2	17	-20	-5
01N22W26K03S	Saline Intrusion Management Area	FCA	-71.8	6/16/2015	-18	2	-75	-50

[22] Since 2016, an obstruction in the well head has prevented manual depth to water measurements at well 01N22W26J03S. This well has been removed from the monitoring network.

Table 6-2. Potential Minimum Threshold and Measurable Objective Groundwater Elevations for the Oxnard Subbasin with EBB

SWN	Aquifer	Management Area	Historical Low (ft msl) and Date Measured		Minimum Thresholds and Measurable Objectives Defined in the GSP[c]		Potential Minimum Thresholds and Measurable Objectives[c]	
					MT (ft msl)	MO (ft msl)	MT (ft msl)	MO (ft msl)
01N23W01C02S	West Oxnard Plain Management Area	FCA	-50.4	1/7/1991	7	22	-15	5
02N21W07L04S	Forebay Management Area	FCA	-32	10/14/2015	17	42	-20	20
02N22W23B03S	Forebay Management Area	FCA	-128.7	2/28/1991	-3	17	-50	-20
01N21W32Q02S	Saline Intrusion Management Area	GCA	-115.2	11/30/2015	-23	2	-80	-55
01N21W32Q03S	Saline Intrusion Management Area	GCA	-125.8	11/30/2015	-23	2	-80	-55
01N21W07J02S	Oxnard Pumping Depression Management Area	Multiple	-145.4	10/21/2014	-38	2	-90	-40
01N21W21H02S	Oxnard Pumping Depression Management Area	Multiple	-149.4	10/20/2014	-68	-8	-110	-50
02N21W07L03S	Forebay Management Area	Multiple	-24.6	10/15/2015	17	37	-25	15
02N21W07L05S	Forebay Management Area	Multiple	-7.4	12/30/2015	27	57	5	57

Notes: FCA= Fox Canyon Aquifer, GCA = Grimes Canyon Aquifer; MT = minimum threshold; MO = measurable objective; ft. msl = feet mean sea level. Strikethrough indicates well was removed from the key well network.

[a] Bolded and underlined where different than the GSP (FCGMA 2019).

In the UAS and LAS of the Forebay Management Areas, the minimum threshold groundwater elevations could be lowered by an average of approximately 20 and 37 feet, respectively. In the LAS of the Oxnard Pumping Depression Management Area, the minimum threshold groundwater elevations could be lowered by an average of approximately 47 feet (Table 6-2).

To provide sufficient flexibility to UWCD and operators in the Subbasin while still mitigating seawater intrusion, the minimum threshold elevations at six key wells may occur below historical low groundwater elevations (Table 6-2). If these SMC are adopted following successful implementation of the EBB project, additional land subsidence monitoring may be warranted to ensure that groundwater elevations below historical lows at these wells do not result in land subsidence that significantly and unreasonably impacts land surface uses and nearby infrastructure.

6.3.2 Measurable Objectives

Based on the Future Baseline with EBB simulation results, measurable objectives thresholds in the UAS of the Saline Intrusion Management Area could be lowered by an average of approximately 25 and 60 feet in the Oxnard and Mugu aquifers, respectively. In the LAS of the Saline Intrusion Management Area, the minimum threshold groundwater elevations may need to be lowered by an average of approximately 22, 45, and 57 feet in the Hueneme aquifer, FCA, and GCA, respectively (Table 6-2).

In the UAS and LAS of the Forebay Management Areas, the minimum threshold groundwater elevations could be lowered by an average of approximately 7 and 28 feet, respectively. In the LAS of the Oxnard Pumping Depression Management Area, the minimum threshold groundwater elevations could be lowered by an average of approximately 42 feet (Table 6-2).

7 Monitoring Network

This section summarizes changes to the monitoring network for the Subbasin, including revisions to the key well network. Groundwater wells that are included in the monitoring network are shown in Figures 7-1, Monitoring Network Wells Screened in the Oxnard Aquifer, through Figure 7-5, Monitoring Network Wells Screened in the Grimes Canyon Aquifer.

7.1 Summary Of Changes to the Monitoring Network

Groundwater data for the Subbasin has been collected from a network of more than 200 wells screened in the UAS and LAS. These wells are monitored regularly for water level and water quality by United Water Conservation District (UWCD) and Ventura County Watershed Protection District. A summary of the changes to the monitoring network for each district are described below.

Changes to UWCD's Monitoring Activities

UWCD monitors the majority of the wells in the network. Since the adoption of the GSP, nine wells have been removed from the UWCD monitoring network (Table 7-1, UWCD Wells Removed from the Network), either due to lack of access or well destruction, and 14 wells have been added to the monitoring network (Table 7-2, UWCD Wells Added to the Network). Of the wells removed from the network, seven were either screened in multiple or unassigned aquifers, one was screened in the Mugu aquifer, and one was screened in the Hueneme aquifer. Two wells had been used to monitor water quality and seven were for water level measurements. The wells added to the monitoring schedule include five wells screened in the Mugu aquifer; two wells screened in each the Oxnard and Fox Canyon aquifers; one well screened in each the Hueneme and Grimes Canyon aquifers, and two wells screened in multiple aquifers within the LAS. All of the wells are scheduled for monthly or bimonthly water level sampling and one well also includes quarterly water quality sampling.

Table 7-1. UWCD Wells Removed from the Network

State Well Number (SWN)	Main Use	Screened Aquifer	Screened Aquifer System	Water Level, Water Quality
02N22W27M02S	Municipal	Unassigned	UAS	WQ
02N21W06P01S	Agricultural	Multiple	Unassigned	WL
02N21W29L04S	Agricultural	Multiple	LAS	WL
02N21W30A01S	Agricultural	Unassigned	LAS	WL
02N22W14P02S	Municipal	Multiple	UAS	WL
02N22W23B02S	Municipal	Multiple	UAS	WL
02N22W27M02S	Municipal	Unassigned	UAS	WQ
02N22W36E04S	Municipal	Hueneme	LAS	WL
02N22W36E05S	Municipal	Mugu	UAS	WL

Table 7-2. UWCD Wells Added to the Network

State Well Number (SWN)	Main Use	Screened Aquifer	Screened Aquifer System	Manual Water Level Monitored Bimonthly or Monthly	Transducer and Manual Water Levels	Water Level Sampling Schedule[a,b]	Water Quality Sampling Schedule[a]
02N22W23H05S	Monitoring	Mugu	UAS	Monthly	Yes	Monthly	Quarterly
01N21W16P05S	Monitoring	Hueneme	LAS	Monthly		Monthly	
01N21W16P06S	Monitoring	Mugu	UAS	Monthly		Monthly	
01N21W16P07S	Monitoring	Oxnard	UAS	Monthly		Monthly	
01N21W16P08S	Monitoring	Grimes	LAS	Monthly		Monthly	
01N21W16P09S	Monitoring	Fox	LAS	Monthly		Monthly	
01N21W16P10S	Monitoring	Fox	LAS	Monthly		Monthly	
01N22W05C03S	Agricultural	Oxnard	UAS	Bi-monthly		Bimonthly	
02N21W30F02S	Agricultural	Multiple	LAS	Monthly		Monthly	
02N22W13B01S	Agricultural	Multiple	LAS	Monthly		Monthly	
02N22W23F07S	Municipal	Mugu	UAS		Yes	Monthly	
02N22W14P04S	Municipal	Mugu	UAS		Yes	Monthly	
02N22W23B10S	Municipal	Mugu	UAS		Yes	Monthly	

Ventura County Watershed Protection District had a total of 18 wells removed from and 6 wells added to the monitoring schedule (Table 7-3, VCWPD Wells Removed from the Network; and Table 7-4, VCWPD Wells Added to the Network). Of the wells removed from the monitoring schedule, 15 were screened in multiple or unassigned aquifers, 1 was screened in the FCA, 1 was screened in the Hueneme aquifer, and 1 was screened in the Oxnard aquifer. Thirteen of the wells removed were sampled for water quality and five were monitored for water levels. The wells added to the monitoring schedule are all scheduled for quarterly water level monitoring. Two wells are screened within the FCA, and one well is screened in each the Hueneme, Mugu, Oxnard, and Grimes Canyon aquifers.

Table 7-3. VCWPD Wells Removed from the Network

State Well Number (SWN)	Main Use	Screened Aquifer	Screened Aquifer System	Water Level, Water Quality
01N21W19J05S	Agricultural	Multiple	LAS	WQ
01N21W20N07S	Domestic	Multiple	UAS	WL
01N21W21H03S	Agricultural	Unassigned	LAS	WQ
01N21W32K01S	Municipal	FCA	LAS	WL
01N22W12N03S	Agricultural	Multiple	LAS	WL
01N22W14K01S	Agricultural	Oxnard	UAS	WL
01N22W19A01S	Municipal	Hueneme	LAS	WQ
01N22W21B03S	Municipal	Multiple	LAS	WL
01N22W25K01S	Agricultural	Unassigned	UAS	WQ
01N22W26Q01S	Agricultural	Unassigned	Both	WQ
02N21W19A01S	Domestic	Multiple	UAS	WQ
02N21W20M03S	Agricultural	Multiple	UAS	WQ
02N22W24R02S	Domestic	Unassigned	UAS	WQ
02N22W25A02S	Agricultural	Unassigned	UAS	WQ
02N22W25F01S	Industrial	Unassigned	UAS	WQ
02N22W27M02S	Municipal	Unassigned	UAS	WQ
02N22W36F01S	Domestic	Unassigned	Unassigned	WQ
02N22W36F02S	Agricultural	Unassigned	UAS	WQ

Table 7-4. VCWPD Wells Added to the Network

State Well Number (SWN)	Main Use	Screened Aquifer	Screened Aquifer System	Manual Water Levels Monitored by VCWPD	Water Quality Samples Collected by VCWPD	Water Level Sampling Schedule	Water Quality Sampling Schedule
01N21W16P05S	Monitoring	Hueneme	LAS	Yes	—	Monthly	—
01N21W16P06S	Monitoring	Mugu	UAS	Yes	—	Monthly	—
01N21W16P07S	Monitoring	Oxnard	UAS	Yes	—	Monthly	—
01N21W16P08S	Monitoring	Grimes	LAS	Yes	—	Monthly	—
01N21W16P09S	Monitoring	Fox	LAS	Yes	—	Monthly	—
01N21W16P10S	Monitoring	Fox	LAS	Yes	—	Monthly	—

7.2 Data Gaps

7.2.1 Data Gaps That Have Been Partially Addressed

7.2.2 Spatial Data Gaps

FCGMA has undertaken several steps toward filling data gaps identified in the GSP. At the request of FCGMA, DWR installed a nested monitoring well cluster in 2019 near Revolon Slough, within the Oxnard Pumping Depression Management Area, through its Technical Support Services program. In addition, FCGMA is constructing two additional nested monitoring well clusters in the Subbasin partially funded through DWR's Sustainable Groundwater Management Implementation Grant: one located near the boundary with the WLPMA, and one located in the EOPMA. Data collected through these wells will help characterize groundwater conditions in areas identified as data gaps in the GSP. The construction of these three monitoring well clusters addresses three spatial data gaps identified in the GSP.

7.2.3 Subsidence Monitoring

The GSP recommended incorporating land subsidence monitoring as data becomes available. Since adoption of the GSP, DWR has begun publishing remotely sensed land subsidence measurements. FCGMA has incorporated these data into the GSP monitoring network.

7.2.4 Shallow Groundwater Monitoring near Surface Water Bodies and GDEs

The GSP identified data gaps in the network of wells that monitoring shallow groundwater monitoring near surface water bodies and GDEs. FCGMA is currently constructing shallow groundwater monitoring wells in three locations in the Subbasin: one along Revolon Slough, one along the lower portion of Santa Clara River, and one near Calleguas Creek. Data collected via these wells will help to characterize the degree of interaction between surface water, groundwater conditions in the perched aquifer, and groundwater conditions in the underlying principal aquifers. These new wells are partially funded through DWR's Sustainable Groundwater Management Implementation Grant.

7.2.5 Remaining Data Gaps

As described in the GSP, the existing monitoring network in the Subbasin is sufficient to document groundwater and can be used to document progress towards sustainability. Potential monitoring network improvements that address data gaps that remain from the GSP are summarized below.

7.2.5.1 Water Level Measurements: Spatial Data Gaps

The GSP identified data gaps in the spatial and vertical distribution of groundwater elevation measurements in the Subbasin and recommended construction of:

- A monitoring well or wells near the boundary between the Subbasin and the WLPMA.
- A monitoring well or wells within the East Oxnard Plain Management Area.

- A monitoring well or wells within the Oxnard Pumping Depression Management Area.
- A monitoring well or wells within the West Oxnard Plain Management Area.

As described in Section 7.2.1, Data Gaps That Have Been Partially Addressed, the newly constructed monitoring wells in the Subbasin, help to address data gaps near the boundary between the Subbasin and WLPMA, and within the Oxnard Pumping Depression Management Area. Opportunities to construct a monitoring well, or wells, within the West Oxnard Plain Management Area will be evaluated as part of FCGMA's formal project evaluation and prioritization process.

Since 2016, an obstruction in the well head has prevented manual depth to water measurements at well 01N22W26J03S, a key well screened in the Oxnard aquifer within the Saline Intrusion Management Area. Because of this, this well has been removed from the key well network. FCGMA anticipates that additional depth-discrete groundwater monitoring wells will be constructed in the Saline Intrusion Management Area over the next five years as part of implementing Phase I of UWCD's EBB project. FCGMA will evaluate the appropriateness of incorporating these wells into the key well network as data are collected.

7.2.5.2 Water Level Measurements: Temporal Data Gap

The DWR Monitoring Protocols Best Management Practices (DWR 2016a) states the following:

> Groundwater elevation data … should approximate conditions at a discrete period in time. Therefore, all groundwater levels in a basin should be collected within as short a time as possible, preferably within a 1-to-2-week period.

The DWR Monitoring Networks Best Management Practices (DWR 2016b) states the following:

> Groundwater levels will be collected during the middle of October and March for comparative reporting purposes.

Currently, groundwater elevation measurements are not scheduled according to these criteria because FCGMA relies on monitoring by several other agencies.

This temporal data gap has affected the consistency of seasonal low and high measurements at three key wells in the Subbasin: 02N22W36E03S, 02N22W36E04S, and 02N22W36E05S. FCGMA anticipates coordinating with the lead monitoring agency to identify opportunities to collect groundwater elevation measurements at these wells within the recommended October and March measurement windows.

To minimize the effects of this type of temporal data gap in the future, it will be necessary to coordinate the collection of groundwater elevation data to occur within a 2-week window during the key reporting periods of mid-March and mid-October. The recommended collection windows are October 9–22 in the fall and March 9–22 in the spring. Additionally, as funding becomes available, pressure transducers should be added to wells in the groundwater monitoring network. Pressure transducer records provide the high-temporal-resolution data that allows for a better understanding of water level dynamics in the wells related to groundwater production, groundwater management activities, and climatic influence. Installing pressure transducers in agricultural irrigation wells requires installation of sounding tubes to below the turbine pump bowls and modification of the wellhead.

7.3 Functionality of the Water Level Monitoring Network

While data gaps remain in the Subbasin, the spatial and temporal coverage of the existing groundwater monitoring network is sufficient to provide an understanding of representative water level conditions in the UAS and LAS throughout the Subbasin (Figures 7-1 to 7-5). FCGMA anticipates evaluating opportunities to fill these data gaps over the next five years as part of GSP implementation.

Actions that would improve the spatial and temporal resolution of aquifer specific groundwater elevations are discussed in the GSP (FCGMA 2019). The new monitoring well cluster in the Oxnard Pumping Depression Area improved spatial resolution across all aquifers. However, only one well in the area is screened within the GCA. Additional wells would help constrain groundwater gradients between the Subbasin and PVB. Additional monitoring well locations within the West Oxnard Plain Management Area would help constrain groundwater gradients in the northwest part of the Subbasin. Currently, groundwater elevations are not scheduled according to the recommended collection windows of October 9 to 22 in the fall and March 9 to 22 in the spring, based on DWR Monitoring Networks Best Management Practices (DWR 2016). This temporal resolution could be improved further with additional wells equipped with transducers as funding becomes available.

7.4 Functionality of Additional Monitoring Network

DWR provides TRE ALTAMIRA InSAR Subsidence Data that characterizes land surface deformations across the Subbasin. Updates are provided annually with point data and raster interpolations of total vertical displacement since June 13, 2015, and annual vertical displacement rates. This data will be used in conjunction with groundwater elevation data to monitor land subsidence with relation to groundwater extraction.

Table 7-5. Revisions to the Key Well Network

State Well Number	Management Area	Aquifer	GSP Undesirable Result	Issue	Identified alternative	Resolution
01N22W26J03S	Saline Water Intrusion Management Area	Mugu	SWI, reduction in groundwater storage	Obstructed access to the well has not allowed for measurements since 2016. Needs repair or replacement with another well.	01N22W35E04S	Monitoring well (closer to the coast) is measured for WL and WQ by UWCD.

8 FCGMA Authorities and Enforcement Actions

8.1 Actions Taken by the Agency

This section describes relevant actions taken by FCGMA and includes a summary of regulations or ordinances related to the GSP, per GSP Emergency Regulations Section 356.4(g). As a groundwater management agency established by the California Legislature in 1982 with the Fox Canyon Groundwater Management Agency Act, FCGMA had adopted many ordinances and regulations related to managing the Basin prior to adoption of the GSP in December 2019.

Table 8-1. Summary of Actions Taken by the Agency

Date Adopted	Regulatory Action	Description
4/22/2020	Resolution No. 2020-03 Establishing Policies and Procedures for Granting Variances from the Initial Extraction Allocation Under the Ordinance to Establish an Allocation System for the Oxnard and Pleasant Valley Groundwater Basins	Facilitated implementation of new extraction allocation system by establishing policies and procedures for granting variances to initial allocations.
5/27/2020	An Ordinance to Adjust Extraction Allocations to Facilitate the Transition from Calendar Year to Water Year Reporting of Groundwater Extractions	Established the process to transition from Agency's traditional calendar year extraction reporting to reporting by water year.
7/22/2020	An Ordinance to Amend the Ordinance Extending the Phase 2 Water Market Pilot Program	Extended FCGMA's Water Market Pilot Program through October 31, 2021.
10/28/2020	An Ordinance to Amend the Ordinance to Establish an Allocation System for the OPV Groundwater Basins to Reduce the Potential for Imposition of Surcharges	Eased transition to new allocation ordinance for pumpers with reduced extraction allocations under new ordinance.
10/28/2020	Resolution No. 2020-05 Imposing a Fee on Groundwater Extractions to Establish a Reserve Fund to be Used to Pay the Cost and Expenses of Actions and Proceedings Related to FCGMA's Groundwater Sustainability Program	Imposed a new $20 per AF fee on all but de minimus pumpers for legal expenses related to actions and proceedings related to FCGMA's GSP implementation.
10/2/2020	Resolution No. 2020-07 Increasing Tiered Groundwater Extraction Surcharge Rates.	Increased the surcharge rate to $1,549 for extractions that exceed a pumper's extraction allocation.
3/24/2021	Ordinance to Amend the Ordinance to Establish an Allocation System for the Oxnard and Pleasant Valley Groundwater Basins	Modified reporting requirements for mutual water companies, special districts, and municipalities for groundwater or in lieu deliveries for agricultural use outside of the Basin or Agency boundary.
3/24/2021	An Ordinance to Exempt Domestic Operators from the Requirement that Flowmeters be Equipped with Advanced Metering Infrastructure (AMI) Telemetry	Exempts domestic pumpers that extract 2 AF or less per year with specified maximum pump discharge and horsepower from Agency's AMI requirements.

Table 8-1. Summary of Actions Taken by the Agency

Date Adopted	Regulatory Action	Description
2/23/2022	Amended Resolution No. 2020-03 establishing policies and procedures for granting variances from the initial extraction allocation under the ordinance to establish an allocation for the Oxnard and Pleasant Valley Groundwater Basins	Facilitated implementation of extraction allocation system by delegating consideration of certain civil penalties to the Executive Officer and clarified text to avoid potential confusion.
5/25/2022	Ordinance 8.10 to Amend the Fox Canyon Groundwater Management Agency Ordinance Code Relating to Reporting Extractions	Requires monthly extraction reporting by M&I and domestic pumpers, in addition to agricultural pumpers, for wells required to be equipped with AMI.
9/28/2022	Resolution No. 2022-05 Increasing Fee on Groundwater Extractions to Fund the Costs of a Groundwater Sustainability Program.	Increased the groundwater sustainability fee to $29 per AF (except de minimis pumpers) to fund the costs of the groundwater sustainability program.
10/26/2022	Resolution No. 2022-06 Increasing the Tiered Groundwater Extraction Surcharge Rates.	Increased the surcharge rate to $1,841 for extractions that exceed a pumper's allocation.
10/25/2023	Resolution No. 2023-02 Regarding the Accrual, Extraction, and Transfer of Recycled Water Pumping Allocation [Supersedes Resolution 2013-02]	Establishes modified in-lieu program to facilitate City of Oxnard's delivery of recycled water to agricultural pumpers.
3/27/2024	An Ordinance Amending Articles 4 and 6 and Rescinding Section 10.2 of an Ordinance to Establish an Allocation System for the Oxnard and Pleasant Valley Groundwater Basins	Amends the allocation ordinance to comply with a court decision and order; establishes a new Calleguas Flex Program to encourage coordinated use of groundwater and imported water supplies.
4/24/2024	Resolution No. 2024-03 Increasing Tiered Groundwater Extraction Surcharge Rates	Increased the surcharge rate to $1,929 for extractions that exceed a pumper's allocation.

8.1.1 Extraction Reporting

FCGMA implemented several ordinances to improve extraction reporting. These include transition from FCGMA's traditional calendar year reporting to reporting by water year; modified reporting requirements for mutual water companies, special districts, and municipalities for groundwater or in lieu deliveries for agricultural use outside of the Basin; exempting de minimis domestic pumpers from FCGMA's AMI requirements; and requiring monthly extraction reporting by all pumpers required to equip wells with AMI.

8.1.2 Extraction Allocations

Regulating extraction allocations is the primary management action available to FCGMA for managing groundwater demand in the Basin. FCGMA's previous allocation system needed to be replaced to sustainably manage the Basin and a new allocation system was developed over several years concurrent with development of the GSP. The new allocation ordinance was adopted in October 2019 and became effective on October 1, 2020. Since adoption of the GSP, FCGMA has adopted ordinance amendments and resolutions to facilitate transition to the new ordinance, provide policies and procedures for seeking variances, and made modifications required under a court order addressing a challenge to the ordinance. Additionally, FCGMA adopted resolutions increasing tiered groundwater surcharge rates for extractions that exceed allocation. The surcharge provides an economic disincentive to extract groundwater exceeding allocation.

8.1.3 Additional Management Actions

Management actions taken by FCGMA since GSP adoption in addition to extraction allocations include an in-lieu use of recycled water for agricultural irrigation program and extension of a pilot water market. The in-lieu program provides a “recycled water pumping allocation” to the City of Oxnard for delivery of recycled water from its Advanced Water Purification Facility to agricultural operators in the Saline Intrusion and Pumping Depression Management Areas for irrigation in lieu of pumping groundwater. Under the program, the City of Oxnard can extract its recycled water pumping allocation from less impacted areas of the Basin. FCGMA’s Water Market Pilot Program was in effect through the end of Water Year 2021 and allowed purchase of annual allocation for use in the current water year.

8.1.4 Funding

FCGMA adopted a “groundwater sustainability” regulatory fee on extractions to fund development of the GSP. Subsequent to adoption of the GSP, the fee was increased from $14 per acre-foot to $29 per acre-foot to fund the cost of FCGMA’s groundwater sustainability program. FCGMA also adopted a $20 per acre-foot “reserve fee” to fund the cost and expense of legal actions and proceedings brought against FCGMA related to implementation of FCGMA’s groundwater sustainability program. Surcharges collected for extractions exceeding allocation are accounted separate from the operating account and are to be used for acquisition of supplemental water or actions to increase the yield of the Basin. FCGMA has also been investigating establishment of a “groundwater replenishment” fee to fund groundwater supply and replenishment projects and programs.

8.2 Enforcement and Legal Actions by the Agency

FCGMA has a robust ordinance code and set of resolutions that establish programs for basin management and reporting. These include ordinances and resolutions adopted under both the authority of the FCGMA Act and SGMA. The FCGMA Board has adopted policies and procedures for ordinance code violations, including sending notices of violation and assessing civil penalties, for failure to:

- Register an extraction facility.
- Report a change in owner or operator of an extraction facility within 30 days.
- Submit a semi-annual groundwater extraction statement.
- Install and maintain AMI on an extraction facility, unless exempt.
- Submit monthly reports of extractions from AMI, unless exempt.
- Install a flowmeter prior to pumping groundwater from an extraction facility.
- Report flowmeter failure and repair or replace the flowmeter within the required timeframe.
- Test and calibrate a flowmeter at the required frequency.
- Remit payment of groundwater extraction fees or civil penalties

The FCGMA Board additionally established a tiered surcharge for extractions in excess of extraction allocation.

8.3 Plan Amendments

The work completed as part of this periodic GSP evaluation will be integrated into an amendment of the Oxnard Subbasin GSP. This amendment will include updates to the:

- List of projects and management actions that support GSP implementation.
- Hydrogeologic conceptual model of the Subbasin.
- Future scenario modeling.
- Estimates of the sustainable yield for the UAS and LAS.
- Minimum thresholds, measurable objectives, and interim milestones.
- Representative Monitoring Well (Key Well) Network.
- GSP monitoring network.

FCGMA anticipates adopting the Oxnard Subbasin GSP amendment and submitting to DWR in the first quarter of 2025.

9 Outreach, Engagement, and Coordination

9.1 Outreach And Engagement

A public outreach and engagement plan was developed for the Oxnard Subbasin GSP (FCGMA 2019). The outreach and engagement plan:

- Discusses FCGMA's decision-making process and how public input and responses will be used.
- Identifies opportunities for public engagement.
- Describes how FCGMA encourages the active involvement of diverse social, cultural, and economic elements of the population in the PVB; and
- Describes the method FCGMA shall follow to inform the public about progress implementing the plan, including the status of projects and management actions.

Since adopting the GSP for the Subbasin in 2019, the FCGMA Board of Directors has continued to prioritize outreach and engagement with interested parties and has followed the elements of the outreach and engagement plan developed for the GSP. Review of the outreach and engagement plan for this First Periodic Evaluation indicates that the methods described for outreach and engagement activities are relevant to GSP implementation and are being used successfully to support interested party involvement in the GSP implementation process.

During the GSP development and adoption process, interested parties expressed an interest in developing additional projects to increase the sustainable yield of the Subbasin. FCGMA engaged with interested parties to solicit project descriptions, which were included in the 2022 GSP annual report (FCGMA 2022). In order to assist the FCGMA Board with evaluating the projects, FCGMA collaborated with interested parties to develop a project evaluation criteria checklist and held multiple operations committee meetings at which the project evaluation process was discussed, and project descriptions were refined. This process will allow FCGMA and project proponents to pursue project funding opportunities and has helped the implementation of project and management actions.

FCGMA has provided updates on GSP implementation activities and public participation opportunities to interested parties through direct electronic communications and posts to the FCGMA website. Additional, updates and opportunities for public comment were provided at FCGMA Regular Board meetings, FCGMA Special Board meetings, and FCGMA Board committee meetings. Meeting agendas and minutes, as well as video recordings of all FCGMA Board meetings and workshops, were made available on the FCGMA website. The Draft Periodic Evaluation of the GSP, was made available for review on the GSP website for 45 days. FCGMA encouraged active participation from interested parties through public workshops (August 30, 2023; April 25, 2024; and September 9, 2024). Additionally, in response to requests from interested parties, the FCGMA Board held a technical workshop focused on baseline and future model scenarios for both the Subbasin and the PVB on May 30, 2024. This workshop provided interested parties with an opportunity to review the numerical model updates and future model scenarios during the development of this periodic evaluation. Comments made during the technical workshop were used to refine the model scenarios proposed and to develop an additional modeling scenario to evaluate impacts of a geographic redistribution groundwater production on seawater intrusion in the Subbasin.

9.2 GSA Board

The FCGMA Board of Directors holds monthly meetings during which the Board is apprised of ongoing projects and upcoming initiatives that impact groundwater conditions in the basins under its jurisdiction, including the LPVB. Interested parties are informed in advance of each Board meeting via email and the Board meeting schedule is posted on the FCGMA website. Technical updates, consideration of impacts to beneficial uses and users of groundwater, and feedback from interested parties serve as the underpinnings for policy decisions made by the Board.

Since adopting the GSP in 2019, the Board has held 52 regular meetings and 25 special meetings. The topics discussed at these meetings included:

- GSP Implementation
- Grant Opportunities for Projects and Management Actions
- GSP Annual Reports
- GSP Periodic Updates
- Groundwater Allocation Ordinances
- Groundwater Adjudication Proceedings

The Board is composed of members representing the County of Ventura, the United Water Conservation District, the seven small water districts within the FCGMA jurisdiction, the five incorporated cities within the FCGMA jurisdiction, and the farmers. Members of the current Board have served for multiple years and are fully informed of the requirements for sustainable management of the PVB under SGMA.

9.3 Summary of Coordination between Agencies

FCGMA has a long-standing history of coordination with other agencies in the Subbasin, including the Camrosa Water District – Oxnard GSA, the Oxnard Outlying Areas GSA (County of Ventura), and United Water Conservation District. FCGMA also coordinates with the Federal and state agencies that oversee the Channel Islands Air National Guard Station, Naval Base Ventura County, and state beaches within the Subbasin. There are no federally recognized tribal communities within the Oxnard Subbasin. Coordination between relevant agencies in the Subbasin has continued throughout the implementation of the GSP, with FCGMA holding regular meetings to develop projects, pursue grant funding opportunities, and organize collaborative strategies for land use planning, well permitting, and water management within the Subbasin. Because of the history of coordination between agencies that began before SGMA was enacted, no new inter-agency agreements have been required to manage the Subbasin since the GSP was adopted. Similarly, no changes were made to the GSP in response to new local requirements by these agencies.

The Subbasin shares a boundary with both the PVB and LPVB to the east. FCGMA is the primary GSA, along with Camrosa Water District and the County of Ventura, for these adjacent basins. The GSPs for the Subbasin, PVB, and LPVB were all prepared by FCGMA using consistent data, methods, and tools, and the sustainable management criteria for each basin were developed with the consideration of impacts on the adjacent basins. The internal coordination that has been in place since the formation of the FCGMA in 1982 has continued through the first 5 years of GSP implementation. The FCGMA Board considers the impacts of implementation activities and policy decisions on the interested parties in all of the basins within the FCGMA jurisdiction.

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10 Other Information

10.1 Consideration of Adjacent Basins

The Subbasin is hydrogeologically connected, to varying degrees, with the PVB, WLPMA, Mound Subbasin, and Santa Paula Subbasin.

FCGMA, as the lead GSA for the Subbasin, PVB, and LPVB, used a regional approach to determine the combined sustainable yield of all three basins during development of the GSP. The individual sustainable yields and sustainable management criteria for each basin were then established to ensure that each basin is managed with mutually beneficial sustainability goals. DWR found that FCGMA's approach demonstrated an adequate consideration of adjacent basins (DWR 2021). FCGMA has not altered this approach as a result of the first periodic evaluation process because implementation of the GSP has not affected the ability of the PVB or LPVB to achieve their respective sustainability goals. FCGMA will continue to manage the Subbasin with consideration of impacts to the adjacent basins and, as part of GSP implementation, will continue to evaluate the relationship between groundwater production in the PVB and groundwater conditions in adjacent basins.

FCGMA will continue to manage the Subbasin with consideration of impacts to the adjacent basins and, as part of GSP implementation, will continue to evaluate the relationship between groundwater production in the Subbasin and groundwater conditions in adjacent basins.

10.2 Challenges Not Previously Discussed

The most significant challenge for successful implementation of the GSP is acquiring funding to fill data gaps, address DWR recommended corrective actions, and construct projects. After adopting the GSP, FCGMA allocated budget and staff resources to work with external consultants to investigate funding mechanisms to support these efforts, and FCGMA and has implemented a reserve fee to respond to legal challenges. However, development and implementation of replenishment fees sufficient to fund full GSP implementation remains a challenge for the agency. FCGMA is currently evaluating Proposition 218 requirements, as required under SGMA, as they relate to a potential replenishment fee.

Additionally, legal challenges have required the focus of significant staff resources that would have been otherwise allocated to pursuing funding to conduct feasibility studies, develop projects, fill data gaps, and address DWR's recommended corrective actions. The upcoming adjudication of the Subbasin has the potential to require additional time and resources that may pose an additional challenge for the FCGMA over the next five years.

10.3 Legal Challenges

Fox Canyon Groundwater Management Agency (FCGMA) did not take legal action or enforcement in the Subbasin or the PVB in furtherance of their sustainability goals (23 C.C.R. § 356.4(h).) The following discussion describes the lawsuits pending against FCGMA and their effect on FCGMA's implementation of the OPV GSPs and sustainable management of the Subbasin and the PVB.

City of Oxnard v. Fox Canyon Groundwater Management Agency, Los Angeles Sup. Ct. Case No. 20STCP00929

In December 2019, the City of Oxnard (City) filed a petition for writ of mandate challenging FCGMA's adoption of an ordinance intended to transition FCGMA's current groundwater management programs to sustainable groundwater management under SGMA. The ordinance establishes extraction allocations (limits) for all users in the Subbasin and PVB and recognizes the need to reduce allocations in the event the sustainable yield of these basins is less than the total extraction allocations established under the ordinance. In August 2023, the Los Angeles Superior Court issued a writ of mandate requiring FCGMA to amend the ordinance; FCGMA amended the ordinance in March 2024; the City challenged FCGMA's adoption of the amended ordinance in April 2024; and a hearing on FCGMA's amended ordinance is scheduled for August 2024. If the amended ordinance is invalidated, FCGMA will be required to rescind or revise the ordinance including provisions governing extraction allocations. If required to further amend the ordinance, it is unclear at this time whether FCGMA will rescind or further amend the ordinance and what amendments will be adopted. Consequently, the legal effect of the City's lawsuit on FCGMA's implementation of the OPV GSPs and the sustainable management of the Subbasin and PVB is uncertain at this time.

OPV Coalition, et al. v. Fox Canyon Groundwater Management Agency, Santa Barbara Sup. Ct. Case No. VENCI00555357

In June 2021, the OPV Coalition filed a lawsuit against FCGMA, challenging the OPV GSPs, the ordinance that establishes extraction allocations (limits) for all users in the Subbasin and PVB, and requesting an adjudication of all groundwater rights in the Subbasin and PVB. In May 2024, the Court stayed the claims challenging the OPV GSPs and the ordinance establishing allocations in favor of the groundwater adjudication. In June 2024, the Court issued an order dividing the adjudication into three phases with Phase 1 deciding the safe yield and total safe yield; Phase 2 adjudicating all groundwater rights; and Phase 3 dedicated to deciding the challenges to the OPV GSPs and the allocation ordinance, basin governance and management, and whether a physical solution is necessary. At this time, it is unclear what legal effect the lawsuit, in particular the adjudication action, will have on FCGMA's continued ability to implement the OPV GSPs and sustainably manage the Subbasin and PVB. If the Court had given priority to the writ claims challenging the OPV GSPs and the allocation ordinance (rather than the adjudication), review of the OPV GSPs (including their sustainable yield estimates) and the allocation ordinance would be limited to the administrative records and discovery on the GSPs and ordinance would likely be avoided. Because the Court decided to prioritize the adjudication, plaintiffs intend to take discovery on the OPV GSPs and ordinance during the adjudication, which will necessarily divert FCGMA resources from implementation of the OPV GSPs and sustainably managing the Subbasin and PVB.

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11 Summary of Proposed or Completed Revisions to Plan Elements

The work completed as part of this periodic GSP evaluation has resulted in:

- An expanded suite of projects considered as part of GSP implementation.
- Improvements to the hydrogeologic conceptual model of the Subbasin based on newly available data.
- Improvements to the estimate of the sustainable yield of Subbasin that accounts for a range of projects and management actions implemented in the Subbasin.
- Revisions to the monitoring network, including the key well network, used to evaluate groundwater conditions and groundwater sustainability in the Subbasin.

These revisions warrant an amendment to the GSP. A summary of planned revisions to the GSP elements are summarized in Table 11-1, Summary of Proposed Plan Element Revisions.

Table 11-1. Summary of Proposed Plan Element Revisions

Section	Proposed Change	Reference to information in this report that warrants Plan Element Revisions
Administrative Information		
There are no proposed changes to the Administrative Information presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation.		
Basin Setting		
Hydrogeologic Conceptual Model	Description of the aquifers that comprise the UAS near Point Mugu	Section 4.1
	Description of the thickness and extent of the Hueneme Aquifer near Port Hueneme	
	Description of the hydrogeologic connectivity between the UAS and LAS near Point Mugu	
	Description of vertical gradients between the UAS and LAS in the Oxnard Pumping Depression Management Area	
	Description of data gaps and uncertainty in the hydrogeologic conceptual model	
Groundwater Conditions	There are no proposed changes to the Groundwater Conditions presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation.	
Water Budget	Description of Projected Future Water Budget	Section 5.2
	Description of Future Sustainable Yield	Section 5.2.3
Management Areas	There are no proposed changes to the Management Areas presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation.	
Sustainable Management Criteria		
Sustainability Goal	There are no proposed changes to the Sustainability Goal presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation.	
Undesirable Results	Update the interpreted extent to reflect the current 500 mg/L chloride concentration contour, rather than using the interpreted 100 mg/L contour.	Section 2.2.3
Minimum Thresholds	Update groundwater elevation minimum thresholds based on revised future scenarios	Section 6.1
Measurable Objectives	Update groundwater elevation measurable objectives based on revised future scenarios	Section 6.2

Table 11-1. Summary of Proposed Plan Element Revisions

Section	Proposed Change	Reference to information in this report that warrants Plan Element Revisions
Monitoring Network		
Monitoring Network Objectives	There are no proposed changes to the monitoring network objectives presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation.	
Description of Monitoring Network	Incorporate updates to UWCD's and VCWPD's current monitoring program and include newly constructed monitoring wells into the key well network	Section 7.1 and 7.3
Monitoring Network Implementation	There are no proposed changes to the monitoring network implementation presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation	
Protocols for Data Collection and Monitoring	There are no proposed changes to the protocols for data collection and monitoring presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation	
Potential Monitoring Network Improvements	Update the potential new well (PNW) locations based on revisions to the existing monitoring network	Section 7.1 and 7.3
Projects and Management Action		
Projects	Provide updated descriptions of projects included in the GSP	Section 3.1
	Include an expanded suit of projects based on information submitted to FCGMA by other agencies in the Subbasin.	Section 3.2
Management Actions	There are no proposed changes to the management actions presented in the GSP based on the information reviewed and evaluated as part of this periodic GSP evaluation	

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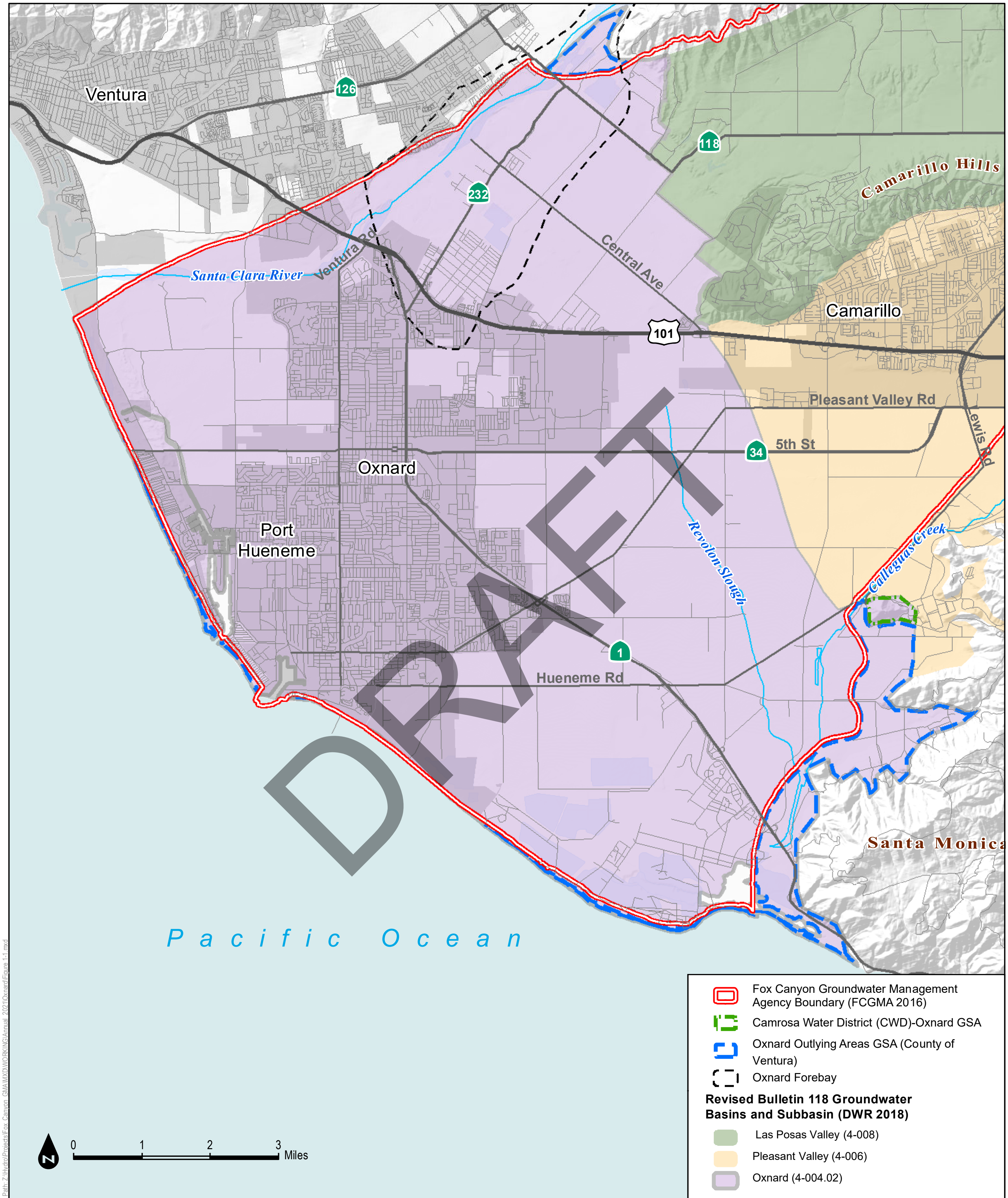
UWCD (United Water Conservation District). 2021d. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. June 2021. Available online: https://www.unitedwater.org/wp-content/uploads/2022/09/UWCD_OFR_2021_01_Ventura_Regional_Groundwater_Flow_Model_Expansion.pdf.

UWCD (United Water Conservation District). 2021e. Model Documentation Report: UWCD Oxnard Plain Surface Water Distribution Model. Open-File Report 2021-03. September 2021. Available online: https://www.unitedwater.org/wp-content/uploads/2021/10/UWCD_OFR_2021_3-Model-Documentation-Report-UWCD-Oxnard-Plain-Surface-Water-Distribution-Model.pdf.



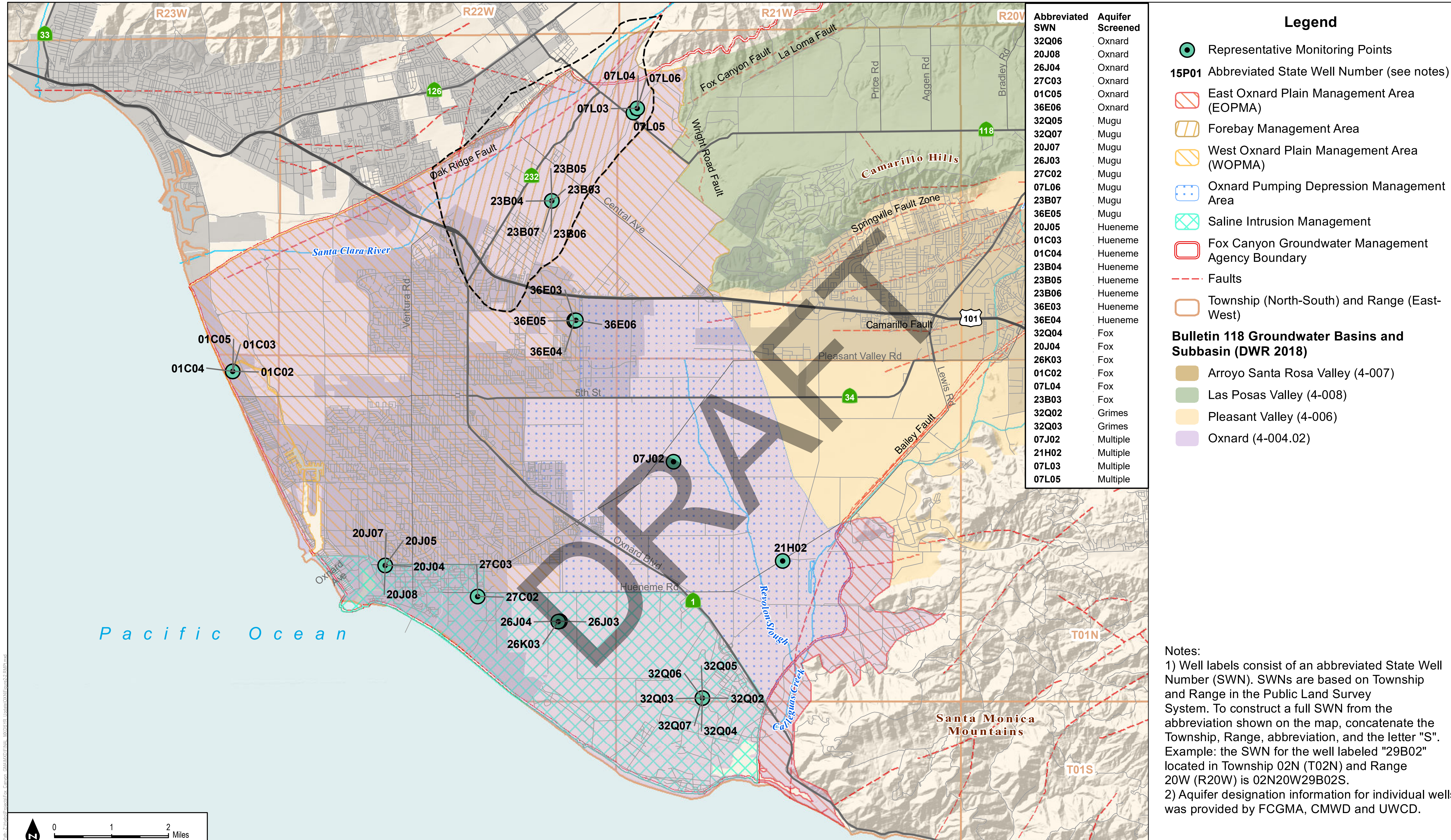
DUDEK

SOURCE: DWR; Santa Barbara County; FCGMA

FIGURE 2-1

Vicinity Map for the Oxnard Subbasin

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

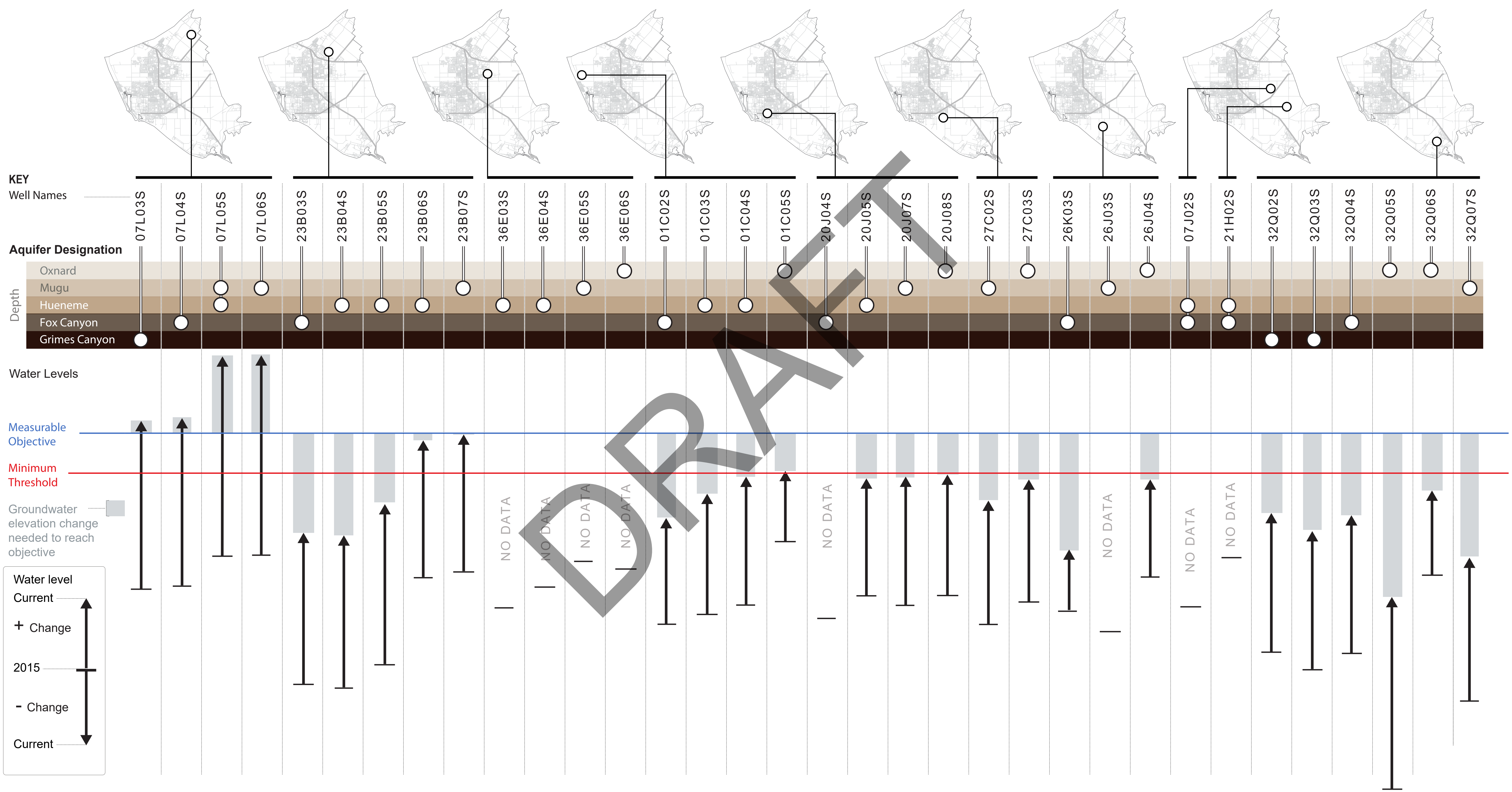


Abbreviated SWN	Aquifer Screened
32Q06	Oxnard
20J08	Oxnard
26J04	Oxnard
27C03	Oxnard
01C05	Oxnard
36E06	Oxnard
32Q05	Mugu
32Q07	Mugu
20J07	Mugu
26J03	Mugu
27C02	Mugu
07L06	Mugu
23B07	Mugu
36E05	Mugu
20J05	Hueneme
01C03	Hueneme
01C04	Hueneme
23B04	Hueneme
23B05	Hueneme
23B06	Hueneme
36E03	Hueneme
36E04	Hueneme
32Q04	Fox
20J04	Fox
26K03	Fox
01C02	Fox
07L04	Fox
23B03	Fox
32Q02	Grimes
32Q03	Grimes
07J02	Multiple
21H02	Multiple
07L03	Multiple
07L05	Multiple

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

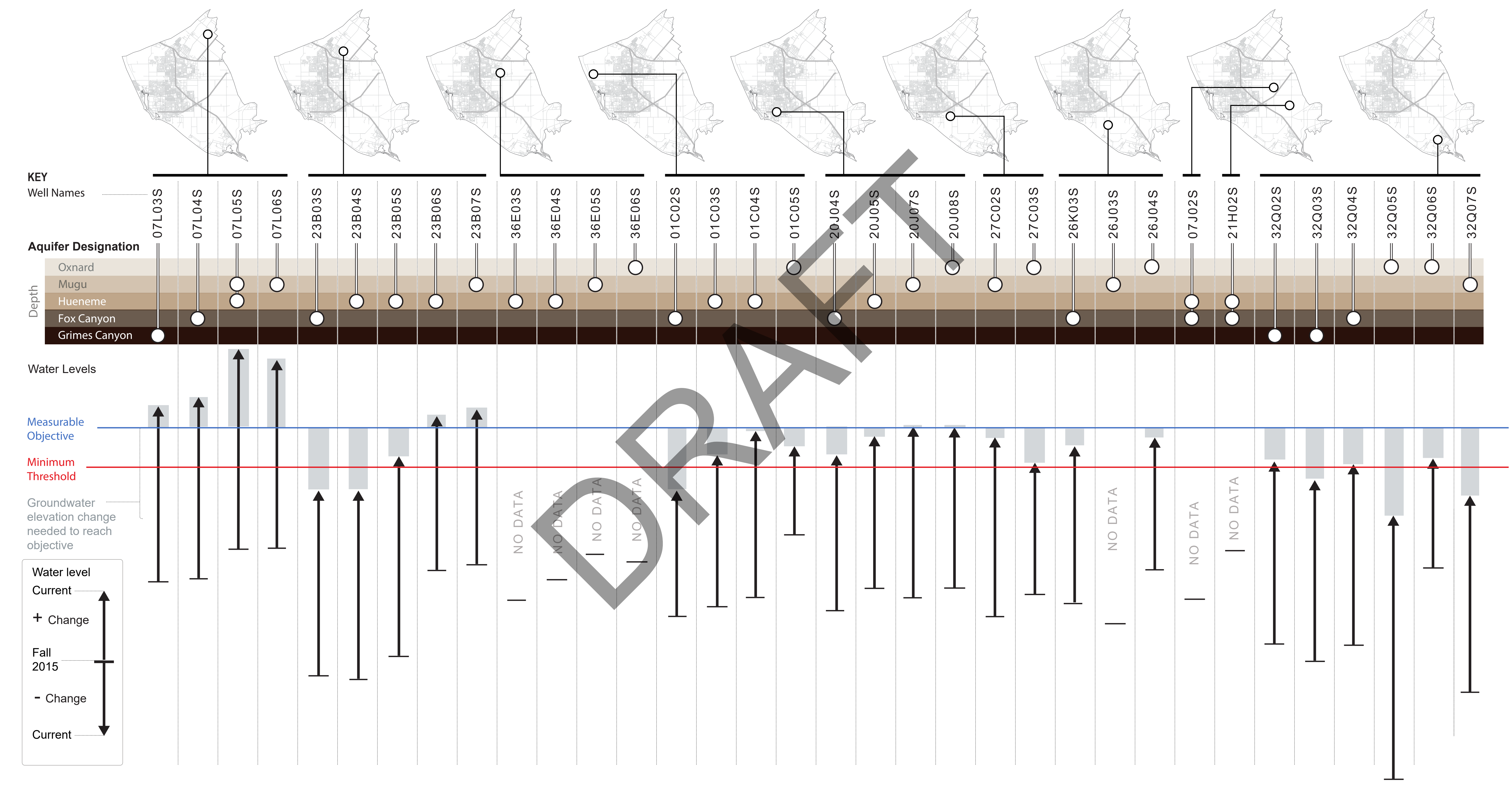
FIGURE 2-2
Representative Monitoring Points in the Oxnard Subbasin



SOURCE:

FIGURE 2-3

Fall 2023 Groundwater Levels Relative to the Minimum Thresholds and Measurable Objectives



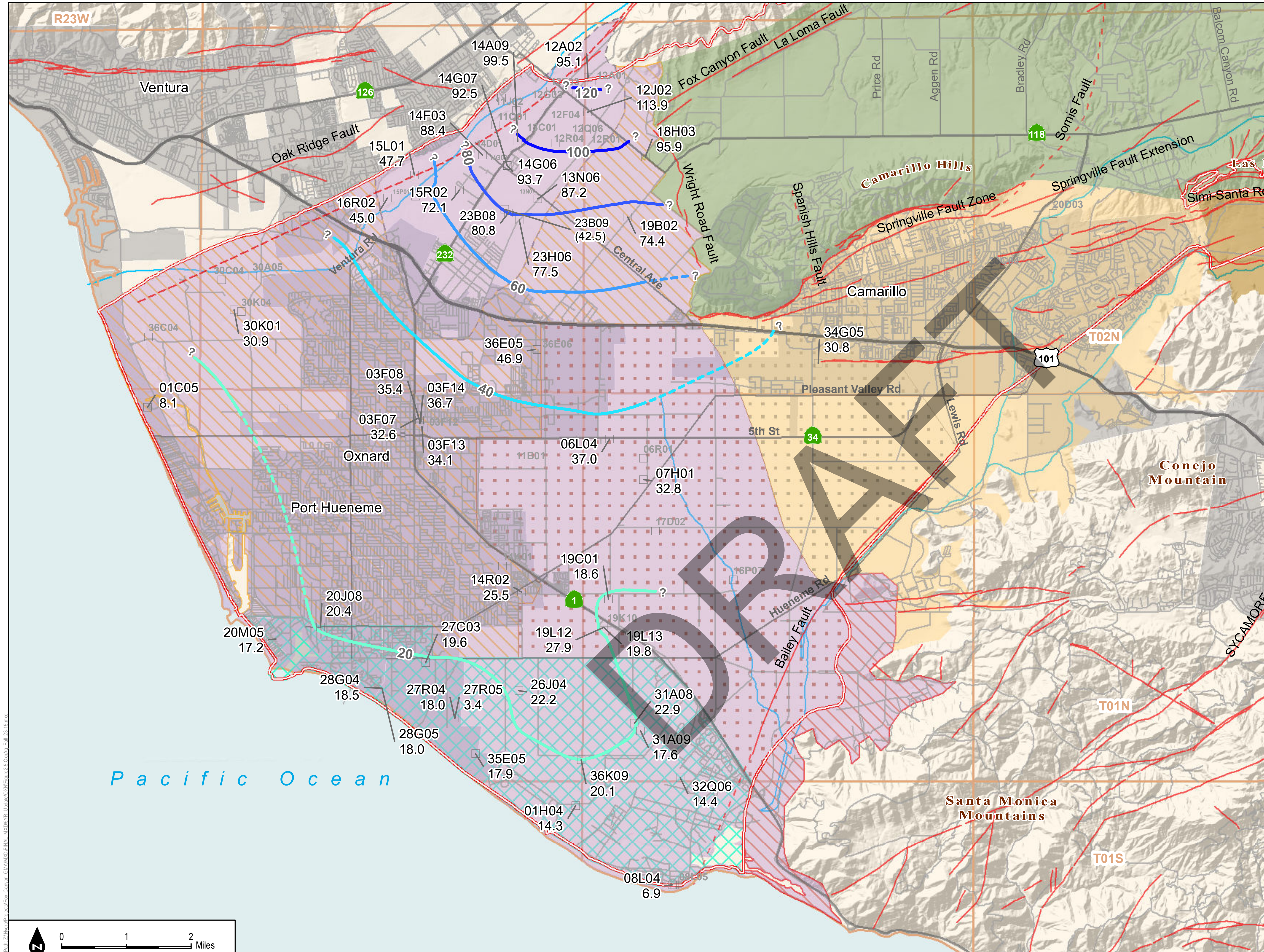
SOURCE:

FIGURE 2-4

Spring 2024 Groundwater Levels Relative to the Minimum Thresholds and Measurable Objectives

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

DUDEK



Legend

- Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.
- Wells screened in the Oxnard Aquifer
- 15P01 — Abbreviated State Well Number (see notes)
- +14.7 — Difference in Fall 2023 to Fall 2015 Groundwater Elevations
- Fox Canyon Groundwater Management Agency Boundary
- Faults (Dashed Where Inferred)
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management
- Pleasant Valley Pumping Depression Management Area
- Township (North-South) and Range (East-West)

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 abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 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 "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.
3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

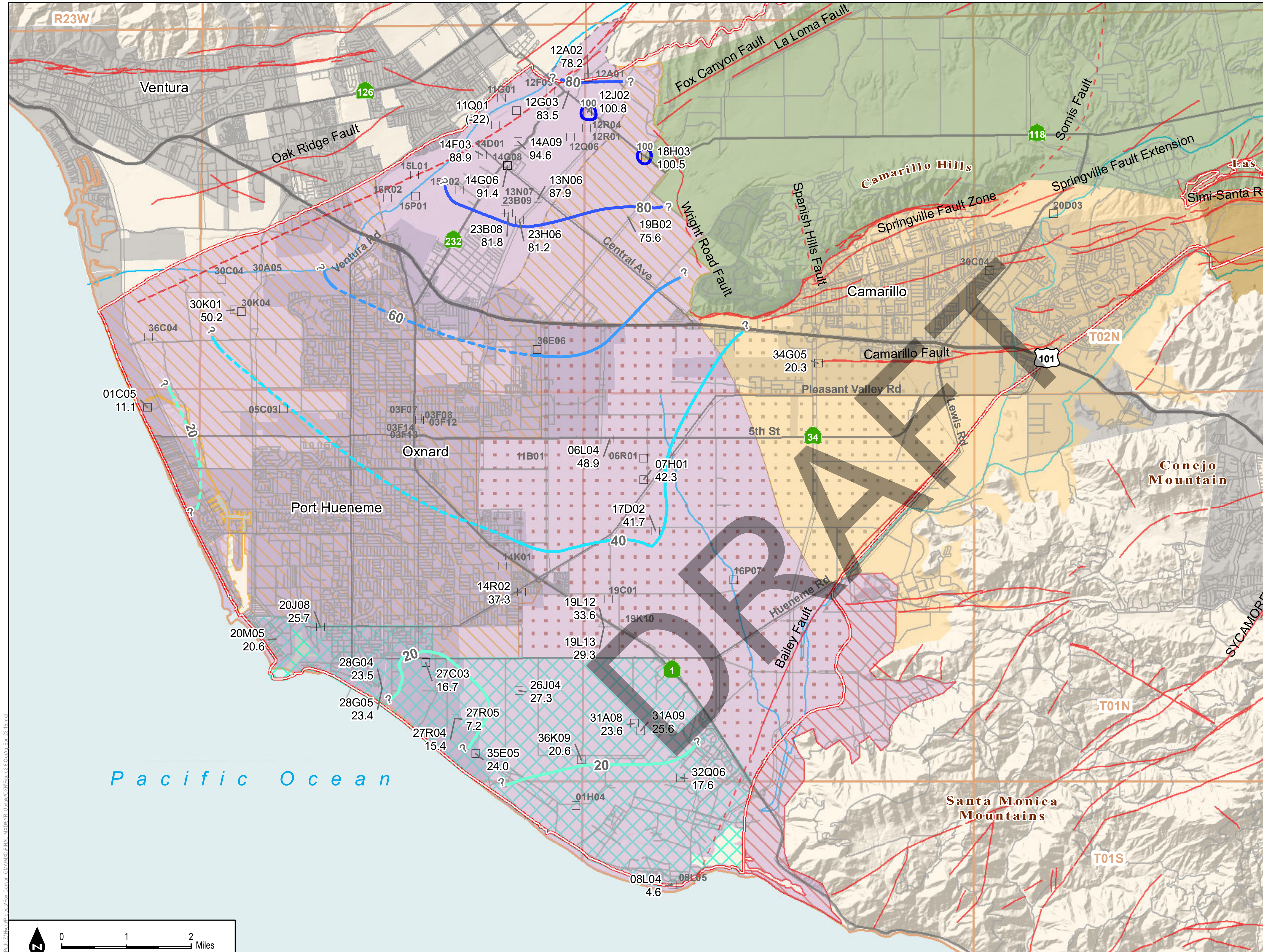
DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-5

Oxnard Aquifer - Groundwater Elevation Changes from Fall 2015 to 2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

- Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.
- Wells screened in the Oxnard Aquifer
- 15P01 Abbreviated State Well Number (see notes)
- +14.7 Difference in Spring 2024 to Spring 2015 Groundwater Elevations
- Fox Canyon Groundwater Management Agency Boundary
- Faults (Dashed Where Inferred)
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management Area
- Pleasant Valley Pumping Depression Management Area
- Township (North-South) and Range (East-West)

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:

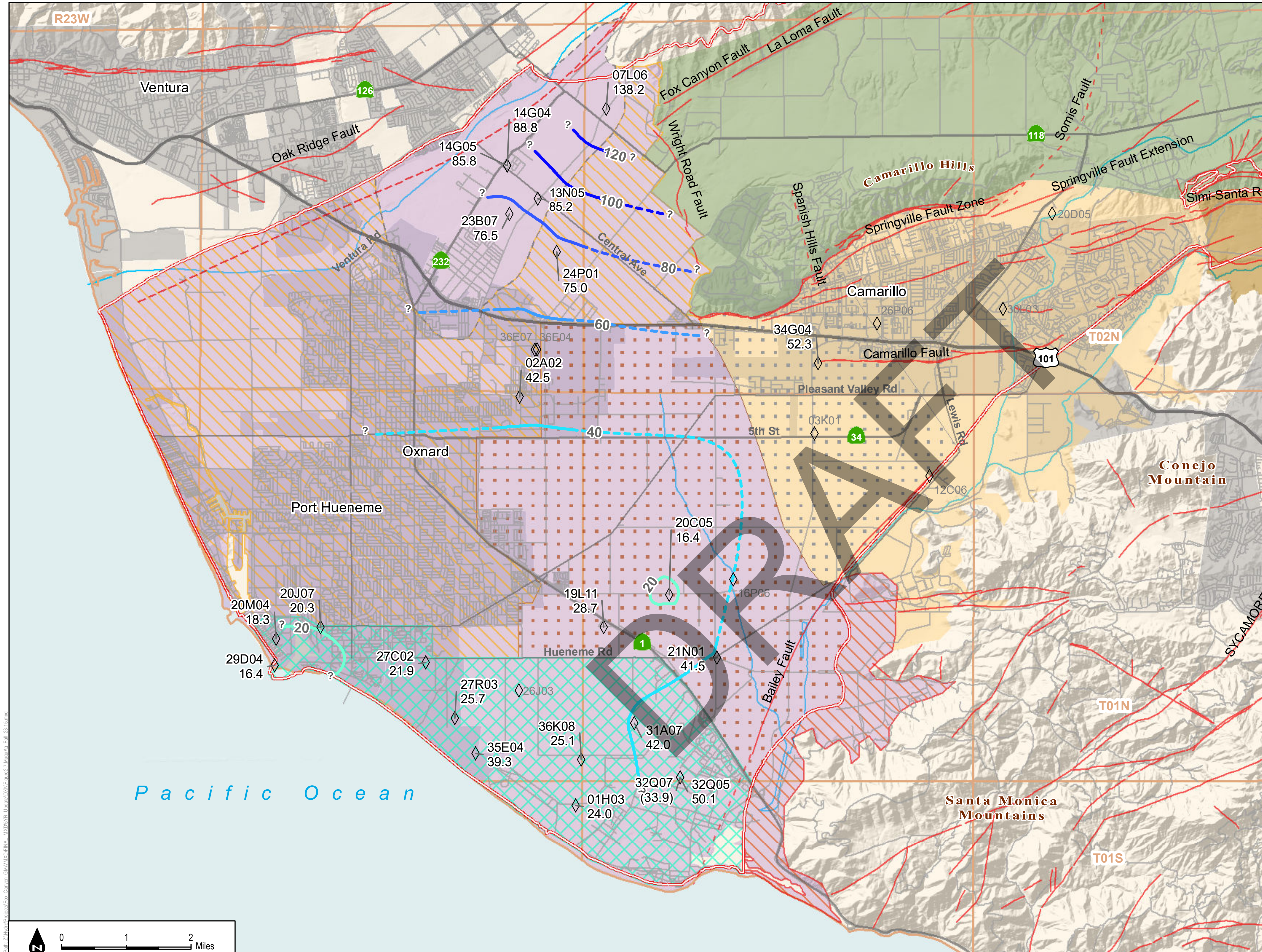
1) Well labels consist of an abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.
3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-6

Oxnard Aquifer - Groundwater Elevation Changes from Spring 2015 to 2024



Legend

- Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.
- ◊ Wells screened in the Mugu Aquifer
- 15P01 Abbreviated State Well Number (see notes)
- +14.7 Change in groundwater elevation (in Feet) from Fall 2023 to Fall 2015
- Faults (Dashed Where Inferred)
- Fox Canyon Groundwater Management Agency Boundary
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management
- Pleasant Valley Pumping Depression Management Area
- Township (North-South) and Range (East-West)

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:

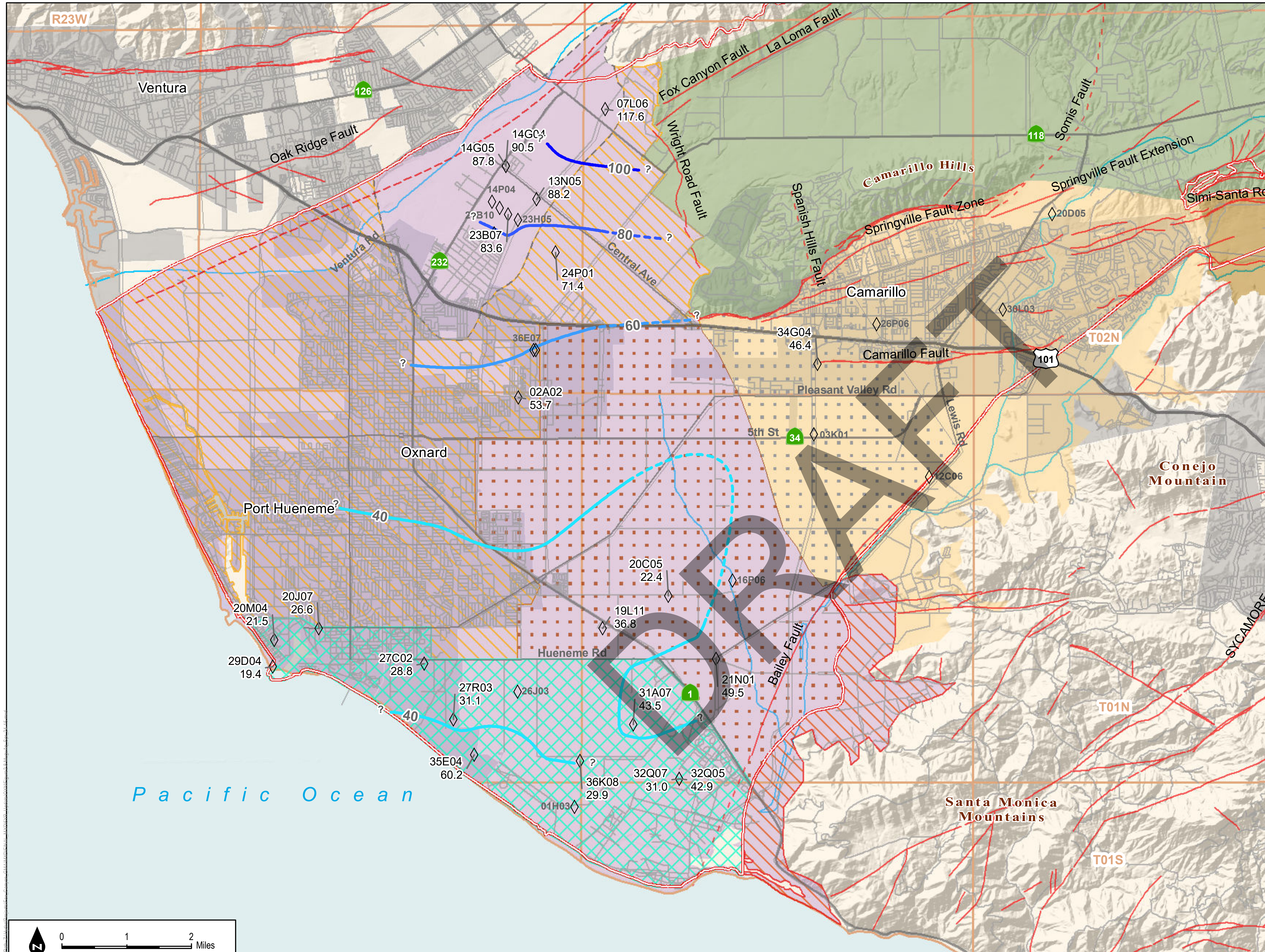
1) Well labels consist of an abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.
3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-7

Mugu Aquifer - Groundwater Elevation Changes from Fall 2015 to 2023



Legend

Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.

Wells screened in the Mugu Aquifer

15P01 Abbreviated State Well Number (see notes)

+14.7 Change in groundwater elevation (in Feet) from Spring 2024 to Spring 2015

Fox Canyon Groundwater Management Agency Boundary

Faults (Dashed Where Inferred)

Forebay Management Area

East Oxnard Plain Management Area (EOPMA)

West Oxnard Plain Management Area (WOPMA)

Oxnard Pumping Depression Management Area

Saline Intrusion Management Area

Pleasant Valley Pumping Depression Management Area

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

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 abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 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 "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.

2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.

3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).

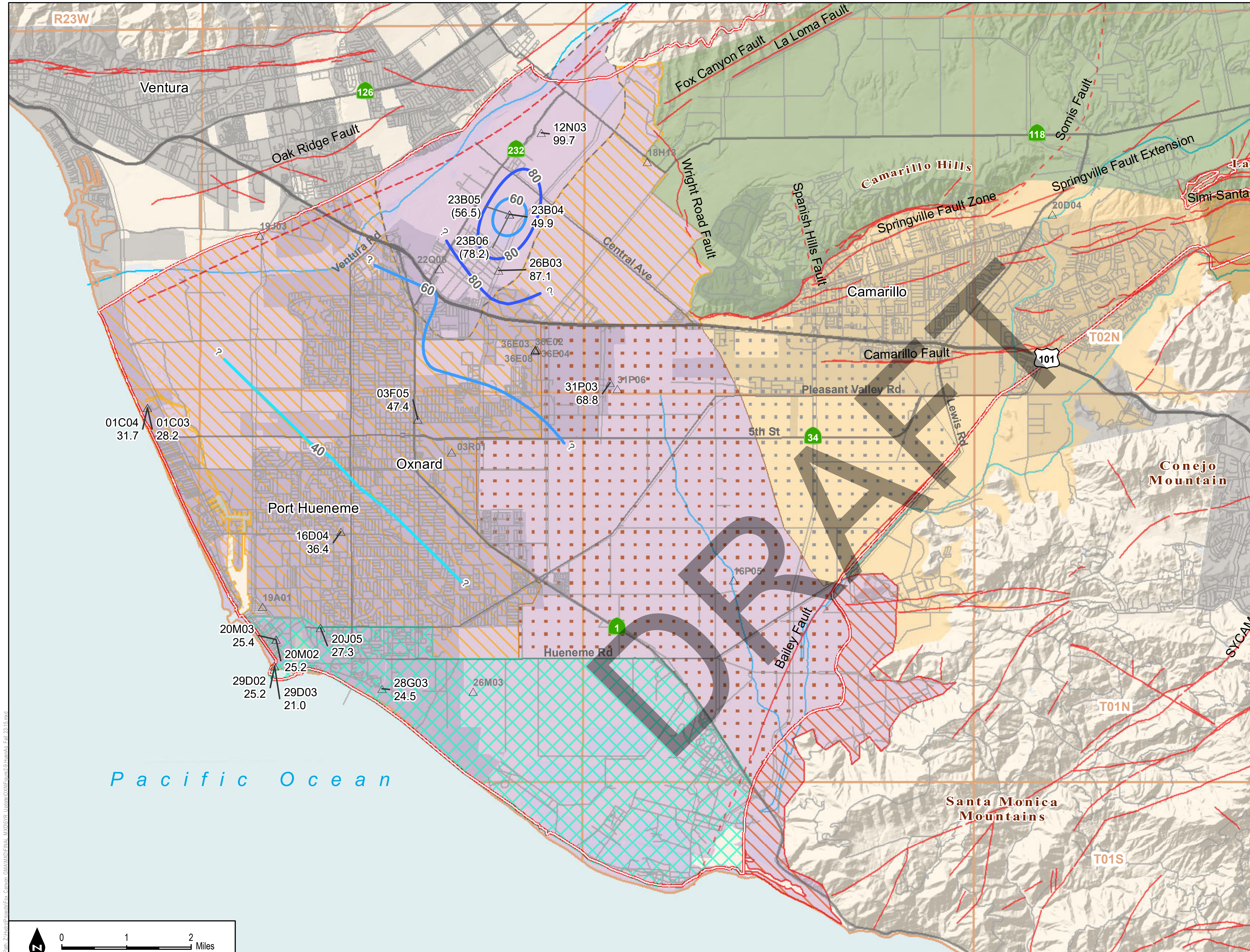
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-8

Mugu Aquifer - Groundwater Elevation Changes from Spring 2015 to 2024



Legend

Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.

Wells Screened in the Hueneme Aquifer

15P01 Abbreviated State Well Number (see notes)

+14.7 Change in groundwater elevation (in feet) from Fall 2015 to Fall 2023

(+14.7) Change in groundwater elevations are not used to create contours

Fox Canyon Groundwater Management Agency Boundary

Faults (Dashed Where Inferred)

Forebay Management Area

East Oxnard Plain Management Area (EOPMA)

West Oxnard Plain Management Area (WOPMA)

Oxnard Pumping Depression Management Area

Saline Intrusion Management Area

Pleasant Valley Pumping Depression Management Area

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

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 abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 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 "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.

2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.

3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).

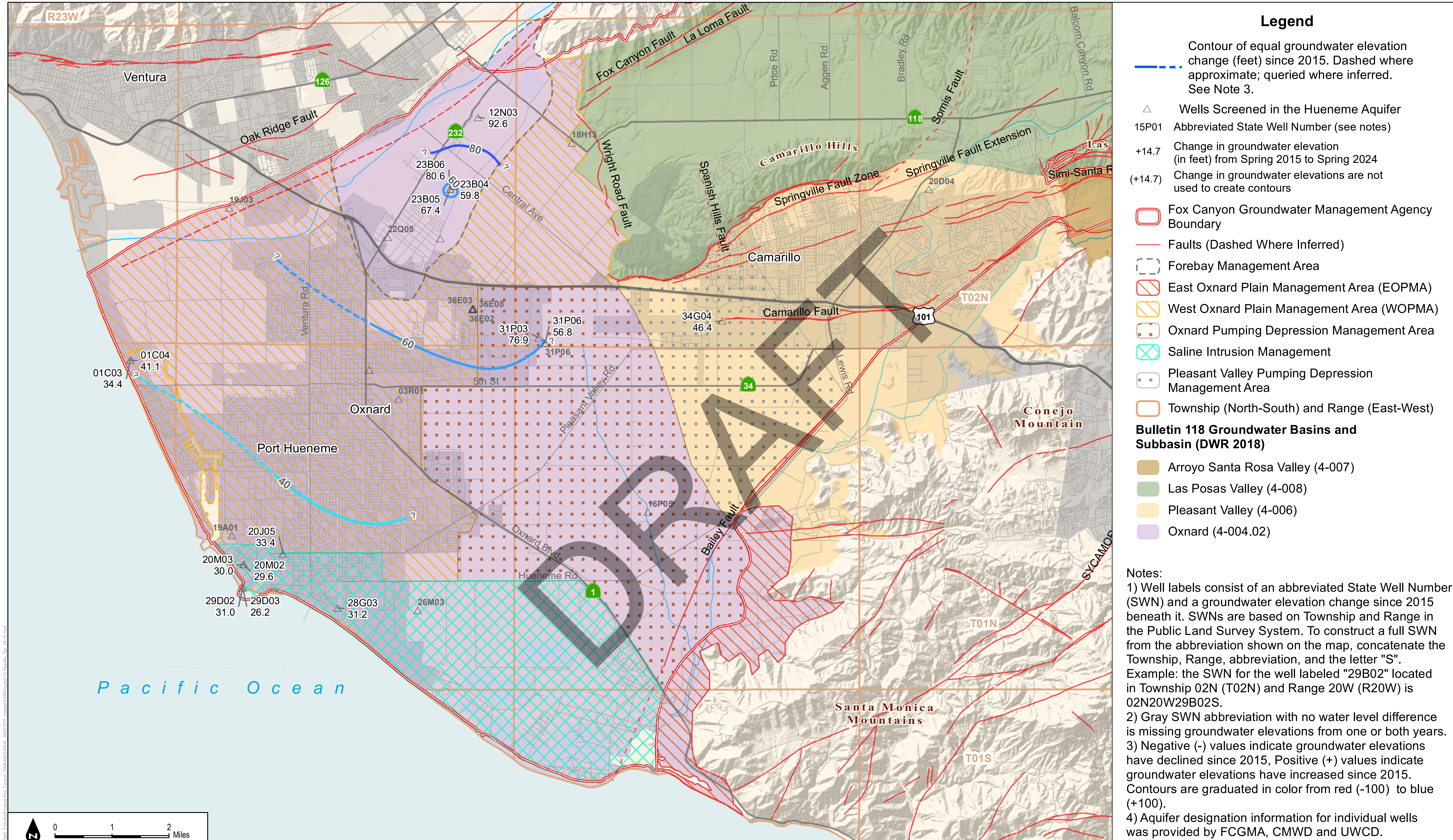
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-9

Hueneme Aquifer - Groundwater Elevation Changes from Fall 2015 to 2023

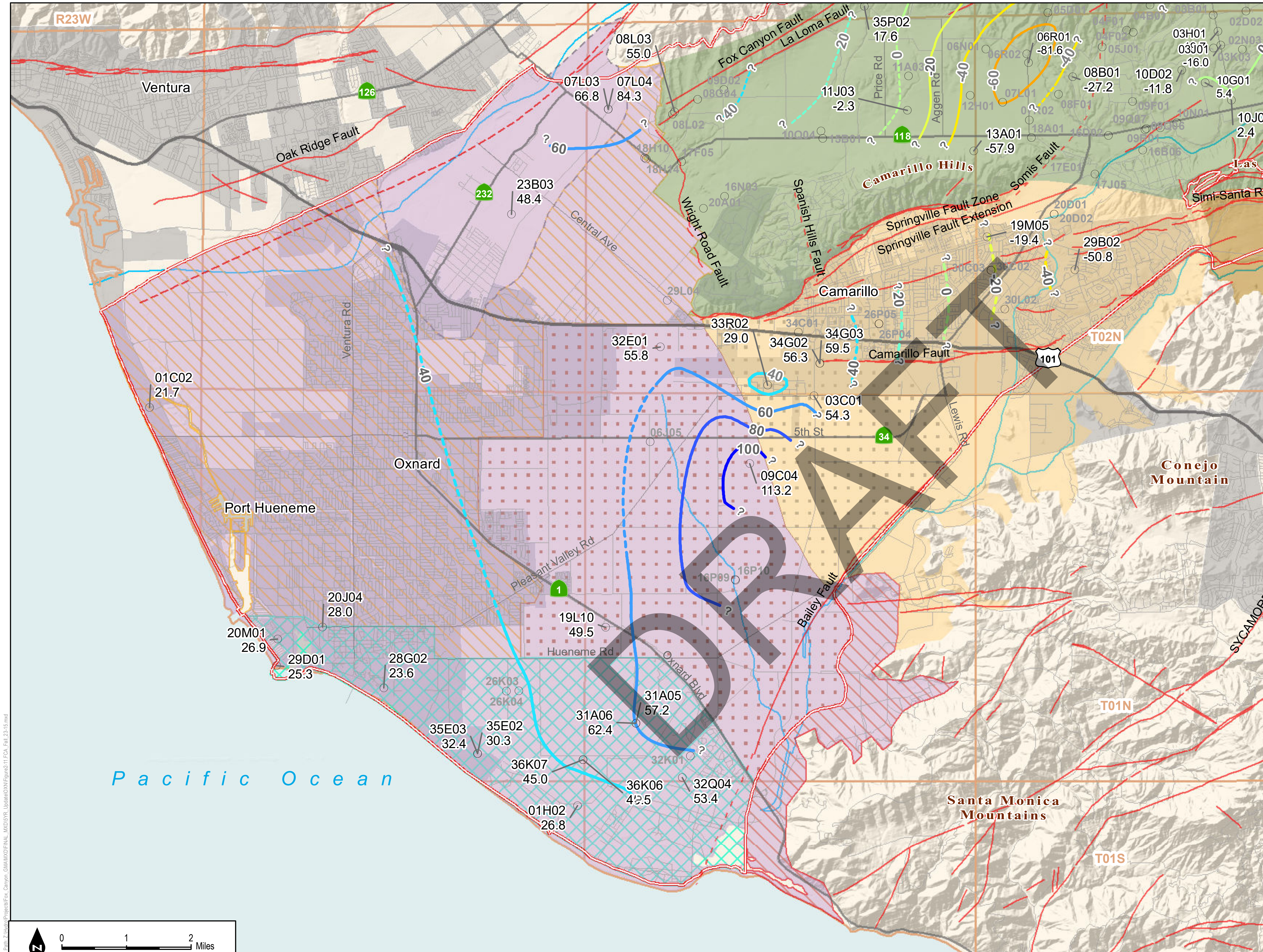


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-10

Hueneme Aquifer - Groundwater Elevation Changes from Spring 2015 to 2024



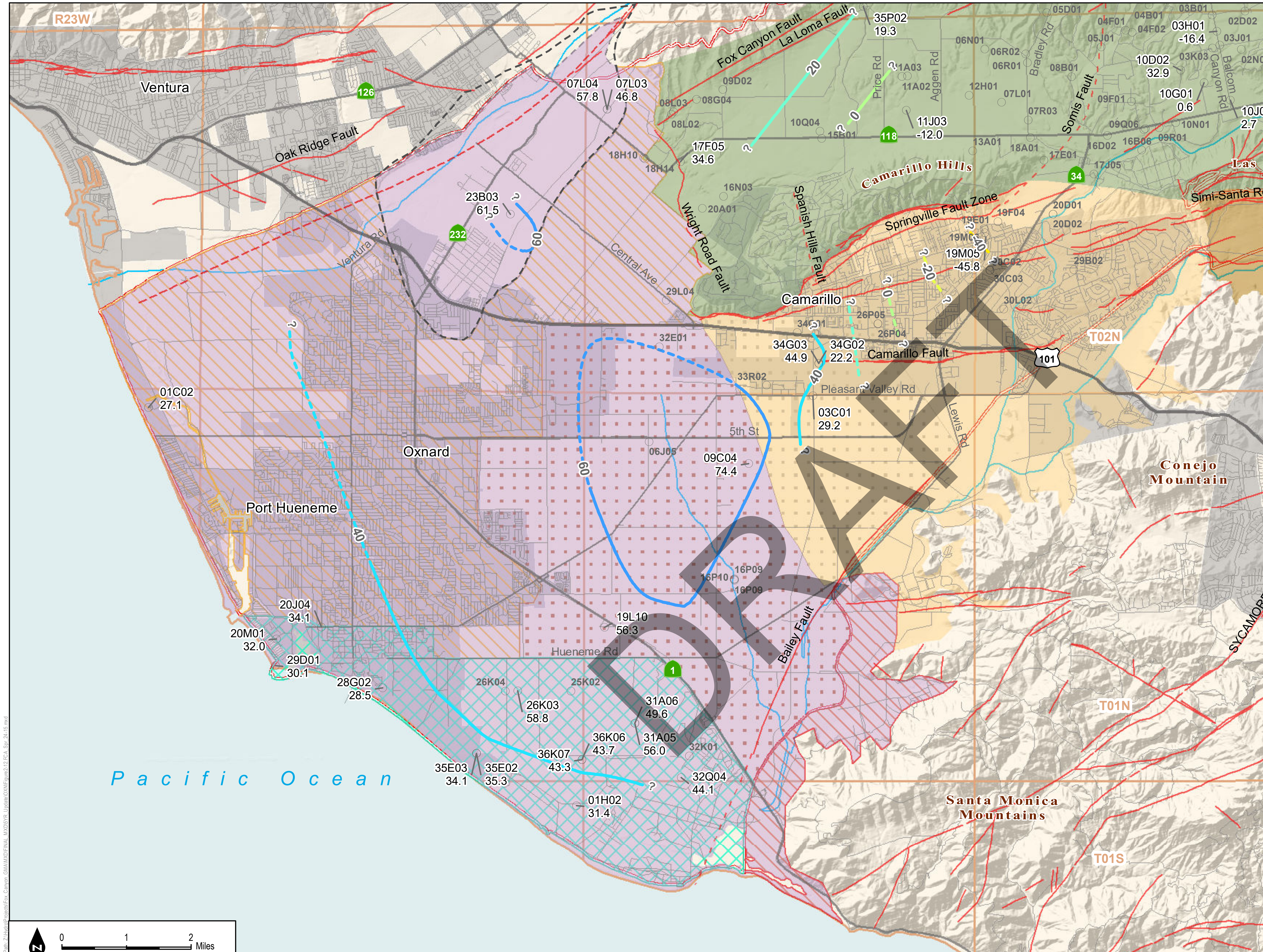
SOURCE: DWR; Ventura County; UWCD; CMWD

DUDEK

FIGURE 2-11

Fox Canyon Aquifer - Groundwater Elevation Changes from Fall 2015 to 2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.

Wells Screened in the Fox Canyon Aquifer

19M05 Abbreviated State Well Number (see notes)

+19 Change in groundwater elevation (in feet) from Spring 2015 to Spring 2024

Faults (Dashed Where Inferred)

Pleasant Valley Pumping Depression Management Area

Forebay Management Area

East Oxnard Plain Management Area (EOPMA)

West Oxnard Plain Management Area

Oxnard Pumping Depression Management Area

Saline Intrusion Management Area

Fox Canyon Groundwater Management Agency Boundary

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 abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 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 "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.

2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.

3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).

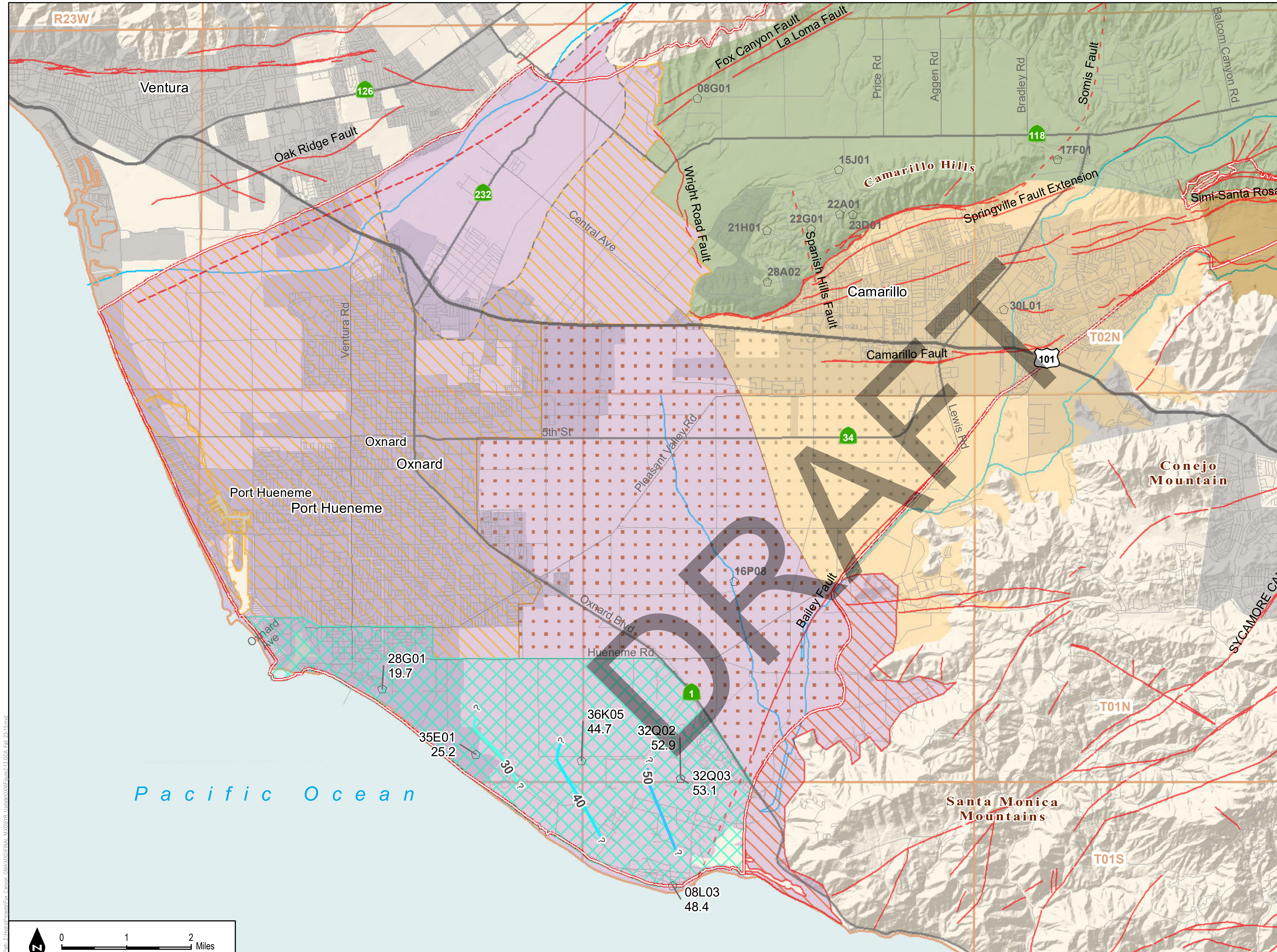
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-12

Fox Canyon Aquifer - Groundwater Elevation Changes from Spring 2015 to 2024



Legend

- Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.
- Wells screened in Grimes Canyon Aquifer
- 15P01 Abbreviated State Well Number (see notes)
- +14.7 Change in groundwater elevation (in feet) from Fall 2015 to Fall 2023
- Fox Canyon Groundwater Management Agency Boundary
- Faults (Dashed Where Inferred)
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management Area
- Pleasant Valley Pumping Depression Management Area
- Township (North-South) and Range (East-West)

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)

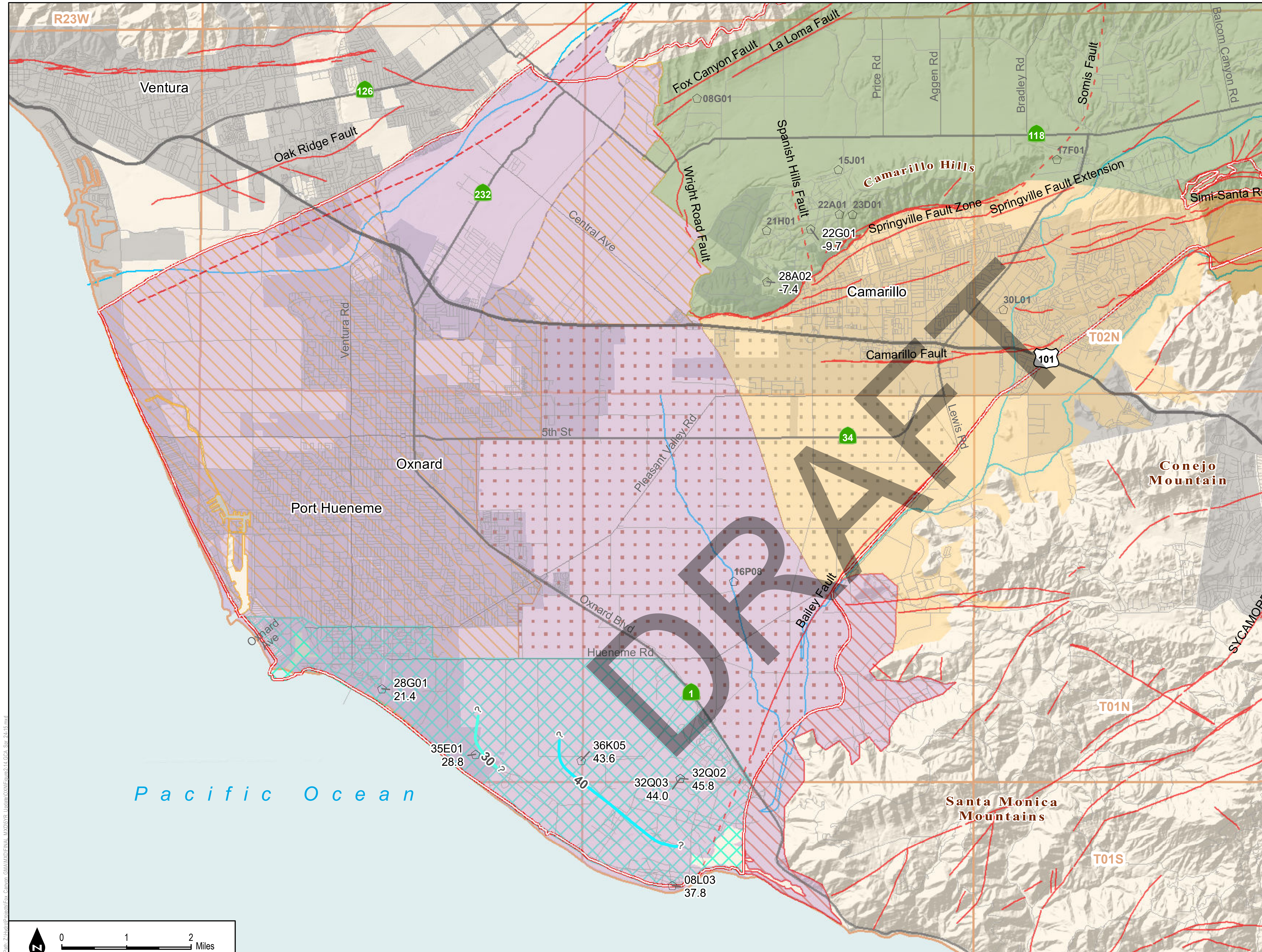
Notes:
1) Well labels consist of an abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.
3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-13

Grimes Canyon Aquifer - Groundwater Elevation Changes from Fall 2015 to 2023



Legend

- Contour of equal groundwater elevation change (feet) since 2015. Dashed where approximate; queried where inferred. See Note 3.
- Wells screened in Grimes Canyon Aquifer
- 15P01 Abbreviated State Well Number (see notes)
- +14.7 Change in groundwater elevation (in feet) from Spring 2015 to Spring 2023
- Fox Canyon Groundwater Management Agency Boundary
- Faults (Dashed Where Inferred)
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management
- Pleasant Valley Pumping Depression Management Area
- Township (North-South) and Range (East-West)

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)

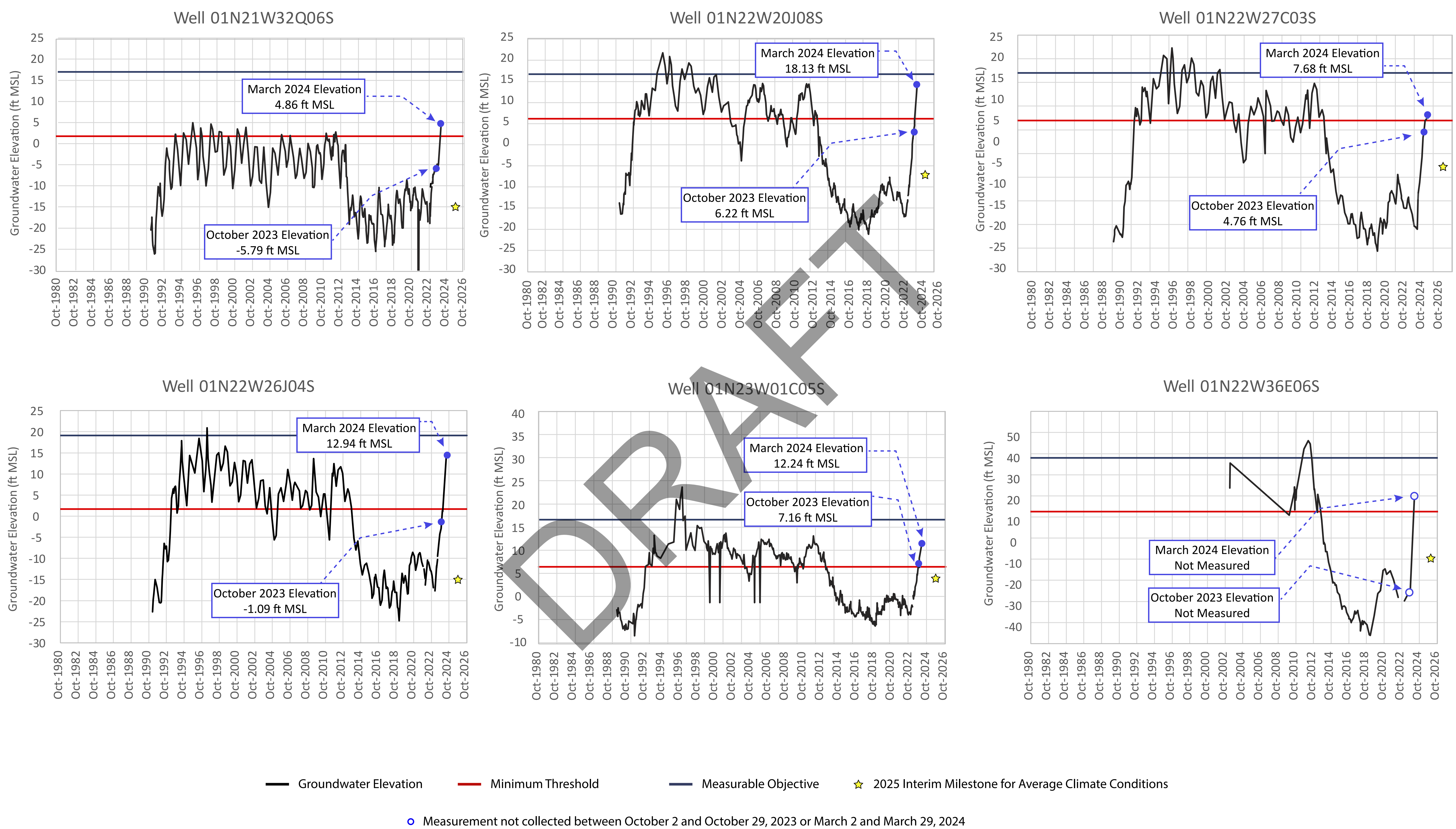
Notes:
1) Well labels consist of an abbreviated State Well Number (SWN) and a groundwater elevation change since 2015 beneath it. SWNs are based on Township and Range in the Public Land Survey System. To construct a full SWN from the abbreviation shown on the map, concatenate the Township, Range, abbreviation, and the letter "S". Example: the SWN for the well labeled "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Gray SWN abbreviation with no water level difference is missing groundwater elevations from one or both years.
3) Negative (-) values indicate groundwater elevations have declined since 2015, Positive (+) values indicate groundwater elevations have increased since 2015. Contours are graduated in color from red (-100) to blue (+100).
4) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-14

Grimes Canyon Aquifer - Groundwater Elevation Changes from Spring 2015 to 2024

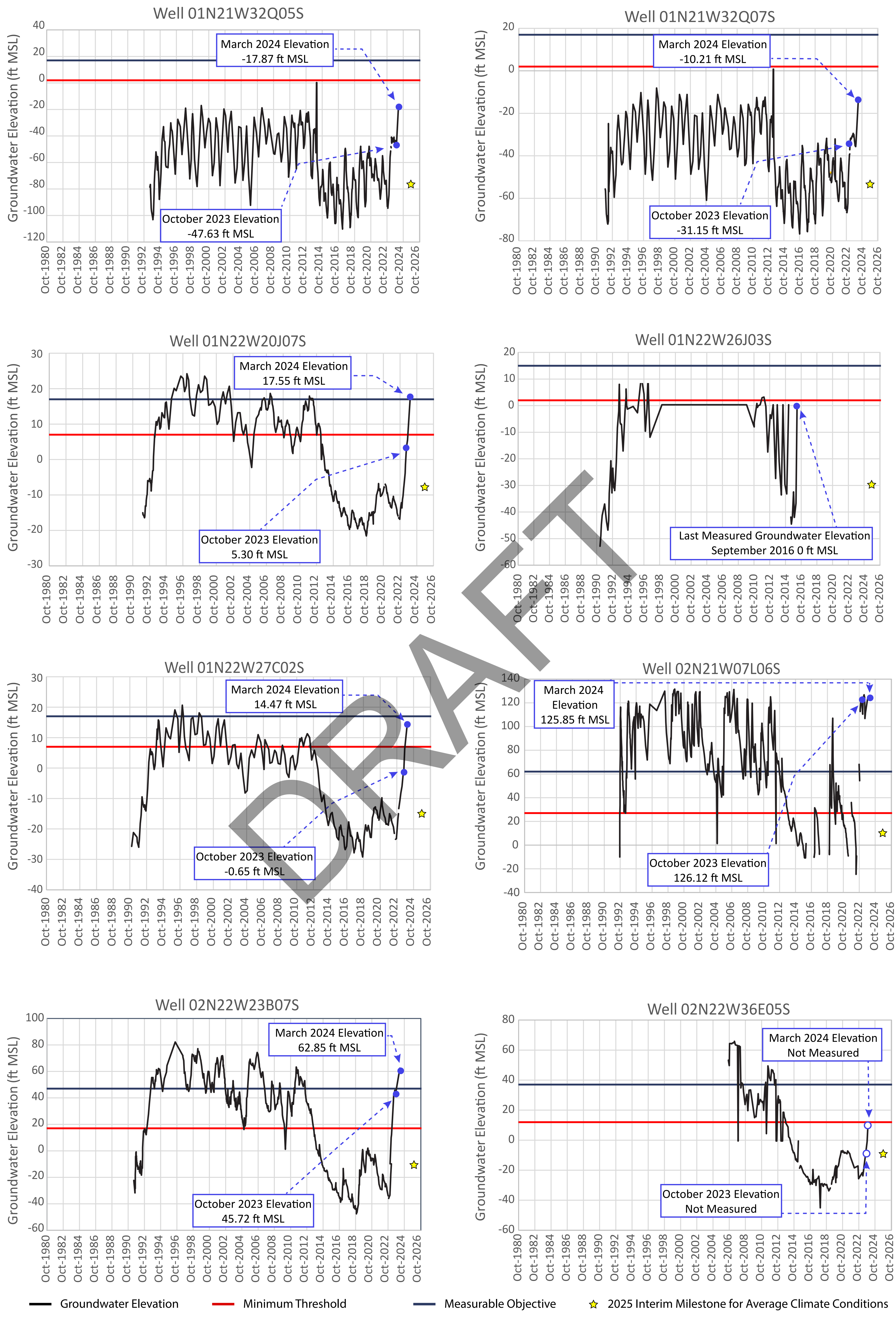


SOURCE: UWCD, VCWPD

DUDEK

FIGURE 2-15

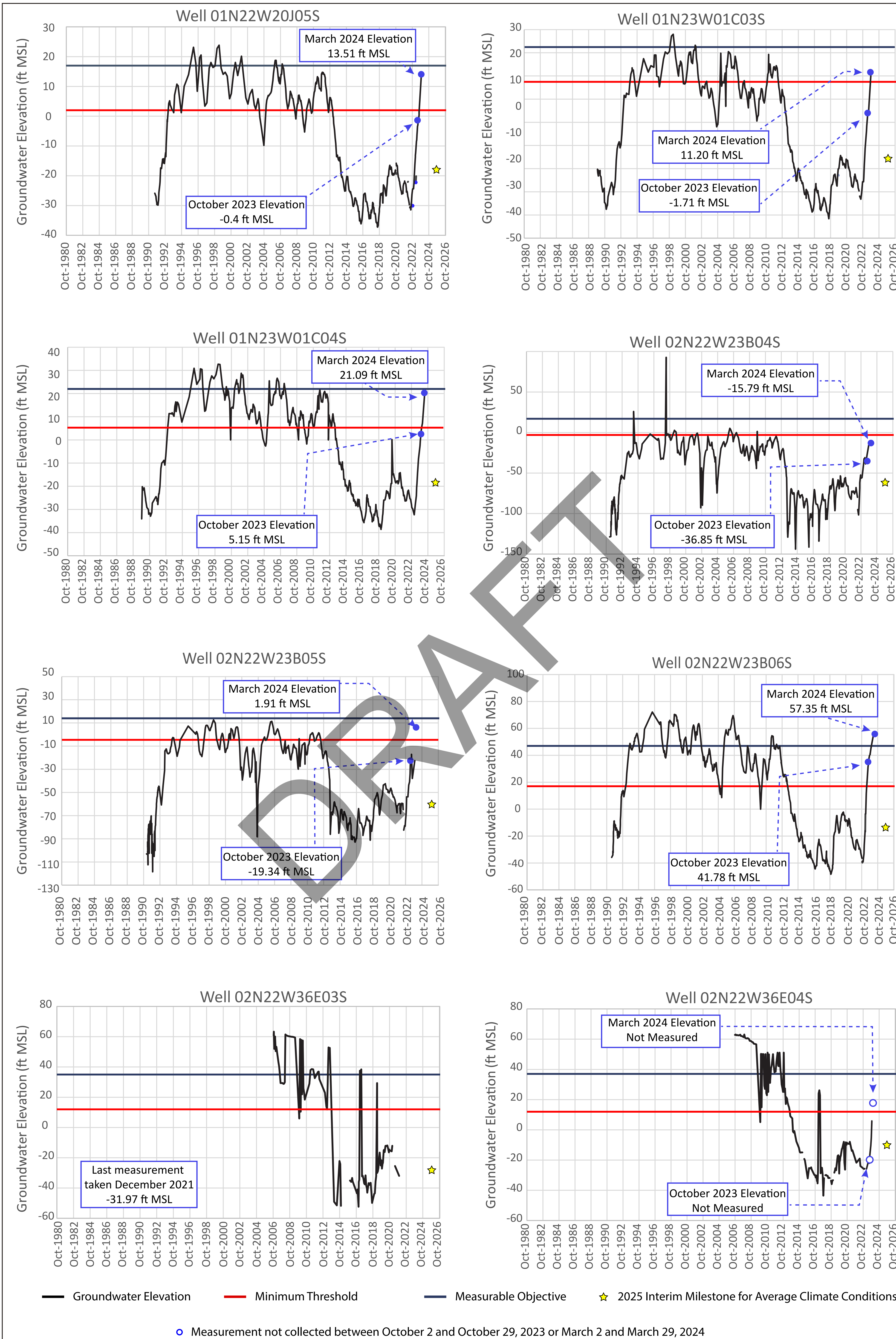
Groundwater Elevation Hydrographs for Representative Monitoring Points in the Oxnard Aquifer



SOURCE: UWCD, VCWPD

FIGURE 2-16

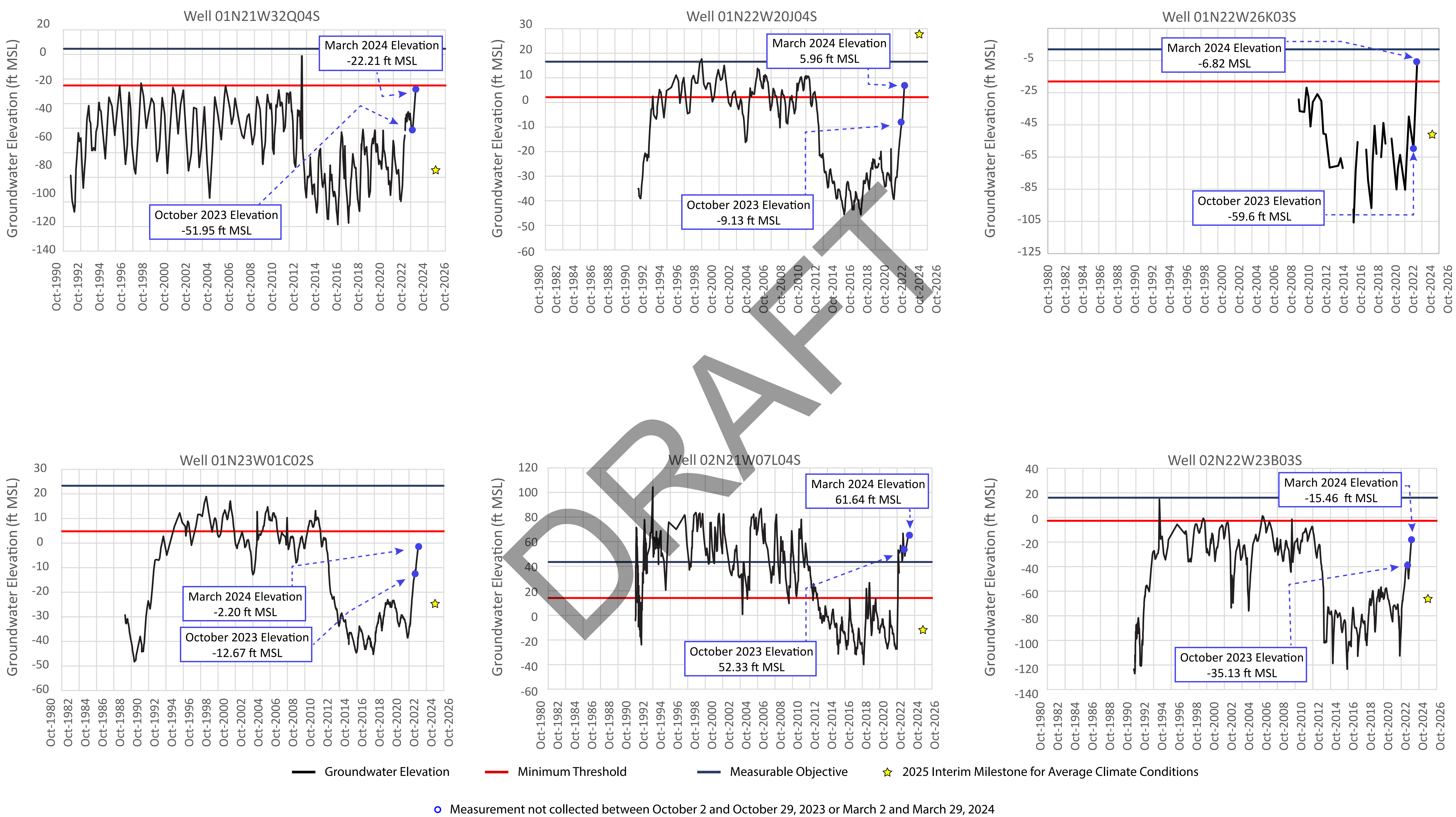
Groundwater Elevation Hydrographs for Representative Monitoring Points in the Mugu Aquifer



SOURCE: UWCD, VCWPD

FIGURE 2-17

Groundwater Elevation Hydrographs for Representative Monitoring Points in the Hueneme Aquifer

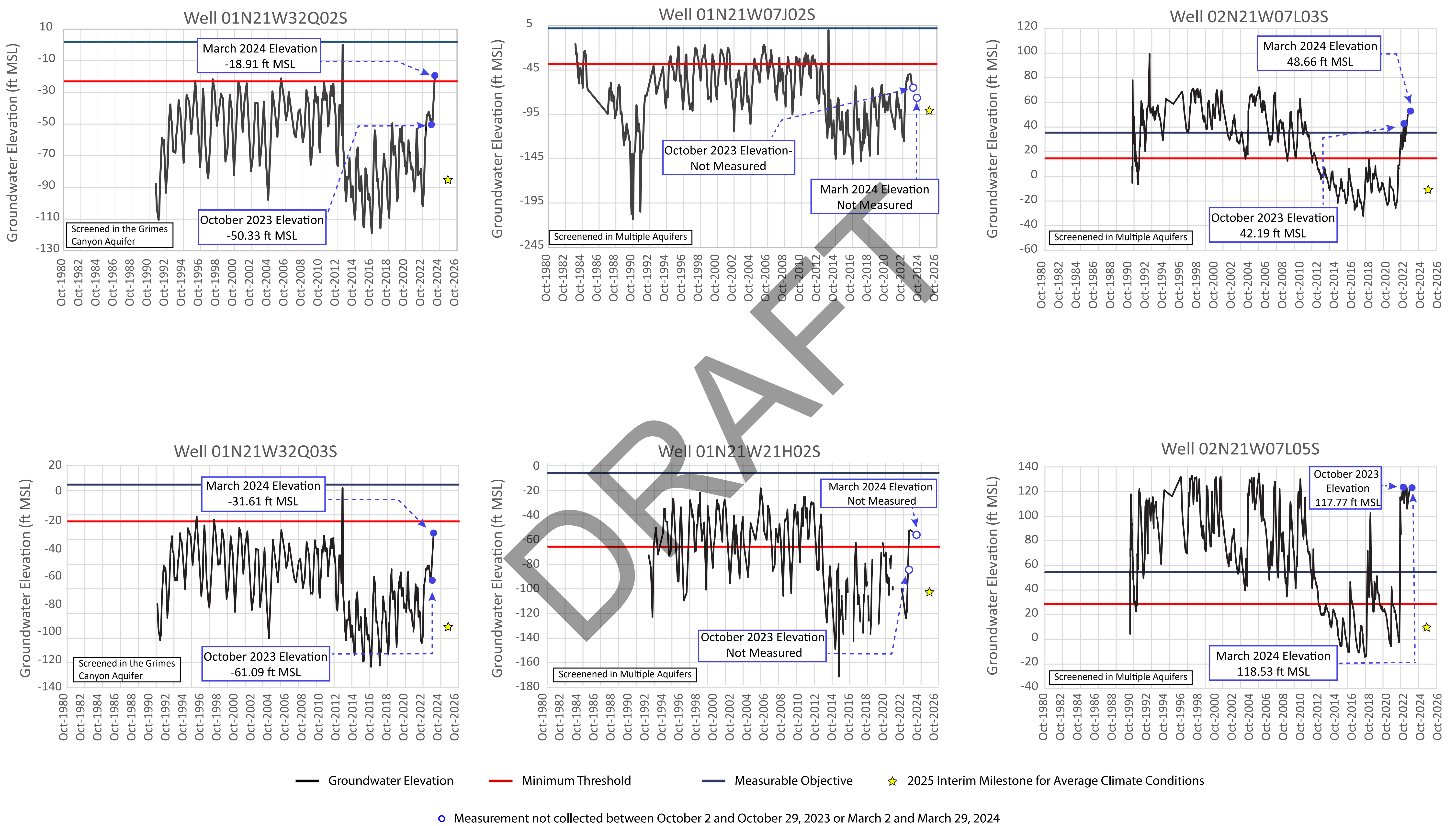


SOURCE: UWCD, VCWPD

DUDEK

FIGURE 2-18

Groundwater Elevation Hydrographs for Representative Monitoring Points in the Fox Canyon Aquifer



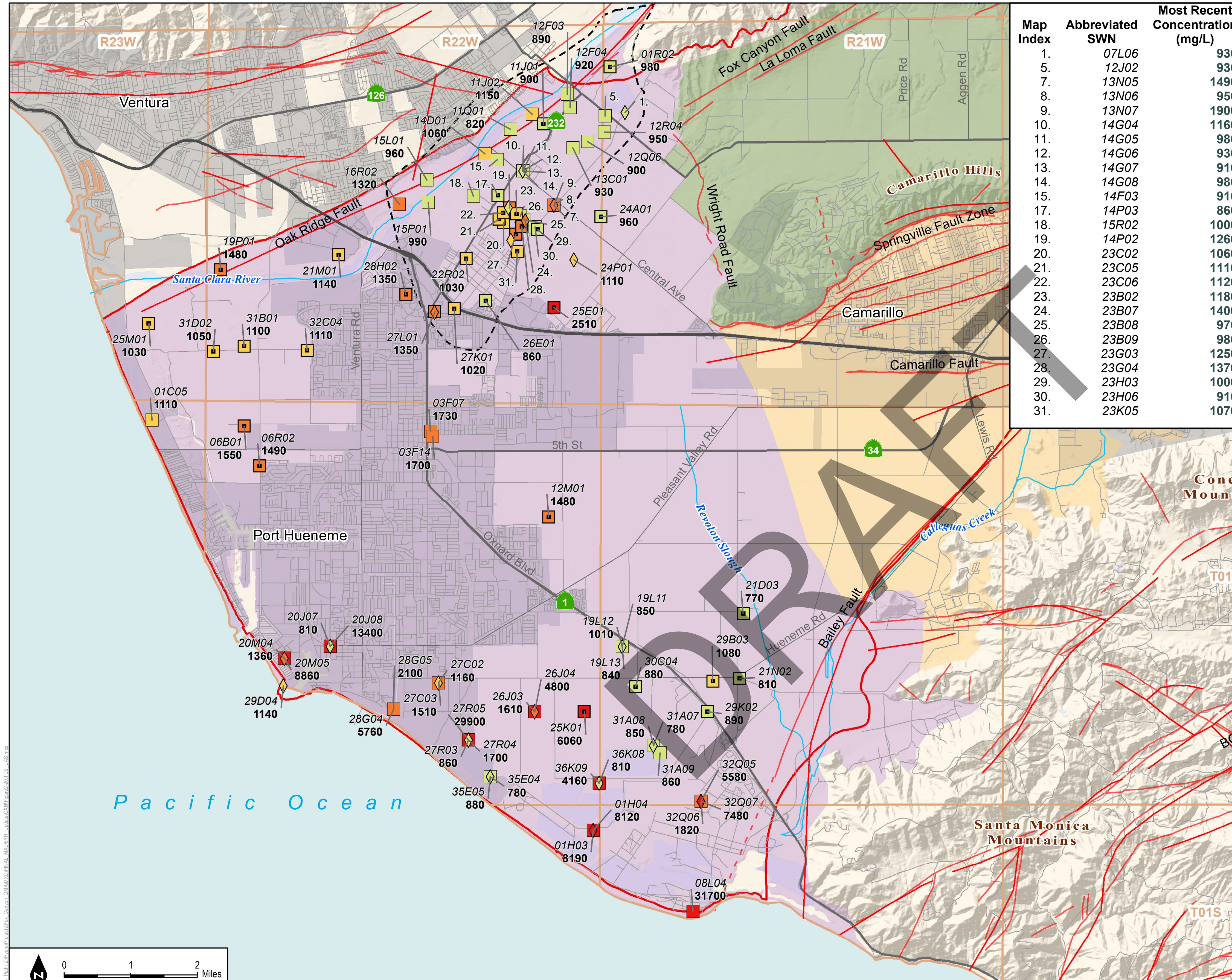
SOURCE: UWCD, VCWPD

FIGURE 2-19

Groundwater Elevation Hydrographs for Representative Monitoring Points in the Grimes Canyon Aquifer

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

DUDEK



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1.	07L06	930
5.	12J02	930
7.	13N05	1490
8.	13N06	950
9.	13N07	1900
10.	14G04	1160
11.	14G05	980
12.	14G06	930
13.	14G07	910
14.	14G08	980
15.	14F03	910
17.	14P03	860
18.	15R02	1000
19.	14P02	1260
20.	23C02	1060
21.	23C05	1110
22.	23C06	1120
23.	23B02	1180
24.	23B07	1400
25.	23B08	970
26.	23B09	980
27.	23G03	1250
28.	23G04	1370
29.	23H03	1000
30.	23H06	910
31.	23K05	1070

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

TDS concentration (mg/L), 2019-2023

- 290 - 500
- >500 - 750
- >750 - 1000
- >1000 - 1200
- >1200 - 2500
- >2500 - 49800

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

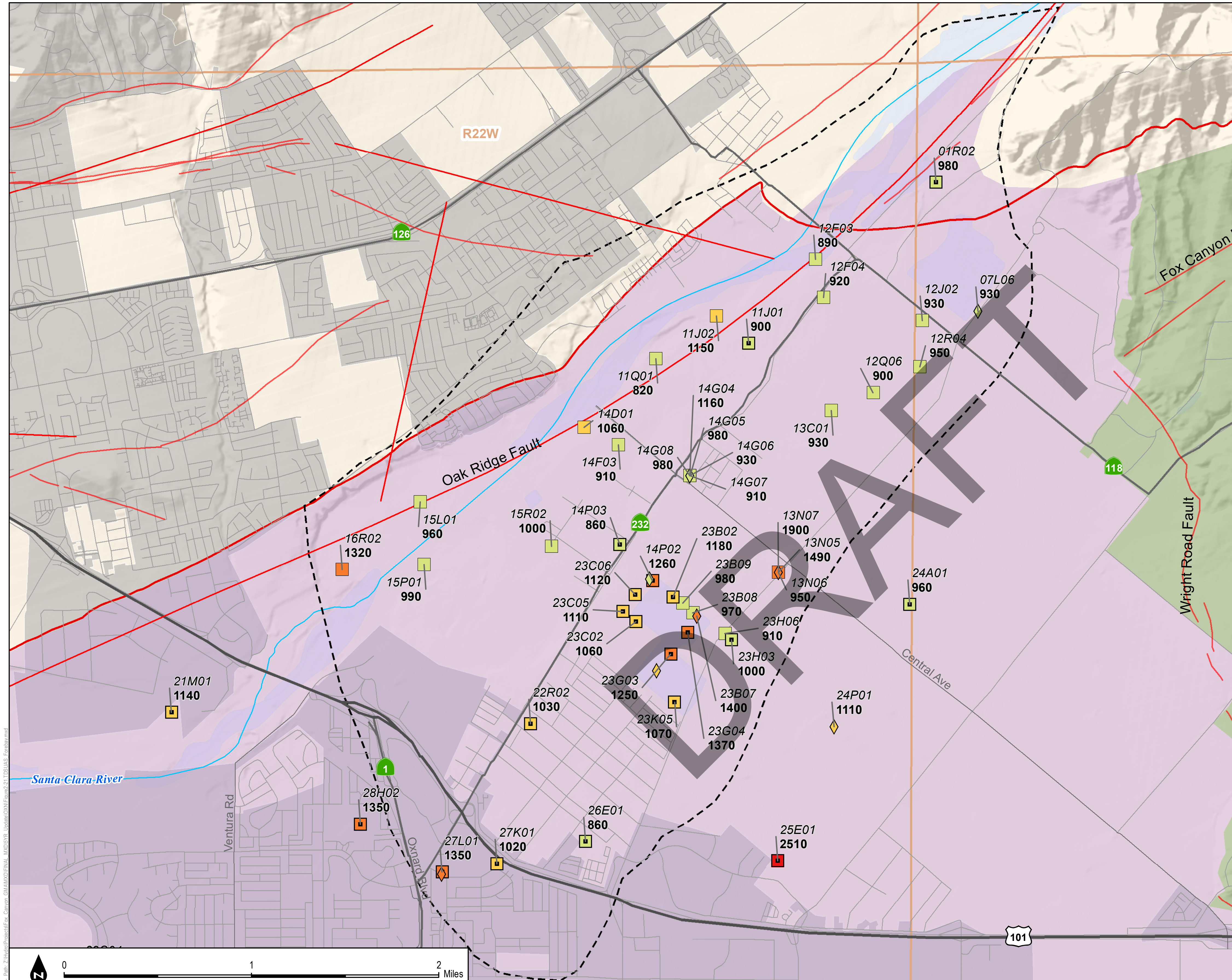
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) SWNs are based on Township and Range 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.
3) The shape of each well symbol corresponds to the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-20

Upper Aquifer System - Most Recent TDS (mg/L) Measured 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

TDS concentration (mg/L), 2019-2023

- 290 - 500
- >500 - 750
- >750 - 1000
- >1000 - 1200
- >1200 - 2500
- >2500 - 49800

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

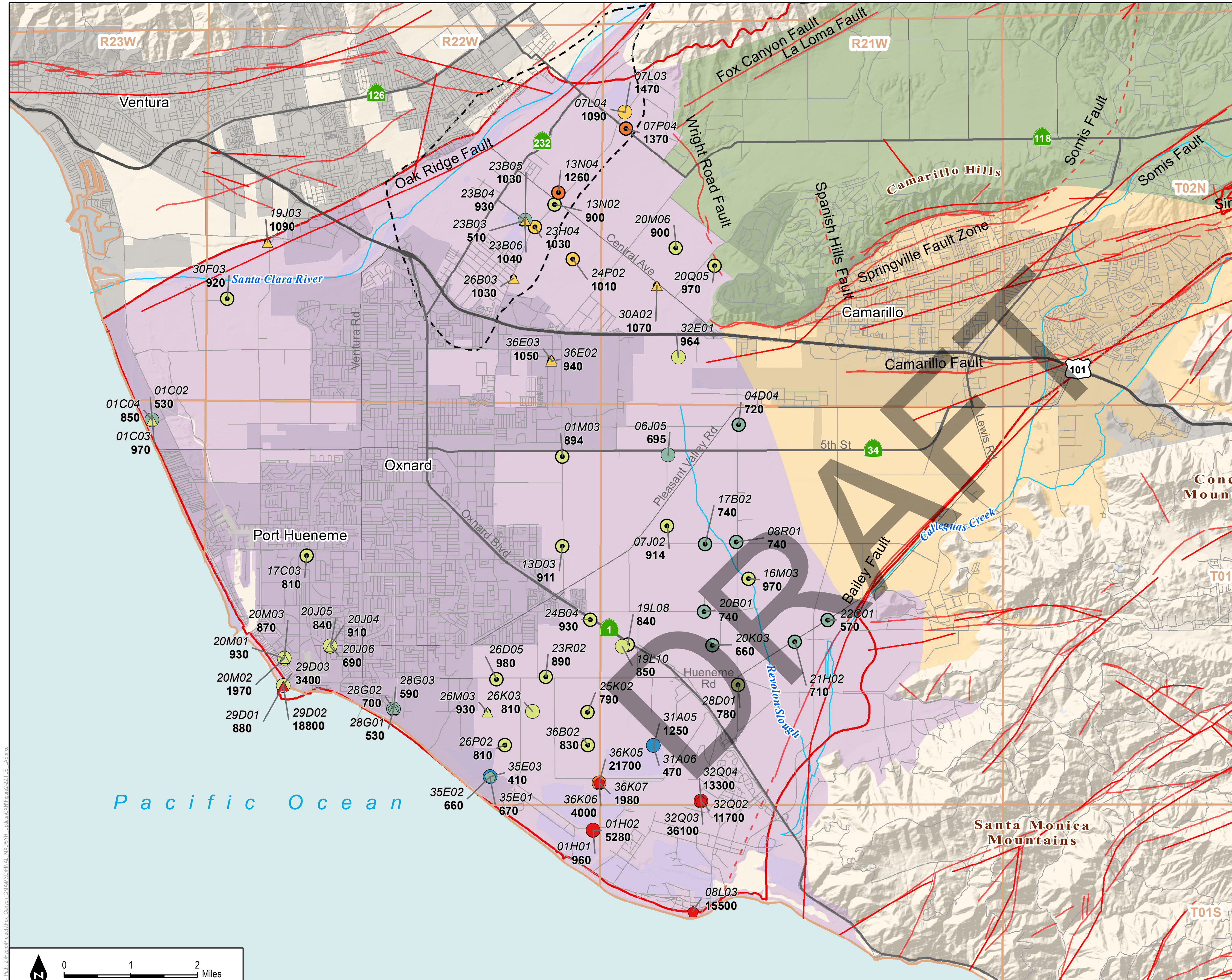
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-21

Upper Aquifer System, Forebay Area - Most Recent TDS (mg/L) Measured 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

TDS concentration (mg/L), 2019-2023

- 290 - 500
- >500 - 750
- >750 - 1000
- >1000 - 1200
- >1200 - 2500
- >2500 - 49800

Aquifer designation

- Well screened in the Hueneme aquifer
- Well screened in the Fox Canyon aquifer
- Well screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS

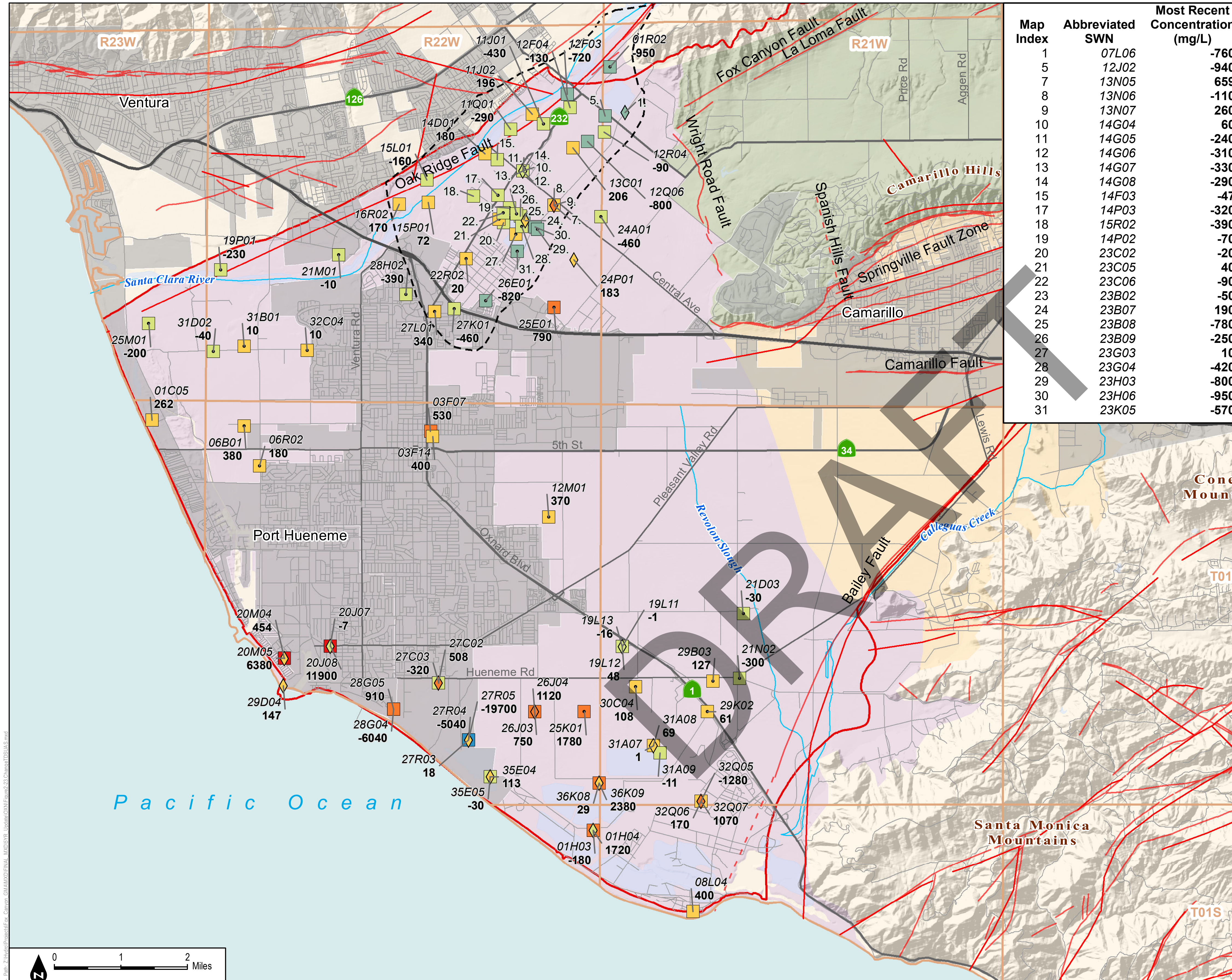
15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-22
Lower Aquifer System - Most Recent TDS (mg/L) Measured 2019-2023



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1	07L06	-760
5	12J02	-940
7	13N05	659
8	13N06	-110
9	13N07	260
10	14G04	60
11	14G05	-240
12	14G06	-310
13	14G07	-330
14	14G08	-290
15	14F03	-47
17	14P03	-320
18	15R02	-390
19	14P02	-70
20	23C02	-20
21	23C05	40
22	23C06	-90
23	23B02	-50
24	23B07	190
25	23B08	-780
26	23B09	-250
27	23G03	10
28	23G04	-420
29	23H03	-800
30	23H06	-950
31	23K05	-570

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream
- Township (North-South) and Range (East-
- Faults (Dashed Where
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

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

TDS change in concentration (mg/L)

- =< -4000
- -3999 - -500
- -499 - 0
- 1 - 500
- 501 - 4000
- >4000

Aquifer designation

- Well screened in the Oxnard
- Well screened in the Mugu
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

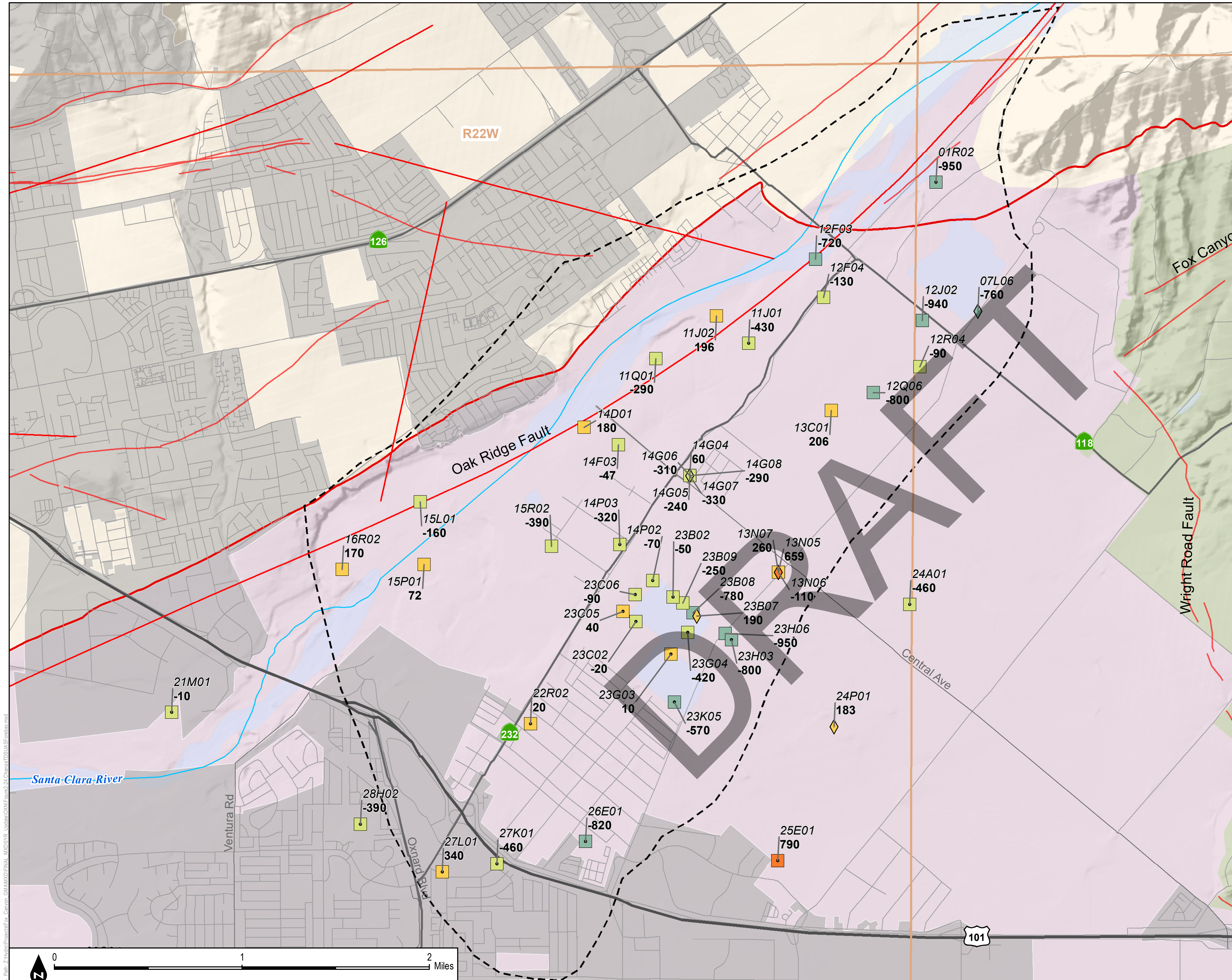
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-23

Change in TDS Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

TDS change in concentration (mg/L)

- =< -4000
- -3999 - -500
- -499 - 0
- 1 - 500
- 501 - 4000
- >4000

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)

10.5 Change in Concentration (mg/L)

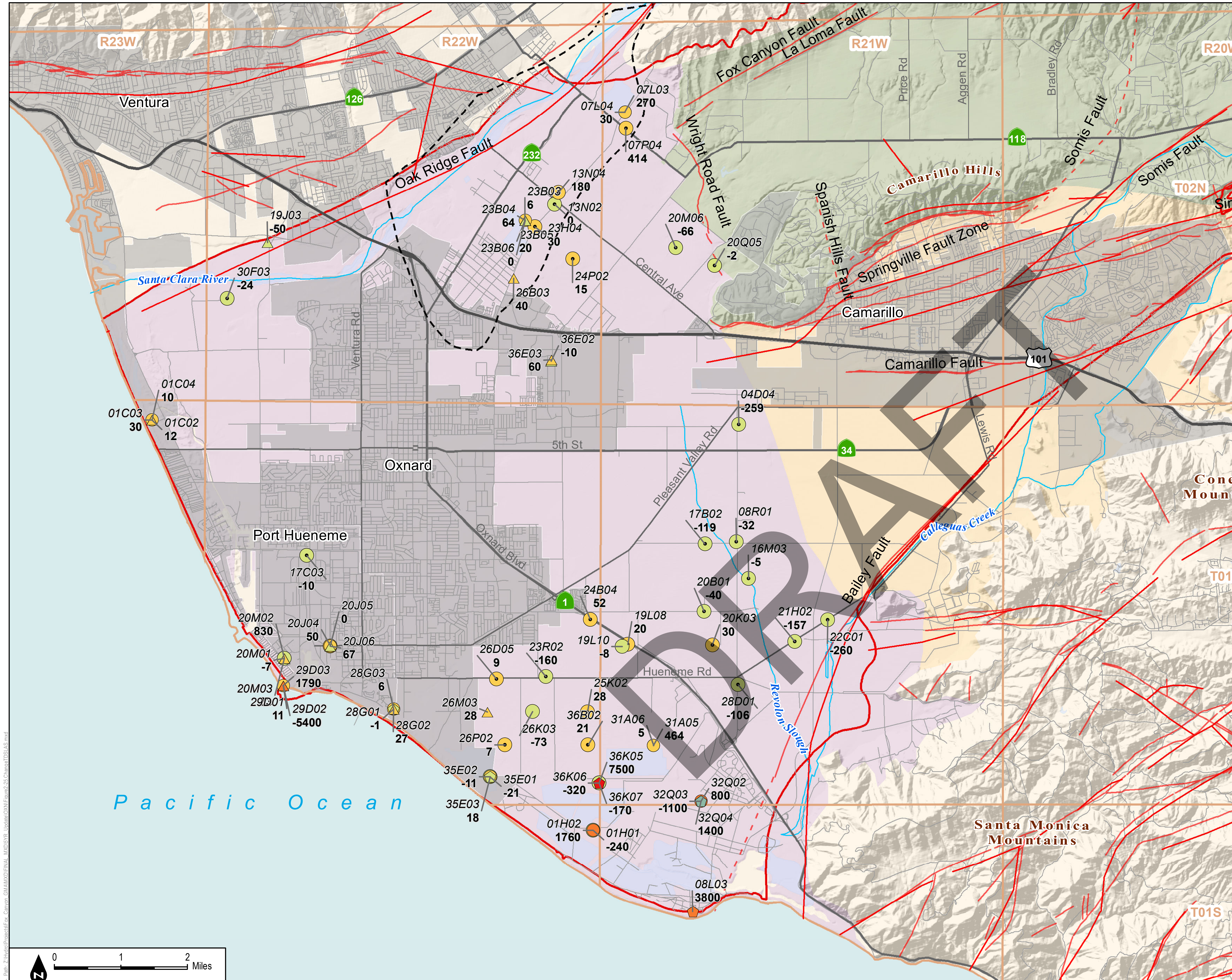
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-24

Change in TDS Concentration (mg/L) in the UAS, Forebay Area, between 2011-2015 and 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

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

TDS change in concentration (mg/L)

- =< -4000
- -3999 - -500
- -499 - 0
- 1 - 500
- 501 - 4000
- >4000

Aquifer designation

- Well screened in the Hueneme
- Well screened in the Fox Canyon
- Well screened in the Grimes Canyon
- Wells screened in multiple aquifers in the LAS

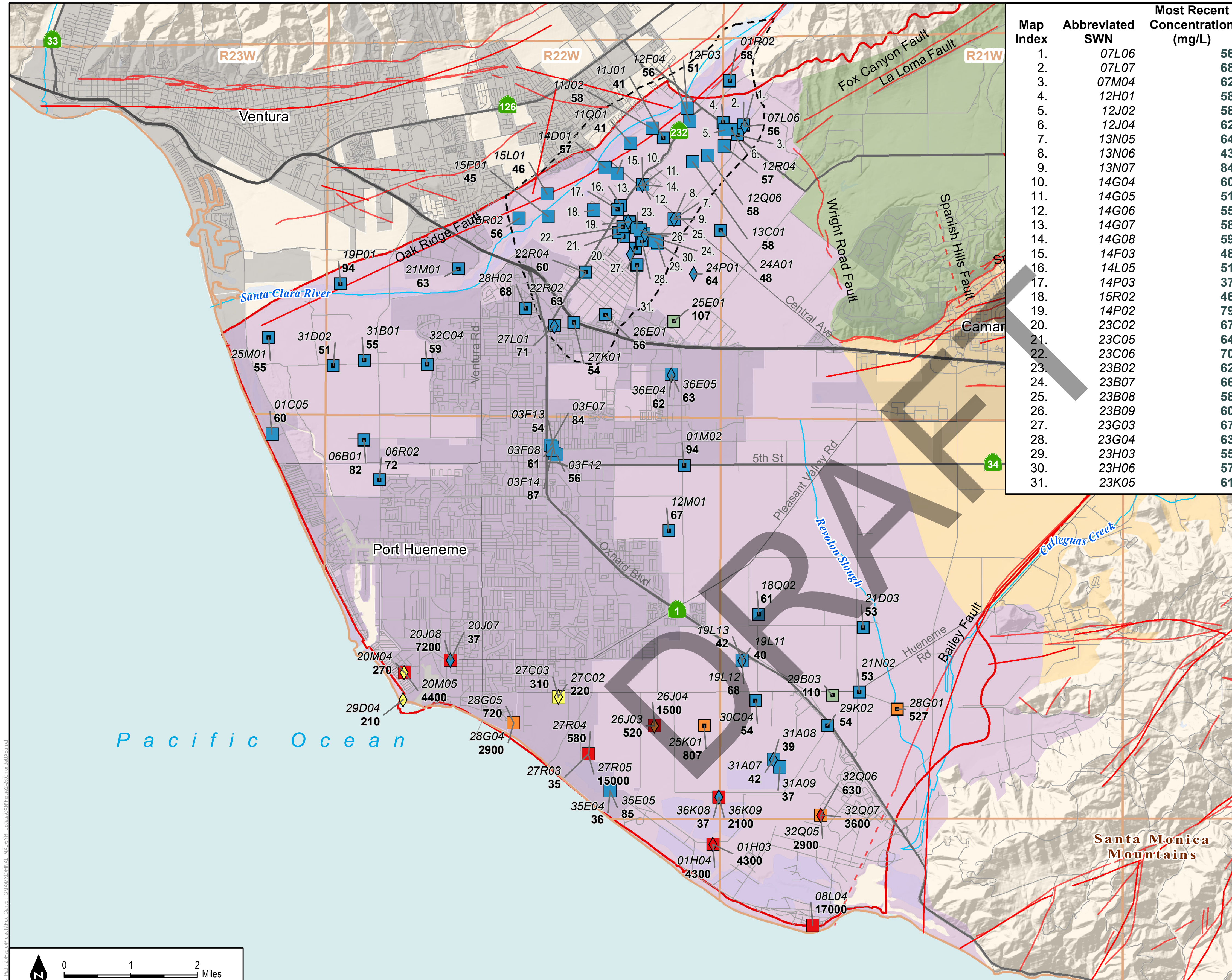
15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it. The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations. Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-25
Change in TDS Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1.	07L06	56
2.	07L07	68
3.	07M04	62
4.	12H01	58
5.	12J02	58
6.	12J04	62
7.	13N05	64
8.	13N06	43
9.	13N07	84
10.	14G04	60
11.	14G05	51
12.	14G06	55
13.	14G07	58
14.	14G08	59
15.	14F03	48
16.	14L05	51
17.	14P03	37
18.	15R02	46
19.	14P02	79
20.	23C02	67
21.	23C05	64
22.	23C06	70
23.	23B02	62
24.	23B07	66
25.	23B08	58
26.	23B09	60
27.	23G03	67
28.	23G04	63
29.	23H03	55
30.	23H06	57
31.	23K05	61

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Chloride concentration (mg/L), 2019-2023

- 23 - 100
- 101 - 200
- 201 - 500
- 501 - 1000
- 1001 - 22500

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

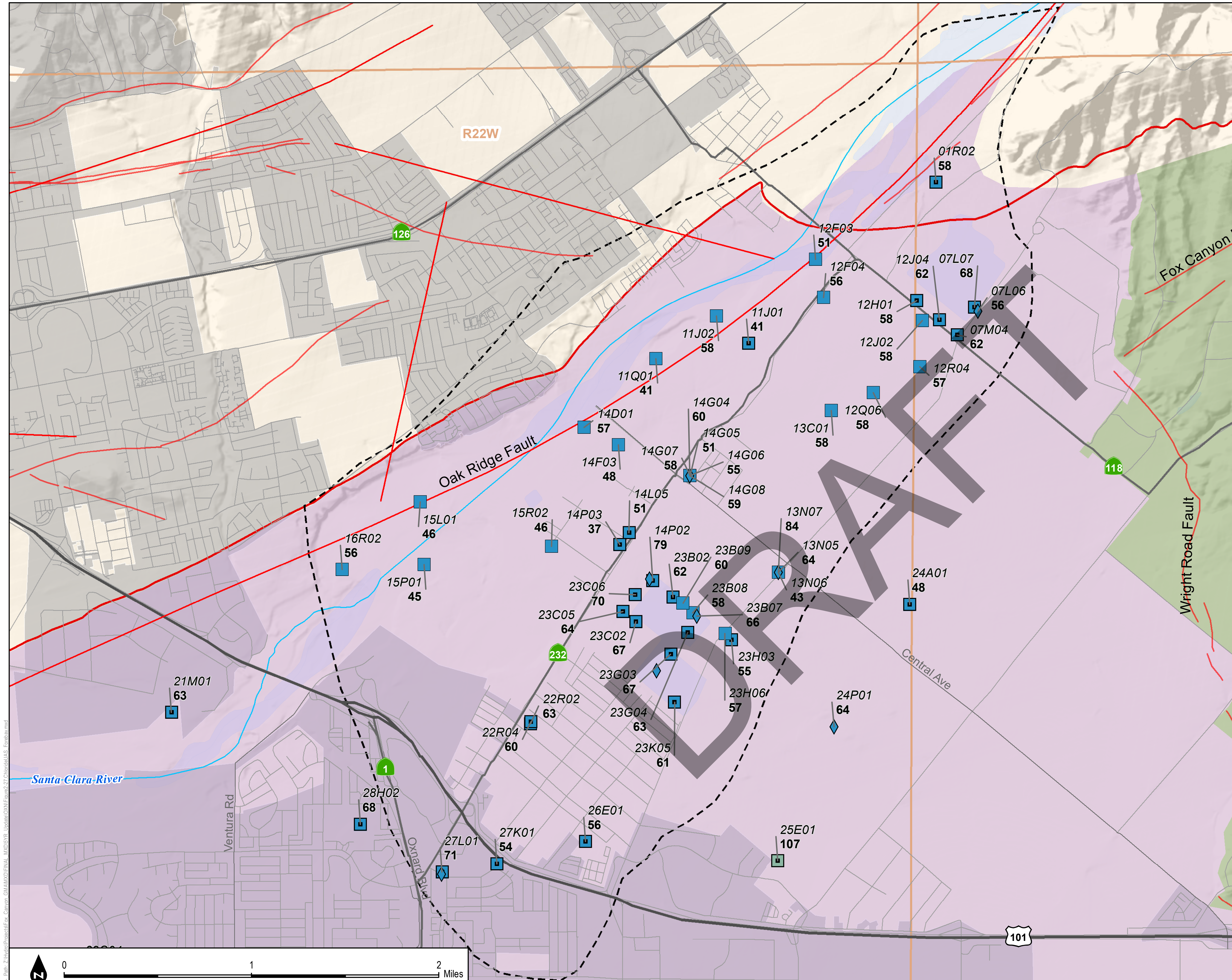
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) SWNs are based on Township and Range 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-26

Upper Aquifer System - Most Recent Chloride (mg/L) Measured 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasins (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Chloride concentration (mg/L), 2019-2023

- 23 - 100
- 101 - 150
- 151 - 200
- 201 - 500
- 501 - 1000
- 1001 - 22500

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

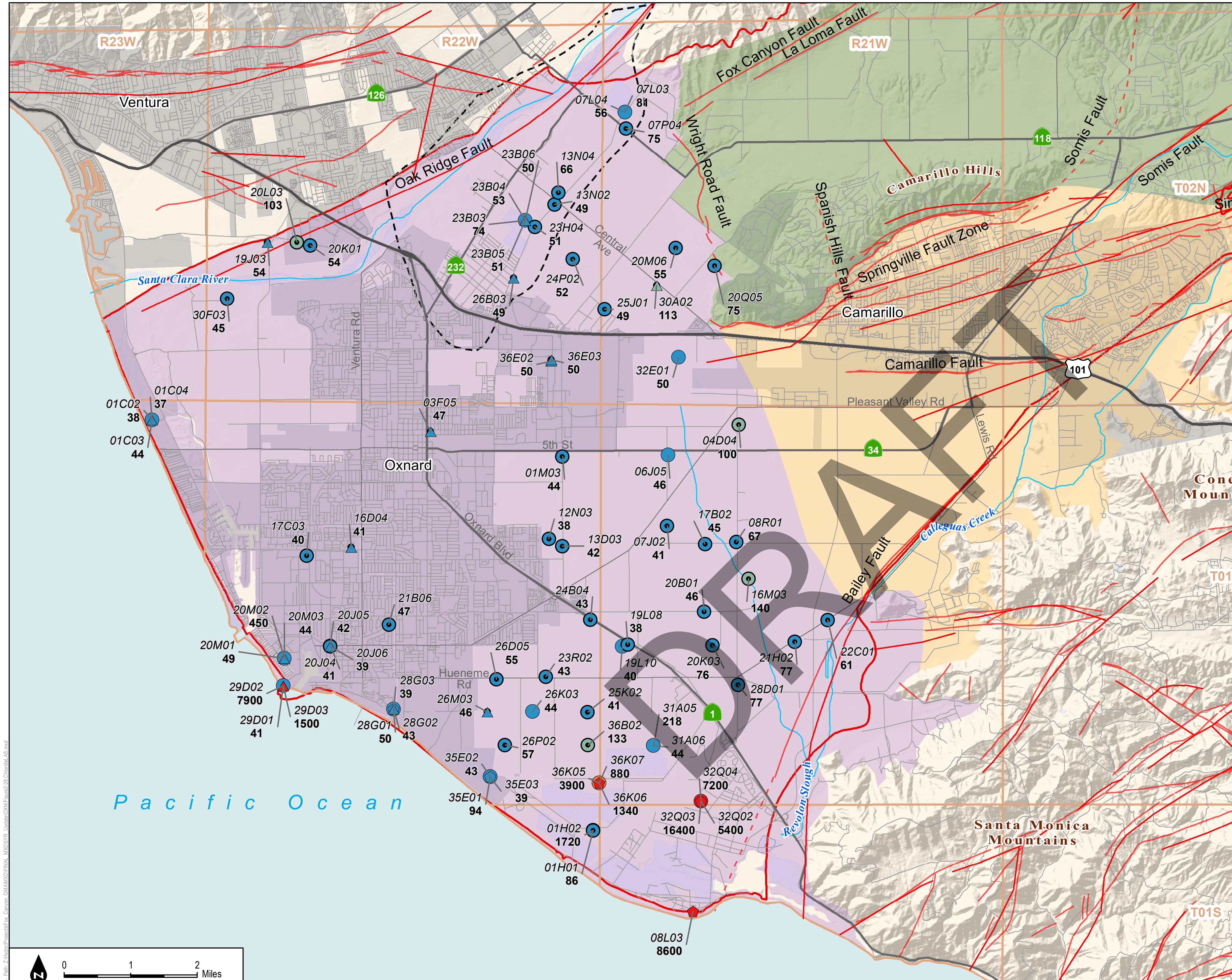
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-27

Upper Aquifer System, Forebay Area - Most Recent Chloride (mg/L) Measured 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Chloride concentration (mg/L), 2019-2023

- 23 - 100
- 101 - 150
- 151 - 200
- 201 - 500
- 501 - 1000
- 1001 - 22500

Aquifer designation

- Well screened in the Hueneme aquifer
- Well screened in the Fox Canyon aquifer
- Well screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

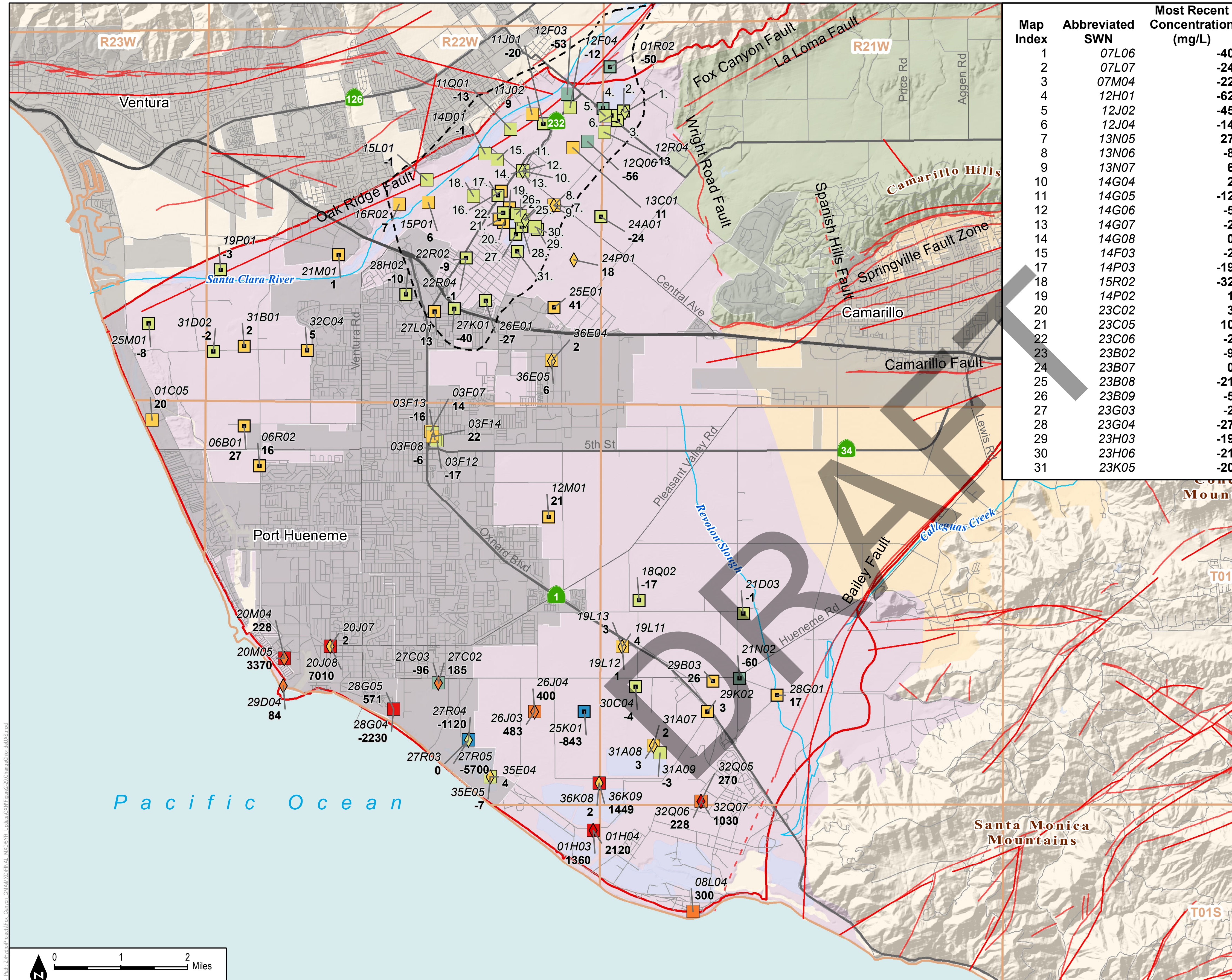
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-28

Lower Aquifer System - Most Recent Chloride (mg/L) Measured 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1	07L06	-40
2	07L07	-24
3	07M04	-22
4	12H01	-62
5	12J02	-45
6	12J04	-14
7	13N05	27
8	13N06	-8
9	13N07	6
10	14G04	2
11	14G05	-12
12	14G06	-5
13	14G07	-2
14	14G08	0
15	14F03	-2
17	14P03	-19
18	15R02	-32
19	14P02	1
20	23C02	3
21	23C05	10
22	23C06	-2
23	23B02	-9
24	23B07	0
25	23B08	-21
26	23B09	-5
27	23G03	-2
28	23G04	-27
29	23H03	-19
30	23H06	-21
31	23K05	-20

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Chloride change in concentration (mg/L)

- =< -100
- > -100 - -50
- > -50 - 0
- >0 - 50
- >50 - 500
- >500

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

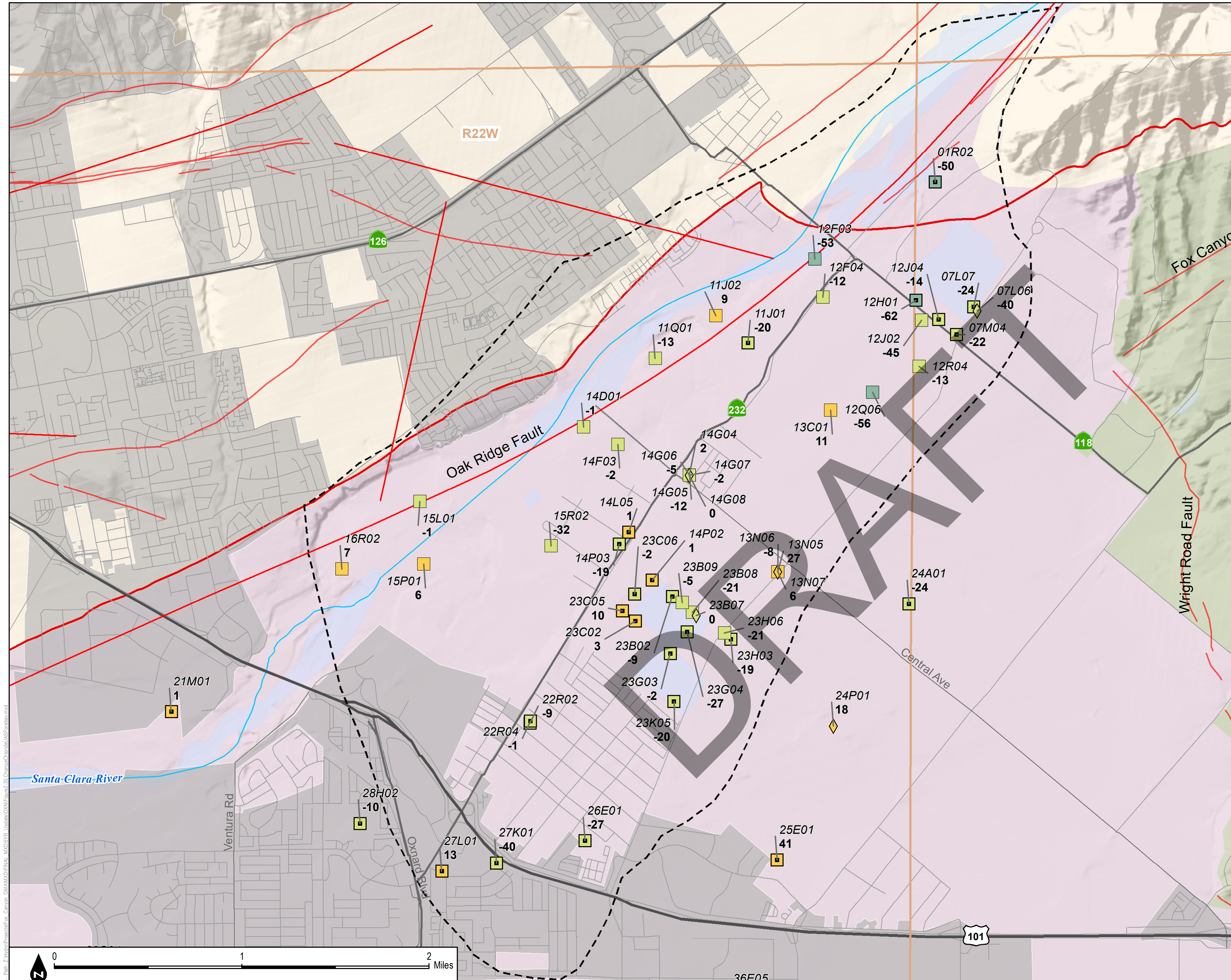
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-29

Change in Chloride Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Chloride change in concentration (mg/L)

- =< -100
- -99 - -50
- -49 - 0
- 1 - 50
- 51 - 100
- >100

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)

10.5 Change in Concentration (mg/L)

Notes:

1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

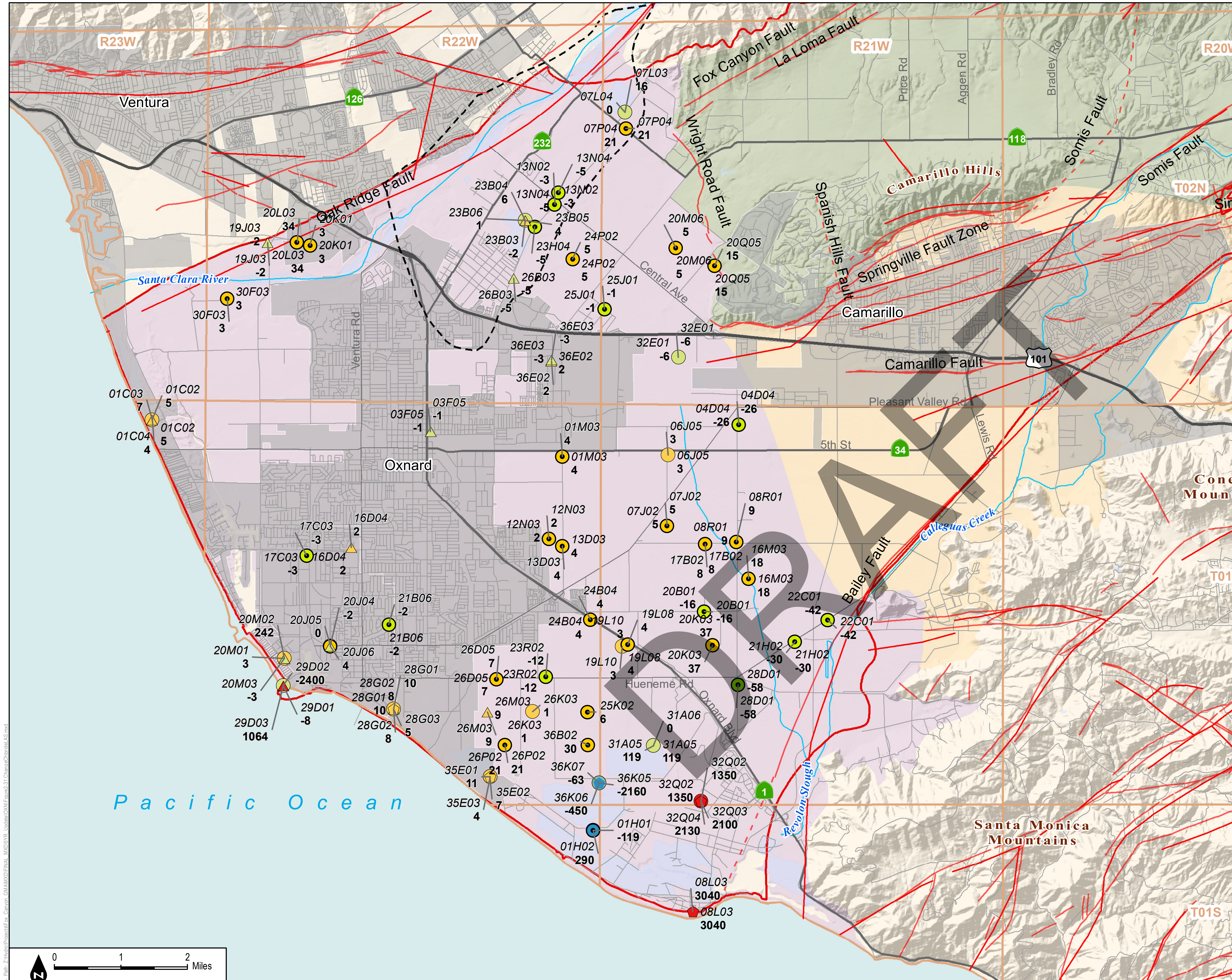
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-30

Change in Chloride Concentration (mg/L) in the UAS, Forebay Area, between 2011-2015 and 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)

Major Rivers/Stream Channels

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

Faults (Dashed Where Inferred)

Oxnard Forebay

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)

Chloride change in concentration (mg/L)

- =< -100
- > -100 - -50
- > -50 - 0
- >0 - 50
- >50 - 500
- >500

Aquifer designation

- Well screened in the Hueneme aquifer
- Well screened in the Fox Canyon aquifer
- Well screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS

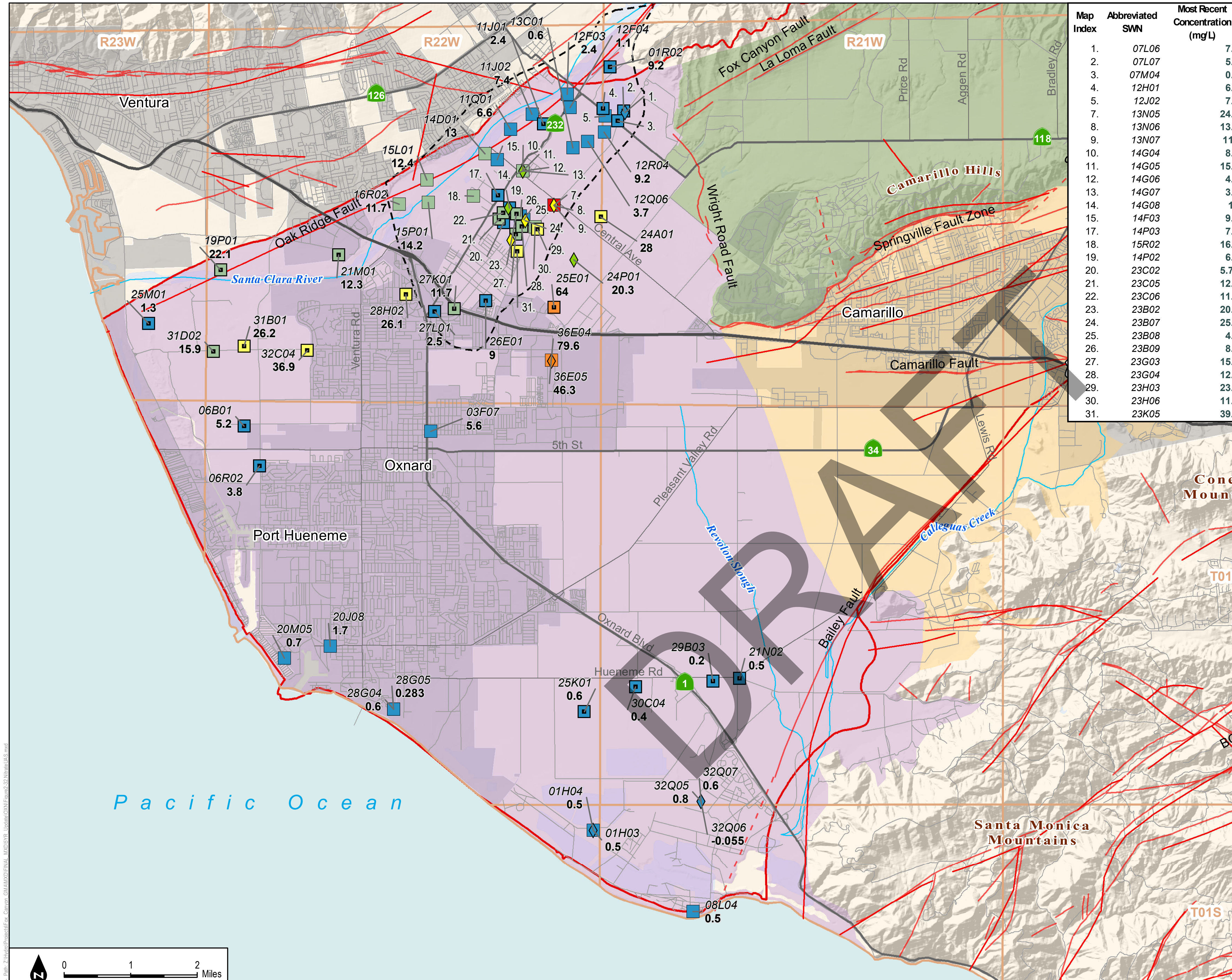
15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration.
Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-31
Change in Chloride Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1.	07L06	7.6
2.	07L07	5.6
3.	07M04	0.4
4.	12H01	6.2
5.	12J02	7.6
7.	13N05	24.8
8.	13N06	13.8
9.	13N07	115
10.	14G04	8.4
11.	14G05	15.7
12.	14G06	4.8
13.	14G07	3.8
14.	14G08	13
15.	14F03	9.8
17.	14P03	7.7
18.	15R02	16.3
19.	14P02	6.2
20.	23C02	5.76
21.	23C05	12.4
22.	23C06	11.5
23.	23B02	20.8
24.	23B07	25.9
25.	23B08	4.6
26.	23B09	8.5
27.	23G03	15.1
28.	23G04	12.4
29.	23H03	23.5
30.	23H06	11.4
31.	23K05	39.4

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Nitrate concentration (mg/L as Nitrate), 2019-2023

- 0 - 10
- >10 - 22.5
- >22.5 - 45
- >45 - 90
- >90 - 528

Aquifer designation

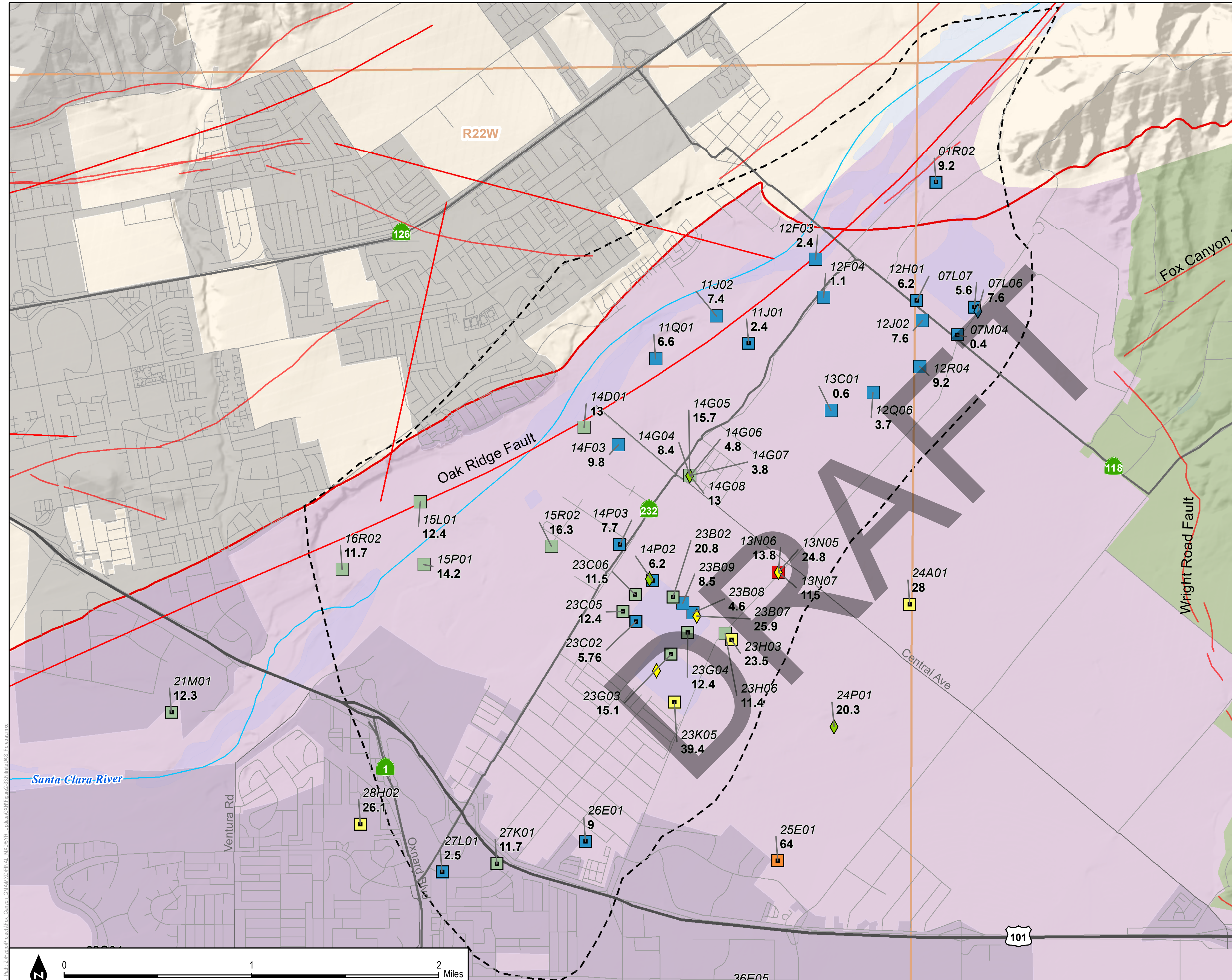
- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) 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.
3) The shape of each well symbol corresponds to the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-32
Upper Aquifer System - Most Recent Nitrate (mg/L) Measured 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Nitrate concentration (mg/L as Nitrate), 2019-2023

- 0 - 10
- >10 - 22.5
- >22.5 - 45
- >45 - 90
- >90 - 528

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

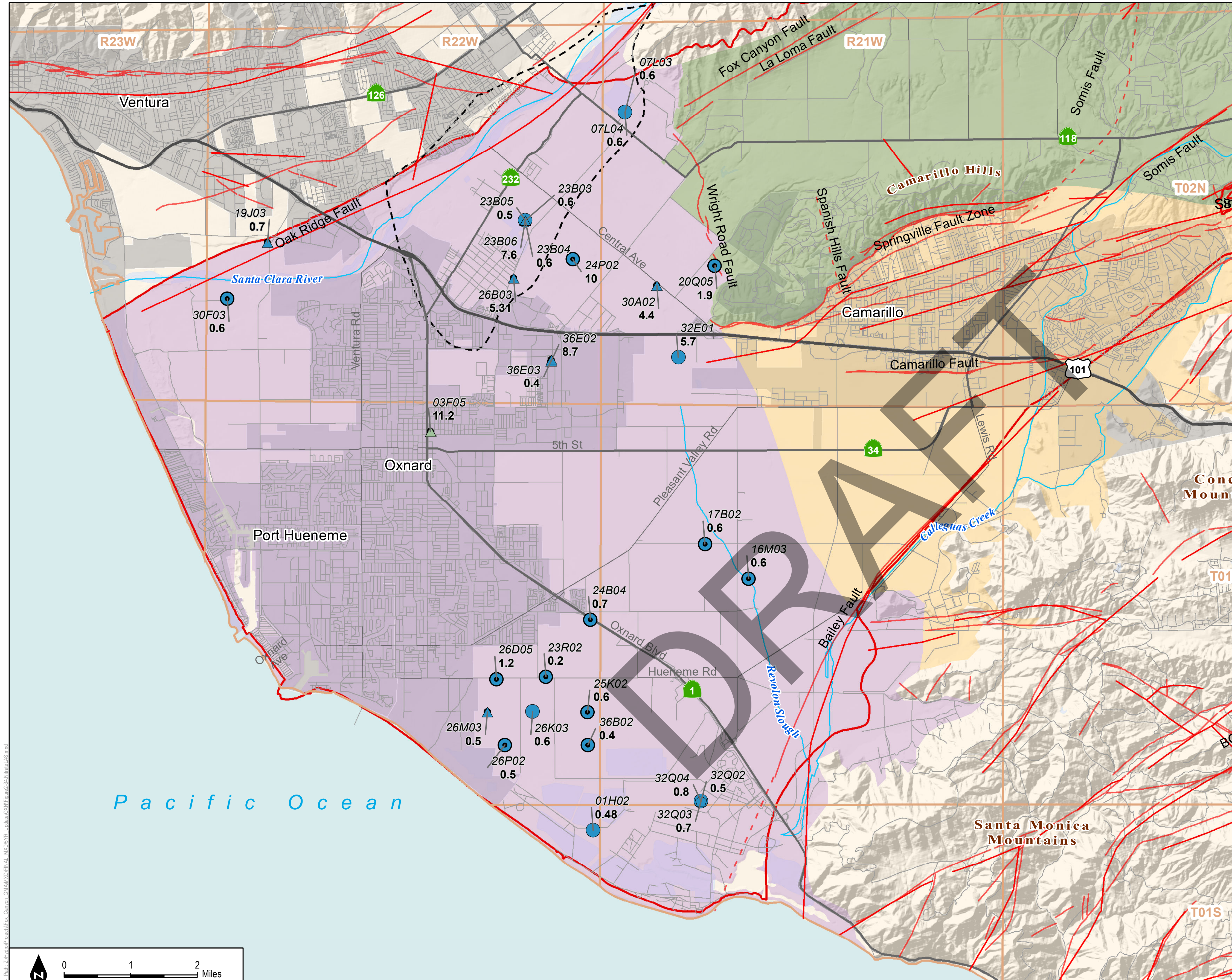
15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-33
Upper Aquifer System, Forebay Area - Most Recent Nitrate (mg/L) Measured 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Nitrate concentration (mg/L as Nitrate), 2019-2023

- 0 - 10
- >10 - 22.5
- >22.5 - 45
- >45- 90
- >90 - 528

Aquifer designation

- Well screened in the Hueneme aquifer
- Well screened in the Fox Canyon aquifer
- Well screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

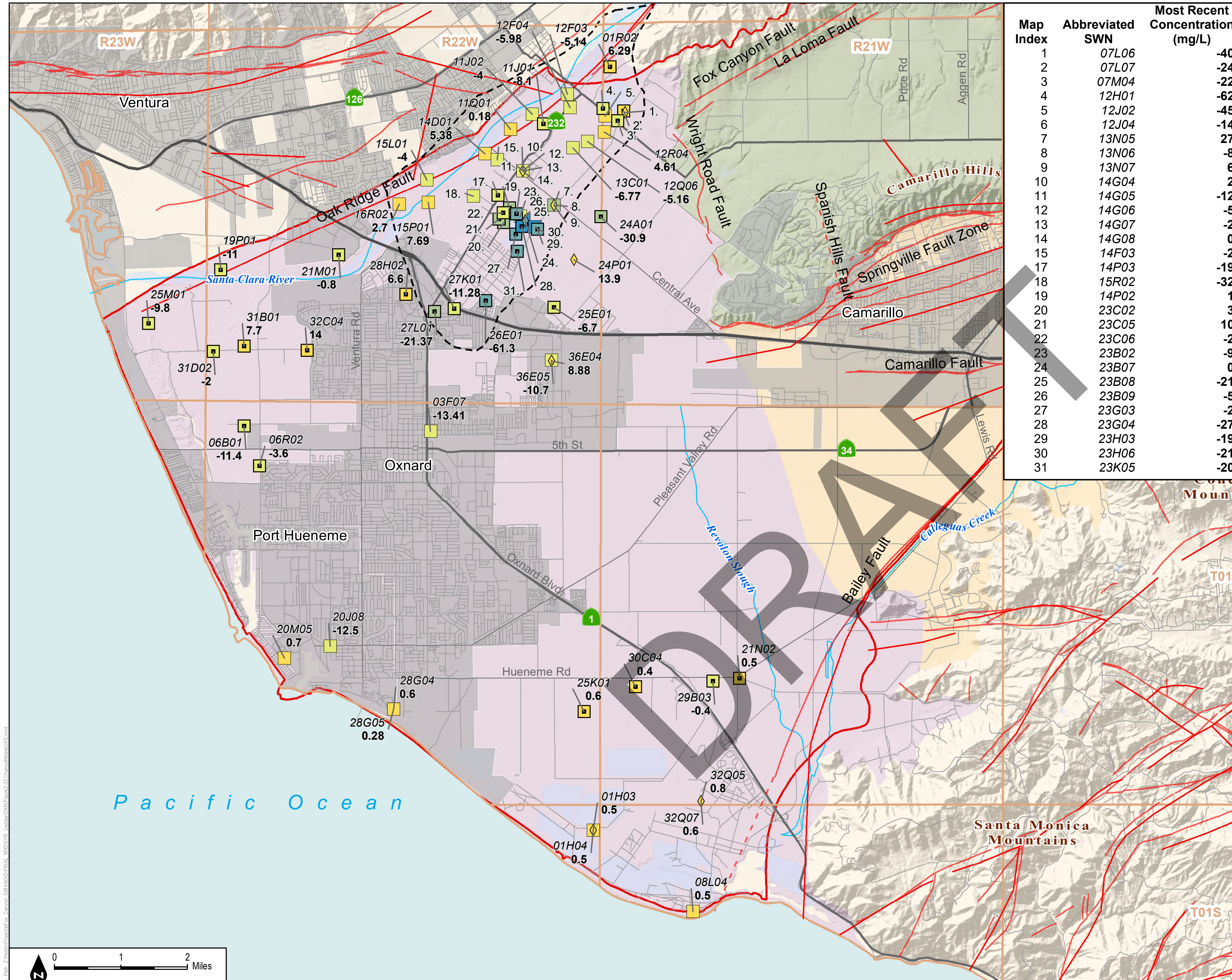
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) SWNs are based on Township and Range 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-34

Lower Aquifer System - Most Recent Nitrate (mg/L) Measured 2019-2023



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1	07L06	-40
2	07L07	-24
3	07M04	-22
4	12H01	-62
5	12J02	-45
6	12J04	-14
7	13N05	27
8	13N06	-8
9	13N07	6
10	14G04	2
11	14G05	-12
12	14G06	-5
13	14G07	-2
14	14G08	0
15	14F03	-2
17	14P03	-19
18	15R02	-32
19	14P02	1
20	23C02	3
21	23C05	10
22	23C06	-2
23	23B02	-9
24	23B07	0
25	23B08	-21
26	23B09	-5
27	23G03	-2
28	23G04	-27
29	23H03	-19
30	23H06	-21
31	23K05	-20

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

Nitrate change in concentration (mg/L)

- =< -100
- -99 - -50
- -49 - -15
- -14 - 0
- 1 - 15
- 16 - 50
- 51 - 100
- > 100

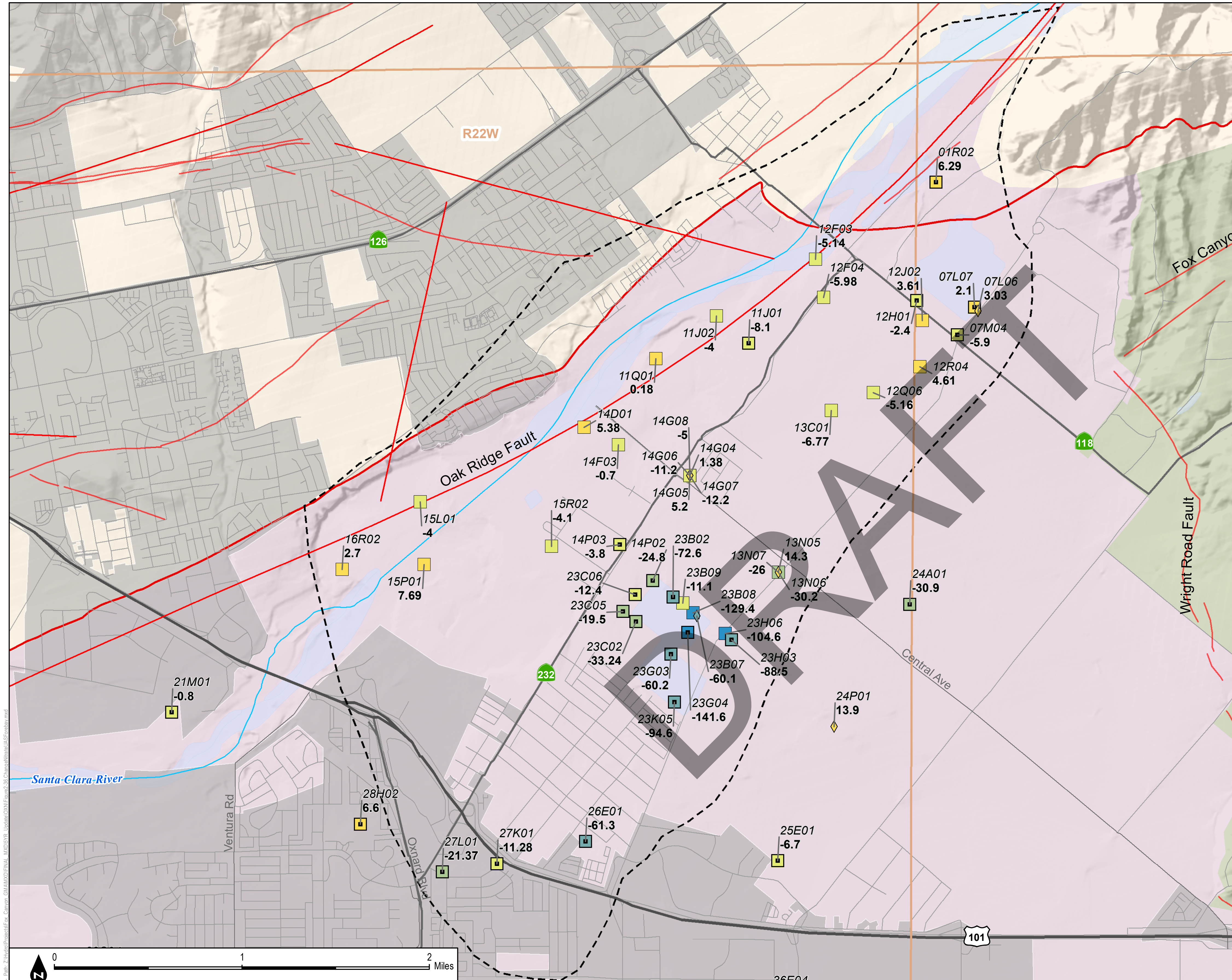
15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-35
Change in Nitrate Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Nitrate change in concentration (mg/L)

- =< -100
- -99 - -50
- -49 - -15
- -14 - 0
- 1 - 15
- 16 - 50
- 51 - 100
- > 100

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

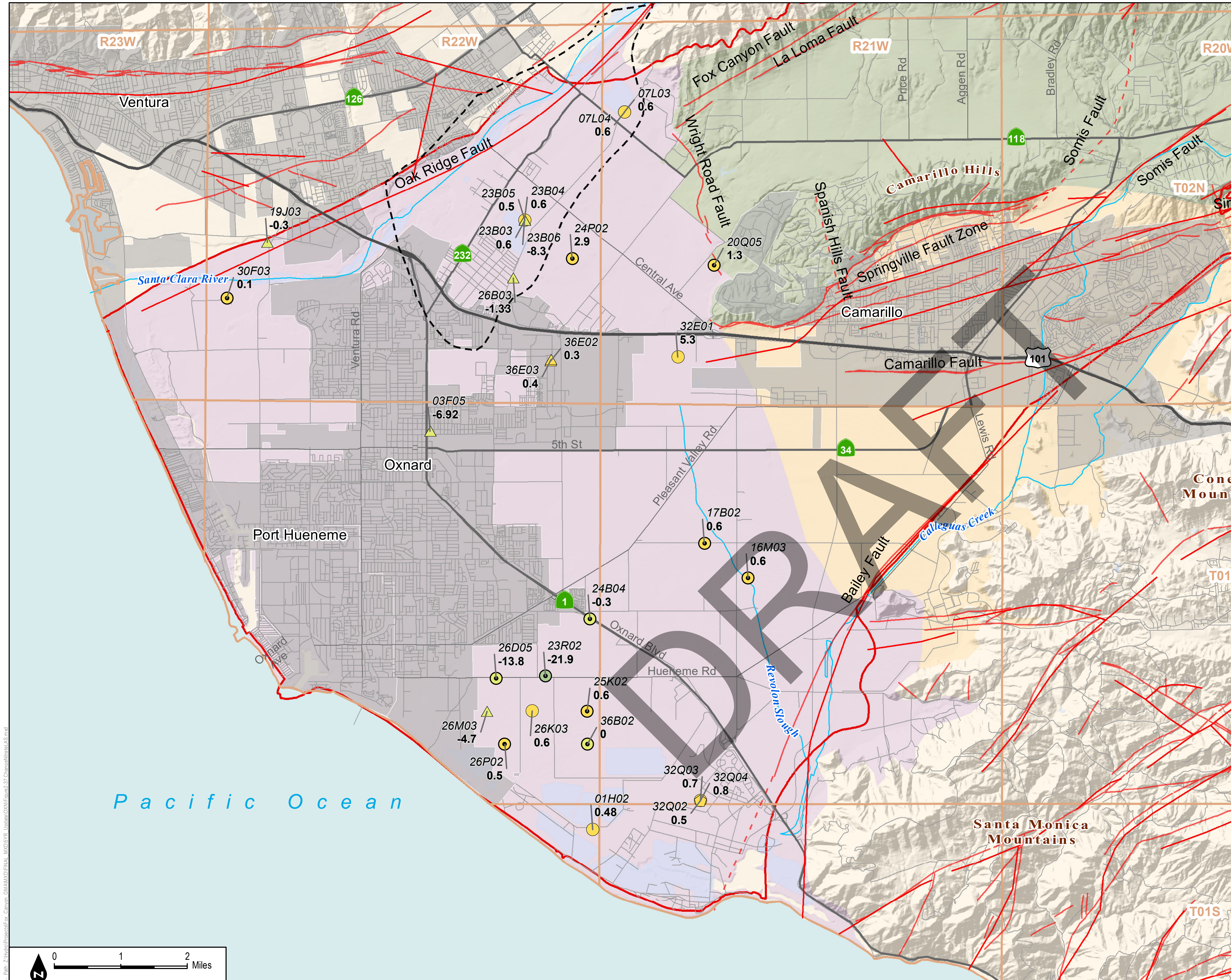
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-36

Change in Nitrate Concentration (mg/L) in the UAS, Forebay Area, between 2011-2015 and 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Aquifer designation

- Well screened in the Hueneme aquifer
- Well screened in the Fox Canyon aquifer
- Well screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS

Nitrate change in concentration (mg/L)

- =< -100
- -99 - -50
- -49 - -15
- -14 - 0
- 1 - 15
- 16 - 50
- 51 - 100
- > 100

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

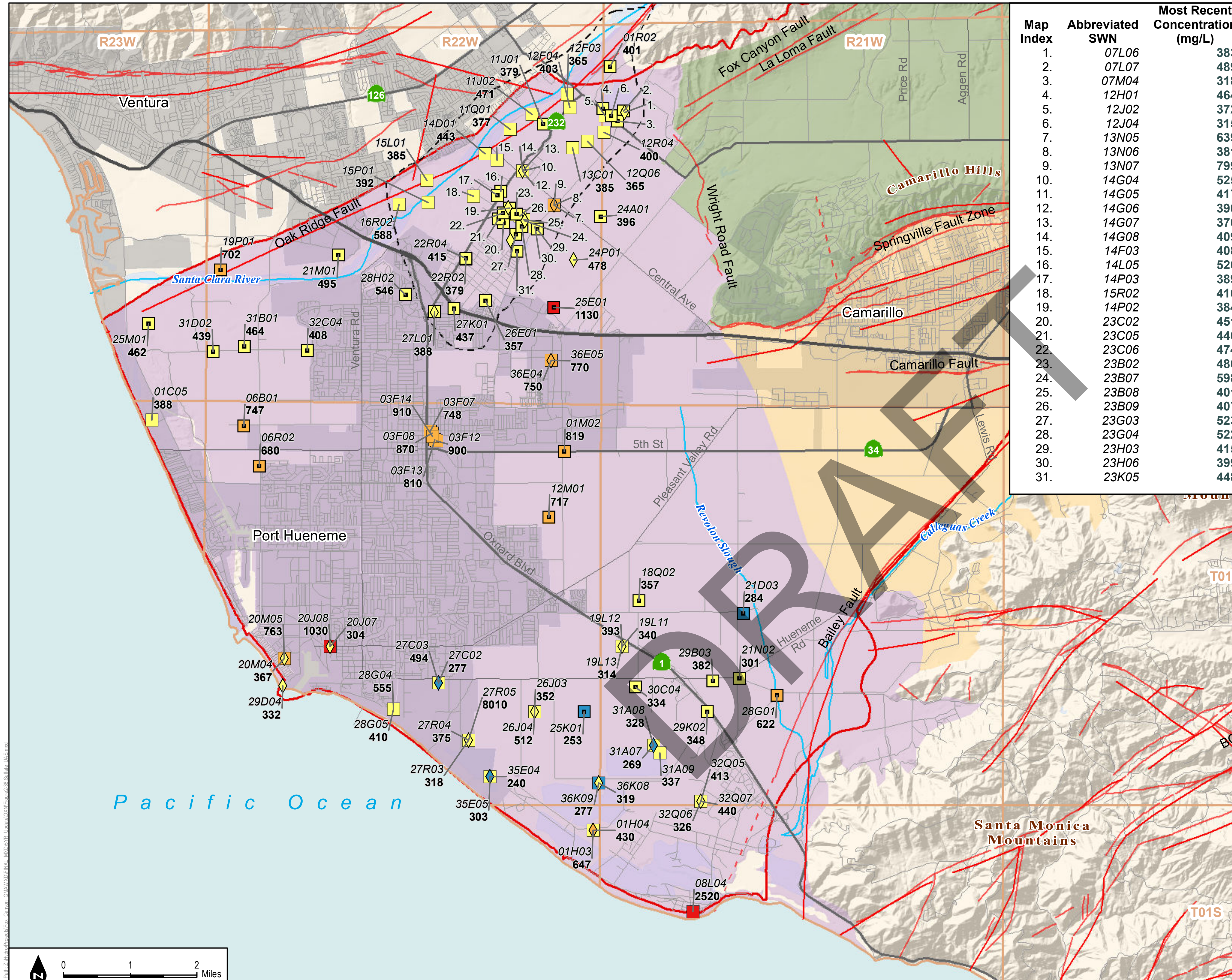
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration.
Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-37

Change in Nitrate Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1.	07L06	383
2.	07L07	489
3.	07M04	318
4.	12H01	464
5.	12J02	372
6.	12J04	315
7.	13N05	639
8.	13N06	381
9.	13N07	799
10.	14G04	525
11.	14G05	417
12.	14G06	390
13.	14G07	376
14.	14G08	409
15.	14F03	408
16.	14L05	526
17.	14P03	389
18.	15R02	416
19.	14P02	384
20.	23C02	451
21.	23C05	446
22.	23C06	474
23.	23B02	486
24.	23B07	598
25.	23B08	401
26.	23B09	407
27.	23G03	523
28.	23G04	522
29.	23H03	415
30.	23H06	399
31.	23K05	448

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Sulfate concentration (mg/L), 2019-2023

- 29 - 300
- 301 - 600
- 601 - 1000
- 1001 - 5740

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

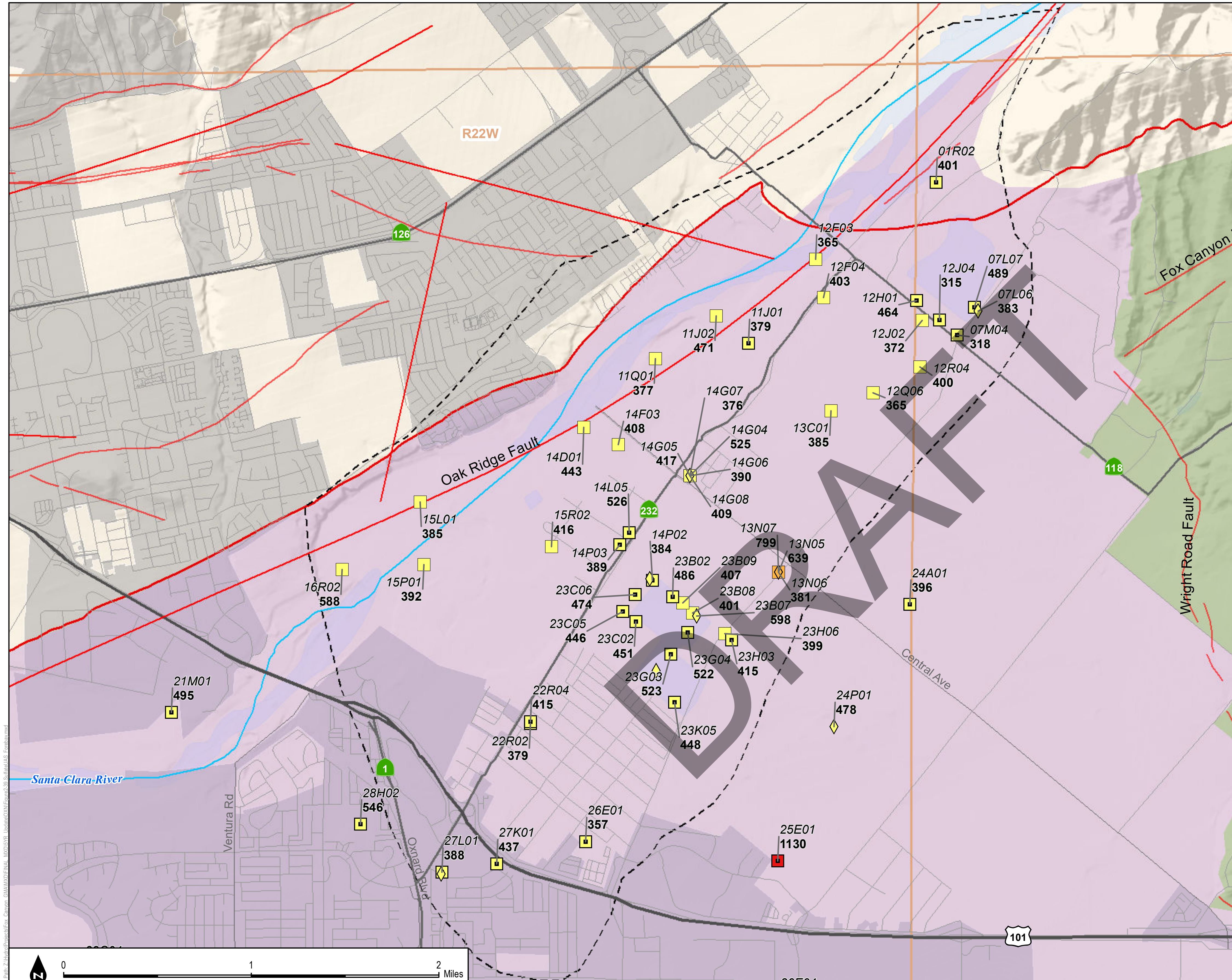
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) SWNs are based on Township and Range 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.
3) The shape of each well symbol corresponds to the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-38

Upper Aquifer System - Most Recent Sulfate (mg/L) Measured 2019-2023



Legend

Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)

Major Rivers/Stream Channels

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

Faults (Dashed Where Inferred)

Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

Las Posas Valley (4-008)

Pleasant Valley (4-006)

Oxnard (4-004.02)

Sulfate concentration (mg/L), 2019-2023

29 - 300

301 - 600

601 - 1000

1001 - 5740

Aquifer designation

Well screened in the Oxnard aquifer

Well screened in the Mugu aquifer

Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)

10.5 Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

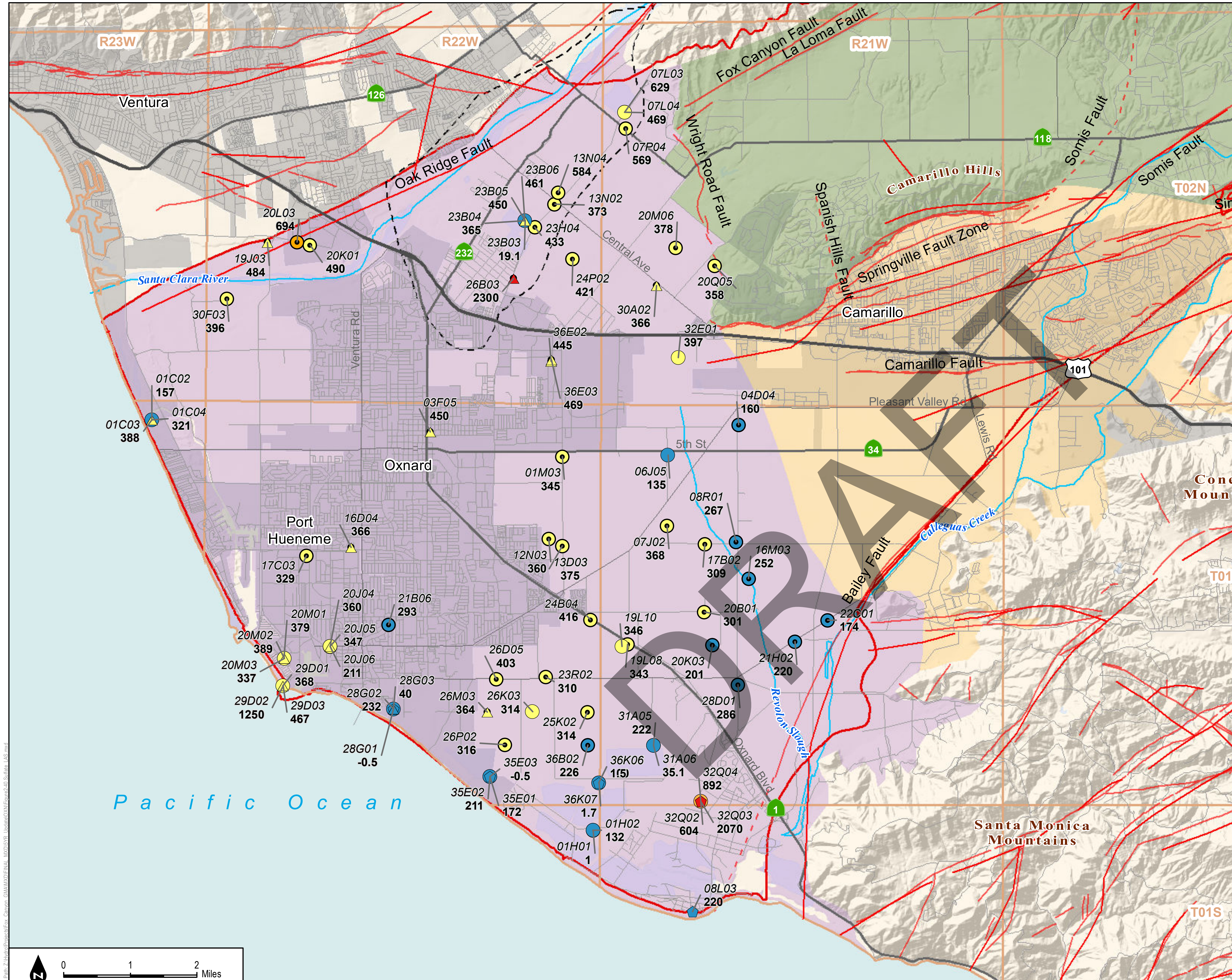
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-39

Upper Aquifer System, Forebay Area - Most Recent Sulfate (mg/L) Measured 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)

Major Rivers/Stream Channels

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

Faults (Dashed Where Inferred)

Oxnard Forebay

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)

Sulfate concentration (mg/L), 2019-2023

29 - 300

301 - 600

601 - 1000

1001 - 5740

Aquifer designation

Well screened in the Hueneme aquifer

Well screened in the Fox Canyon aquifer

Well screened in the Grimes Canyon aquifer

Wells screened in multiple aquifers in the LAS

15P01 Abbreviated State Well Number (see notes)

10.5 Concentration (mg/L)

Notes:

1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.

2) 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.

3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).

4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.

5) All concentrations are in mg/L.

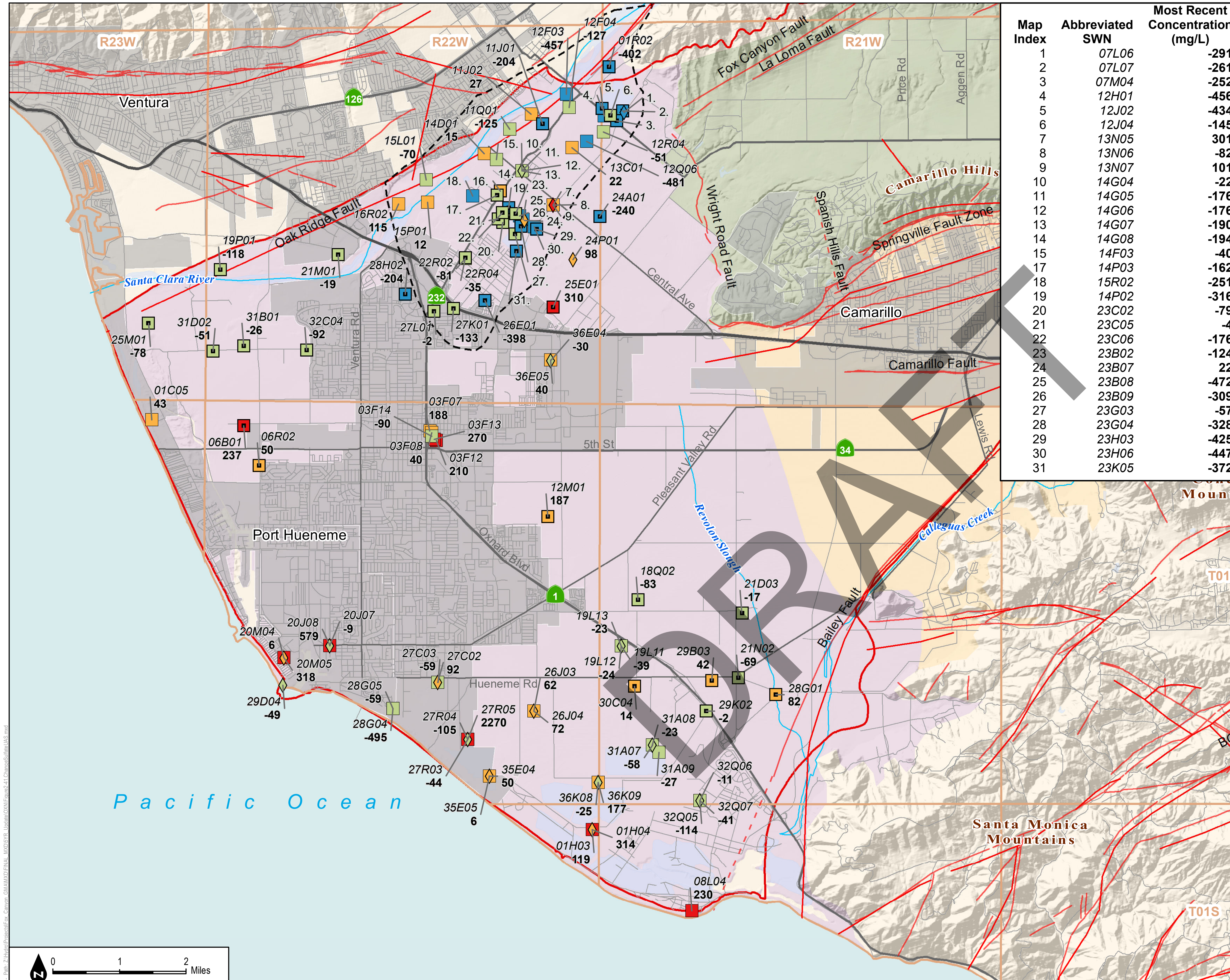
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-40

Lower Aquifer System - Most Recent Sulfate (mg/L) Measured 2019-2023



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1	07L06	-291
2	07L07	-261
3	07M04	-252
4	12H01	-456
5	12J02	-434
6	12J04	-145
7	13N05	301
8	13N06	-82
9	13N07	101
10	14G04	-22
11	14G05	-176
12	14G06	-176
13	14G07	-190
14	14G08	-194
15	14F03	-40
17	14P03	-162
18	15R02	-251
19	14P02	-316
20	23C02	-79
21	23C05	-4
22	23C06	-176
23	23B02	-124
24	23B07	22
25	23B08	-472
26	23B09	-309
27	23G03	-57
28	23G04	-328
29	23H03	-425
30	23H06	-447
31	23K05	-372

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Sulfate change in concentration (mg/L)

- =< -200
- -199 - 0
- 0 - 200
- > 200

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it. The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations. Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

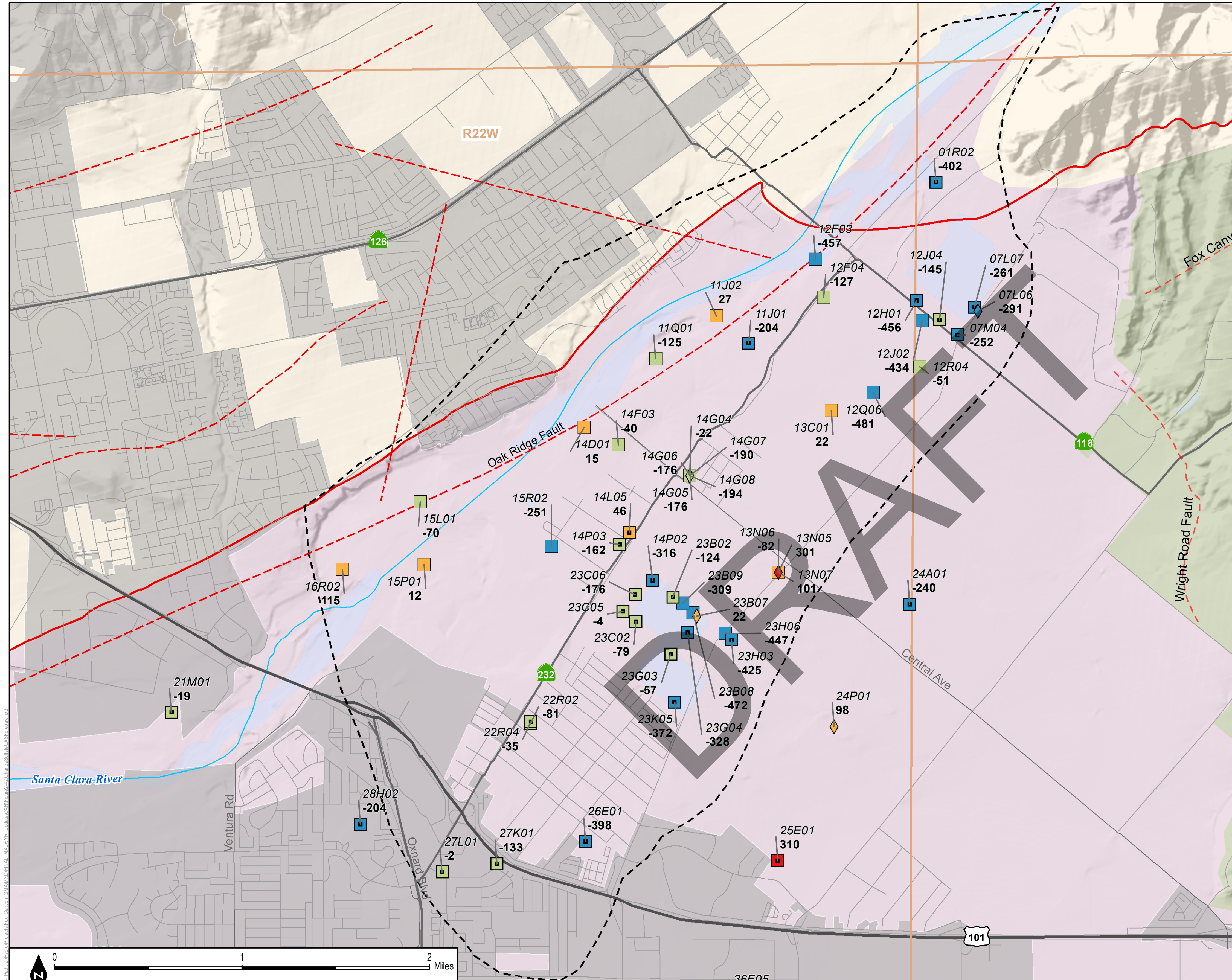
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-41

Change in Sulfate Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Sulfate change in concentration (mg/L)

- =< -200
- -199 - 0
- 1 - 200
- > 201

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

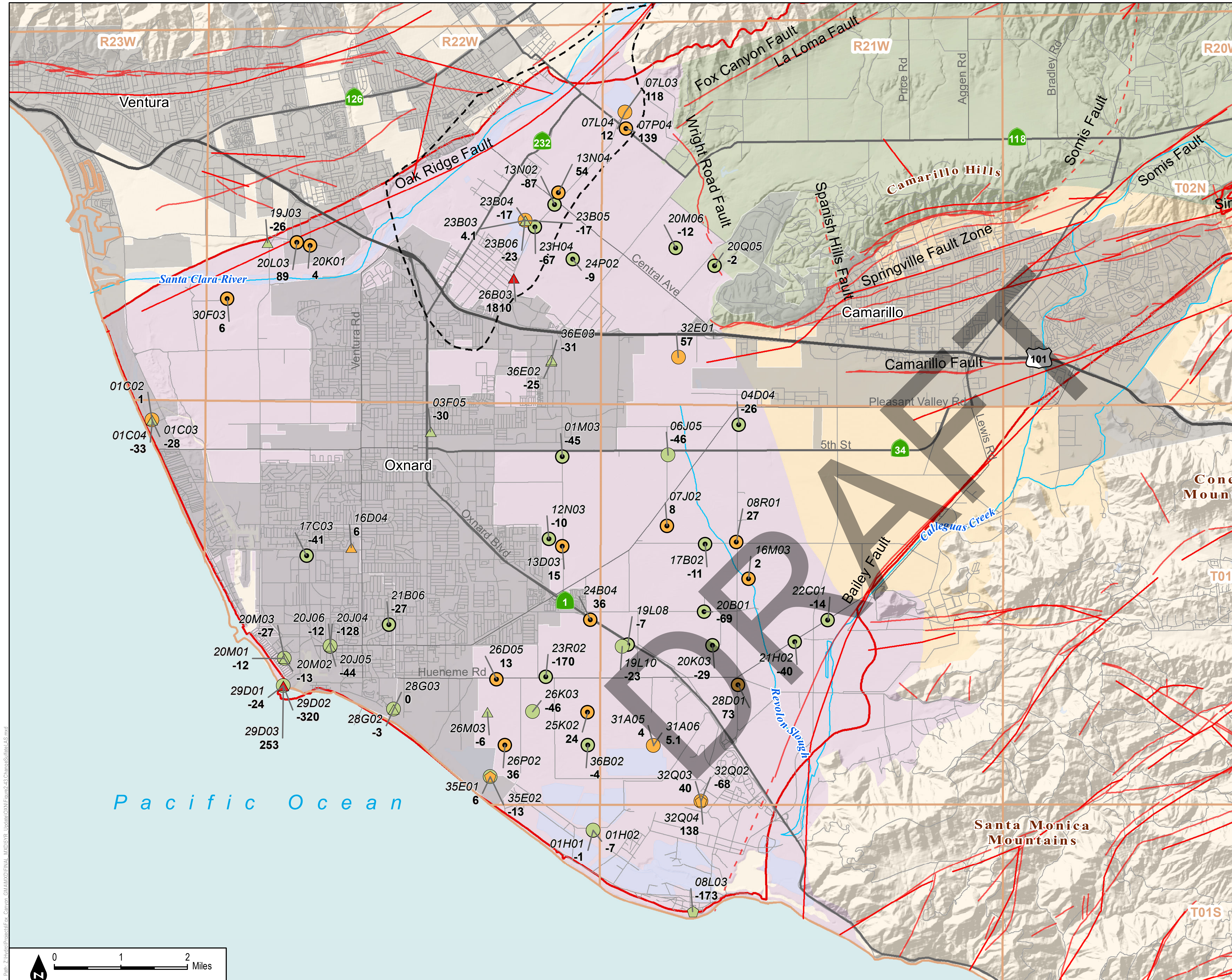
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-42

Change in Sulfate Concentration (mg/L) in the UAS, Forebay Area, between 2011-2015 and 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Sulfate change in concentration (mg/L)

- =< -200
- >-200 - 0
- >0 - 200
- >200

Aquifer designation

- Well screened in the Hueneme aquifer
- Well screened in the Fox Canyon aquifer
- Well screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it. The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations. Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

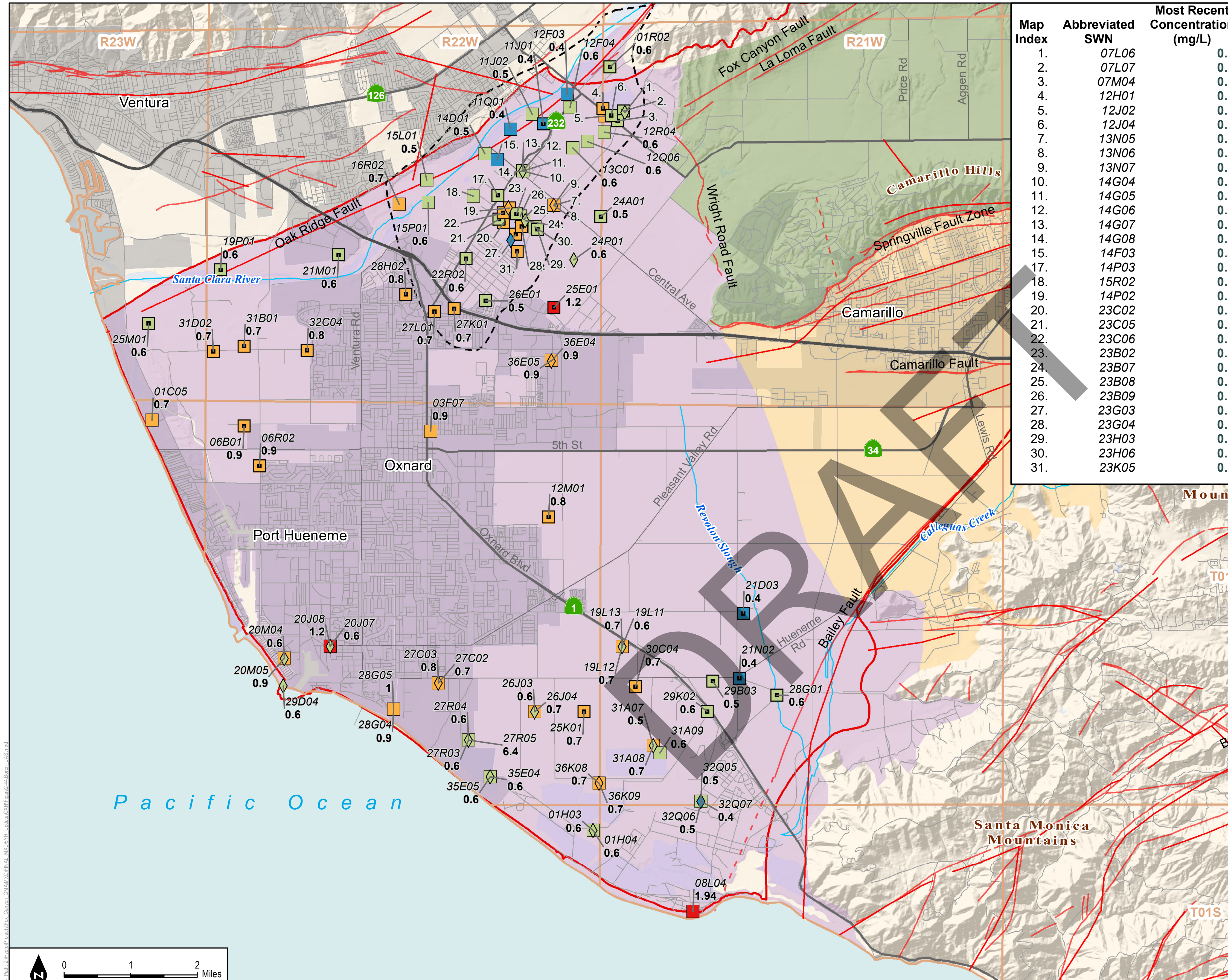
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-43

Change in Sulfate Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1.	07L06	0.6
2.	07L07	0.6
3.	07M04	0.5
4.	12H01	0.7
5.	12J02	0.7
6.	12J04	0.5
7.	13N05	0.7
8.	13N06	0.6
9.	13N07	0.8
10.	14G04	0.6
11.	14G05	0.5
12.	14G06	0.5
13.	14G07	0.5
14.	14G08	0.5
15.	14F03	0.4
17.	14P03	0.5
18.	15R02	0.6
19.	14P02	0.7
20.	23C02	0.7
21.	23C05	0.6
22.	23C06	0.8
23.	23B02	0.6
24.	23B07	0.6
25.	23B08	0.6
26.	23B09	0.6
27.	23G03	0.7
28.	23G04	0.7
29.	23H03	0.6
30.	23H06	0.6
31.	23K05	0.7

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Boron concentration (mg/L), 2019-2023

- 0- 0.4
- >0.4 - 0.6
- >0.6 - 1.0
- >1.0 - 2.0

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

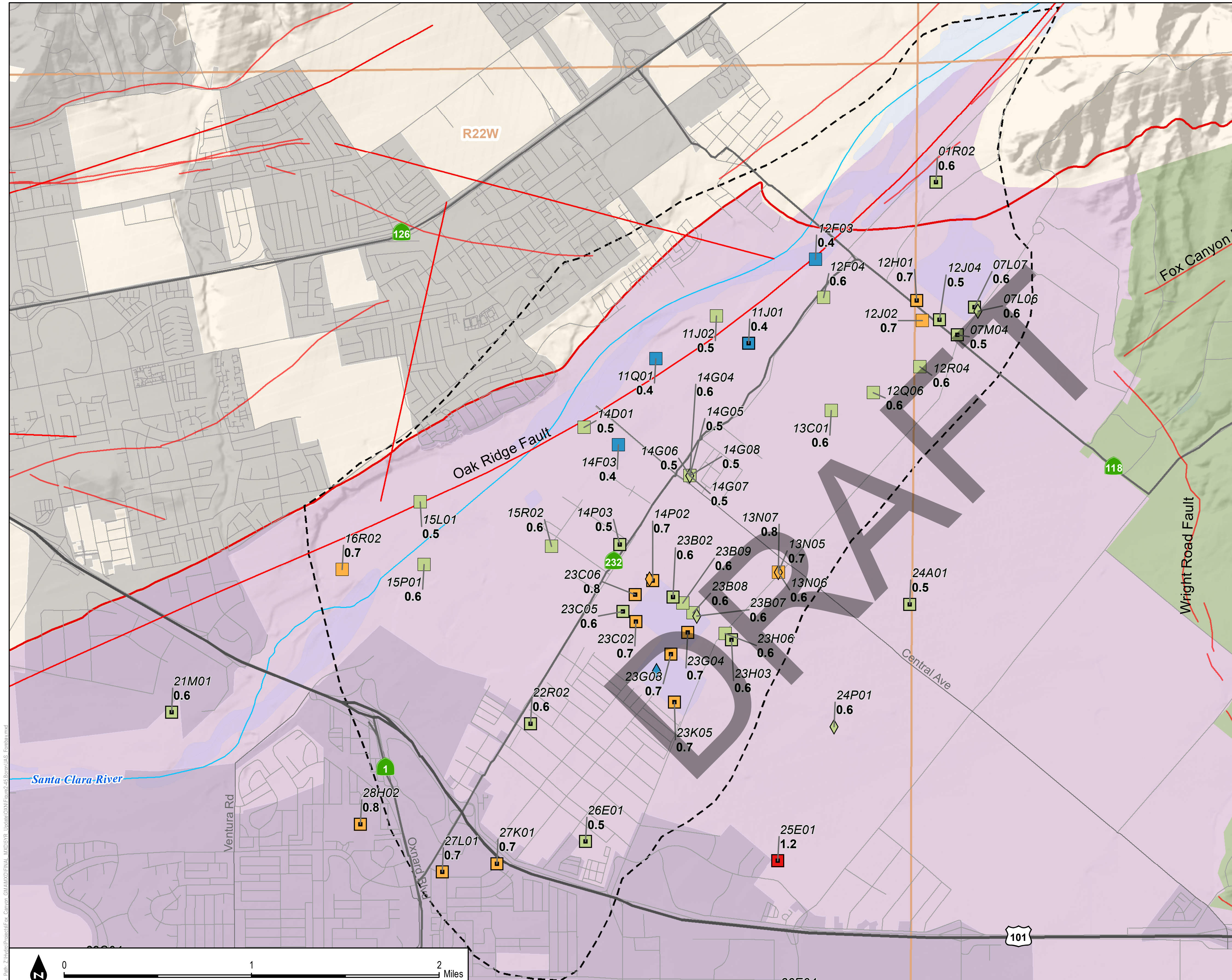
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) SWNs are based on Township and Range 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.
3) The shape of each well symbol corresponds to the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-44

Upper Aquifer System - Most Recent Boron (mg/L) Measured 2019-2023



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Boron concentration (mg/L), 2019-2023

- 0- 0.4
- >0.4 - 0.6
- >0.6 - 1.0
- >1.0 - 2.0

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Concentration (mg/L)

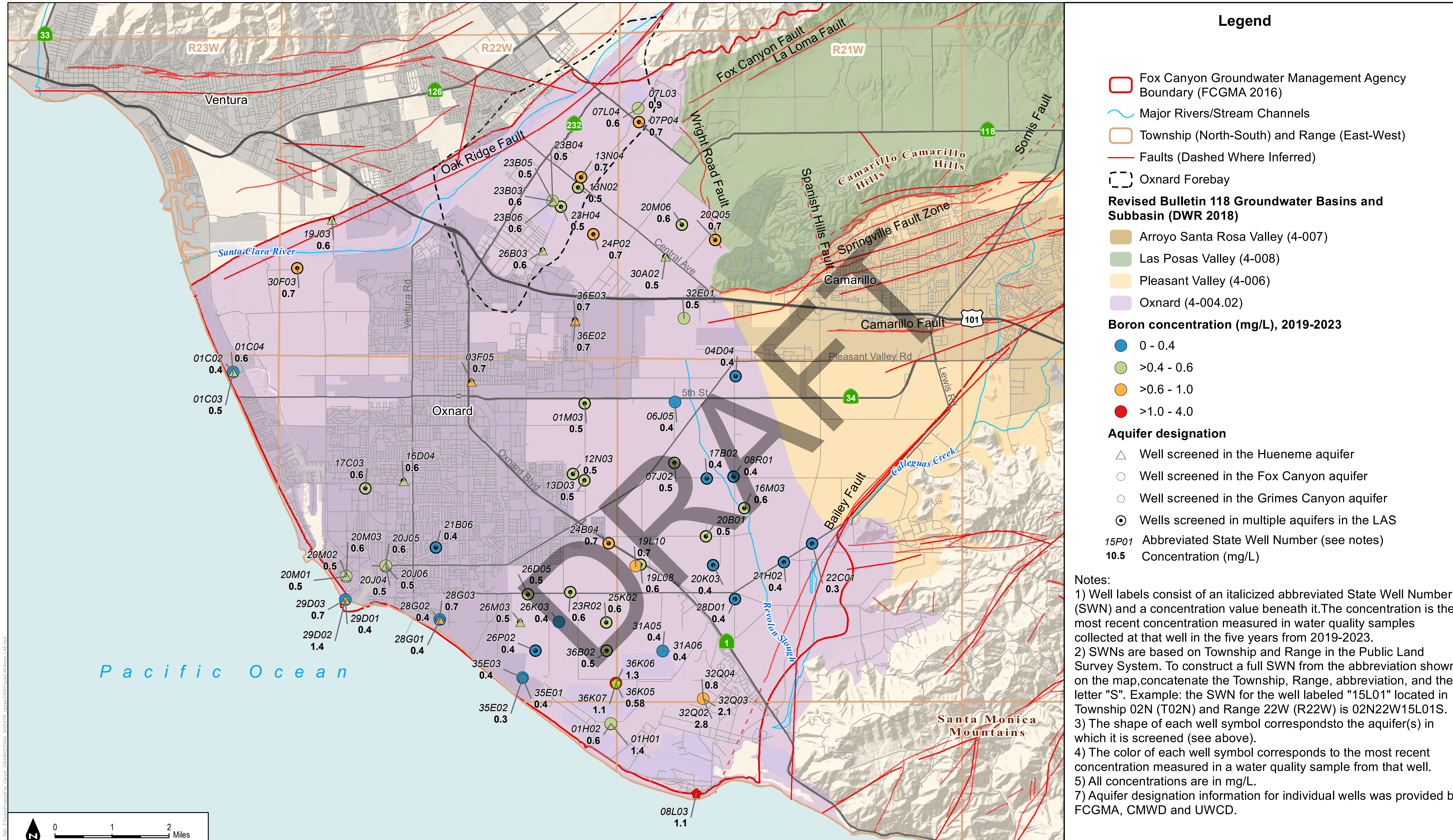
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and a concentration value beneath it.The concentration is the most recent concentration measured in water quality samples collected at that well in the five years from 2019-2023.
2) SWNs are based on Township and Range 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol corresponds to the most recent concentration measured in a water quality sample from that well.
5) All concentrations are in mg/L.
7) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-45

Upper Aquifer System, Forebay Area - Most Recent Boron (mg/L) Measured 2019-2023



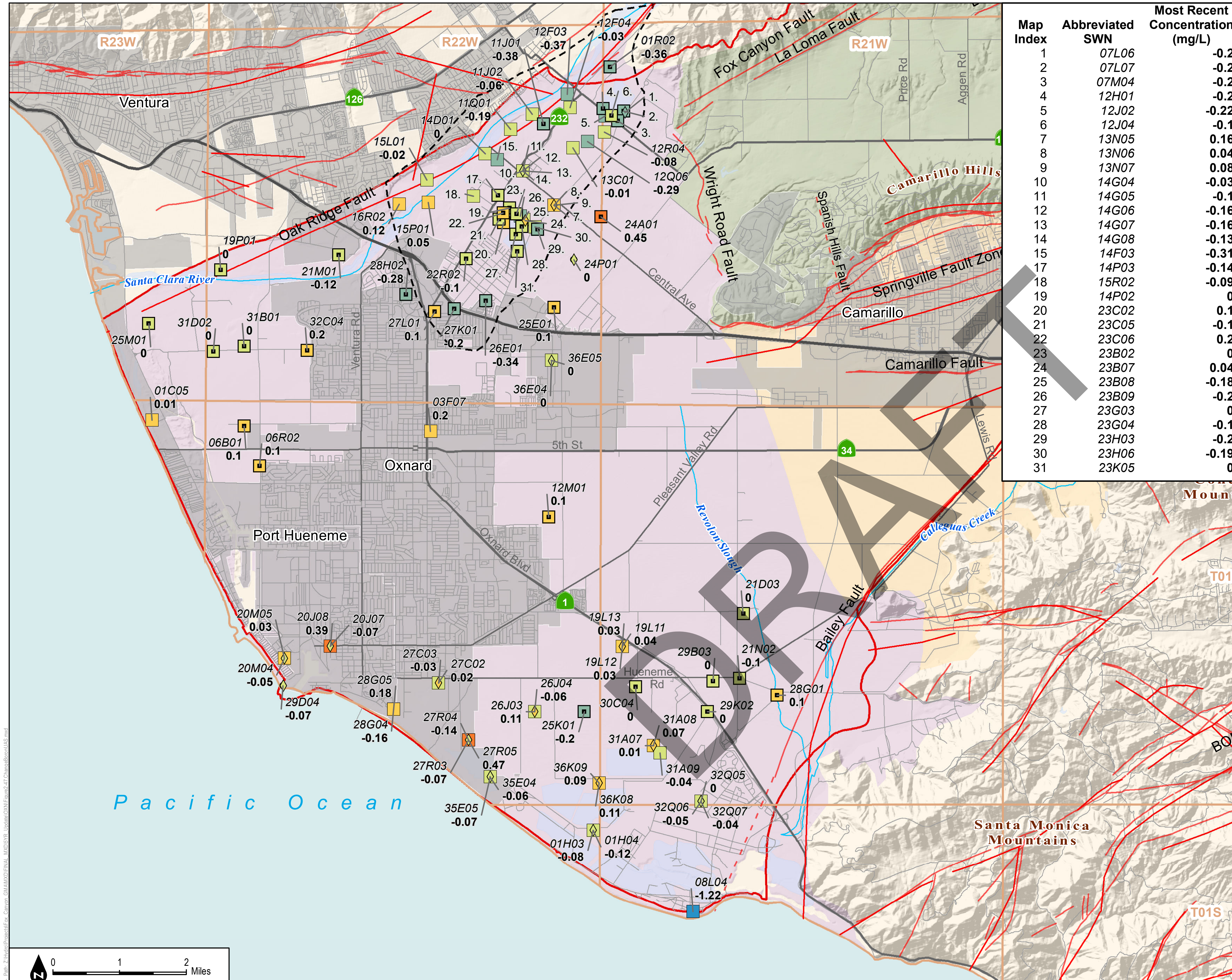
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-46

Lower Aquifer System - Most Recent Boron (mg/L) Measured 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Map Index	Abbreviated SWN	Most Recent Concentration (mg/L)
1	07L06	-0.2
2	07L07	-0.2
3	07M04	-0.2
4	12H01	-0.2
5	12J02	-0.22
6	12J04	-0.1
7	13N05	0.16
8	13N06	0.04
9	13N07	0.08
10	14G04	-0.03
11	14G05	-0.1
12	14G06	-0.16
13	14G07	-0.16
14	14G08	-0.13
15	14F03	-0.31
17	14P03	-0.14
18	15R02	-0.09
19	14P02	0
20	23C02	0.1
21	23C05	-0.1
22	23C06	0.2
23	23B02	0
24	23B07	0.04
25	23B08	-0.18
26	23B09	-0.2
27	23G03	0
28	23G04	-0.1
29	23H03	-0.2
30	23H06	-0.19
31	23K05	0

Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Boron change in concentration (mg/L)

- < -0.60
- -0.59 - -0.20
- -0.19 - 0.00
- 0.01 - 0.20
- 0.21 - 0.60
- > 0.60

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it. The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations. Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

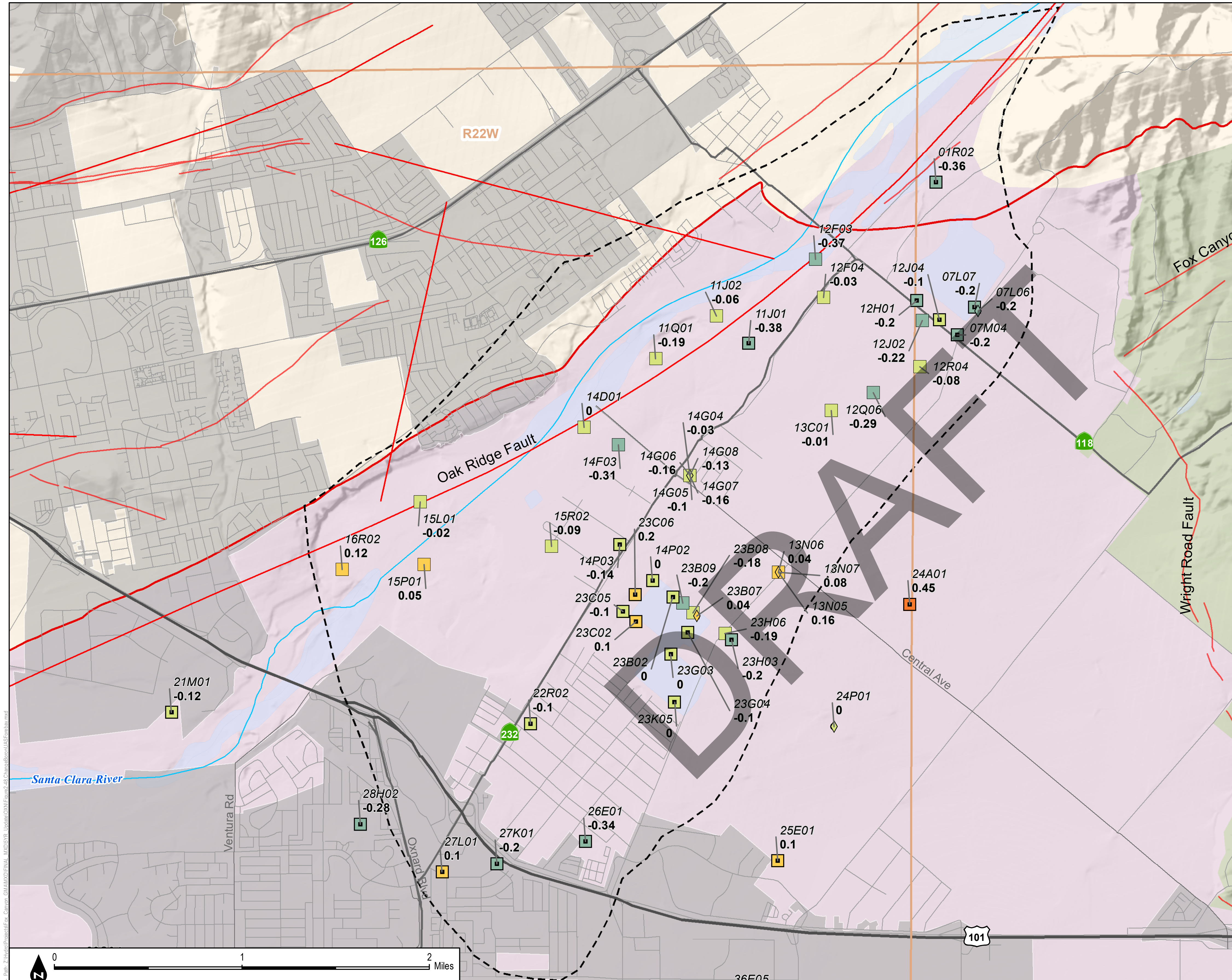
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-47

Change in Boron Concentration (mg/L) in the UAS between 2011-2015 and 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

Revised Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Boron change in concentration (mg/L)

- < -0.60
- -0.59 - -0.20
- -0.19 - 0.00
- 0.01 - 0.20
- 0.21 - 0.60
- > 0.60

Aquifer designation

- Well screened in the Oxnard aquifer
- Well screened in the Mugu aquifer
- Wells screened in multiple aquifers in the UAS
- *15P01* Abbreviated State Well Number (see notes)
- **10.5** Change in Concentration (mg/L)

Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
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5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

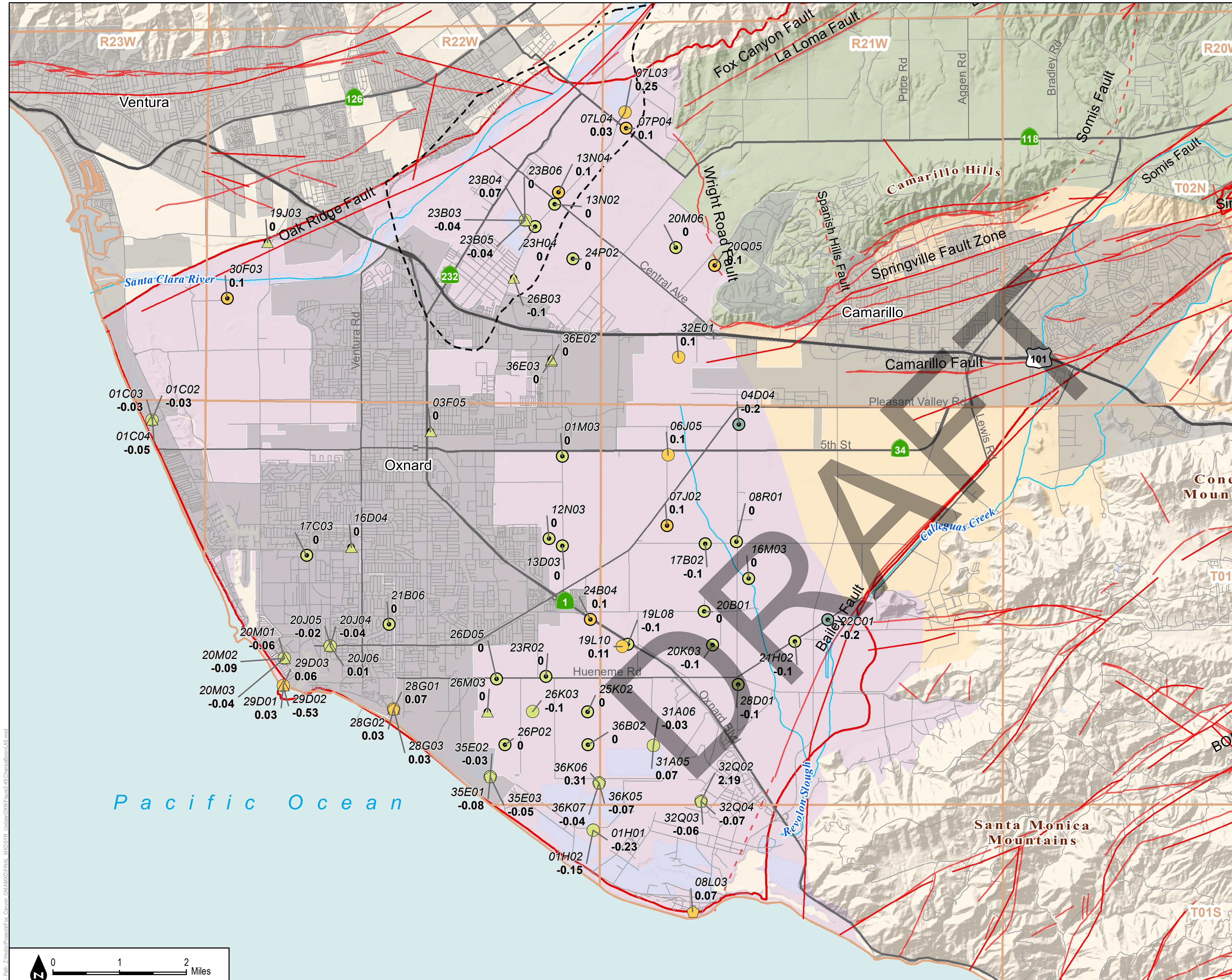
DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-48

Change in Boron Concentration (mg/L) in the UAS, Forebay Area, between 2011-2015 and 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

- Fox Canyon Groundwater Management Agency Boundary (FCGMA 2016)
- Major Rivers/Stream Channels
- Township (North-South) and Range (East-West)
- Faults (Dashed Where Inferred)
- Oxnard Forebay

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)

Boron change in concentration (mg/L)

- =< -0.60
- -0.59- -0.20
- -0.19 - 0.00
- 0.01 - 0.20
- 0.21 - 0.60
- > 0.60

Aquifer designation

- Well screened in the Hueneme aquifer
- Well screened in the Fox Canyon aquifer
- Well screened in the Grimes Canyon aquifer
- Wells screened in multiple aquifers in the LAS

15P01 Abbreviated State Well Number (see notes)
10.5 Change in Concentration (mg/L)

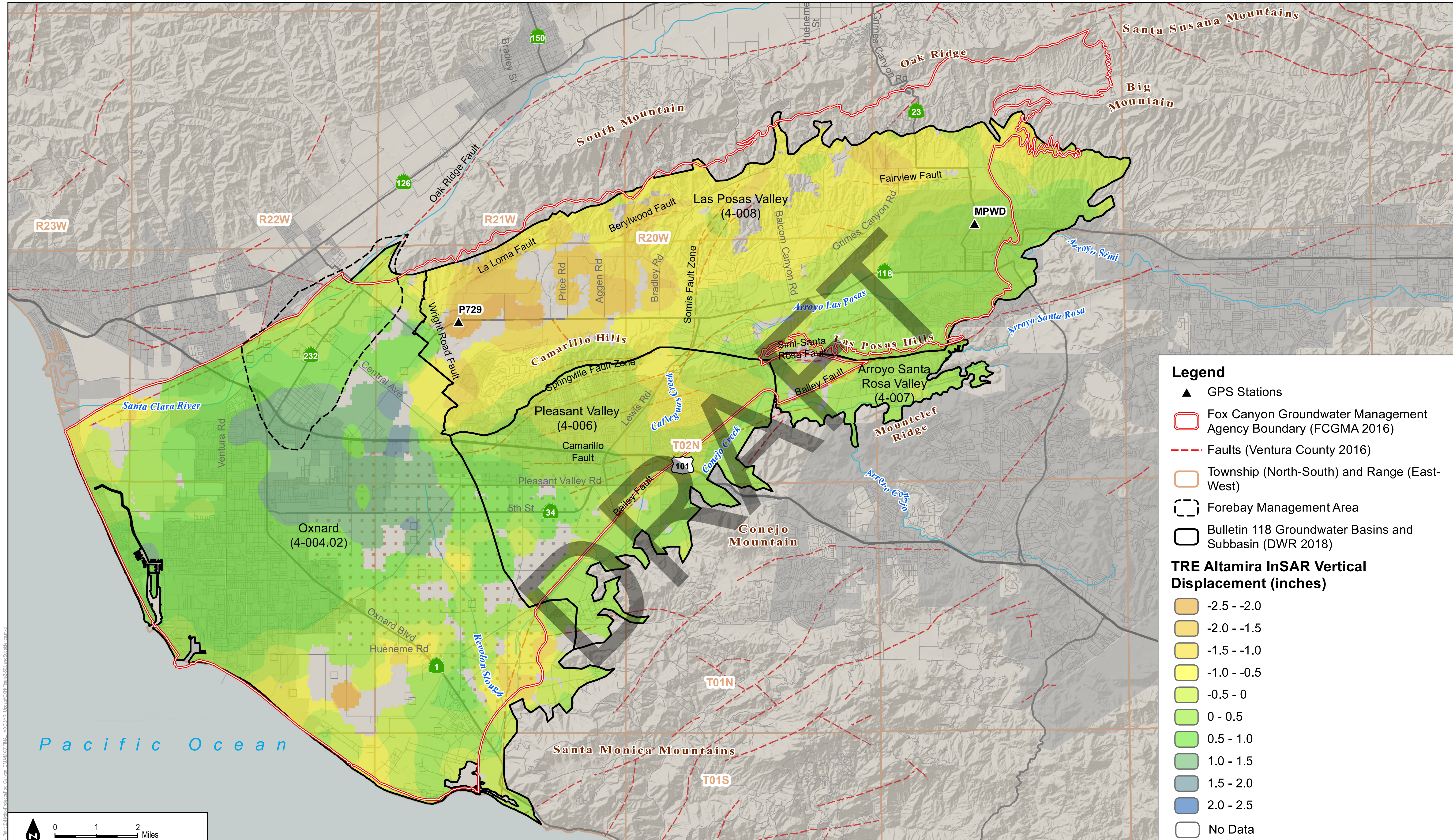
Notes:
1) Well labels consist of an italicized abbreviated State Well Number (SWN) and change in concentration value beneath it.
The change in concentration represents the difference between the 2011-2015 and 2019-2023 most recent concentrations.
Maps of the 2011-2015 most recent concentration are included in the GSP.
2) 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.
3) The shape of each well symbol correspondsto the aquifer(s) in which it is screened (see above).
4) The color of each well symbol represents the change in groundwater quality measured since the 2011 to 2015 period.
5) All change in concentrations are in mg/L.
6) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.
7) Negative (-) values represent a decrease in concentration. Positive (+) values represent an increase in concentration.

DUDEK

SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

FIGURE 2-49
Change in Boron Concentration (mg/L) in the LAS between 2011-2015 and 2019-2023

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



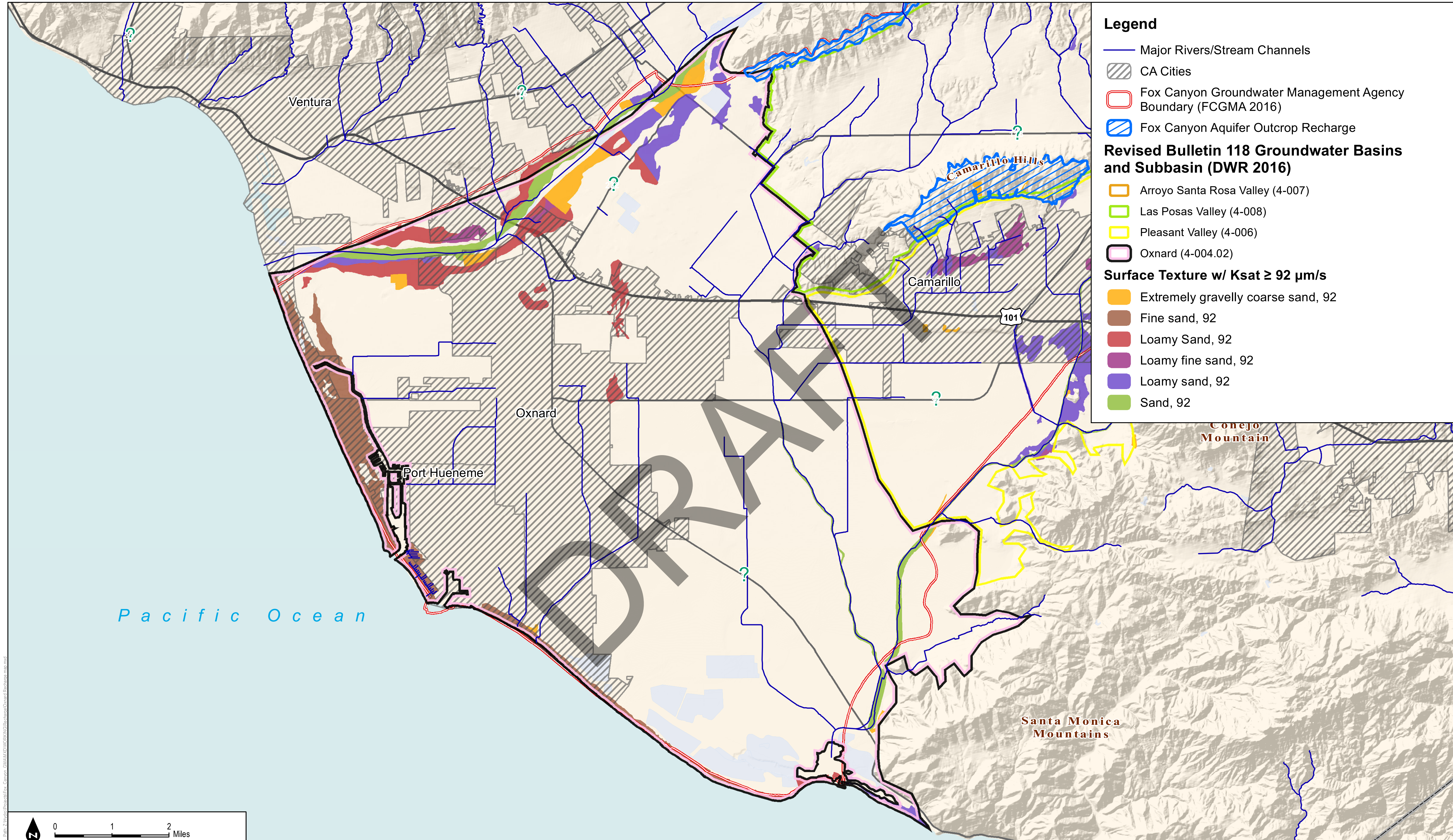
DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 2-50

Land Subsidence June 2015 to January 2024

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



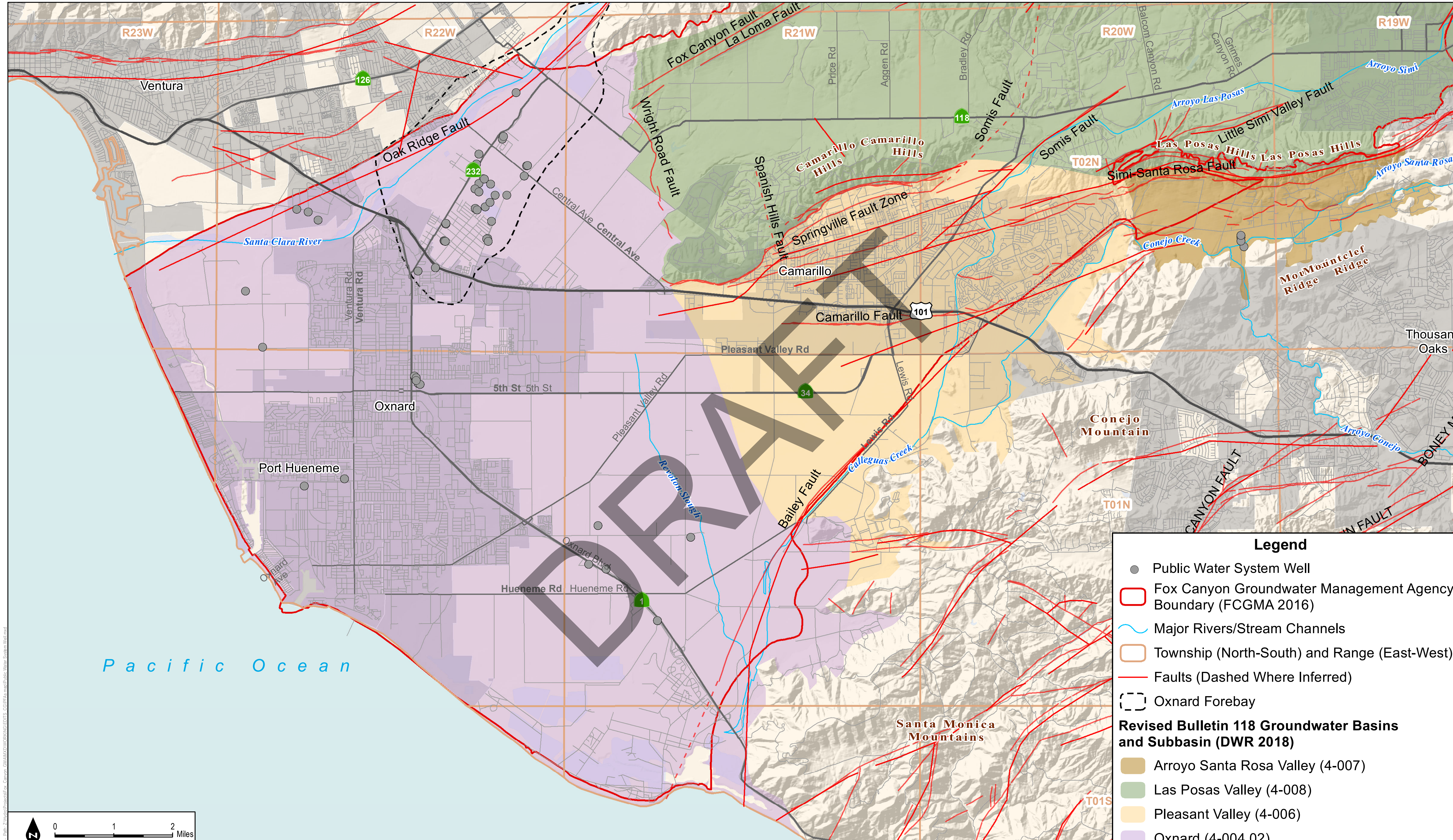
SOURCE: DWR, USGS, NRCS

DUDEK

Figure 4-1

Oxnard Subbasin Potential Recharge Areas

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



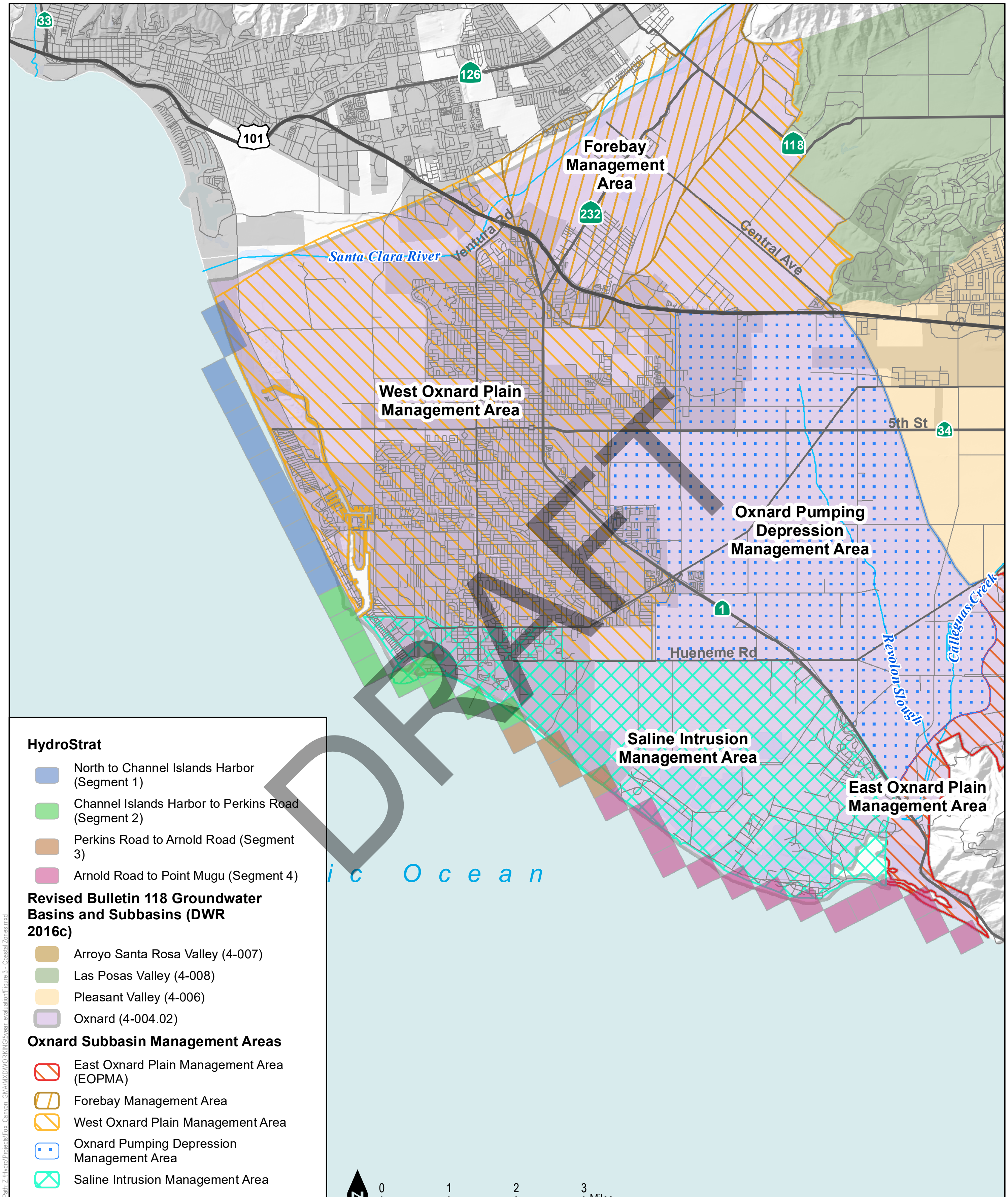
SOURCE: DWR, FCGMA, VCWPD, CMWD, UWCD

DUDEK

FIGURE 4-2

Public Water System Wells Currently Monitoring PFAS Concentrations in Groundwater

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



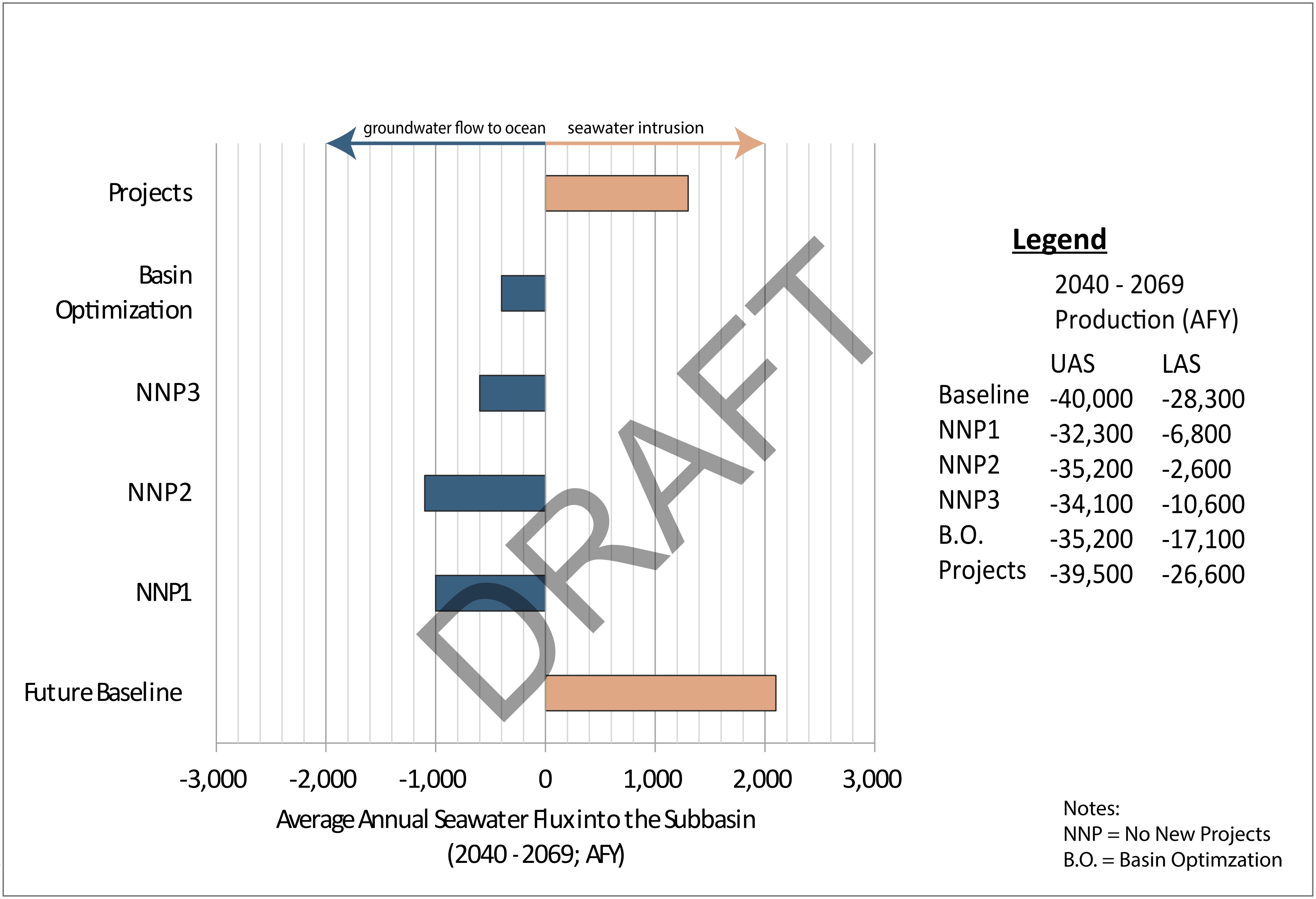
DUDEK

SOURCE: DWR; County of Ventura; FCGMA

FIGURE 5-1

Modeled Seawater Flux Coastal Segments

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

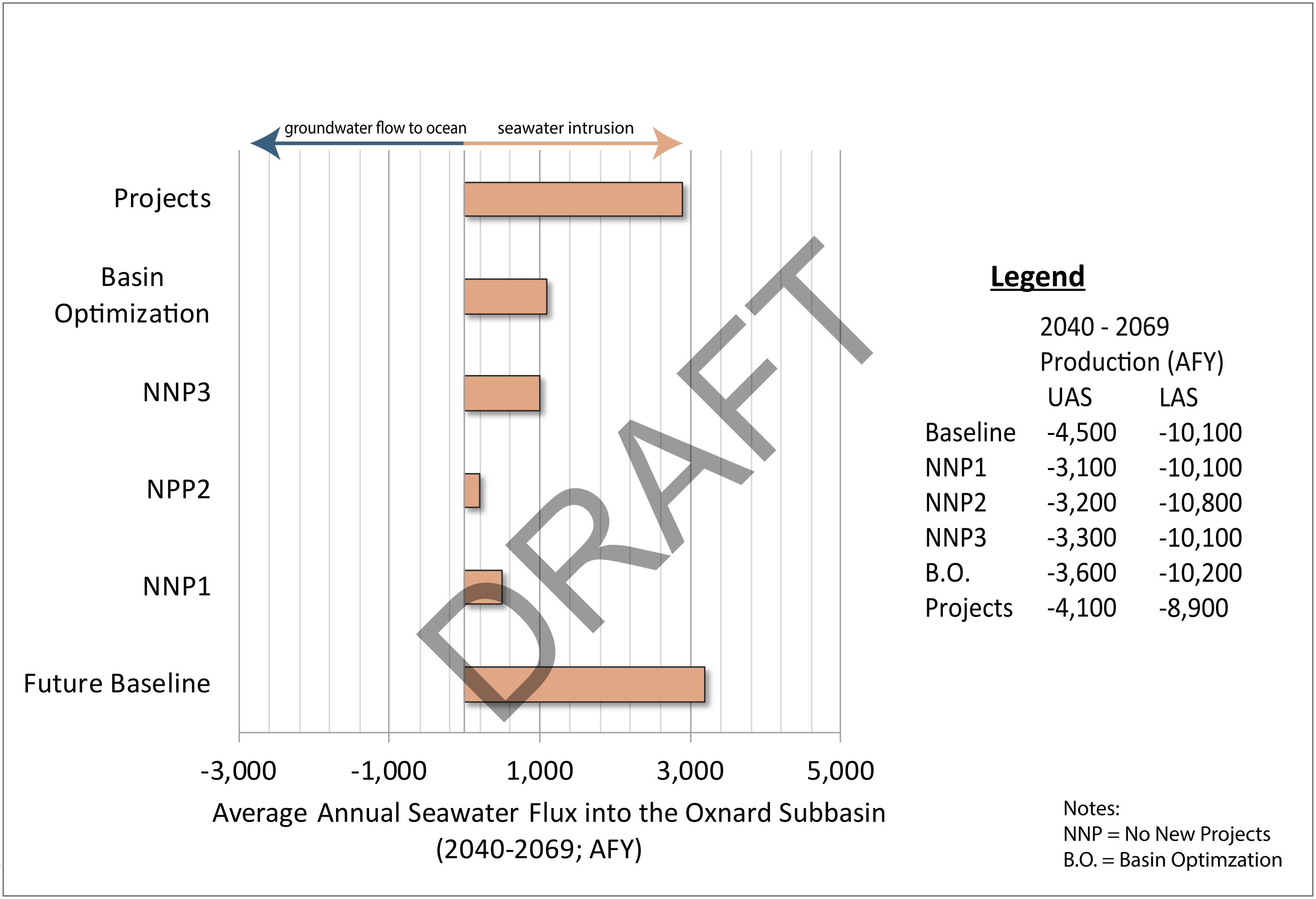


SOURCE: UWCD

DUDEK

FIGURE 5-1

Seawater Flux in the UAS: Future Model Scenarios without UWCD's EBB Project

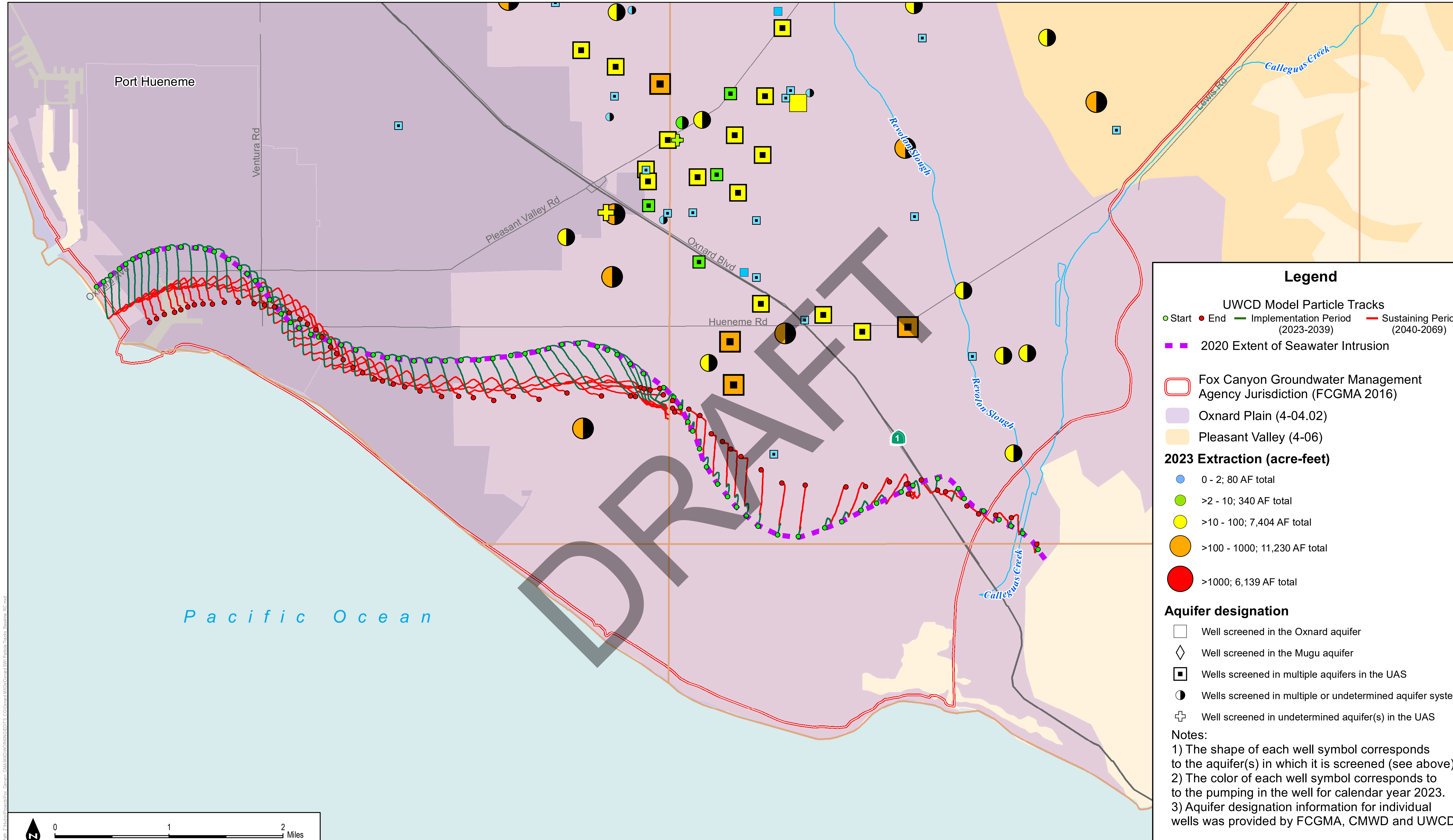


SOURCE: UWCD

DUDEK

FIGURE 5-3

Seawater Flux in the LAS: Future Model Scenarios without UWCD's EBB Project

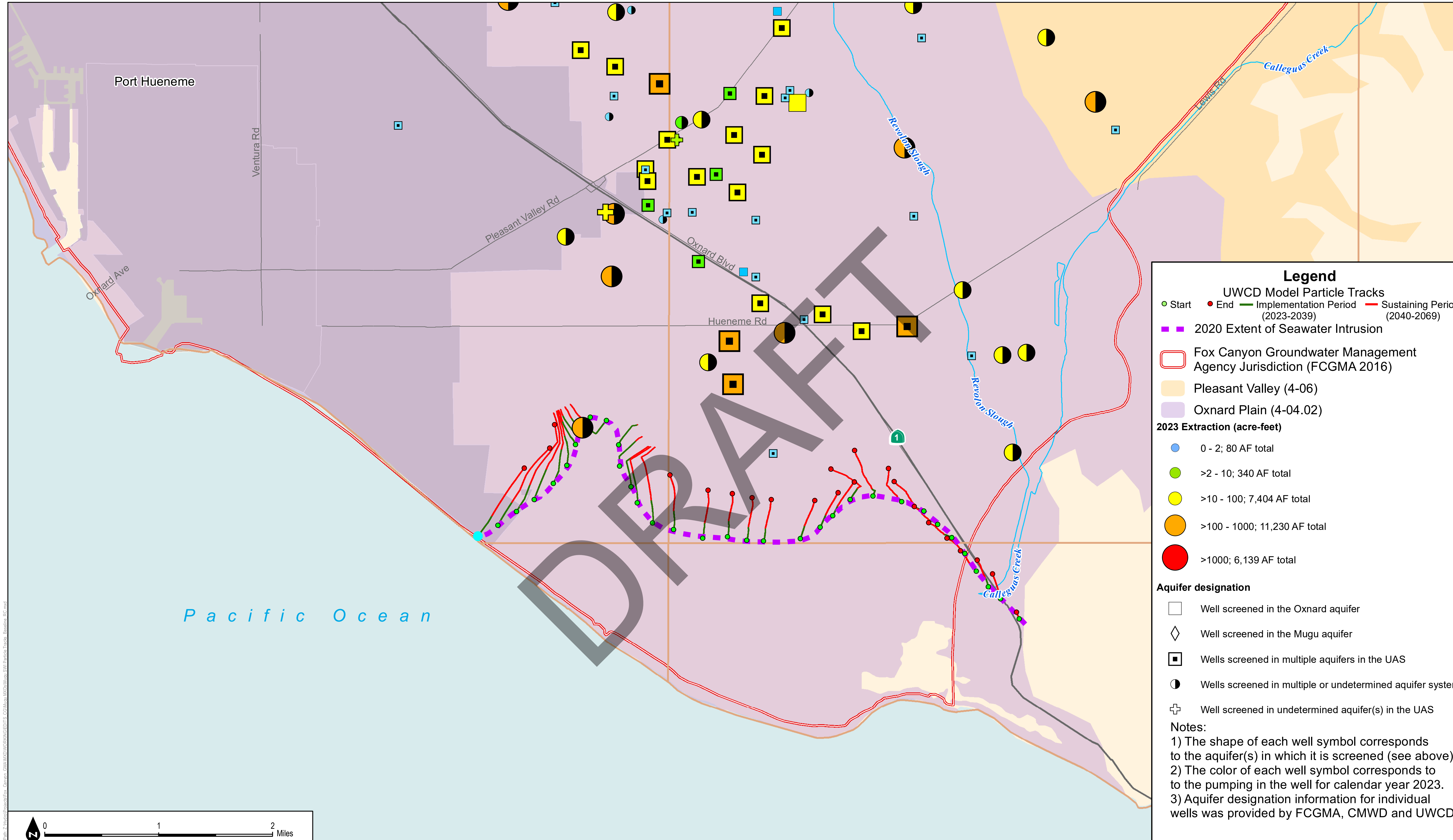


SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-4
UWCD Model Particle Tracks, Oxnard Aquifer, Future Baseline

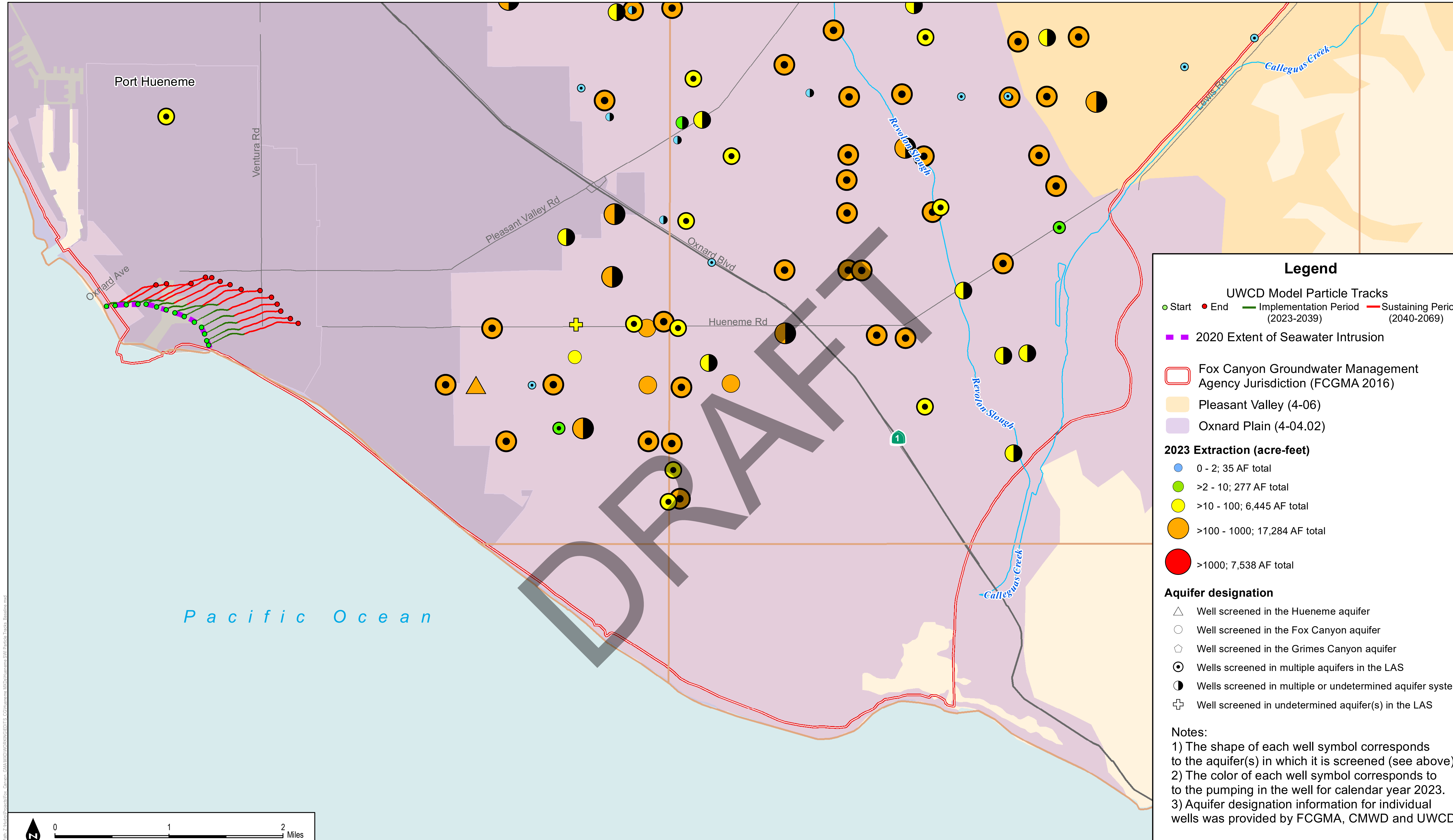
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

Figure 5-5
UWCD Model Particle Tracks, Mugu Aquifer, Future Baseline

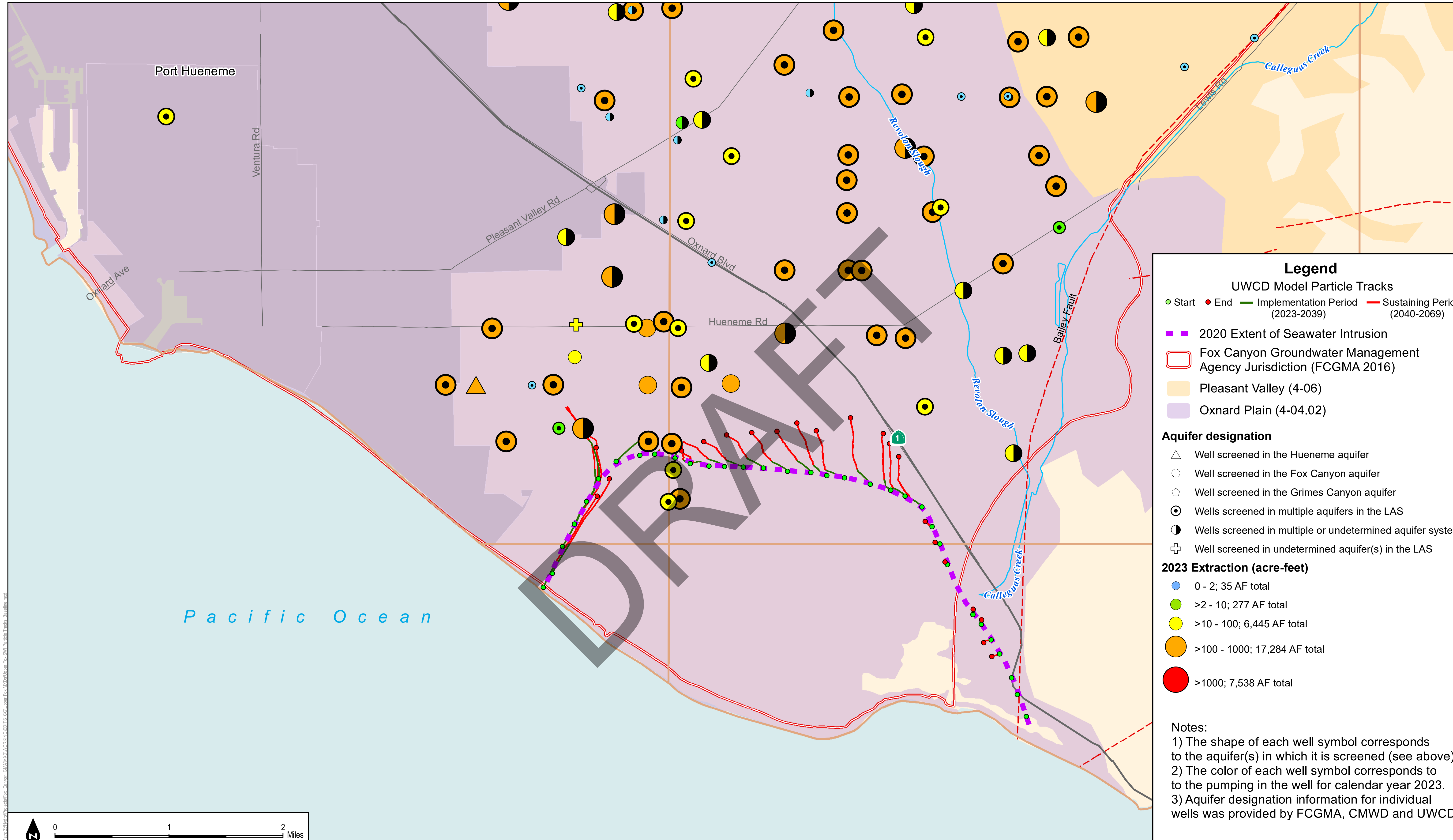


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

Figure 5-6
UWCD Model Particle Tracks, Hueneme Aquifer, Future Baseline

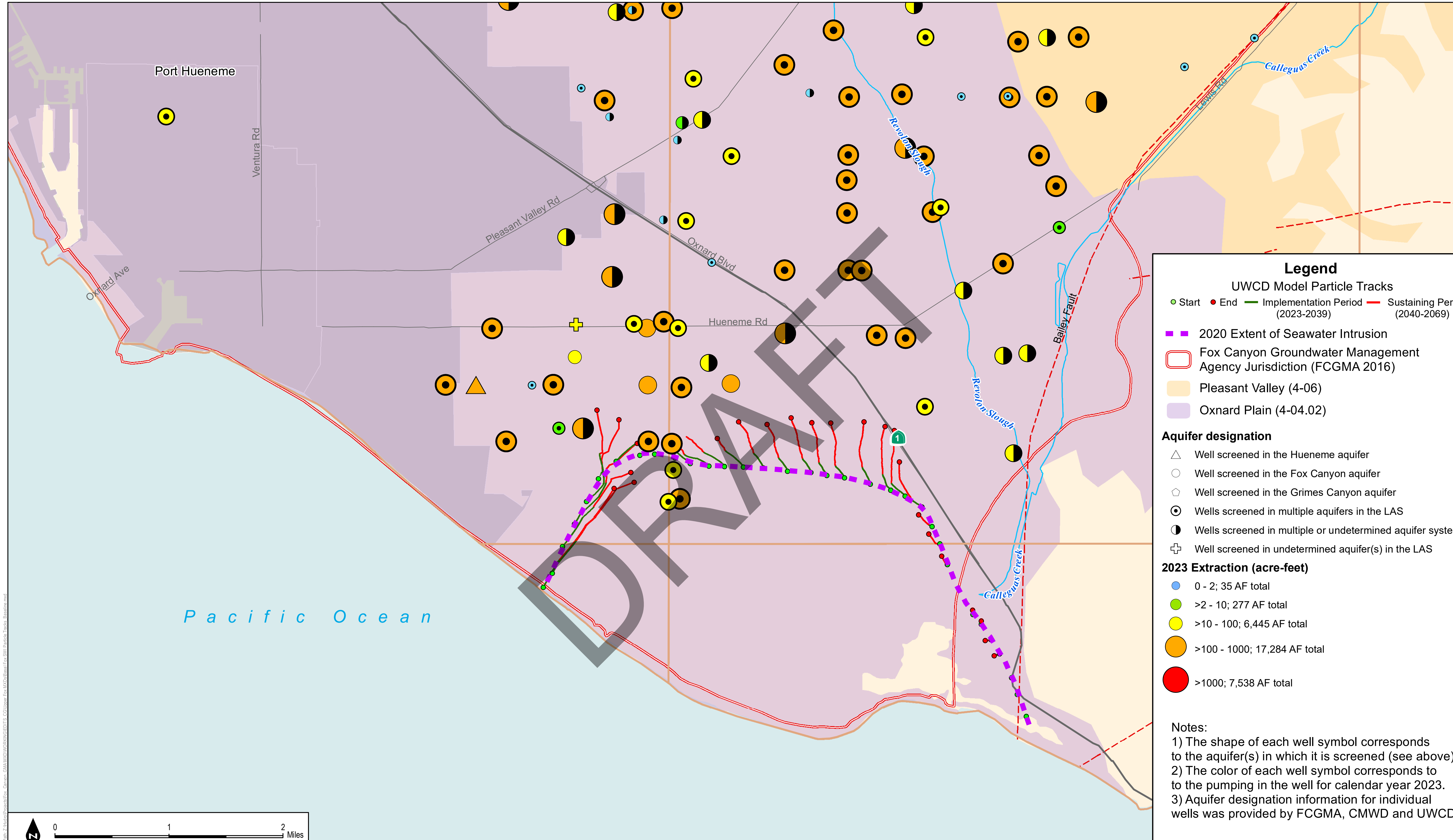
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-7
UWCD Model Particle Tracks, Upper Fox Canyon Aquifer, Future Baseline

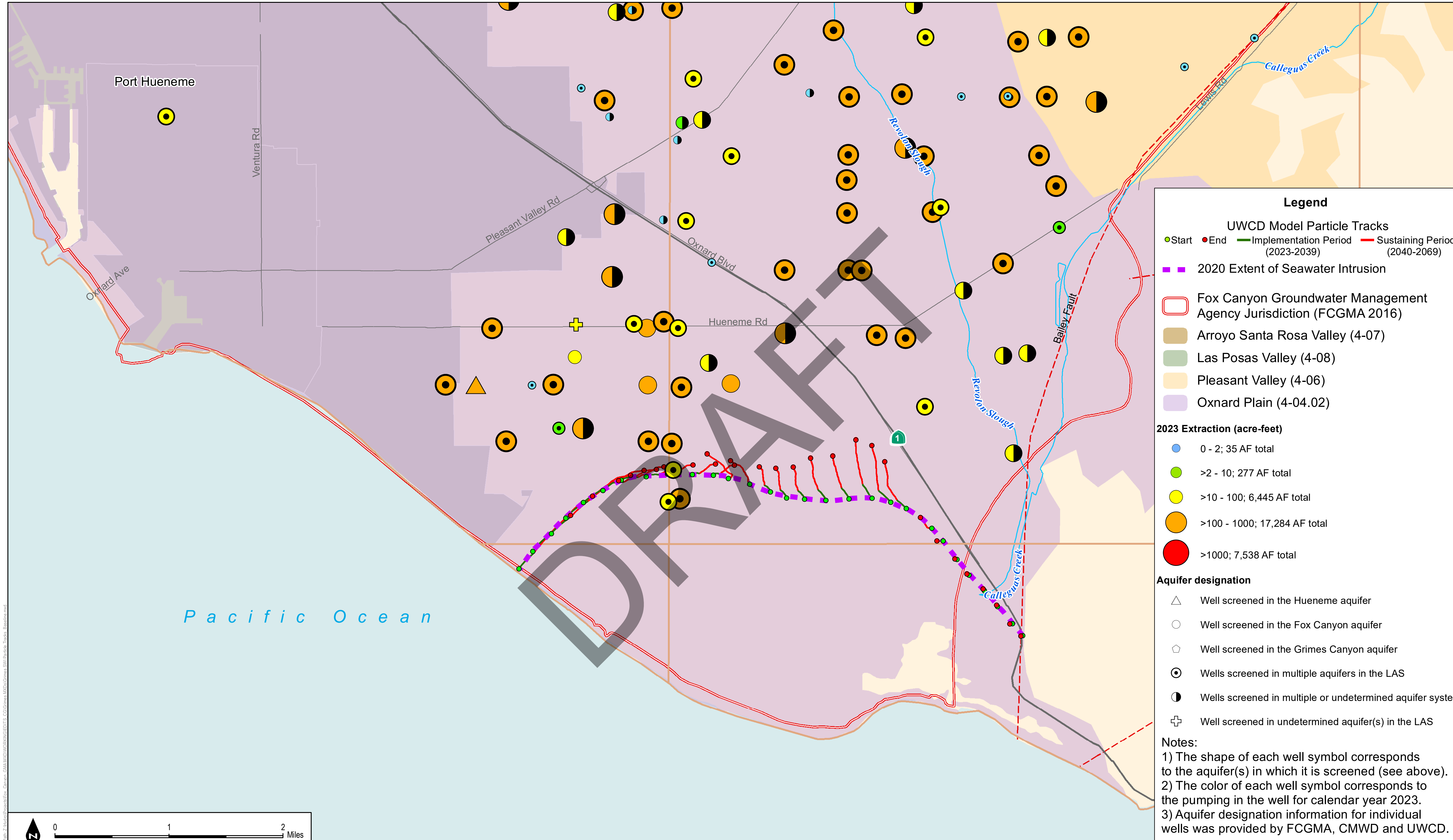


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-8
UWCD Model Particle Tracks, Basal Fox Canyon Aquifer, Future Baseline

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

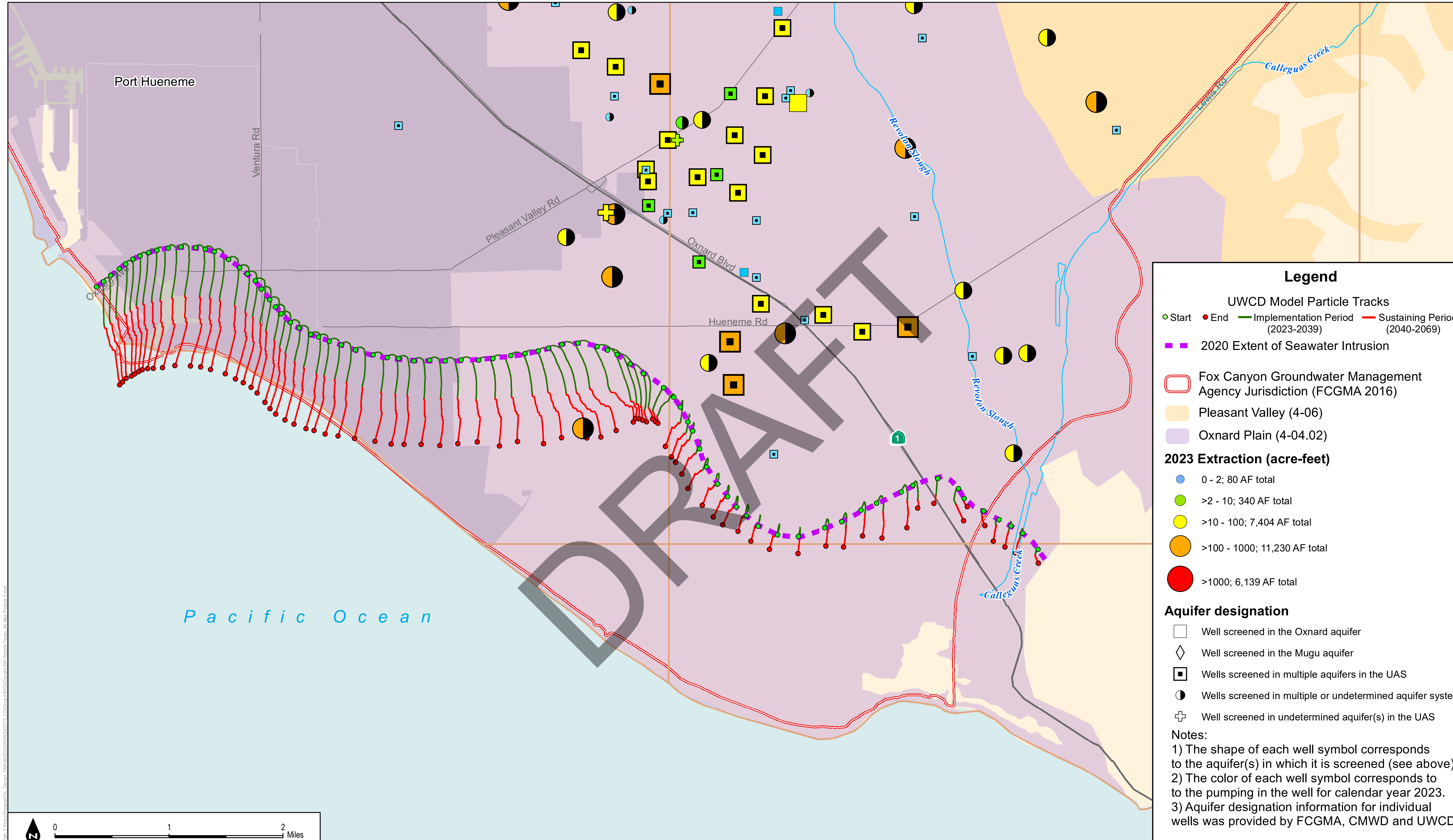


SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-9
UWCD Model Particle Tracks, Grimes Canyon Aquifer, Future Baseline

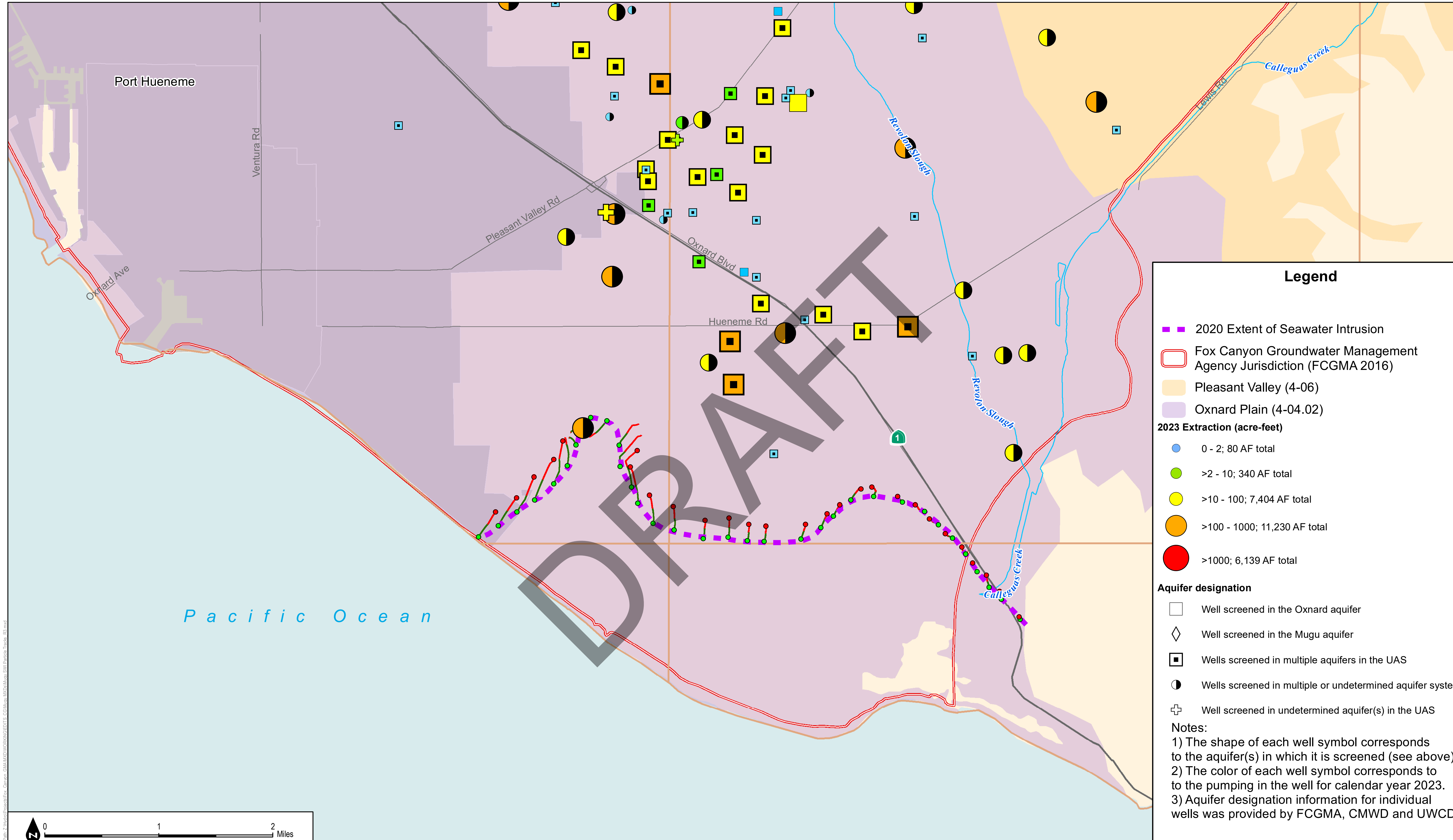
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-10
UWCD Model Particle Tracks, Oxnard Aquifer, NNP3

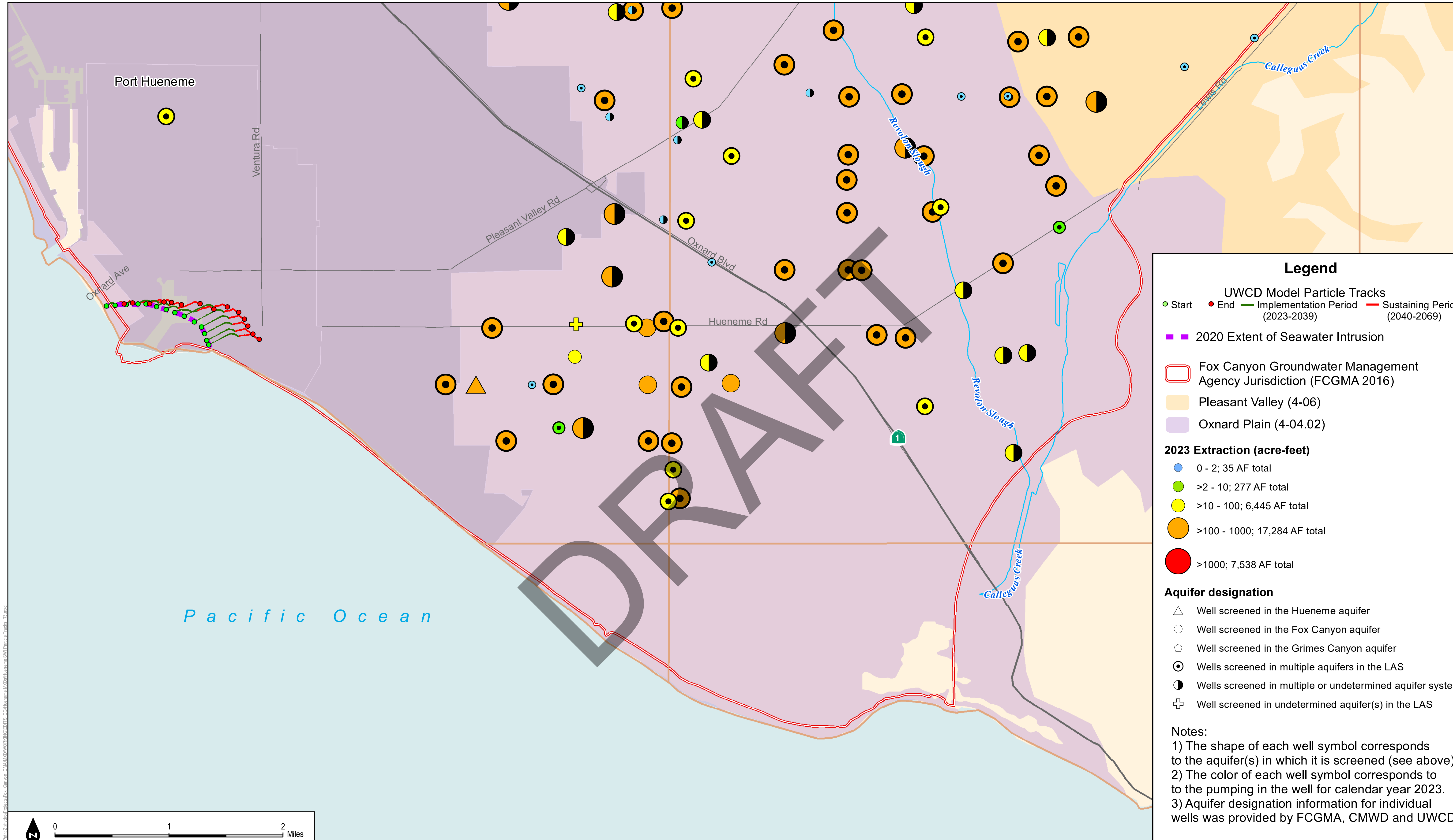


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

Figure 5-11
UWCD Model Particle Tracks, Mugu Aquifer, NNP3

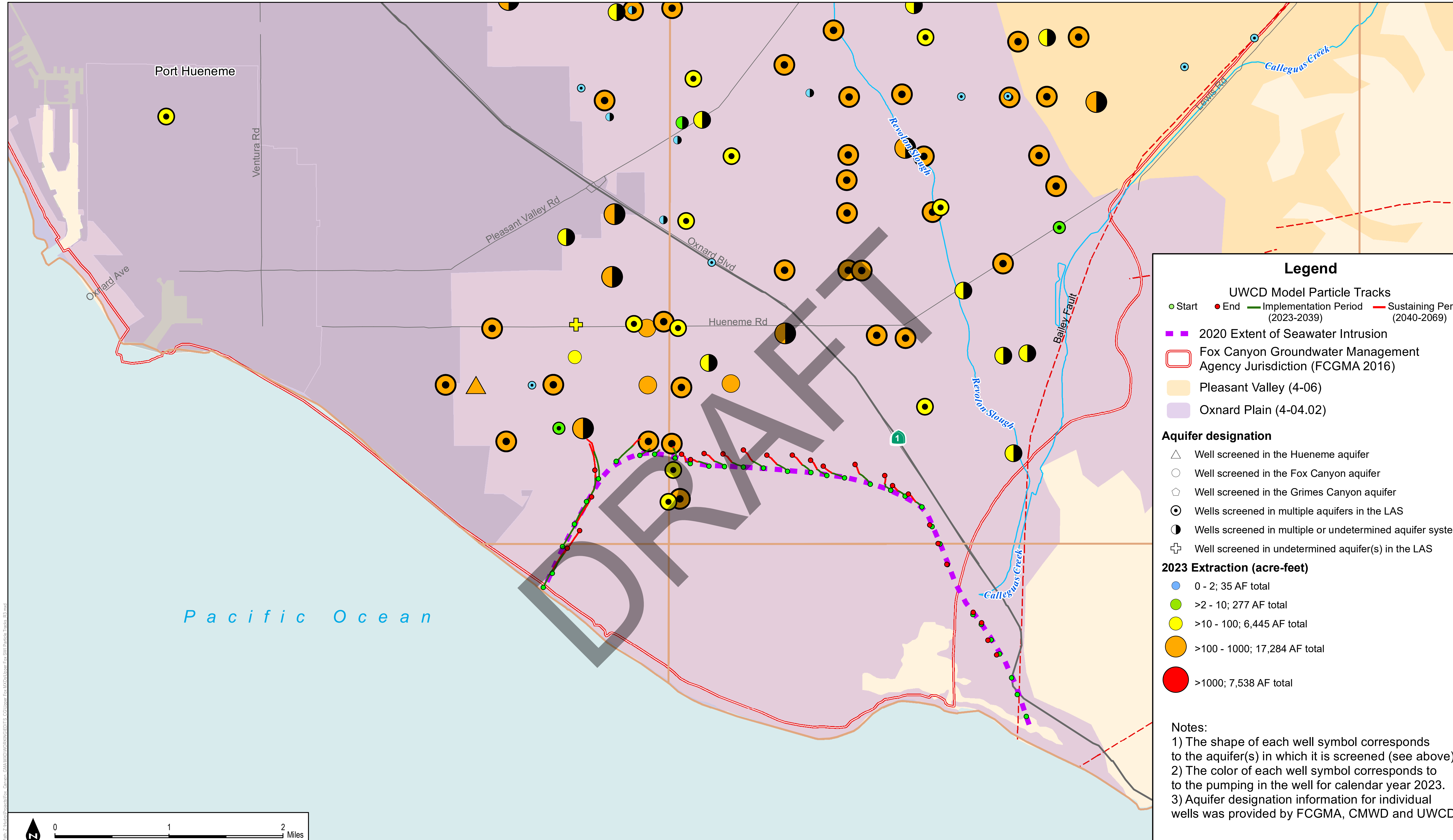
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

DUDEK

Figure 5-12
UWCD Model Particle Tracks, Hueneme Aquifer, NNP3

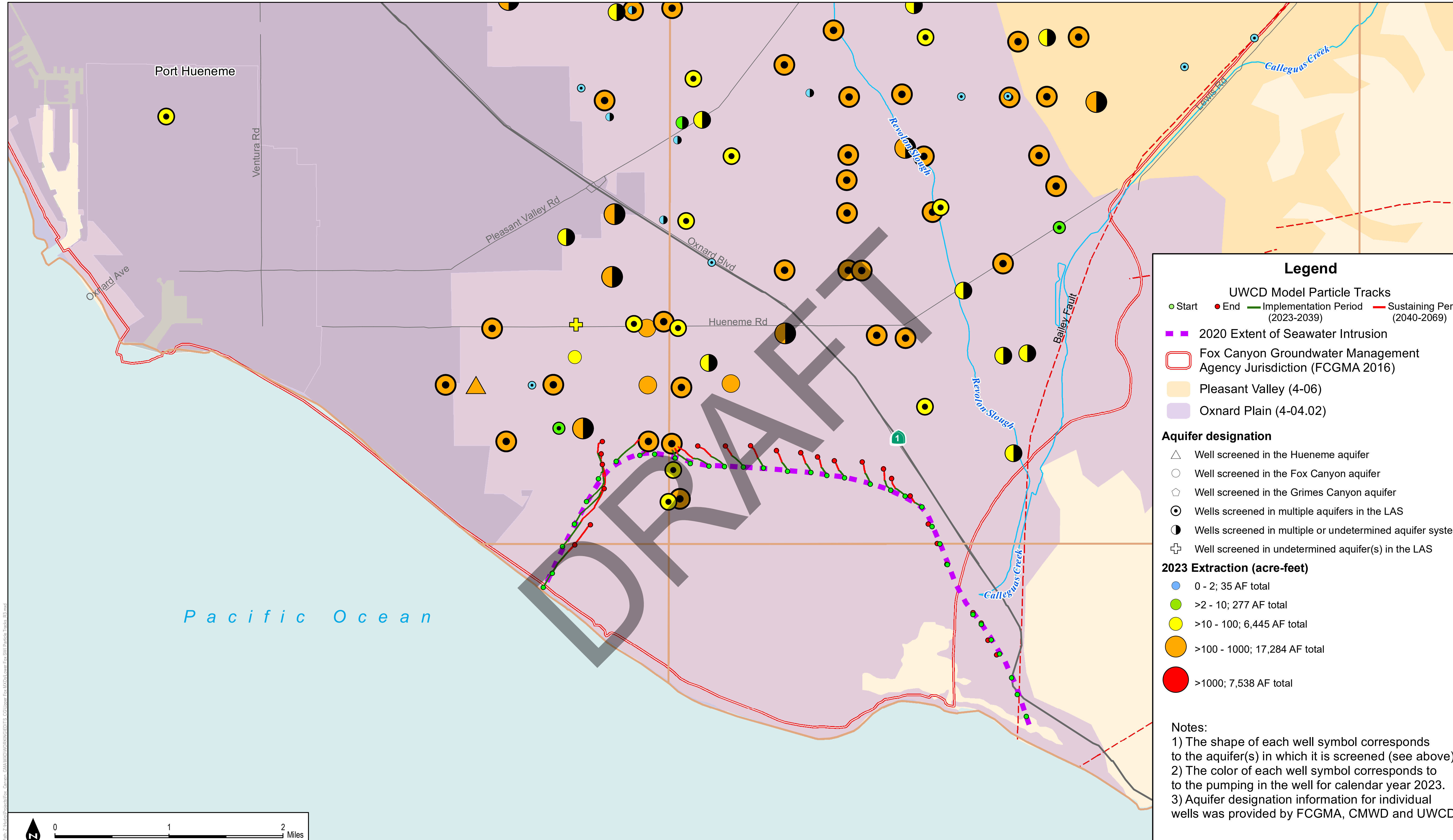


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-13
UWCD Model Particle Tracks, Upper Fox Canyon Aquifer, NNP3

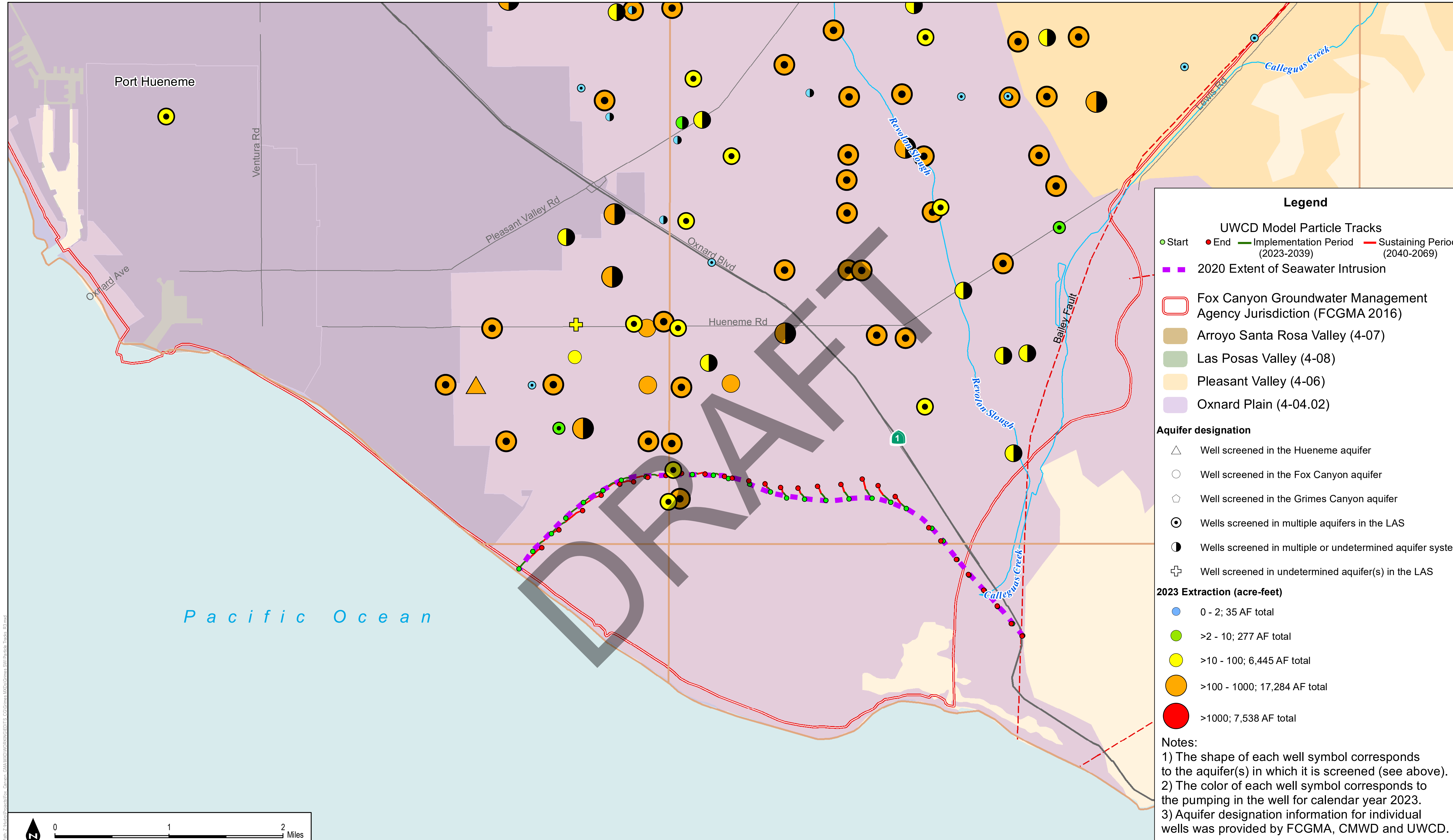
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

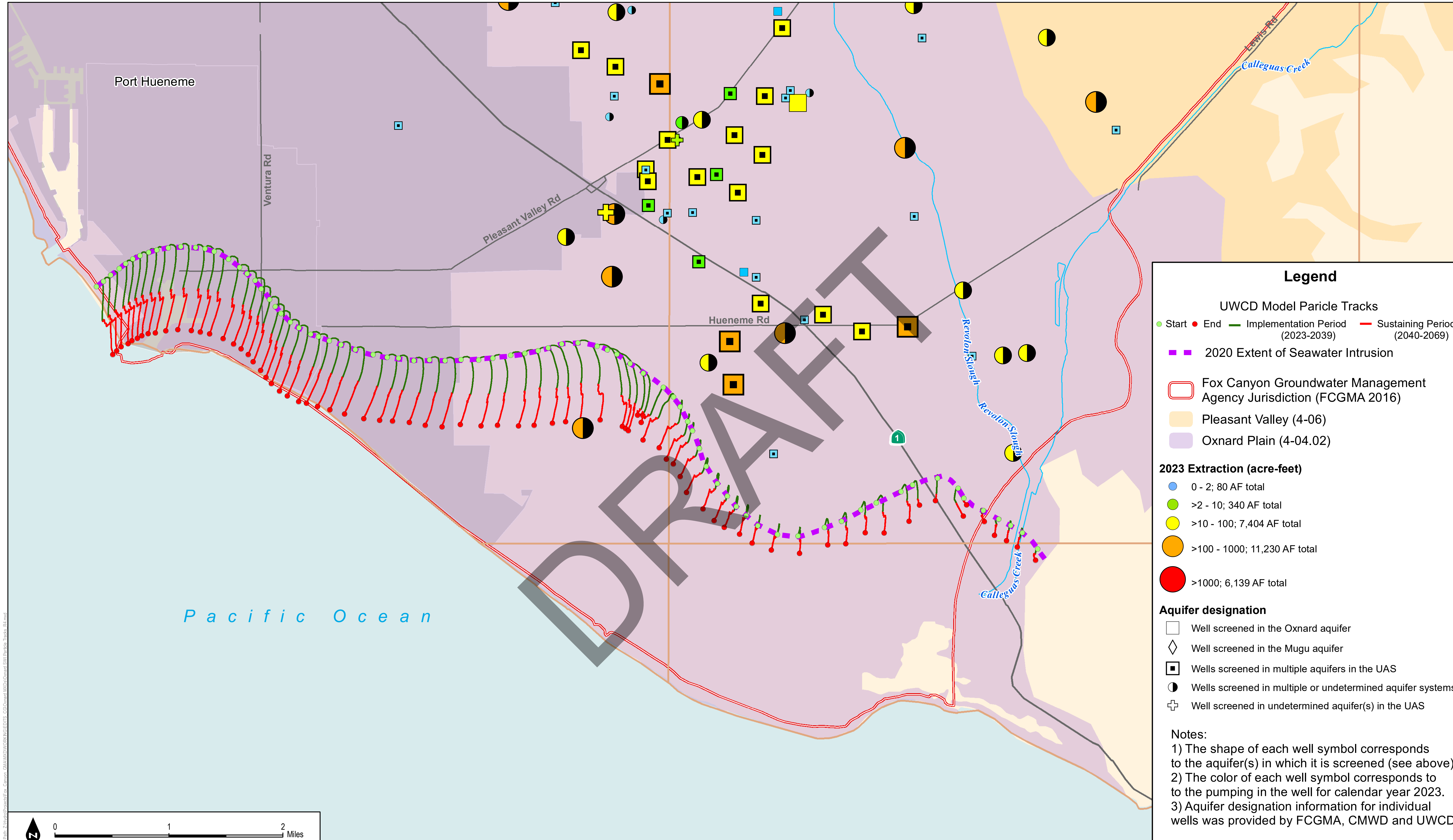
Figure 5-14
UWCD Model Particle Tracks, Basal Fox Canyon Aquifer, NNP3



SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

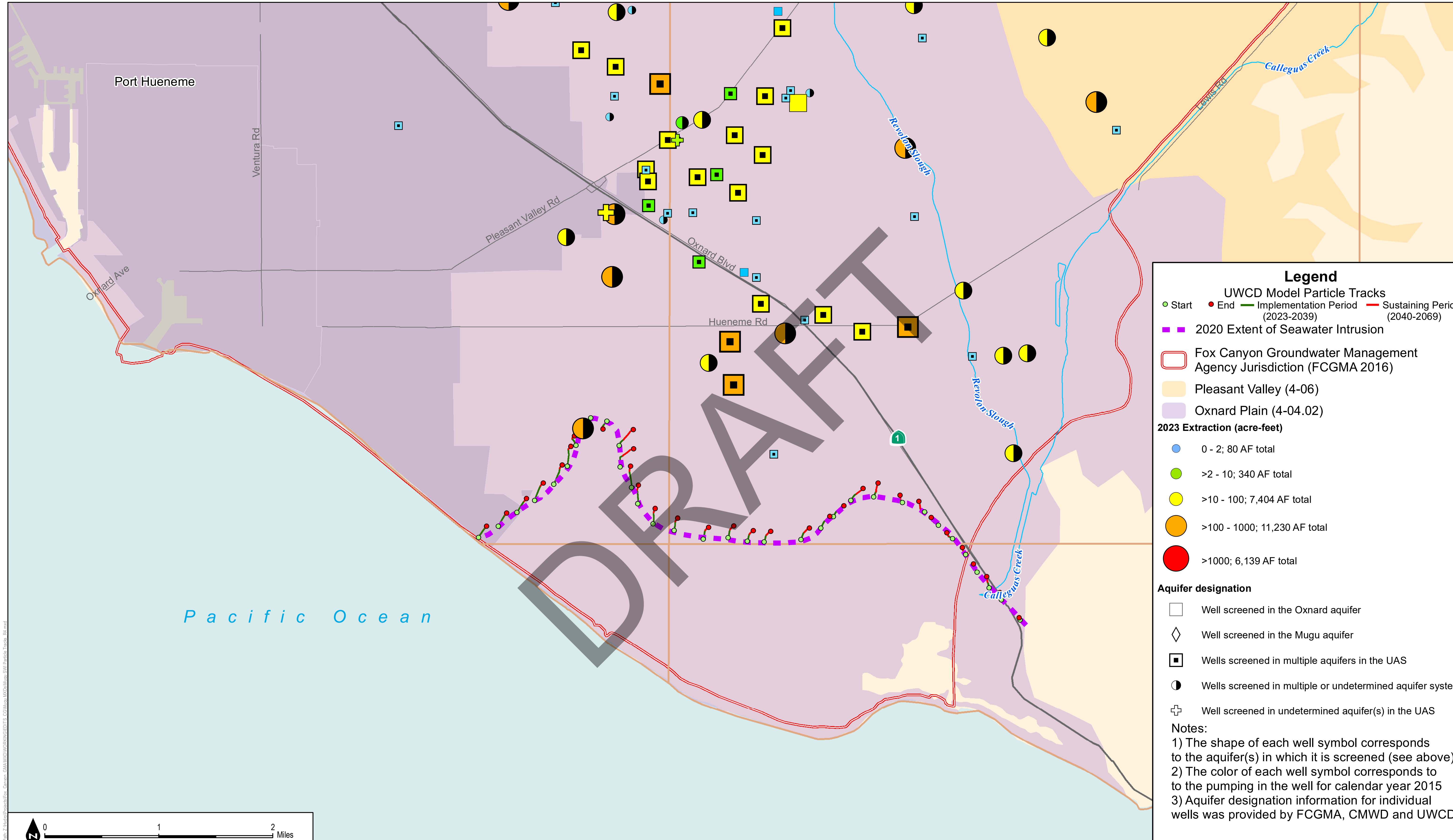
Figure 5-15
UWCD Model Particle Tracks, Grimes Canyon Aquifer, NNP3



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

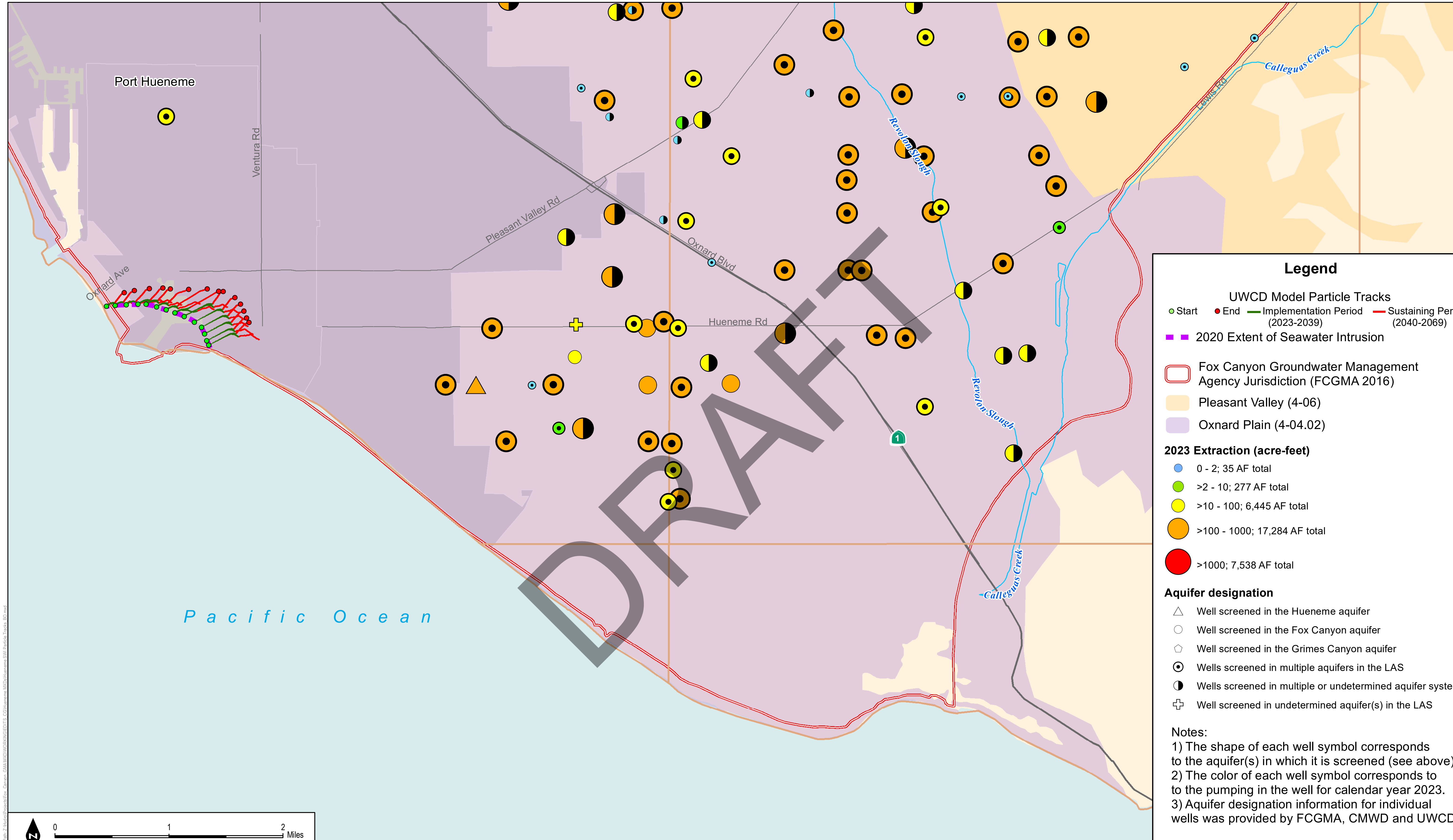
Figure 5-16
UWCD Model Particle Tracks, Oxnard Aquifer, Basin Optimization



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

Figure 5-17
UWCD Model Particle Tracks, Mugu Aquifer, Basin Optimization

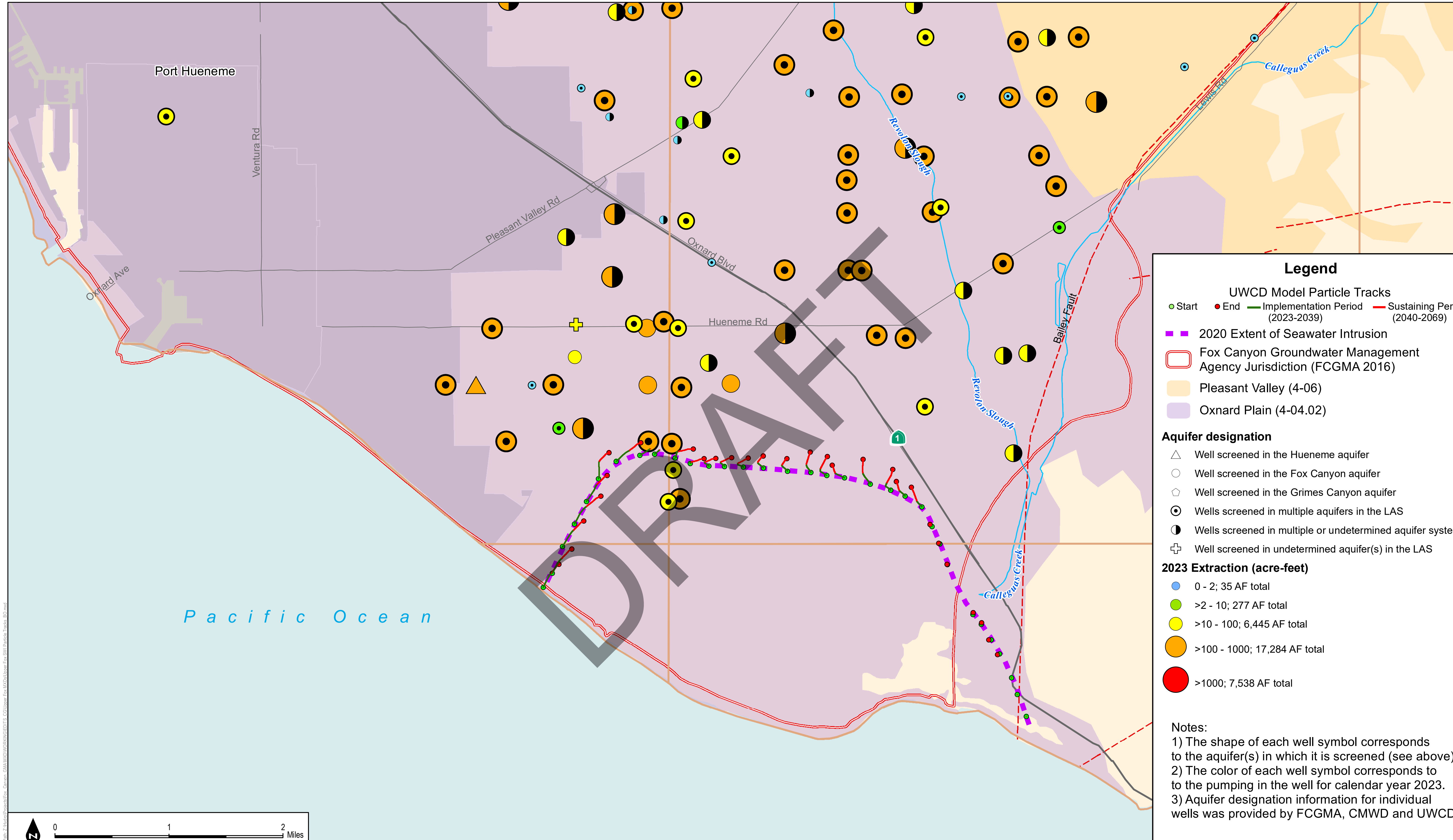


SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

DUDEK

Figure 5-18
UWCD Particle Tracks, Hueneme Aquifer, Basin Optimization

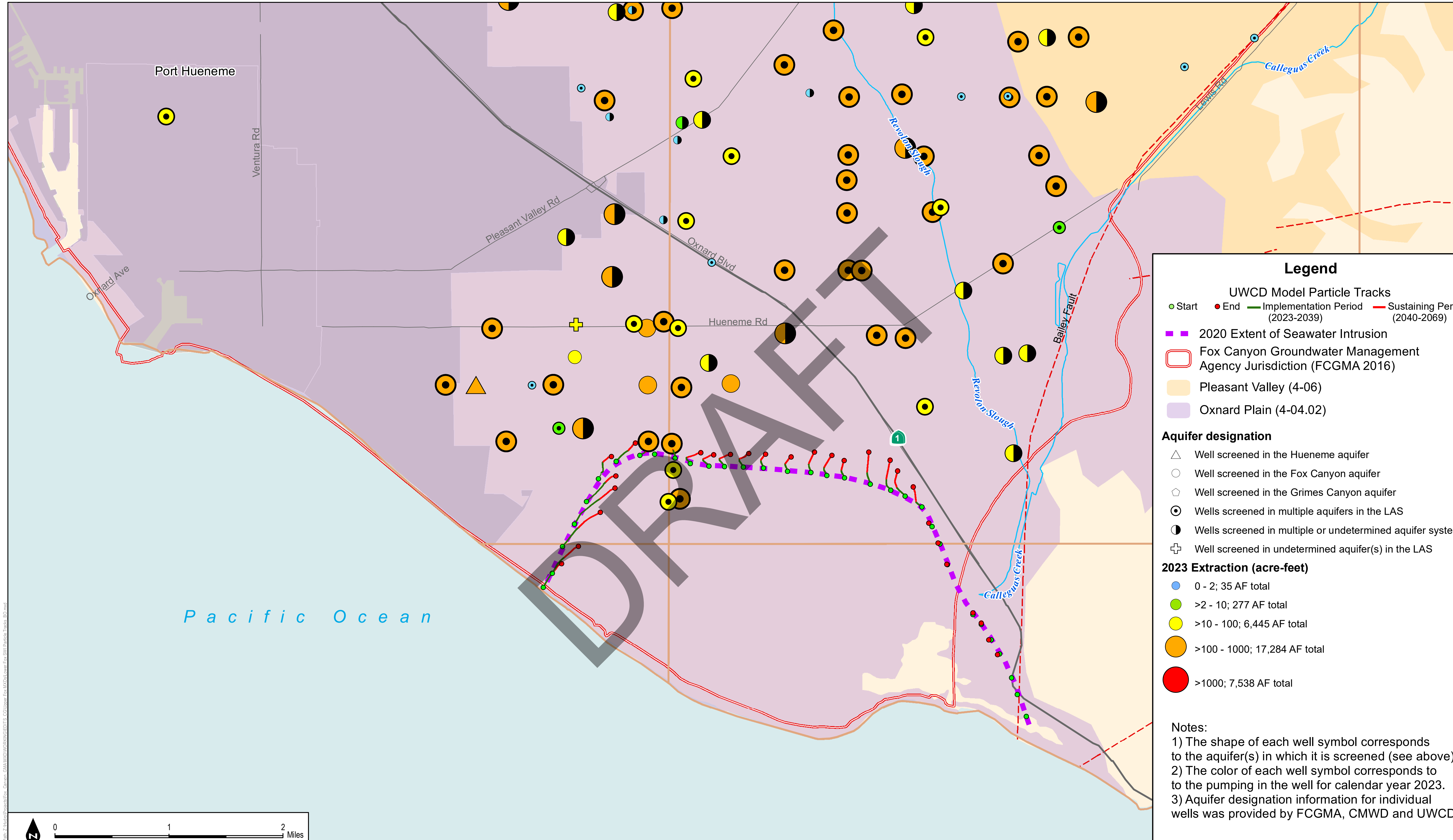
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-19
UWCD Model Particle Tracks, Upper Fox Canyon Aquifer, Basin Optimization

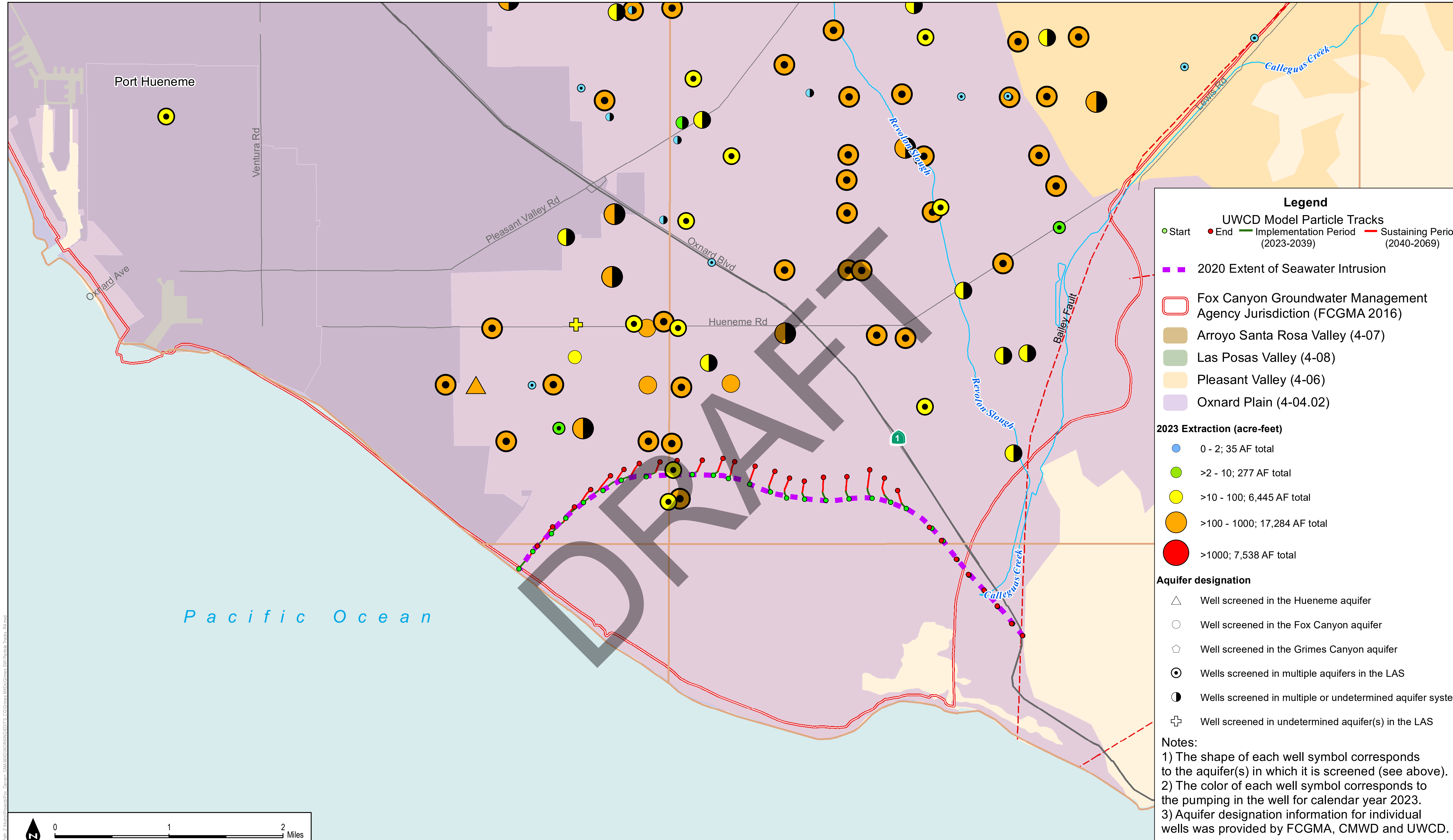


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-20
UWCD Model Particle Tracks, Basal Fox Canyon Aquifer, Basin Optimization

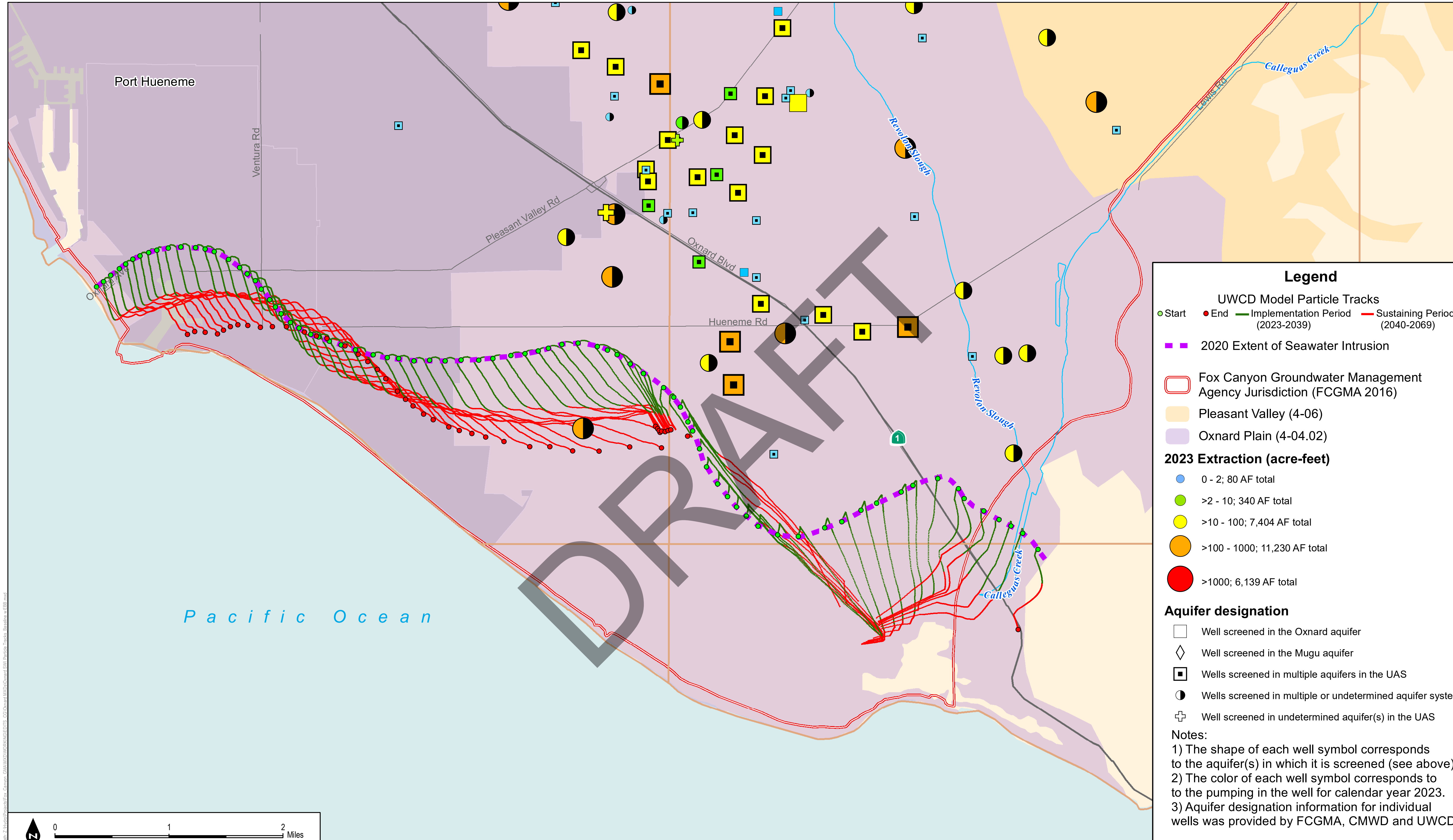
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-21
UWCD Model Particle Tracks, Grimes Canyon Aquifer, Basin Optimization

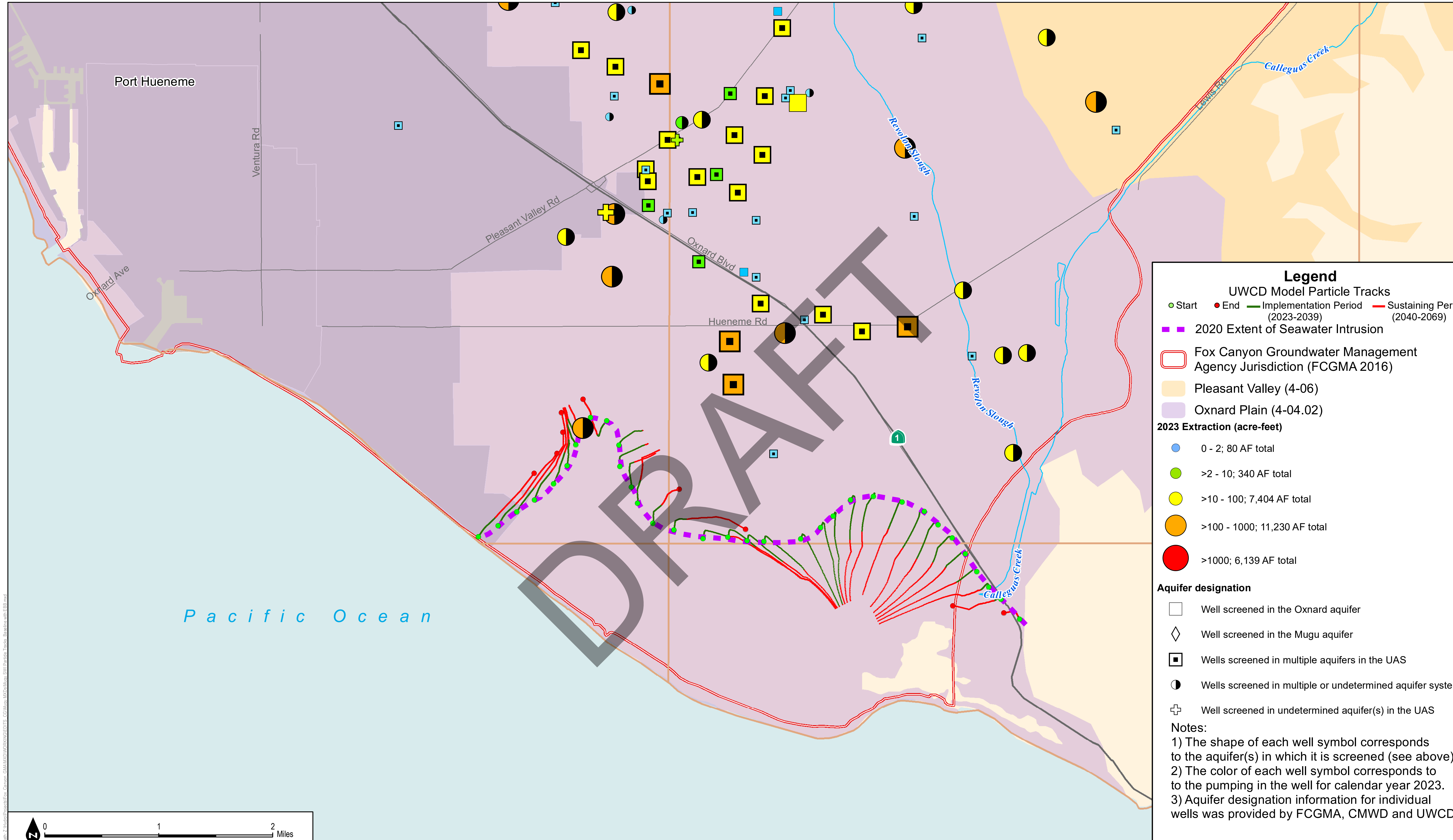


SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-22
UWCD Model Particle Tracks, Oxnard Aquifer, Future Baseline with EBB

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

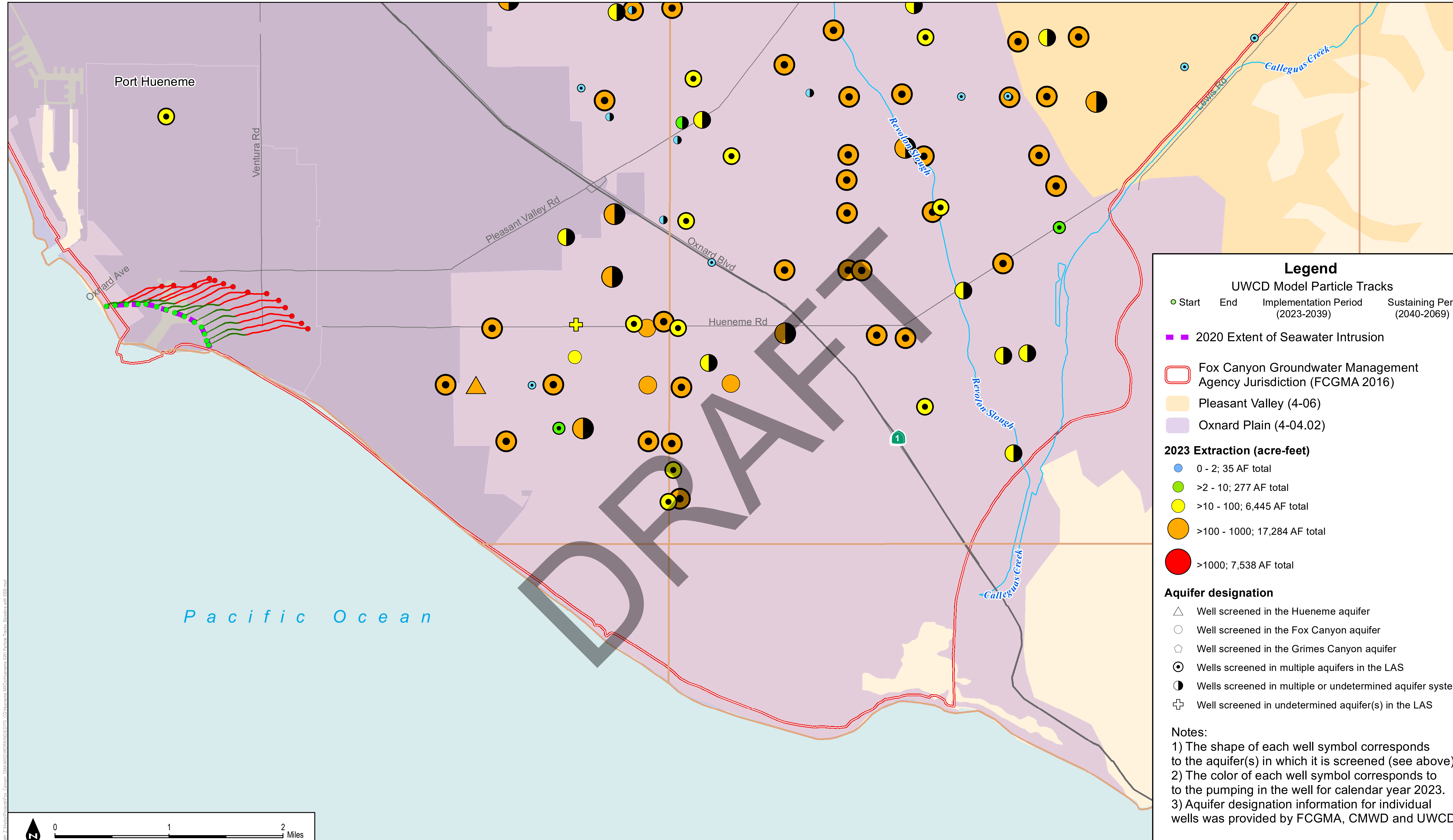


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

Figure 2-23
UWCD Model Particle Tracks, Mugu Aquifer, Future Baseline with EBB

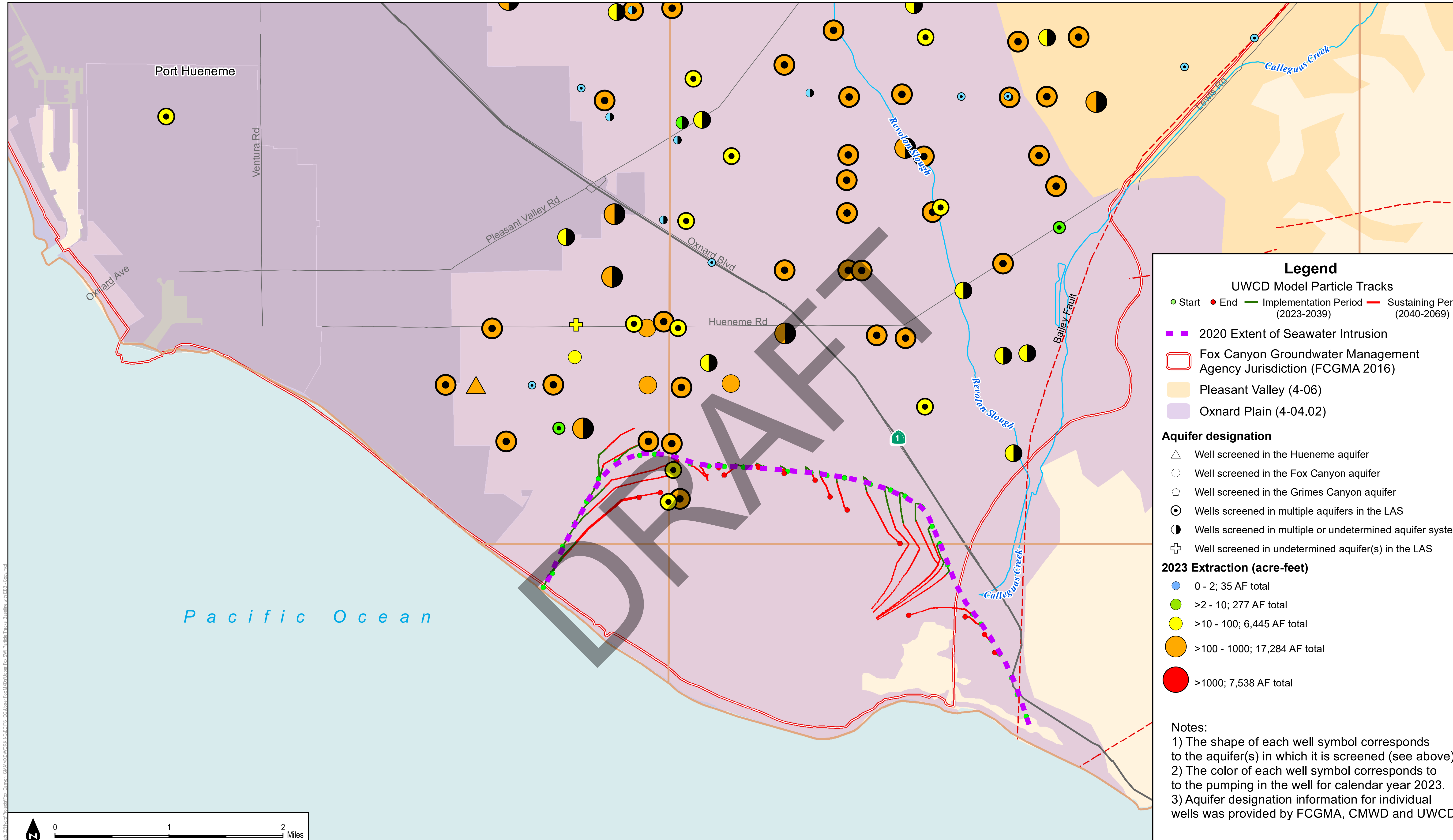
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

DUDEK

Figure 5-24
UWCD Model Particle Tracks, Hueneme Aquifer, Future Baseline with EBB

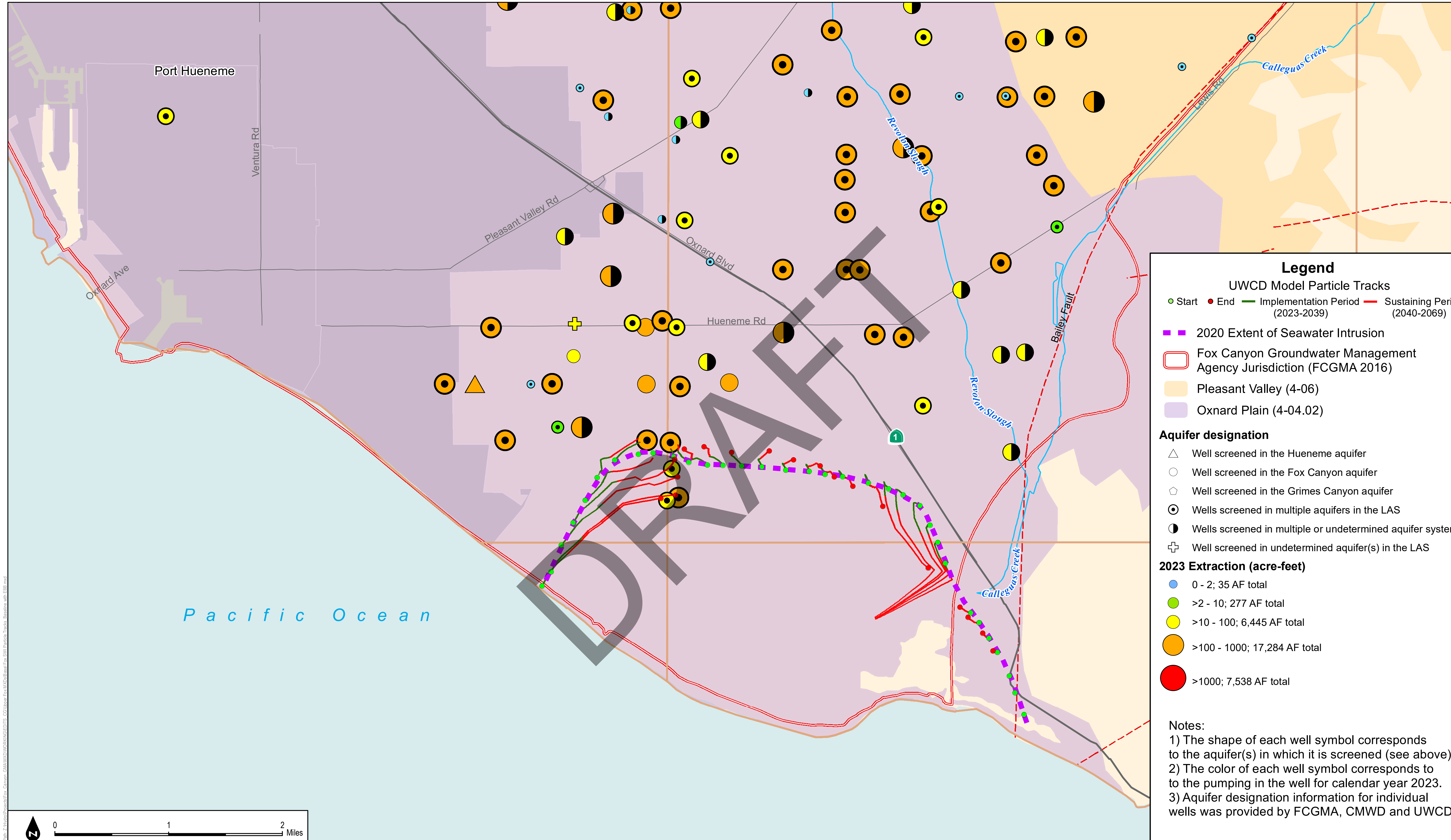


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-25
UWCD Model Particle Tracks, Upper Fox Canyon Aquifer, Future Baseline

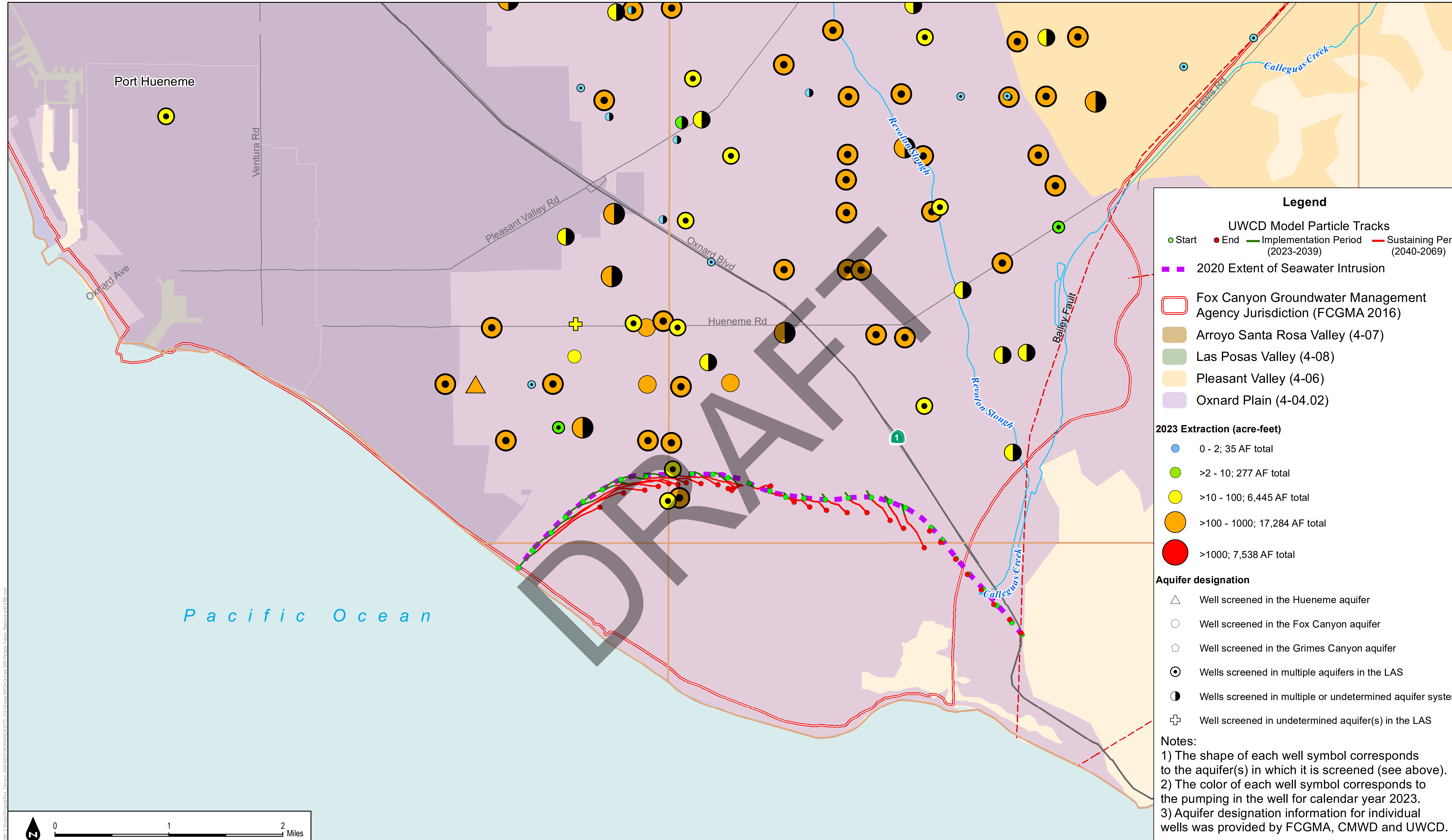
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-26
UWCD Model Particle Tracks, Basal Fox Canyon Aquifer, Future Baseline

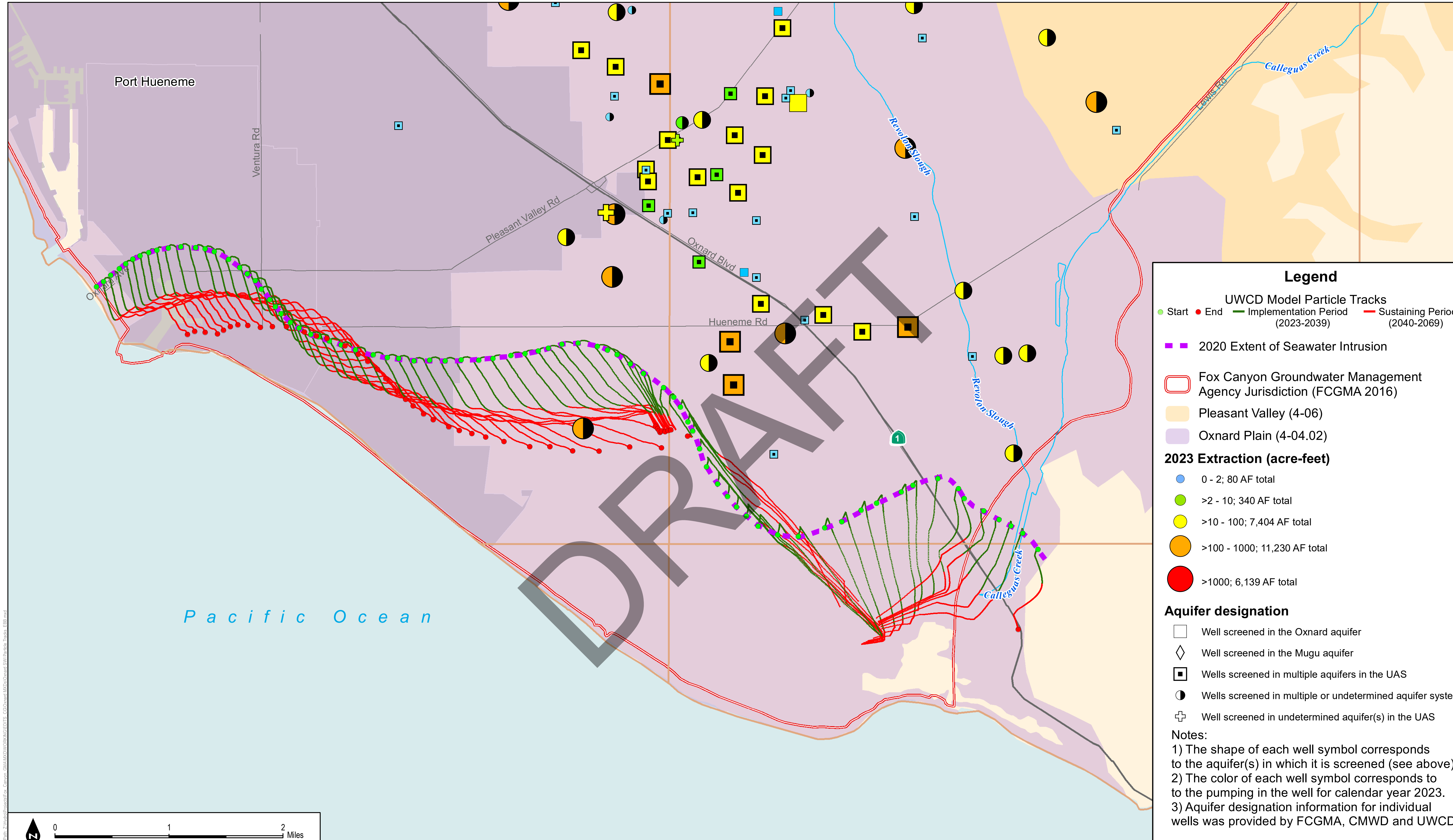


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

Figure 5-27
Baseline with EBB Scenario, Grimes Canyon Aquifer

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

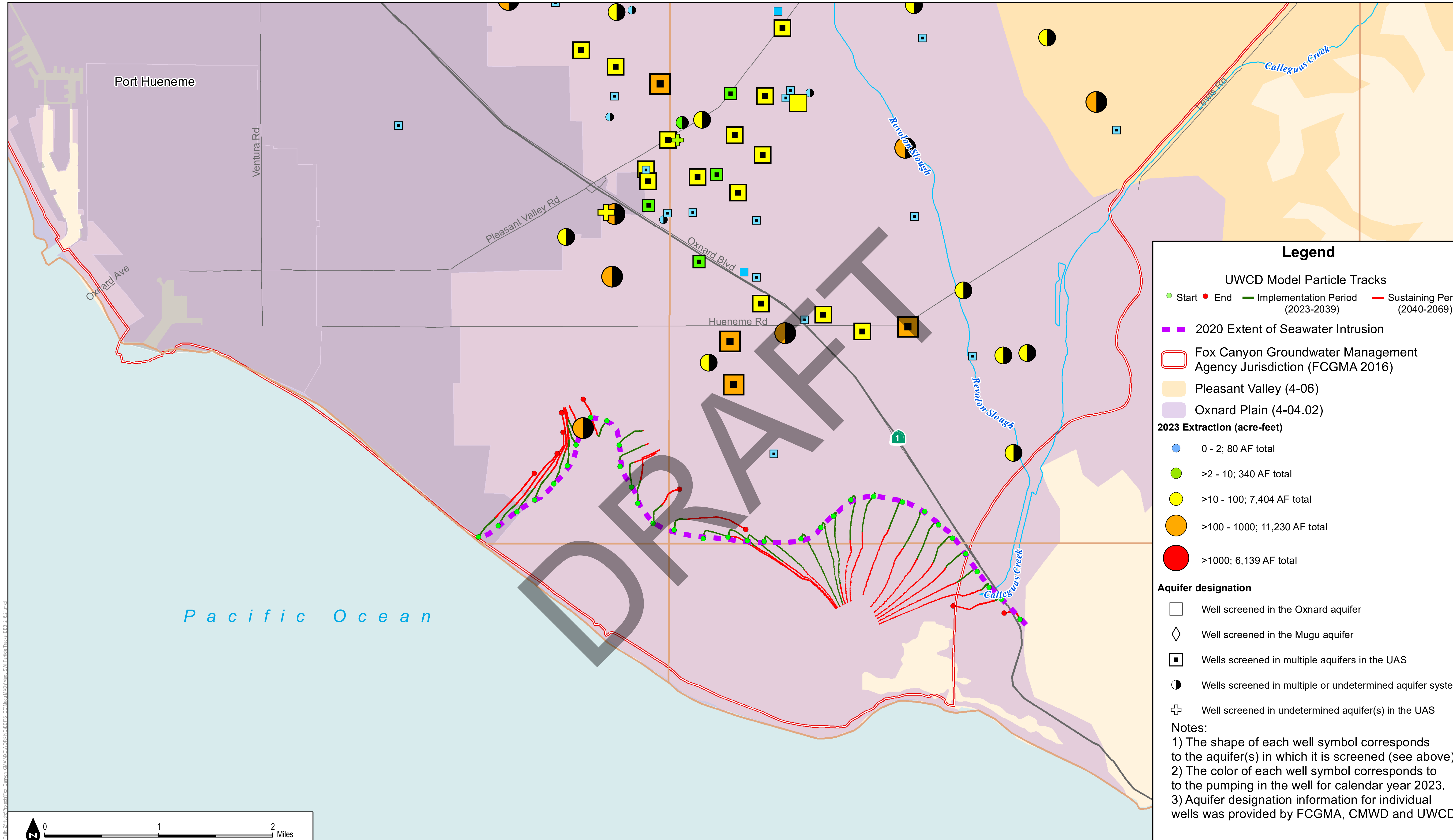


SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-28
UWCD Model Particle Tracks, Oxnard Aquifer, Projects with EBB

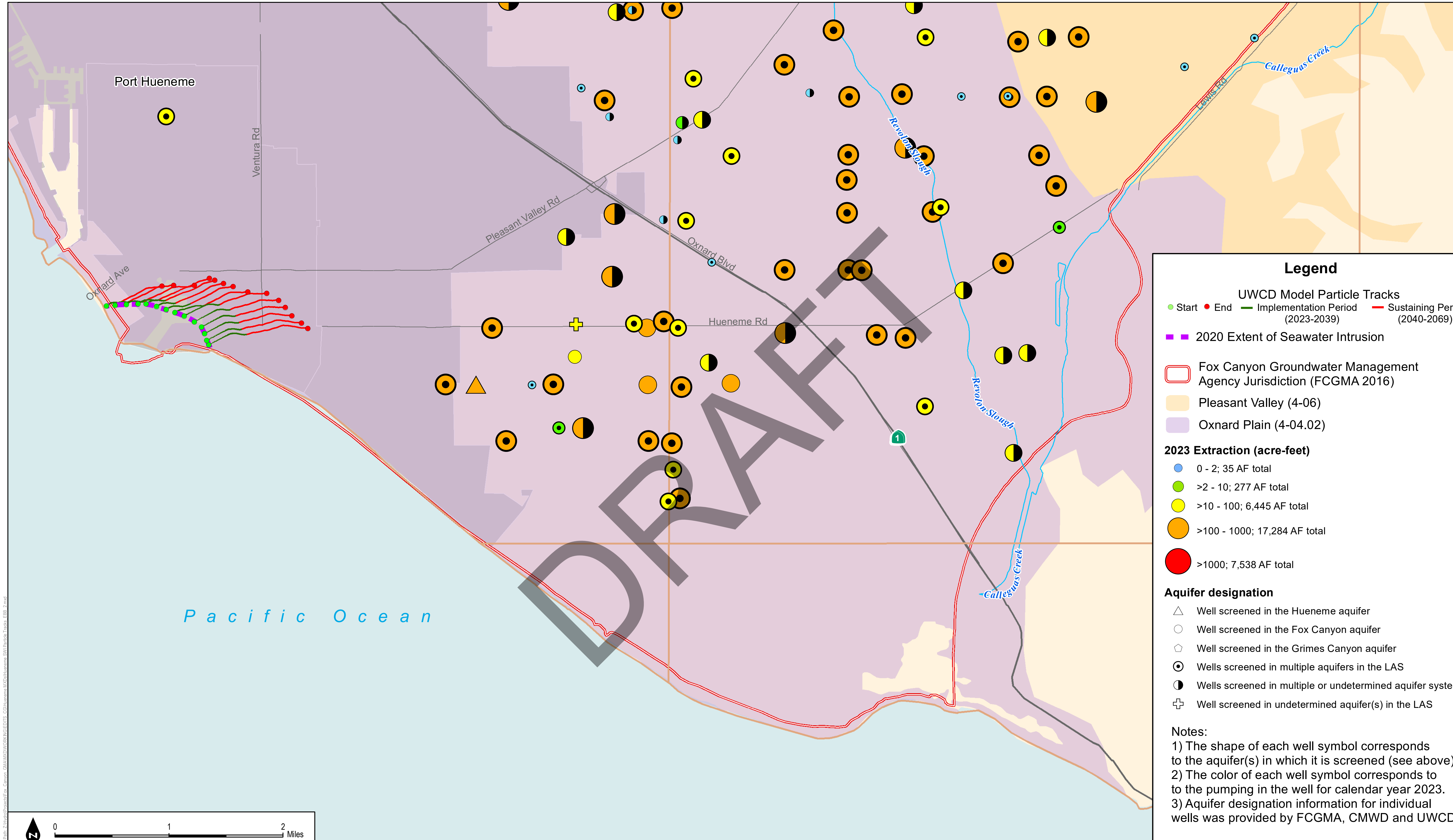
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

Figure 5-29
UWCD Model Particle Tracks, Mugu Aquifer, Projects with EBB

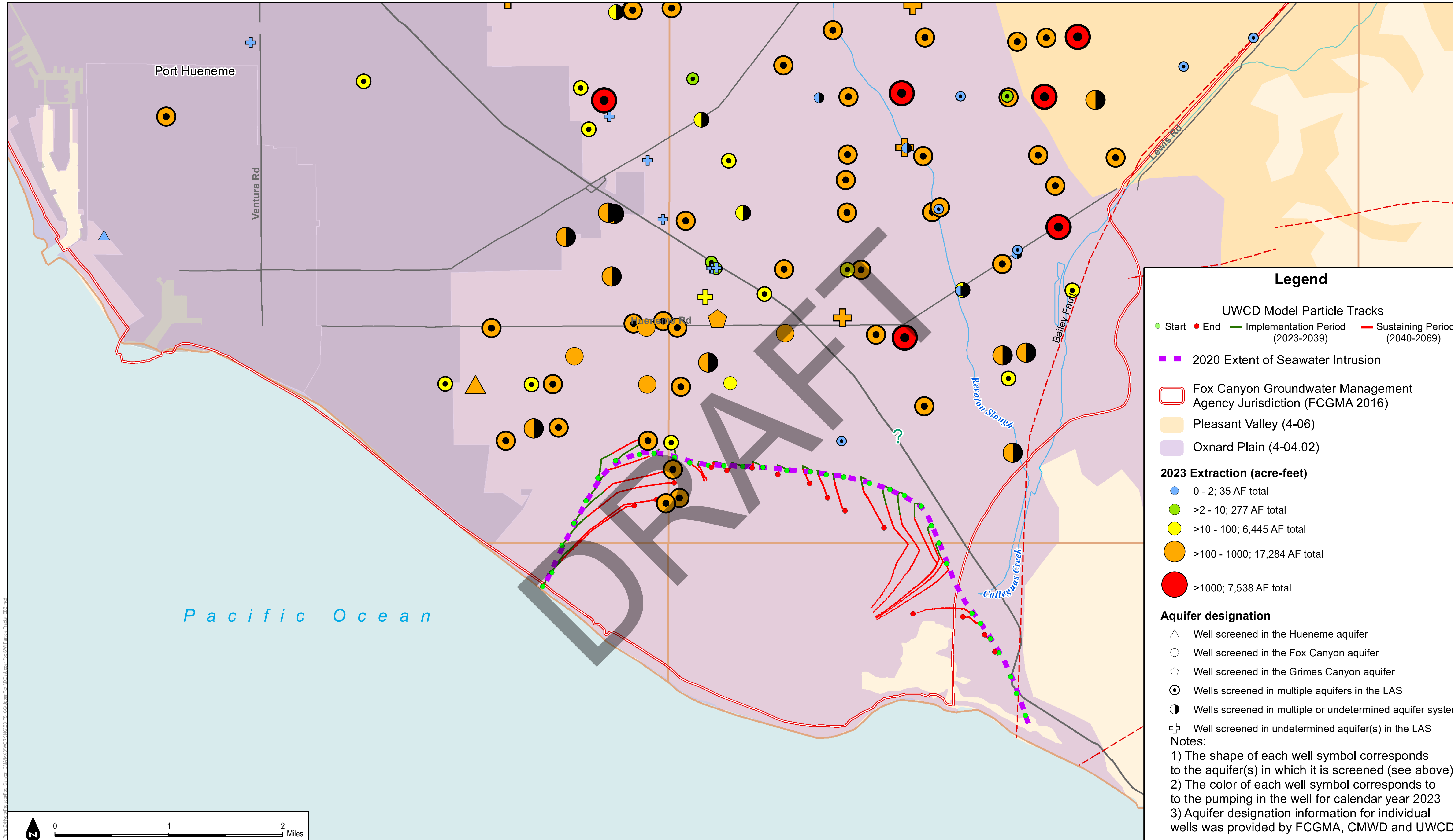


DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD
Climate Period 1930-1979; Climate Change Factor 2070

Figure 5-30
UWCD Model Particle Tracks, Hueneme Aquifer, Projects with EBB

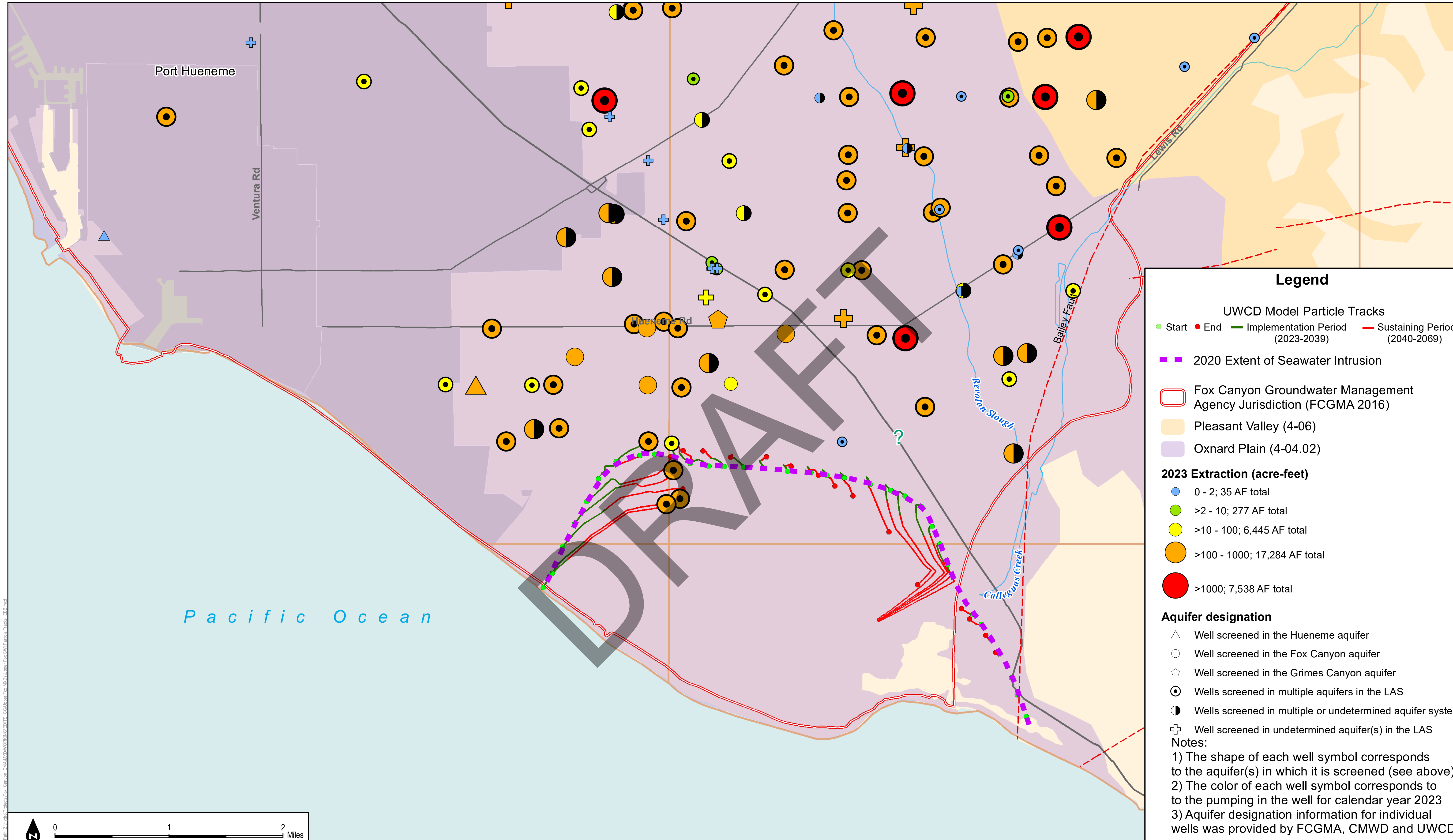
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-31
UWCD Model Particle Tracks, Upper Fox Canyon Aquifer, Projects with EBB

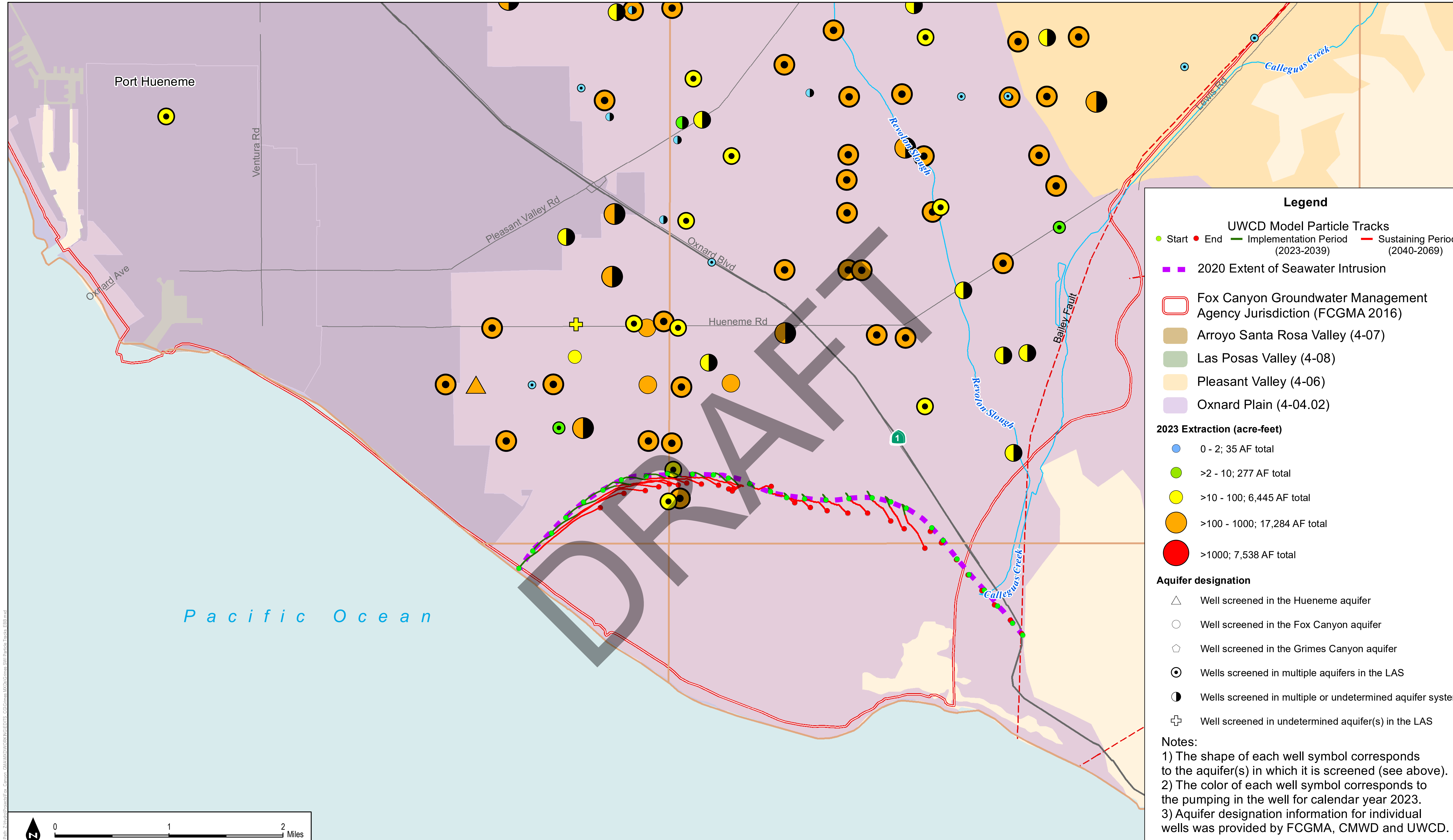


SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-32
UWCD Model Particle Tracks, Basal Fox Canyon Aquifer, Projects with EBB

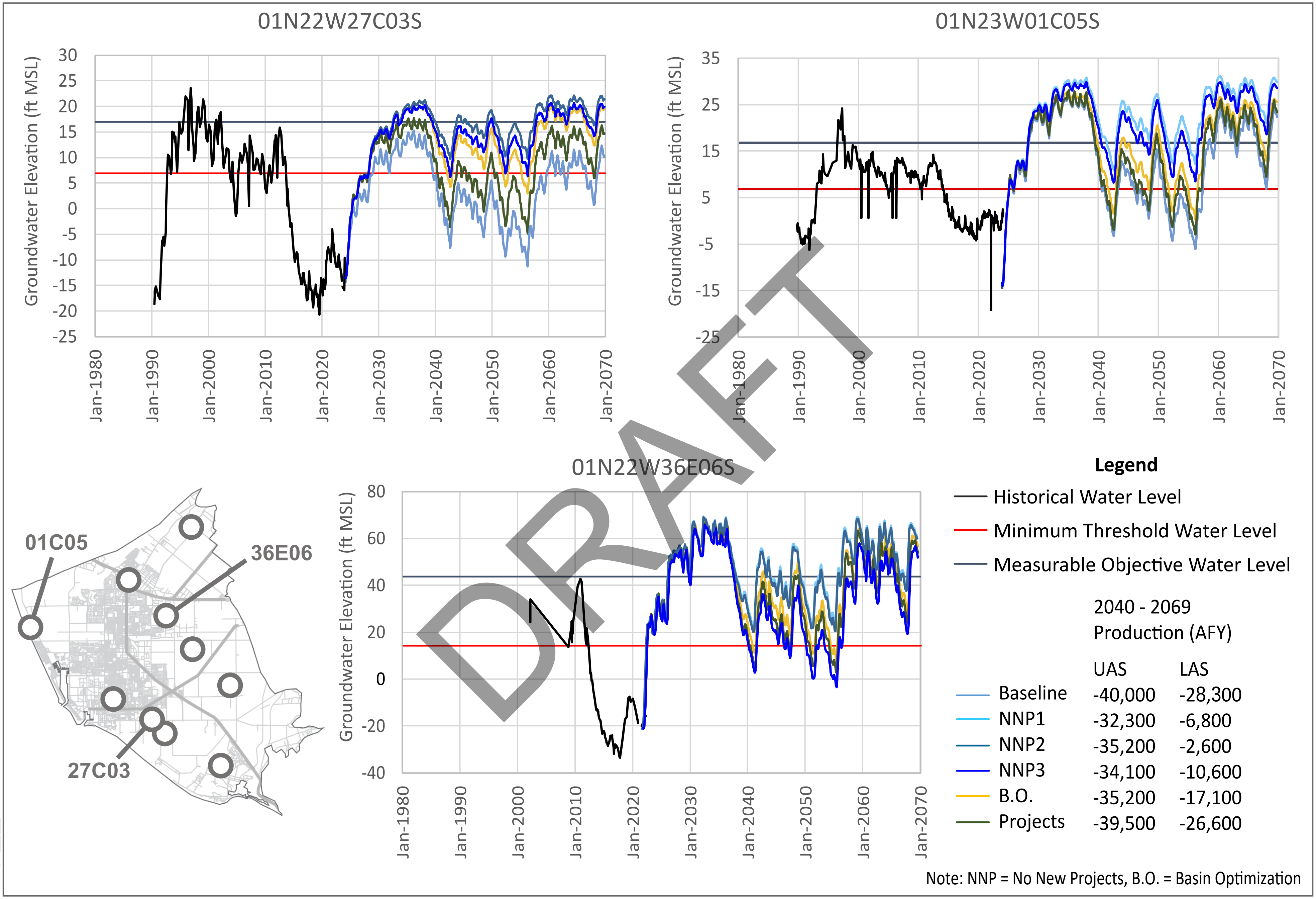
Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



SOURCE: DWR; Ventura County; UWCD; CMWD
1930-1979 Climate Period; 2070 Climate Change Factor

DUDEK

Figure 5-33
UWCD Model Particle Tracks, Grimes Canyon Aquifer, Projects with EBB

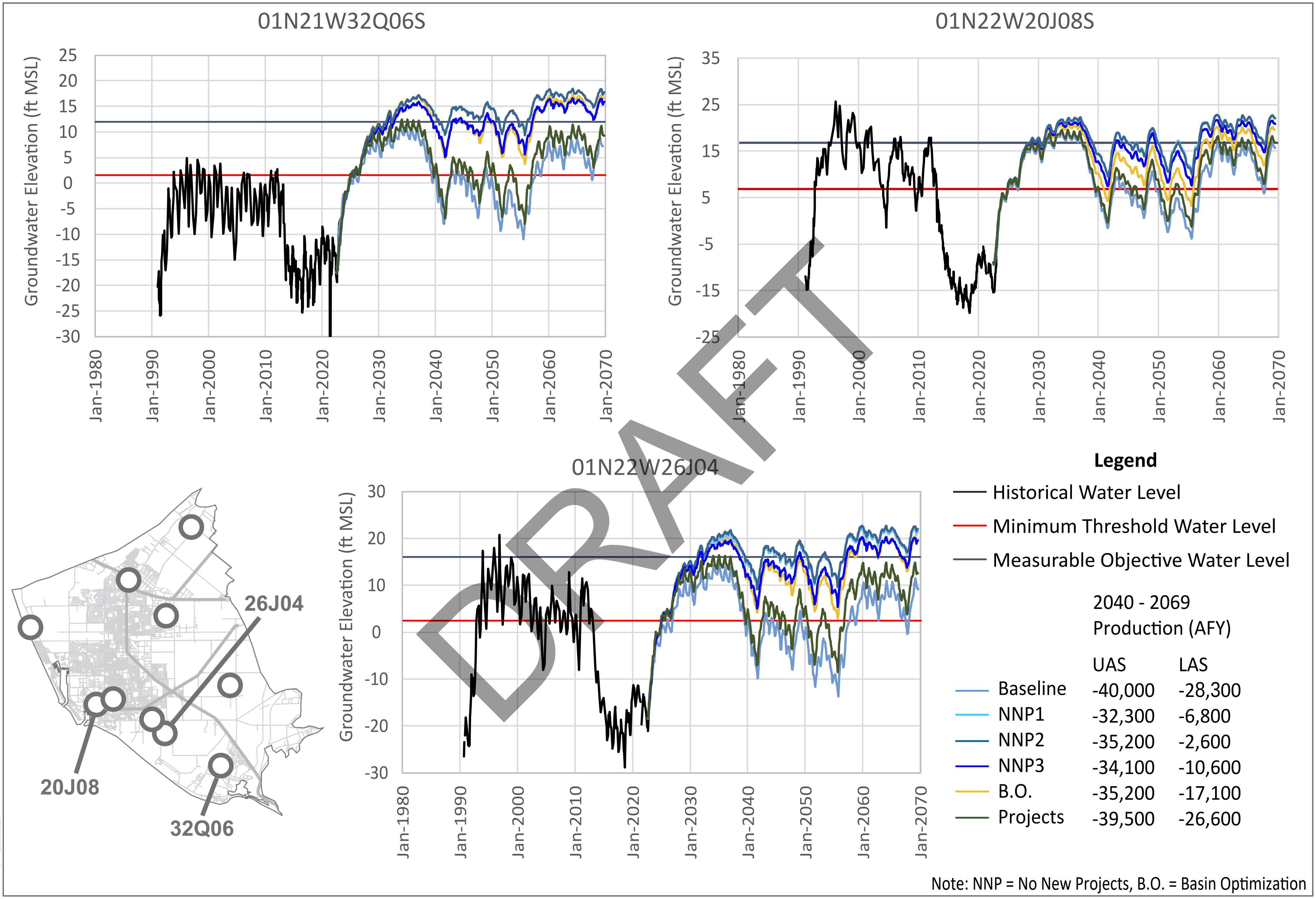


SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-1a

Key Well Hydrographs for Wells Screened in the Oxnard Aquifer



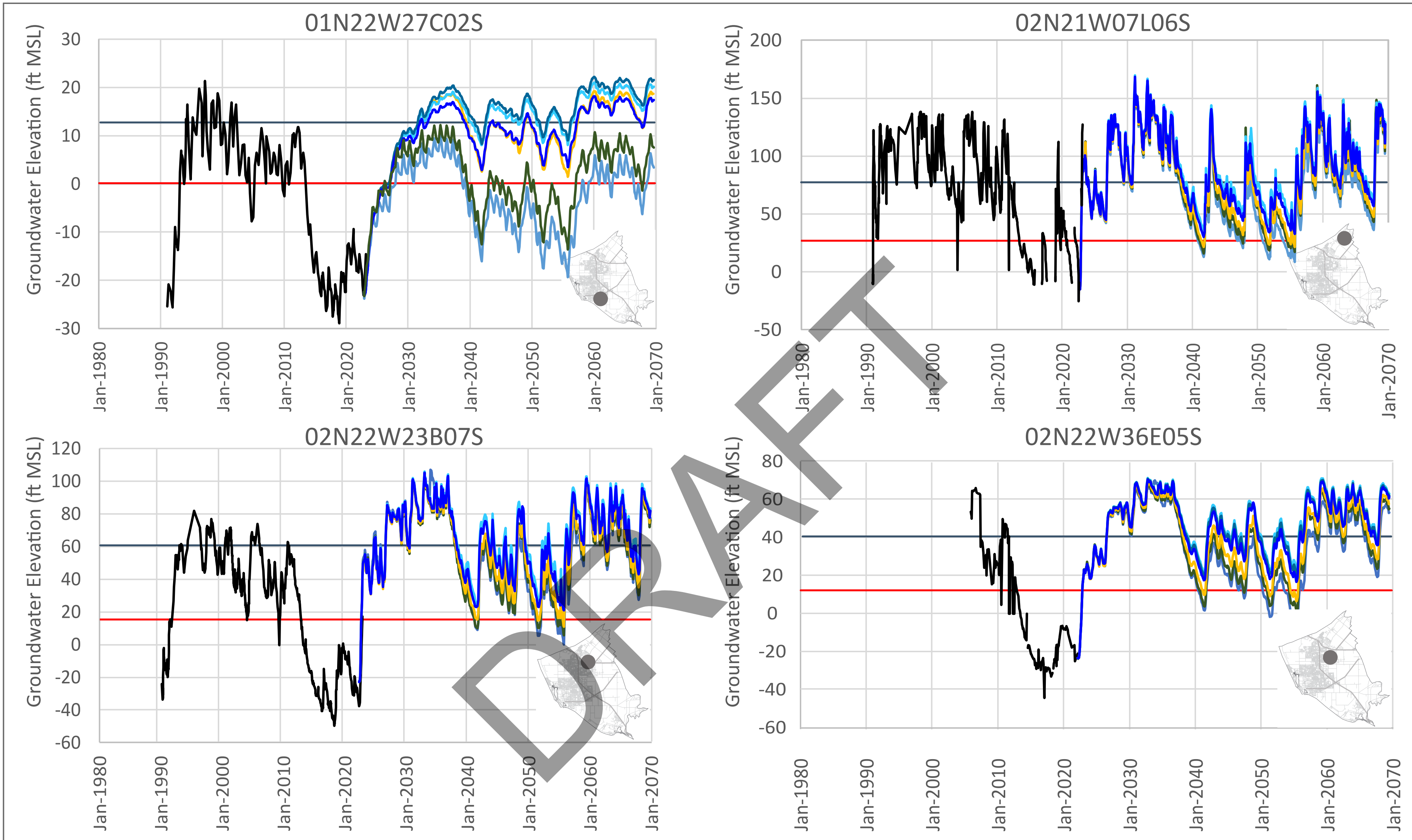
SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-1b

Key Well Hydrographs for Wells Screened in the Oxnard Aquifer

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



— Historical Water Level
— Minimum Threshold Water Level
— Measurable Objective Water Level

Legend

2040 - 2069 Production (AFY)		Baseline	NNP1	NNP2	NNP3	B.O	Projects
	UAS	-40,000	-32,000	-35,200	-34,100	-35,200	-39,500
	LAS	-28,300	-6,800	-2,600	-10,600	-17,100	-26,600

Note: NNP = No New Projects , B.O. = Basin Optimization

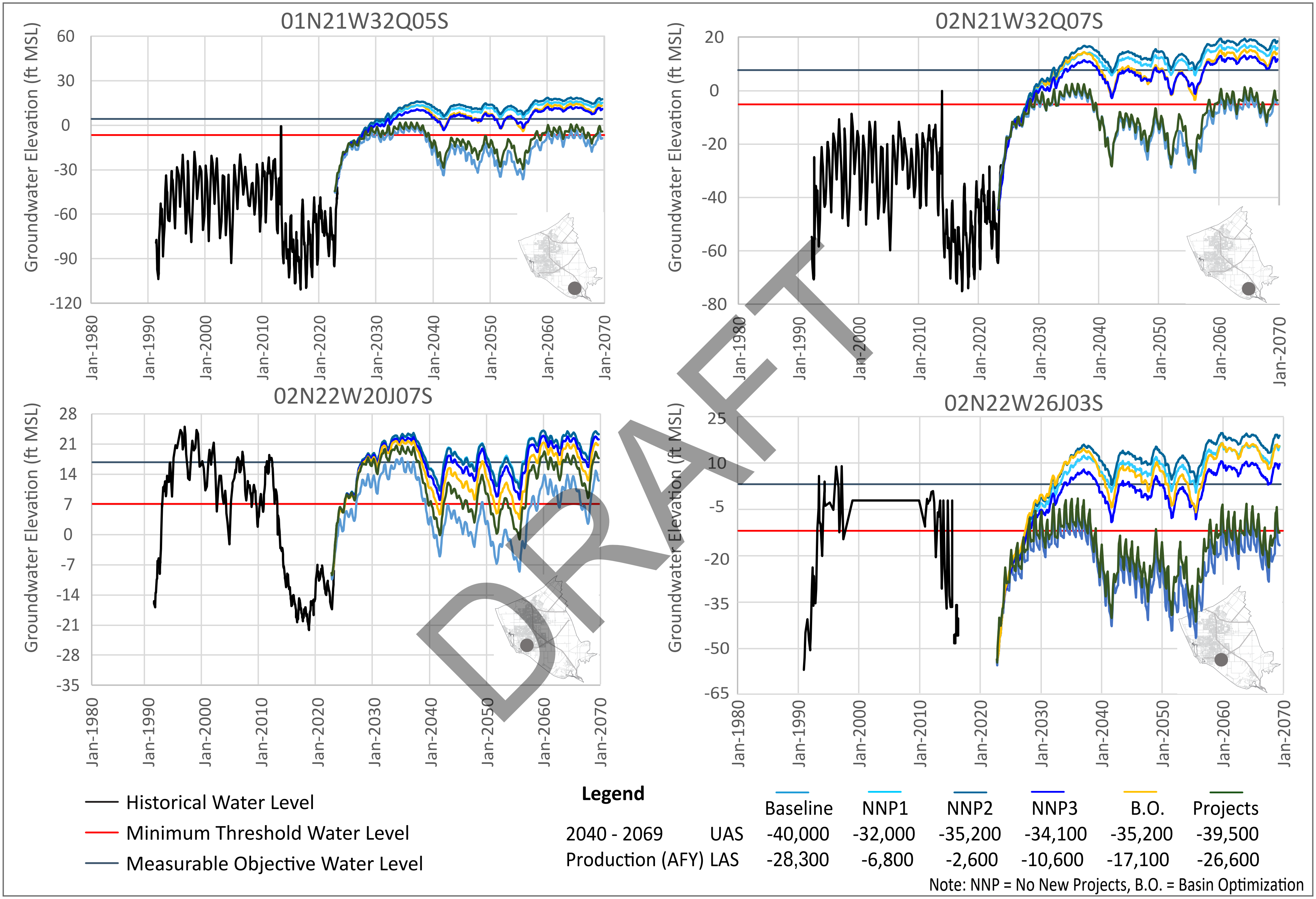
SOURCE: UWCD, VCWPD

FIGURE 6-2a

Key Well Hydrographs for Wells Screened in the Mugu Aquifer

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

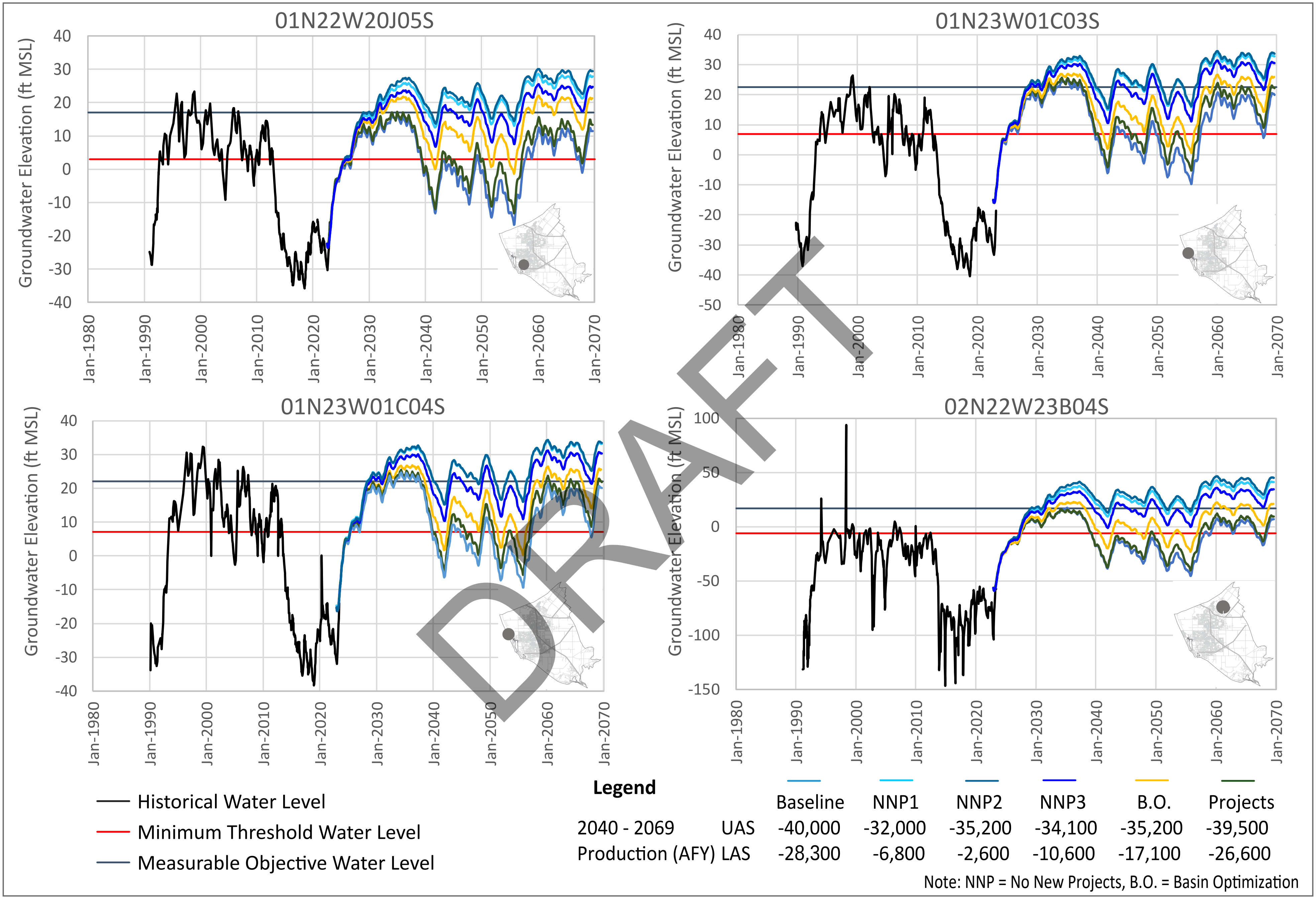
DUDEK



SOURCE: UWCD, VCWPD

FIGURE 6-2b

Key Well Hydrographs for Wells Screened in the Mugu Aquifer



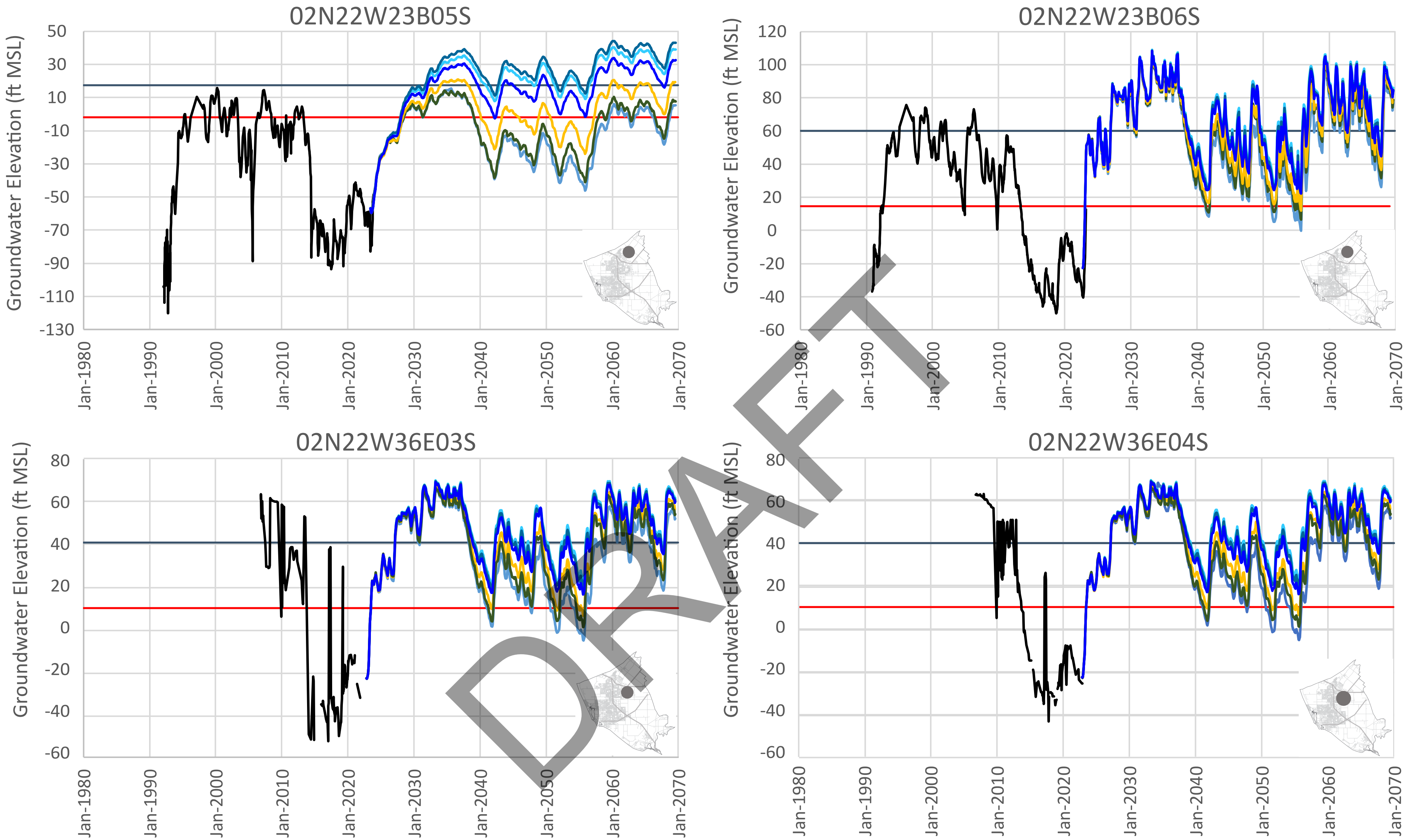
SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-3a

Key Well Hydrographs for Wells Screened in the Hueneme Aquifer

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



Legend

- Historical Water Level
- Minimum Threshold Water Level
- Measurable Objective Water Level

2040 - 2069 Production (AFY)		Baseline	NNP1	NNP2	NNP3	B.O.	Projects
	UAS	-40,000	-32,000	-35,200	-34,100	-35,200	-39,500
	LAS	-28,300	-6,800	-2,600	-10,600	-17,100	-26,600

Note: NNP = No New Projects, B.O. = Basin Optimization

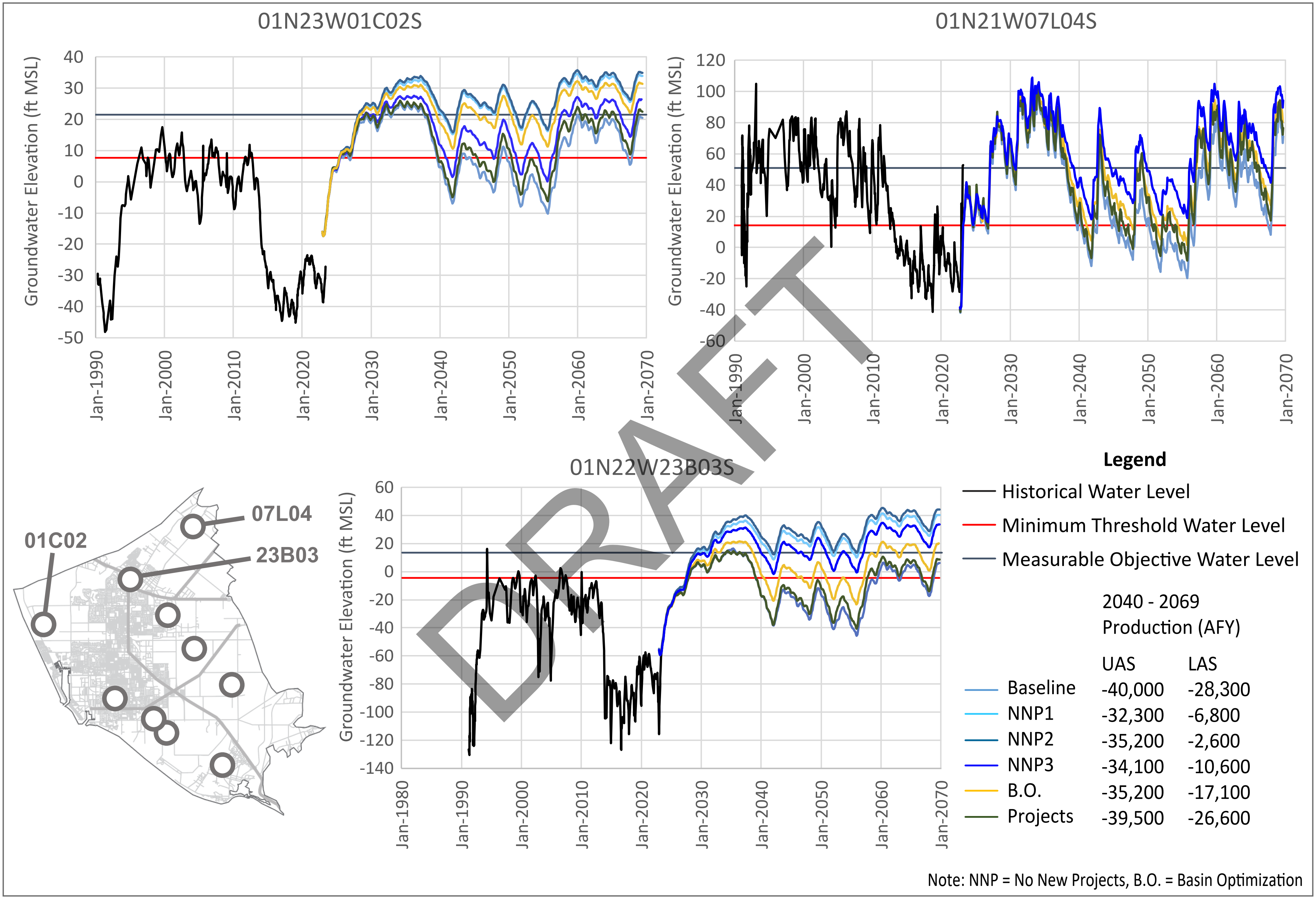
SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-3b

Key Well Hydrographs for Wells Screened in the Hueneme Aquifer

Groundwater Sustainability Plan for the Oxnard Subbasin: First 5-Year Evaluation



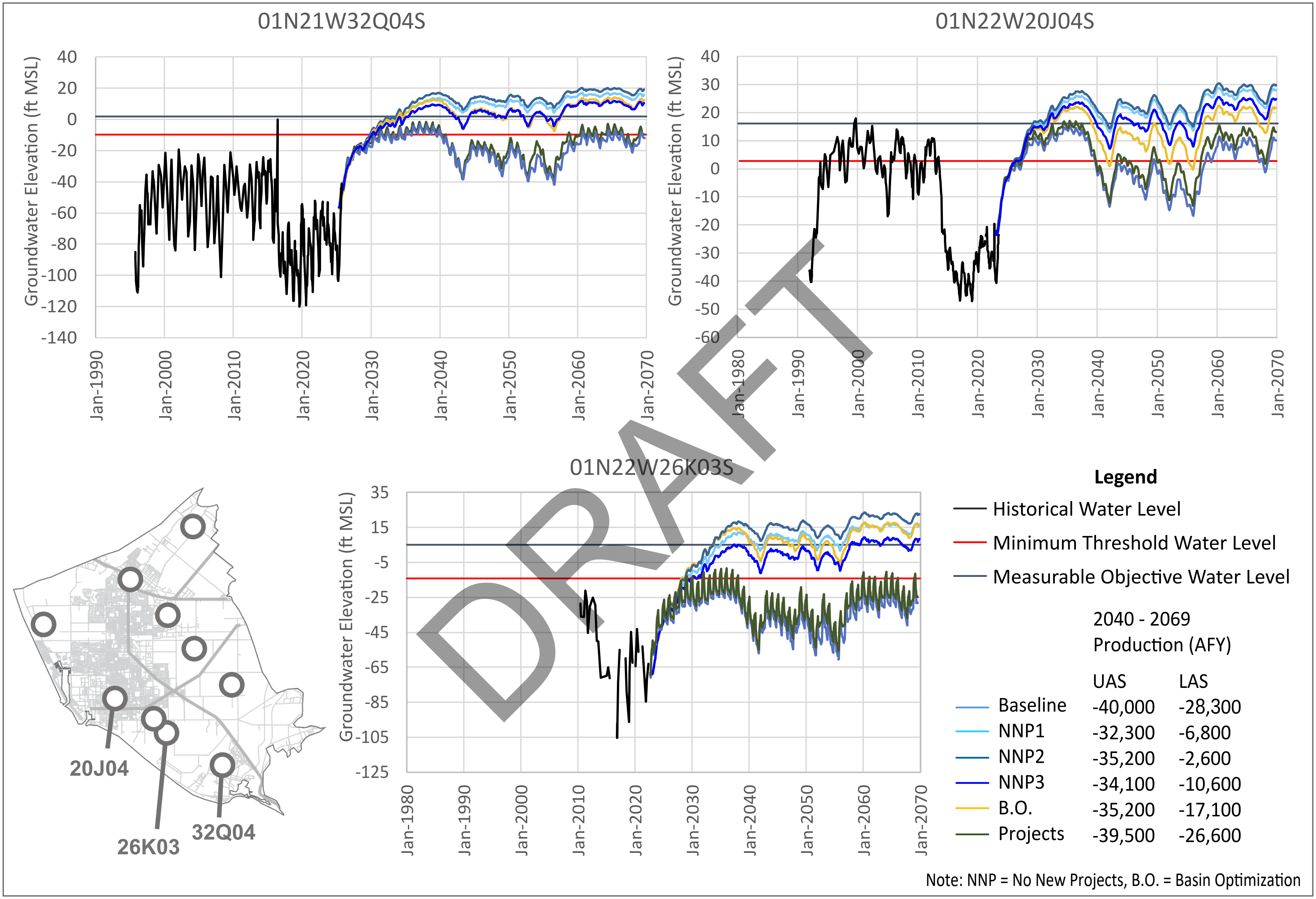
SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-4a

Key Well Hydrographs for Wells Screened in the Fox Canyon Aquifer

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

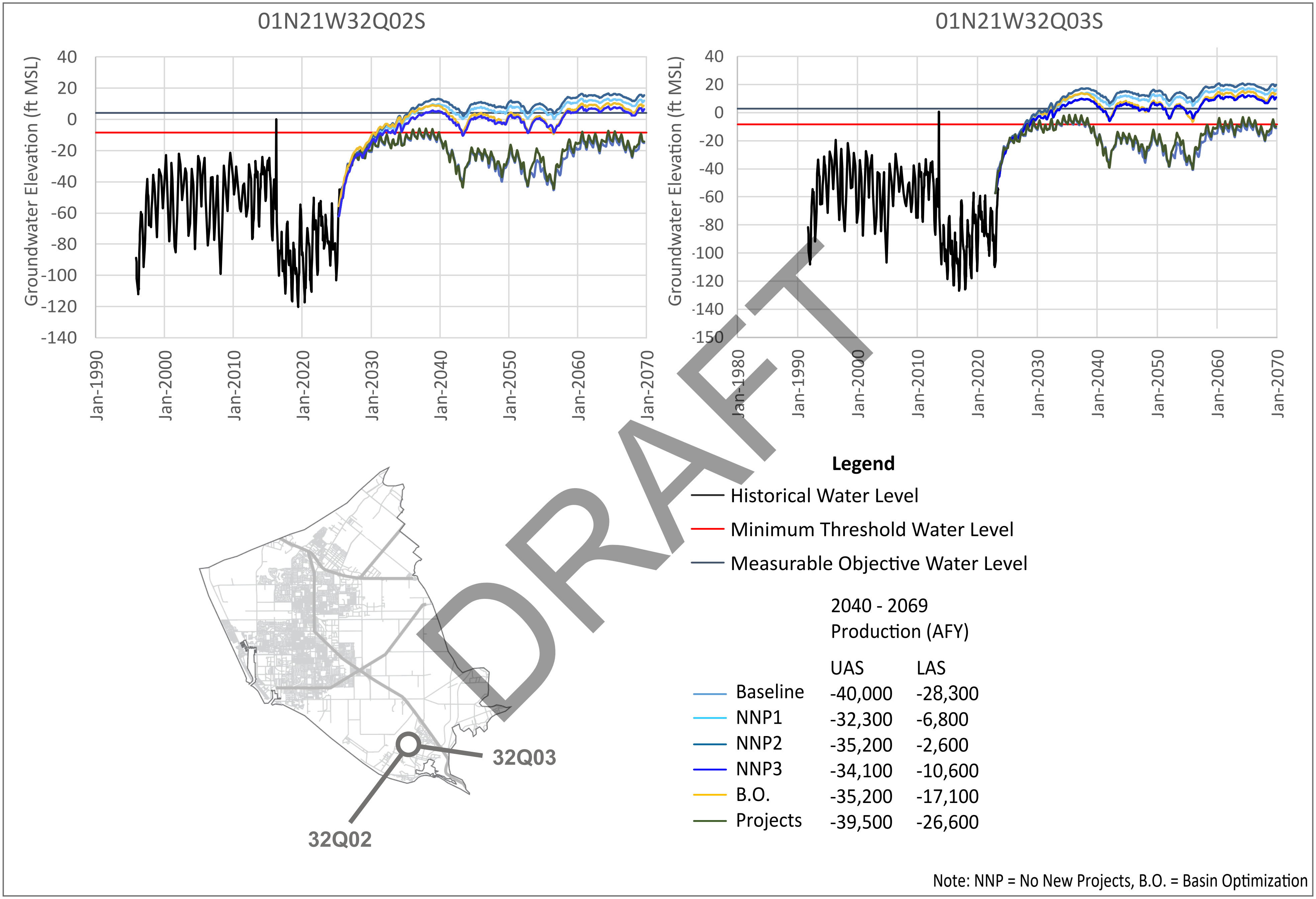


SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-4b

Key Well Hydrographs for Wells Screened in the Fox Canyon Aquifer

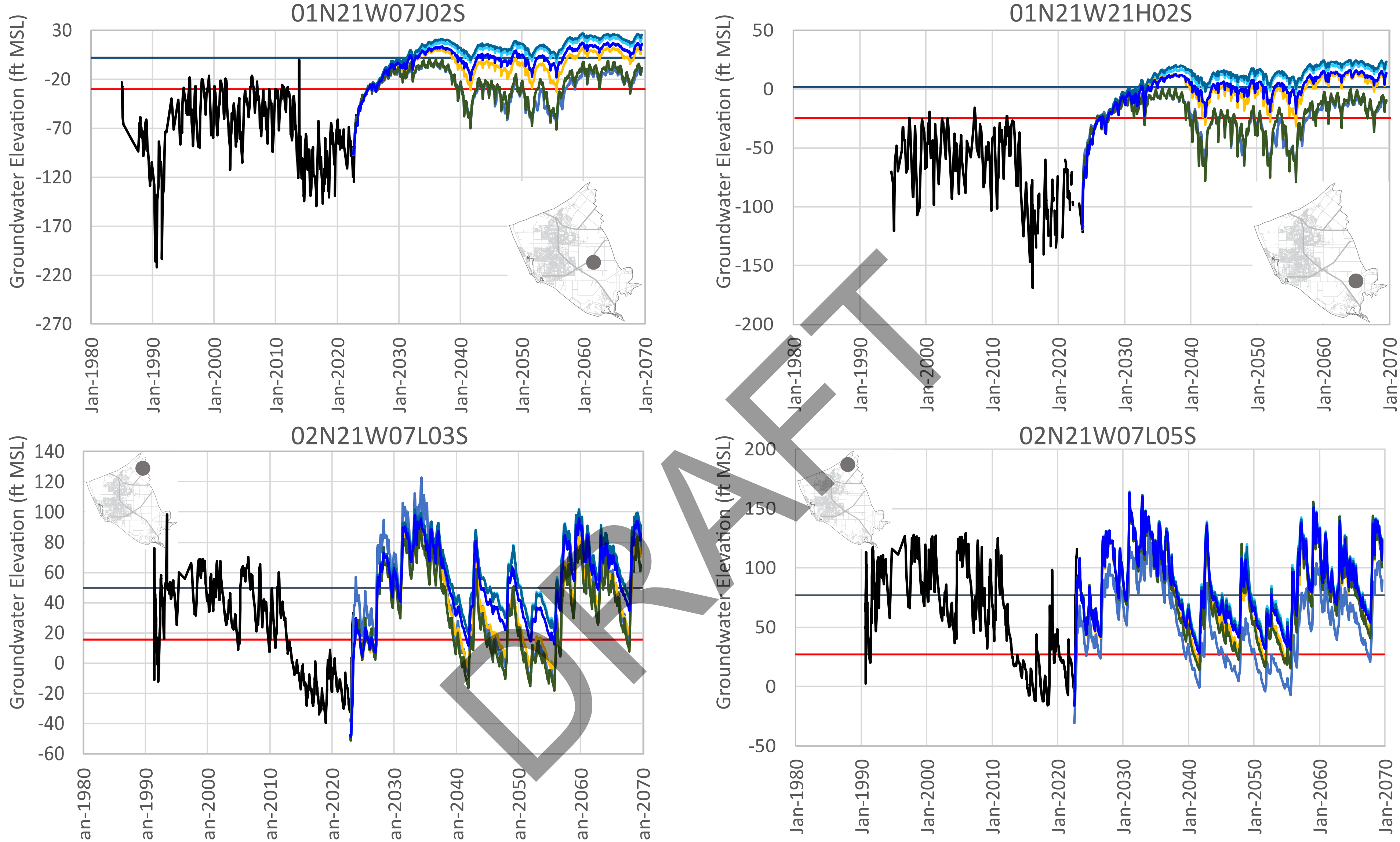


SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-5

Key Well Hydrographs for Wells Screened in the Grimes Canyon Aquifer



Historical Water Level	**Legend**		Baseline	NNP1	NNP2	NNP3	B.O.	Projects
Minimum Threshold Water Level	2040 - 2069	UAS	-40,000	-32,000	-35,200	-34,100	-35,200	-39,500
Measurable Objective Water Level	Production (AFY)	LAS	-28,300	-6,800	-2,600	-10,600	-17,100	-26,600

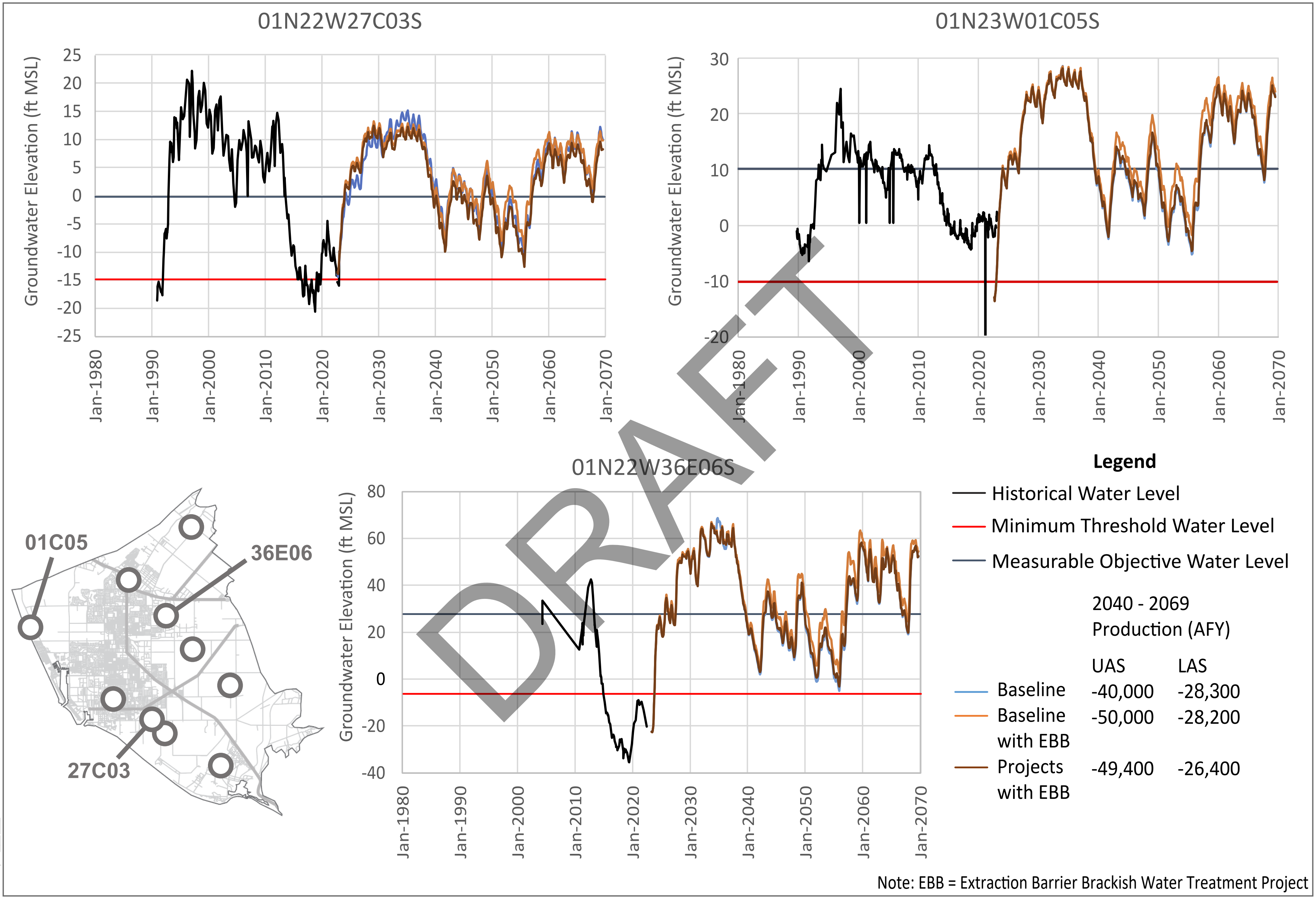
Note: NNP = No New Projects, B.O. = Basin Optimization

SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-6

Key Well Hydrographs for Wells Screened in the Multiple Aquifers



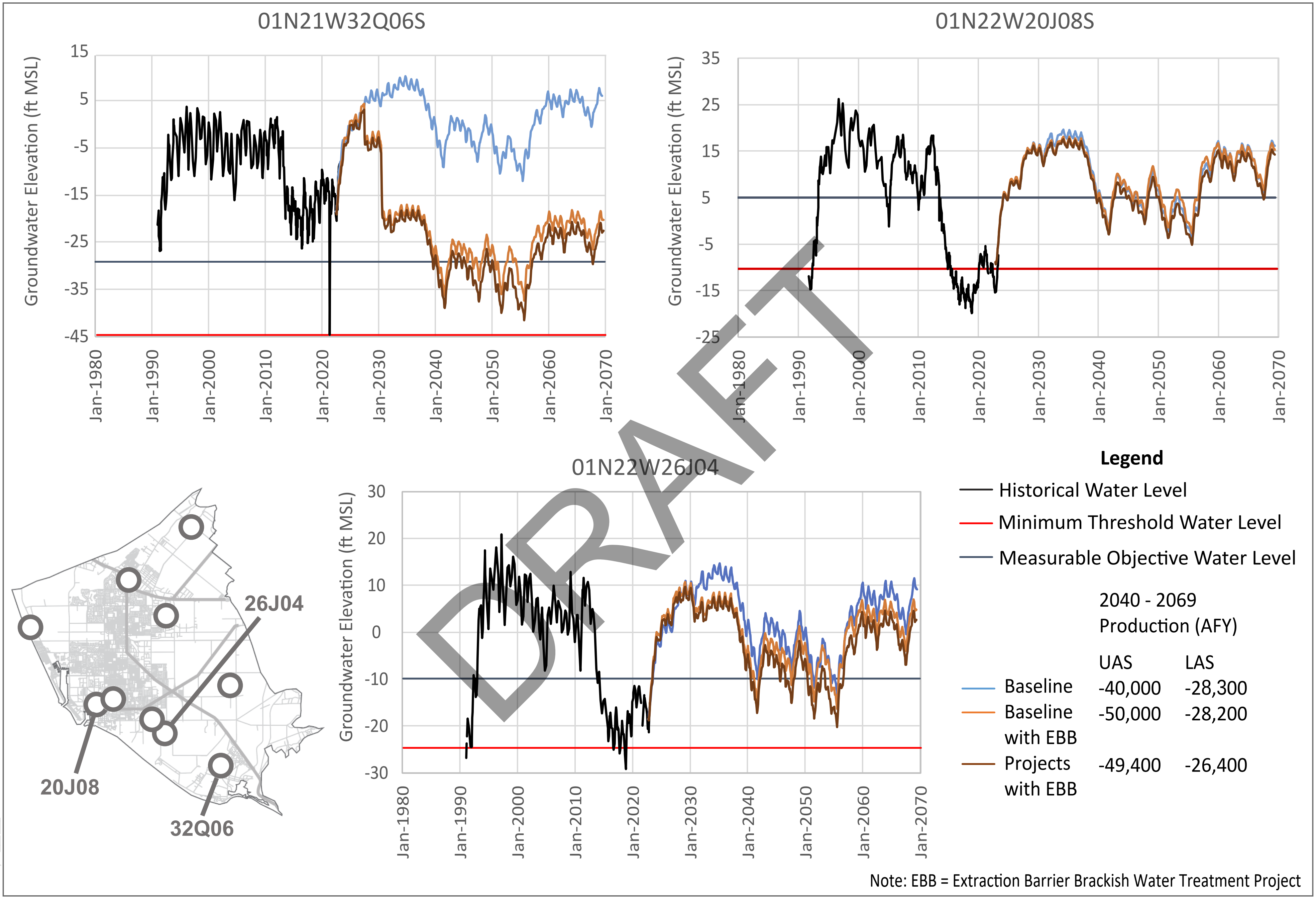
SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-7a

Key Well Hydrographs for Wells Screened in the Oxnard Aquifer: EBB Scenarios

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

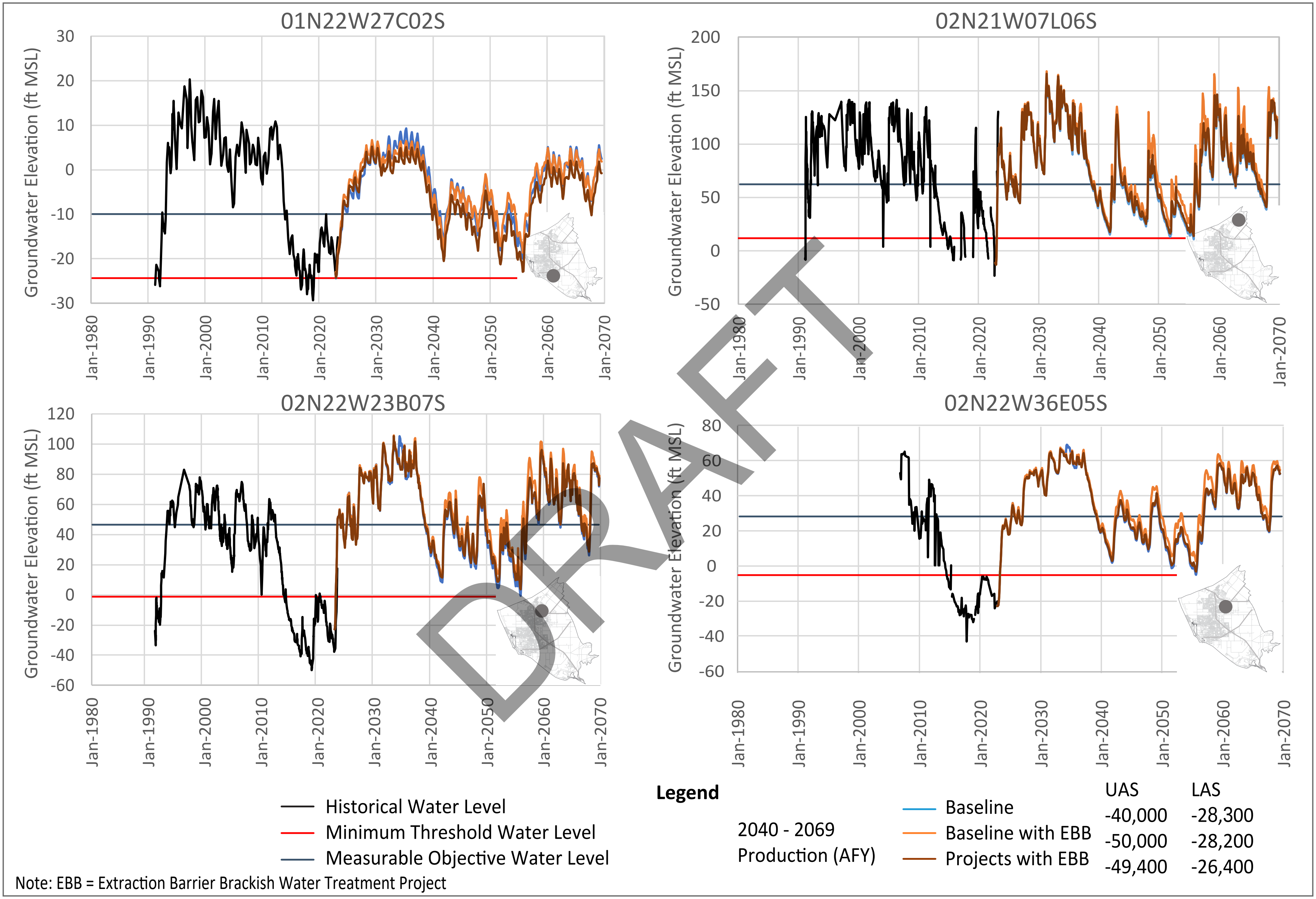


SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-7b

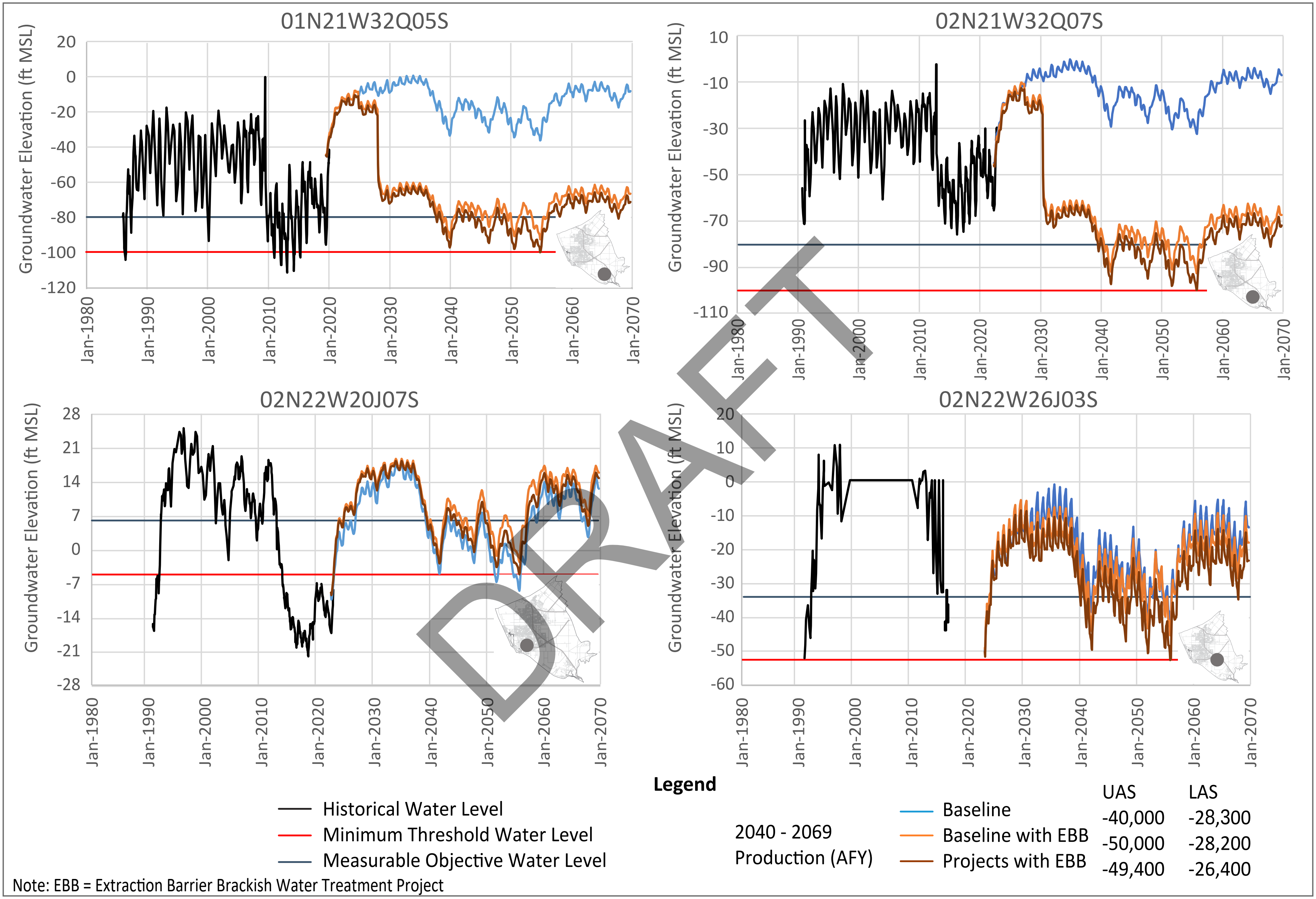
Key Well Hydrographs for Wells Screened in the Oxnard Aquifer: EBB Scenarios



SOURCE: UWCD, VCWPD

FIGURE 6-8a

Key Well Hydrographs for Wells Screened in the Mugu Aquifer: EBB Scenarios



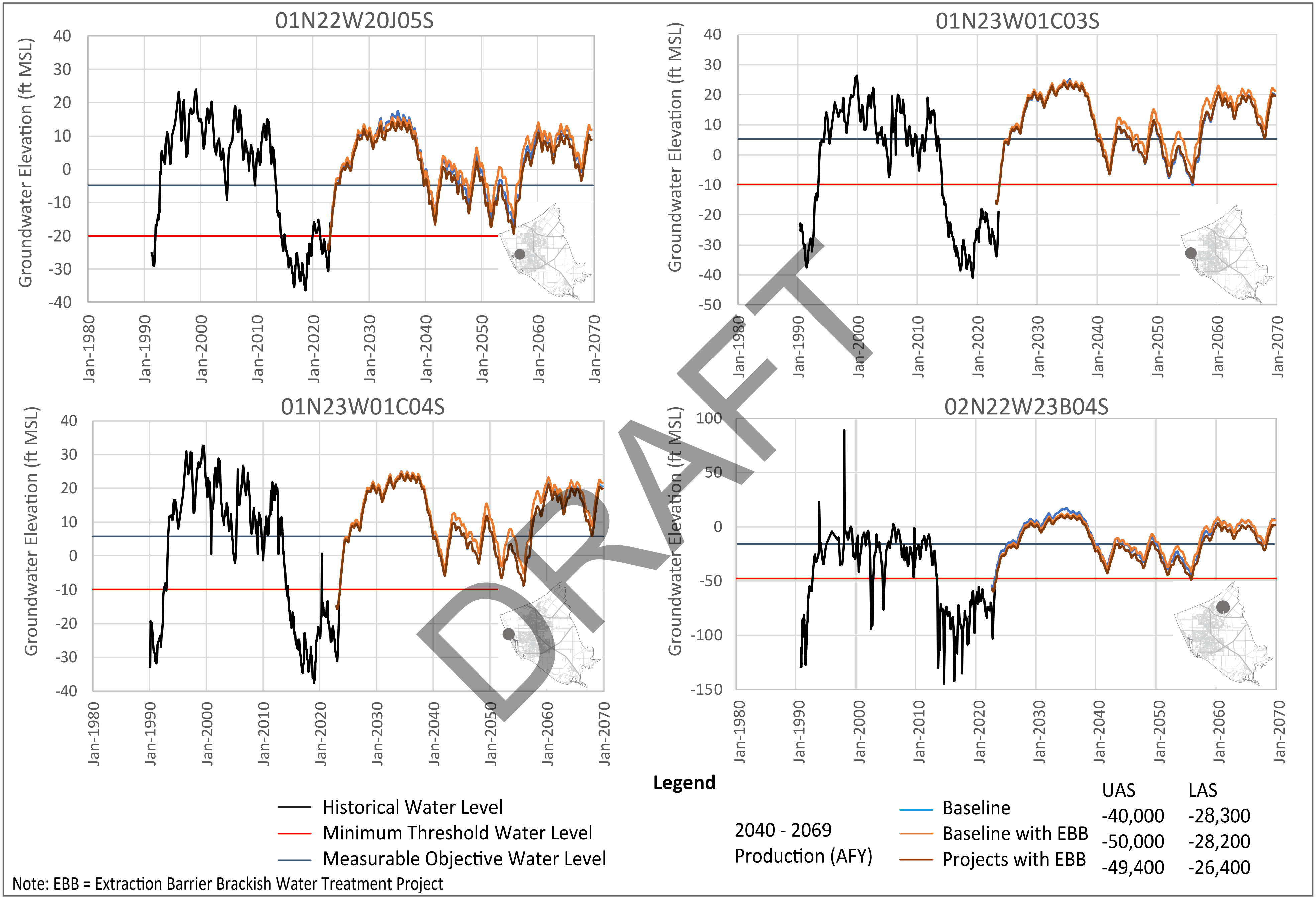
SOURCE: UWCD, VCWPD

FIGURE 6-8b

Key Well Hydrographs for Wells Screened in the Mugu Aquifer: EBB Scenarios

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation

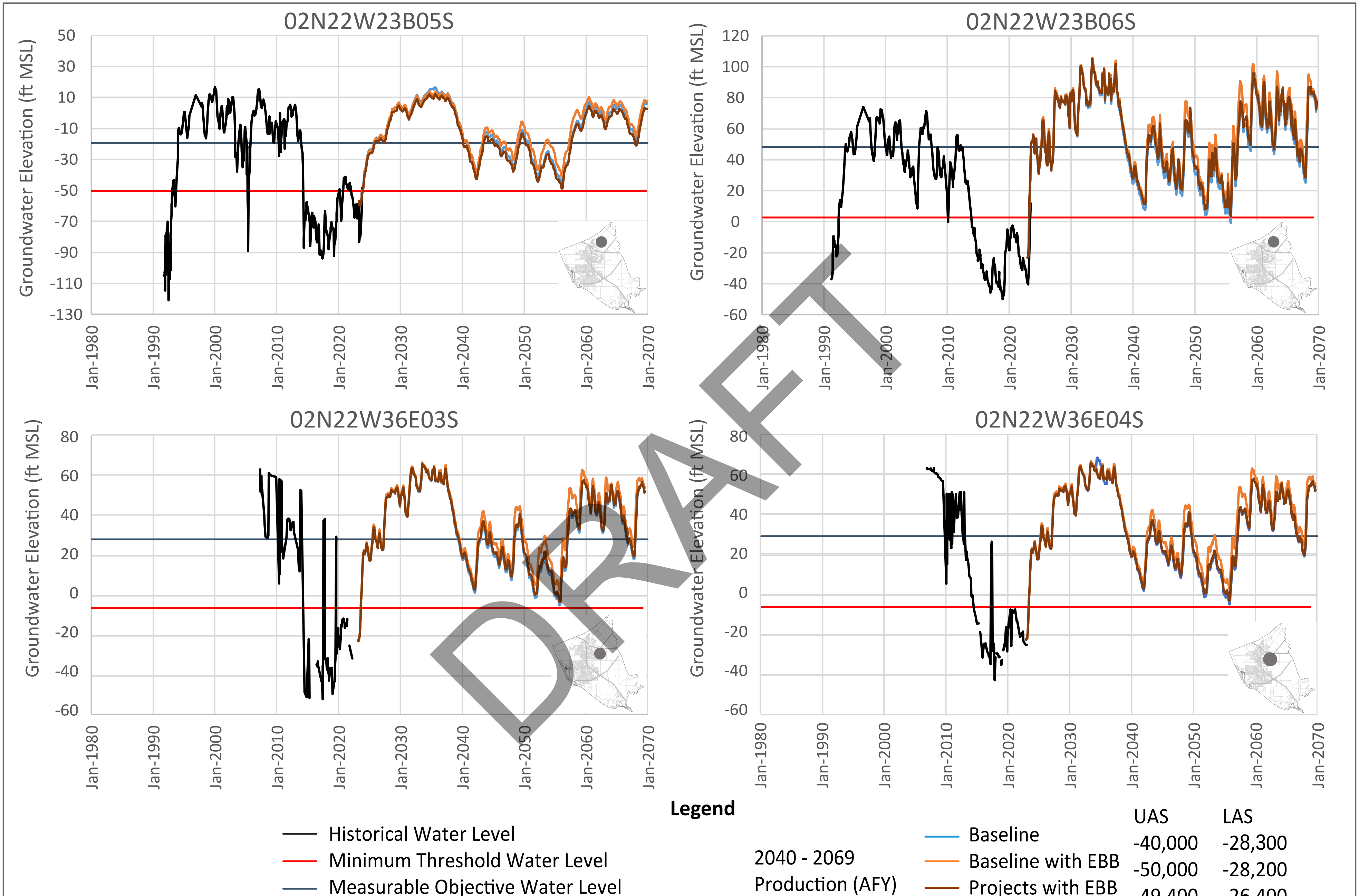
DUDEK



SOURCE: UWCD, VCWPD

FIGURE 6-9a

Key Well Hydrographs for Wells Screened in the Hueneme Aquifer: EBB Scenarios



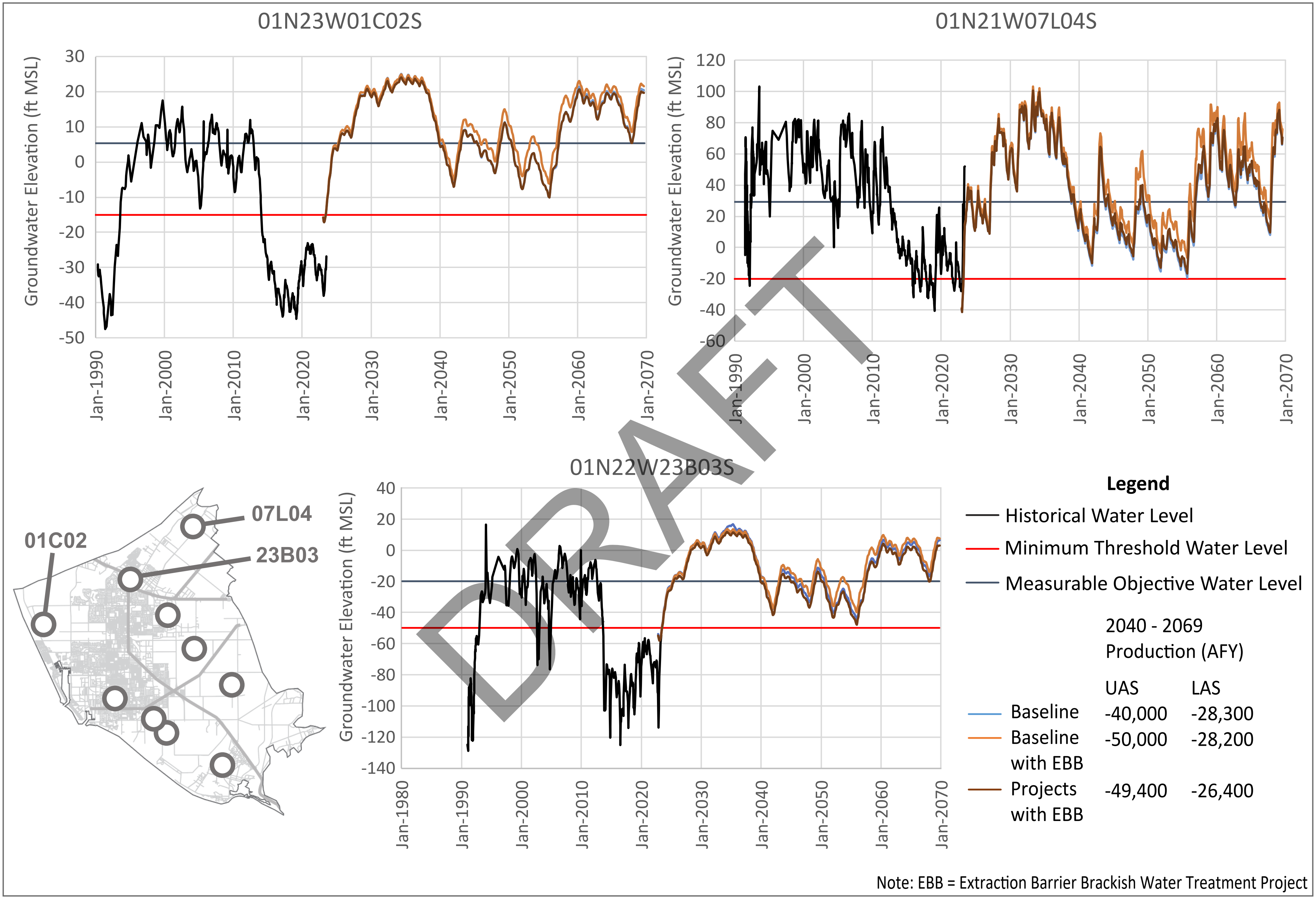
Note: EBB = Extraction Barrier Brackish Water Treatment Project

SOURCE: UWCD, VCWPD

FIGURE 6-9b

Key Well Hydrographs for Wells Screened in the Hueneme Aquifer: EBB Scenarios

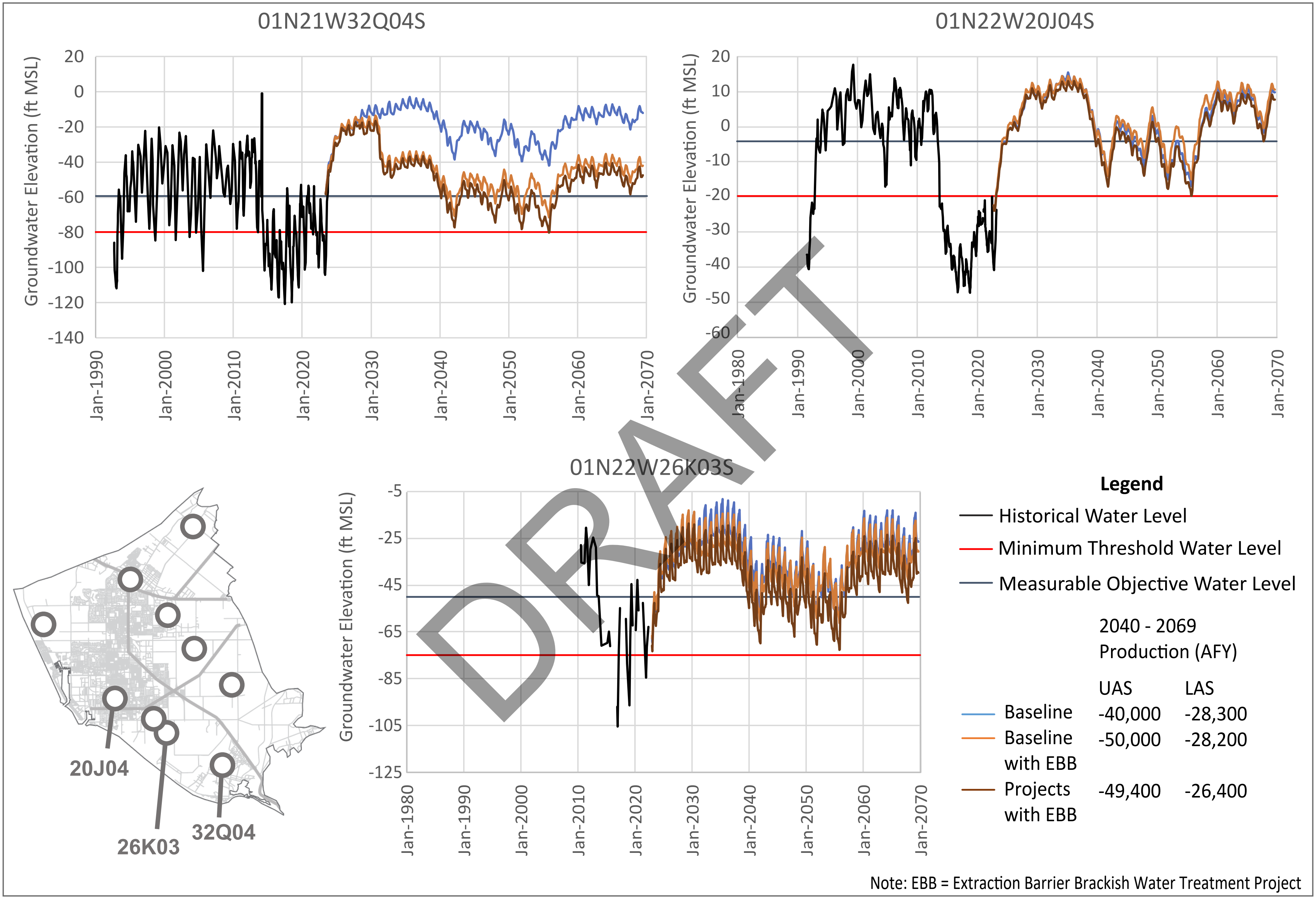
DUDEK



SOURCE: UWCD, VCWPD

FIGURE 6-10a

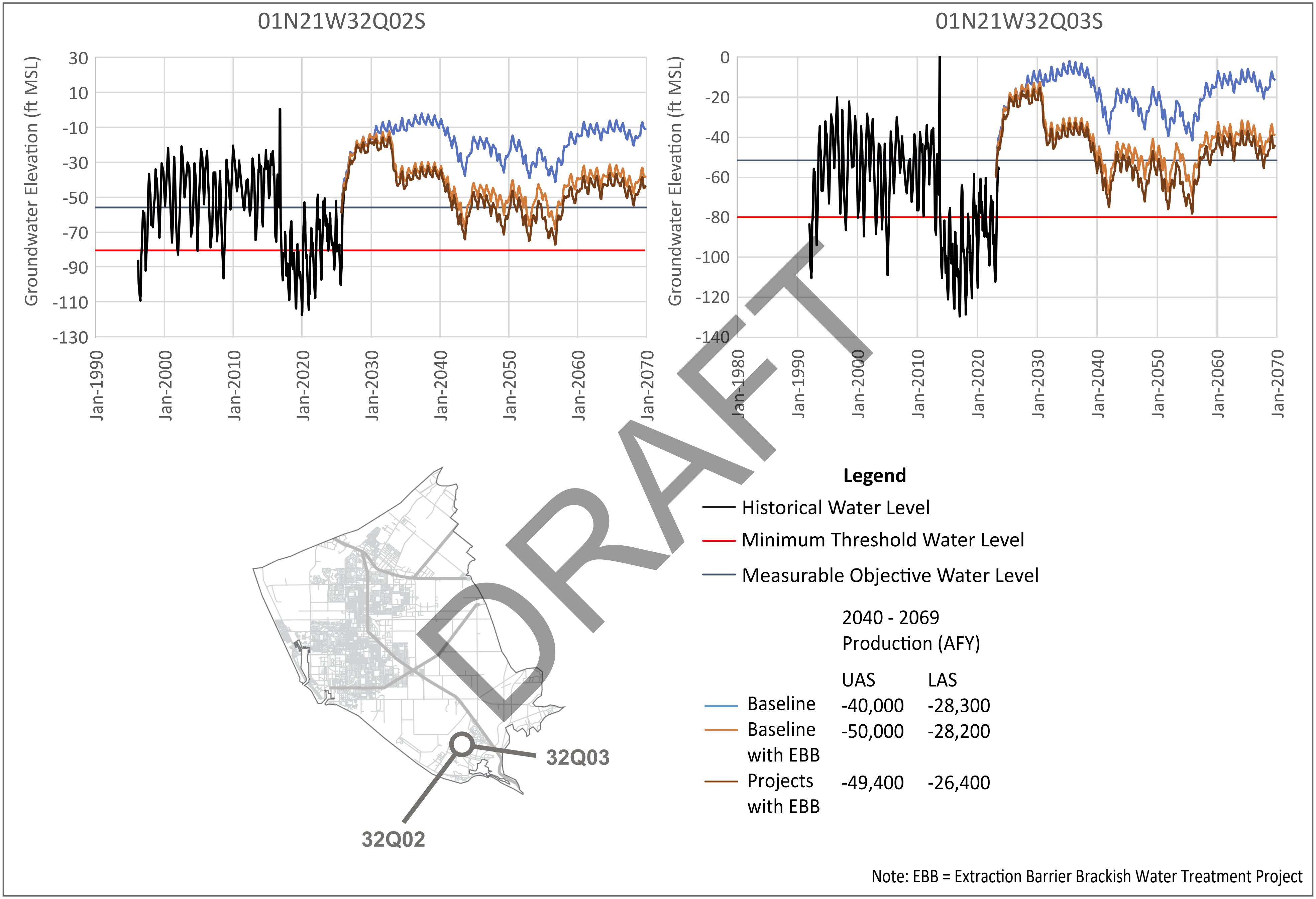
Key Well Hydrographs for Wells Screened in the Fox Canyon Aquifer: EBB Scenarios



SOURCE: UWCD, VCWPD

FIGURE 6-10b

Key Well Hydrographs for Wells Screened in the Fox Canyon Aquifer: EBB Scenarios



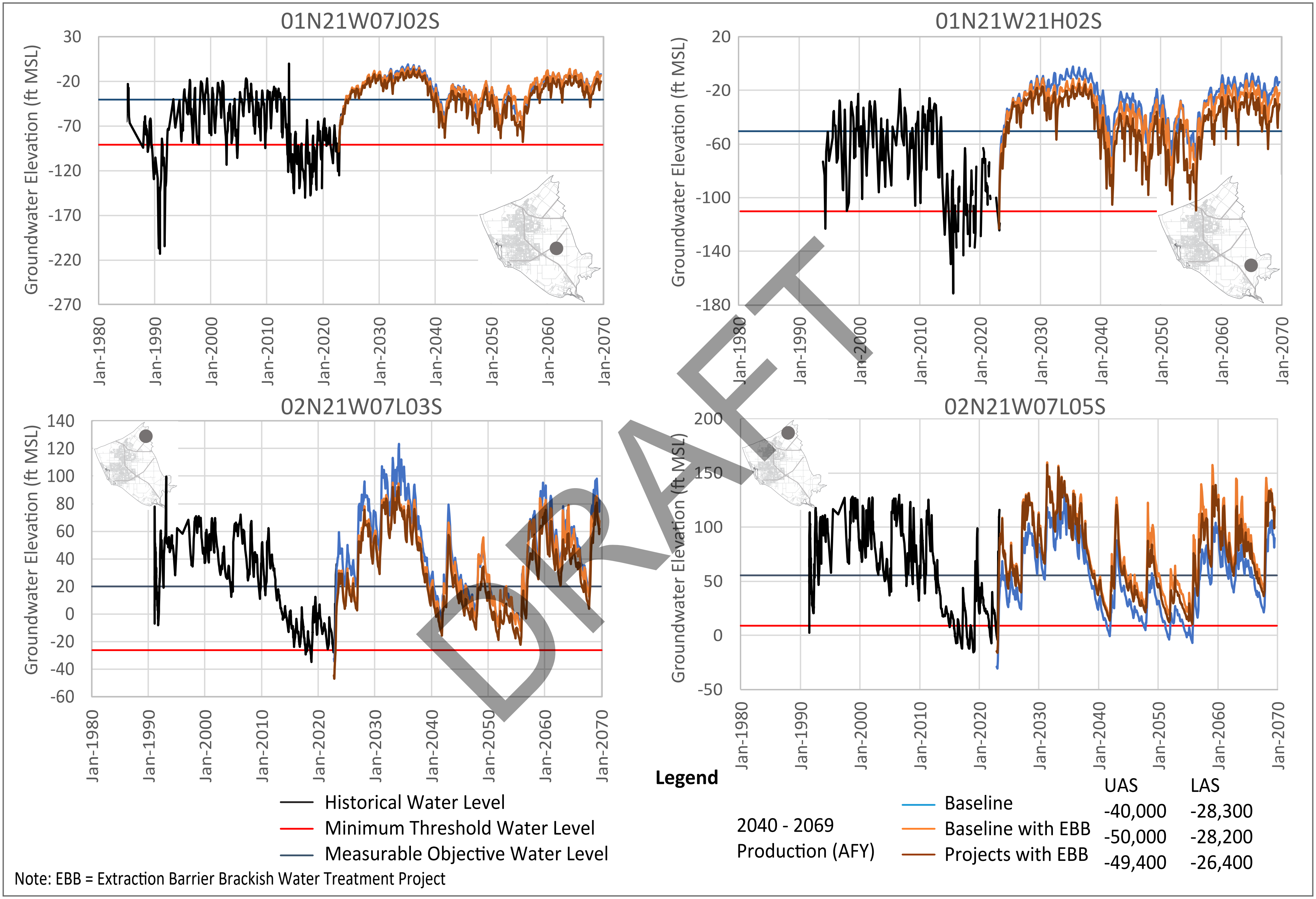
SOURCE: UWCD, VCWPD

DUDEK

FIGURE 6-11

Key Well Hydrographs for Wells Screened in the Fox Canyon Aquifer: EBB Scenarios

Groundwater Sustainability Plan for the Oxnard Subbasin: First Periodic Evaluation



SOURCE: UWCD, VCWPD

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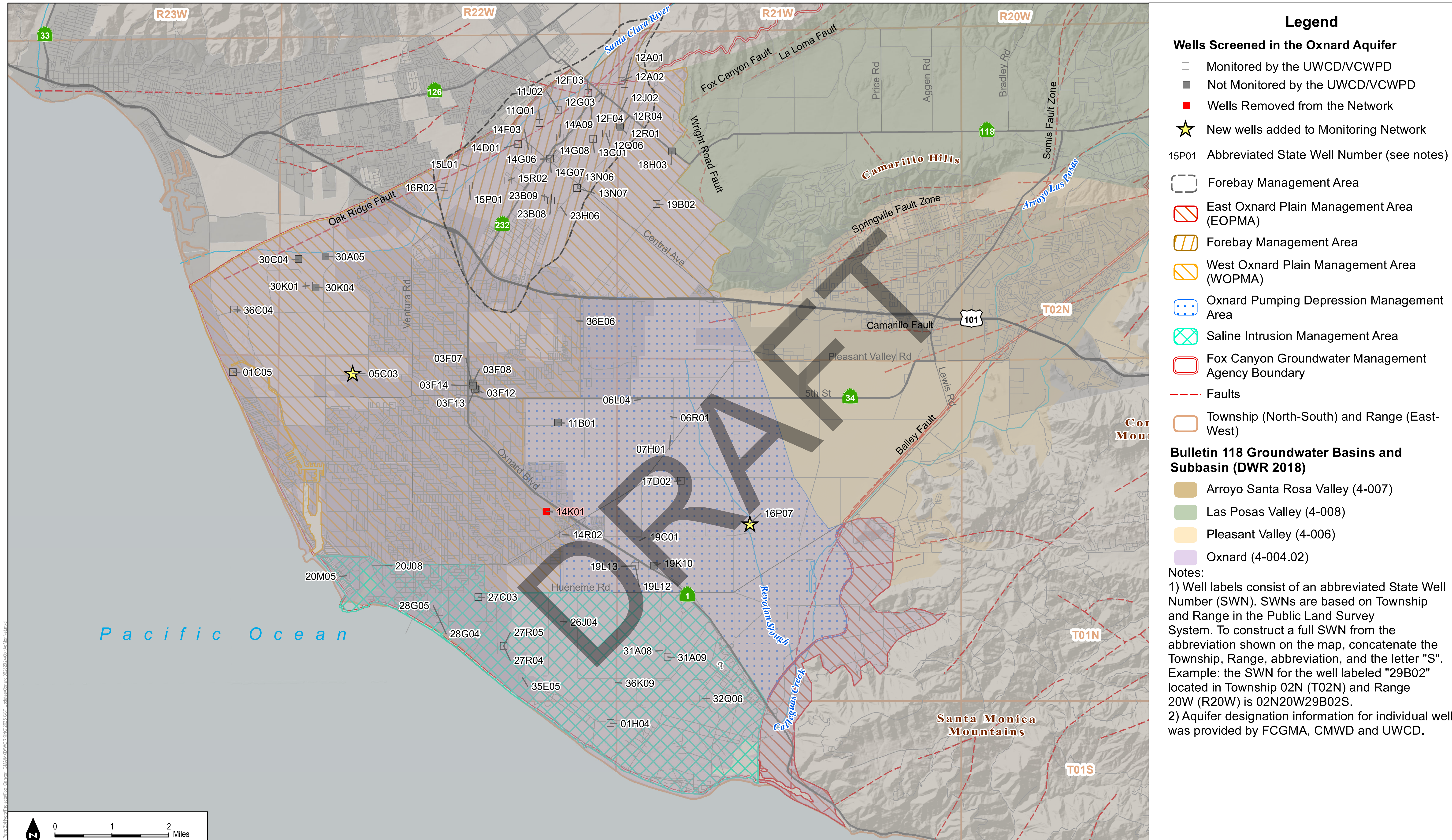
FIGURE 6-12

Key Well Hydrographs for Wells Screened in the Multiple Aquifers: EBB Scenarios



SOURCE: DWR; Ventura County; UWCD; CMWD

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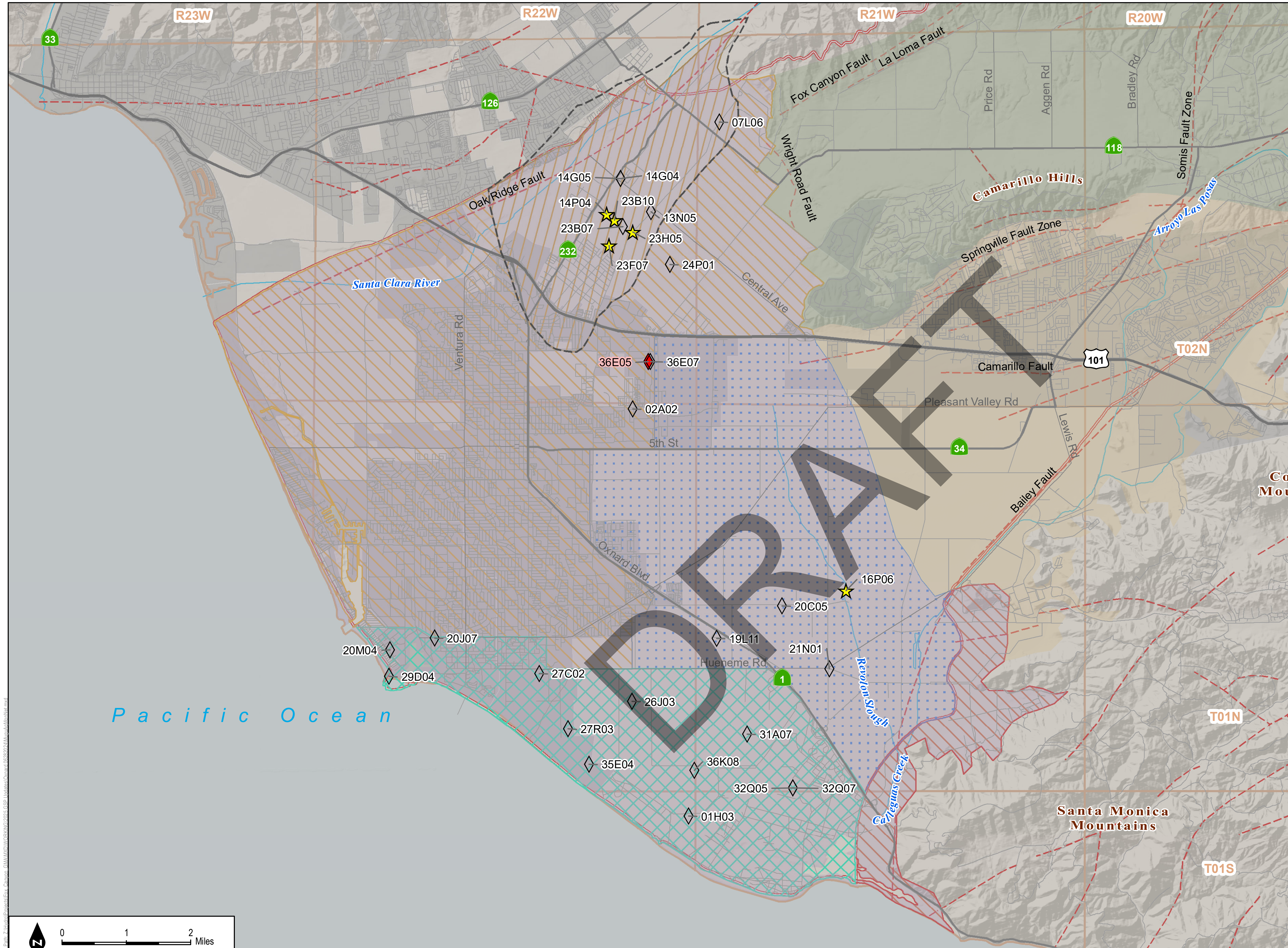
FIGURE 7-1

Monitoring Network Wells Screened in the Oxnard Aquifer



Legend

Wells Screened in the Mugu Aquifer

- Monitored by UWCD/VCWPD
- Not Monitored by UWCD/VCWPD
- UWCD Wells Removed from the Network
- New Wells to Monitoring Network
- 15P01 Abbreviated State Well Number (see notes)
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- Forebay Management Area
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management Area
- Fox Canyon Groundwater Management Agency Boundary
- Faults
- Township (North-South) and Range (East-West)

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 abbreviated State Well Number (SWN). 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 "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

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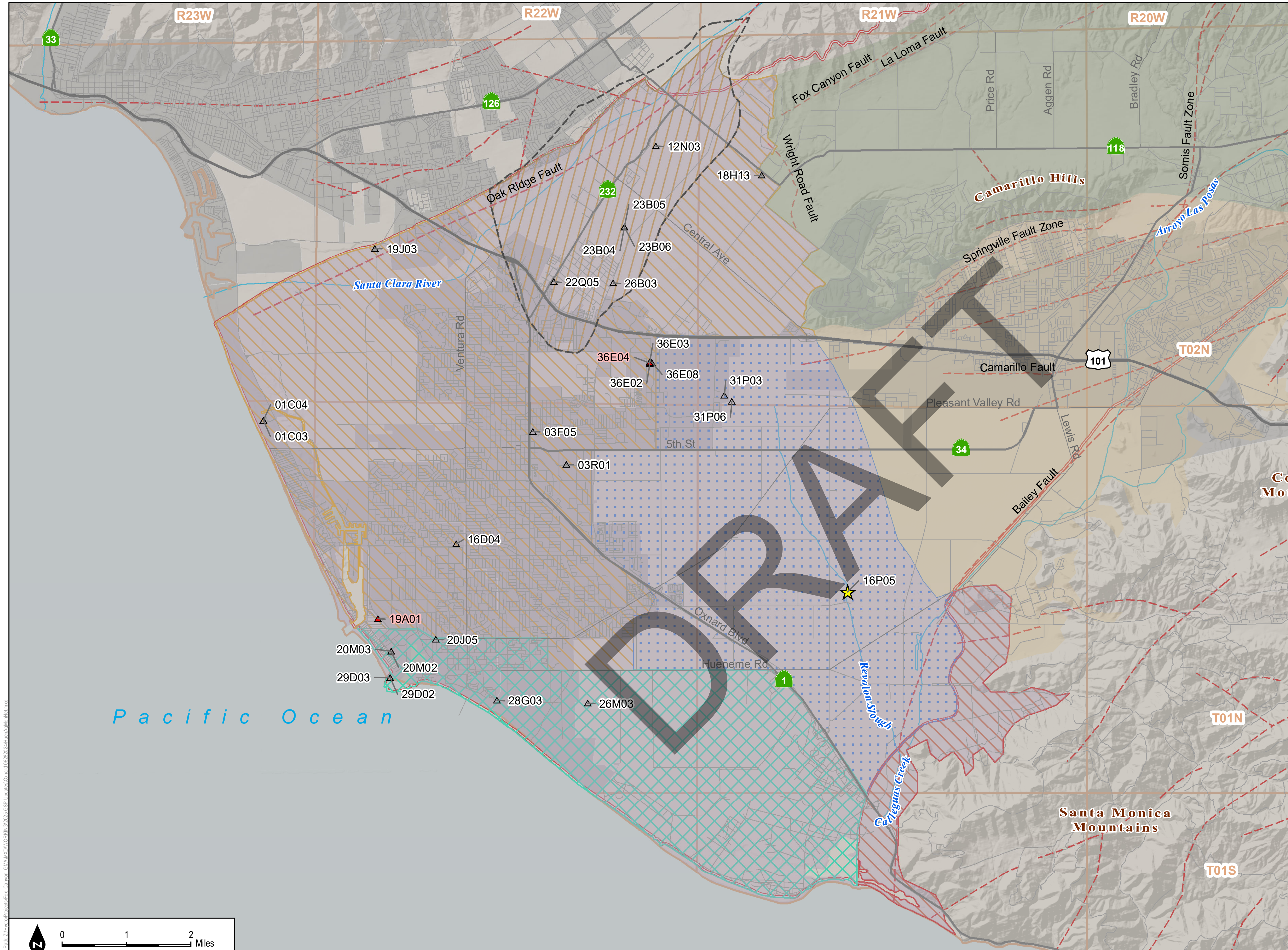
SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 7-2

Monitoring Network Wells Screened in the Mugu Aquifer



Legend

Wells Screened in the Hueneme Aquifer

- Not Monitored by UWCD/VCWPD
- Wells Removed from the Network
- Monitored by UWCD/VCWPD
- New Wells to Monitoring Network
- 15P01 Abbreviated State Well Number (see notes)
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- Forebay Management Area
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management Area
- Fox Canyon Groundwater Management Agency Boundary
- Faults
- Township (North-South) and Range (East-West)

Bulletin 118 Groundwater Basins and Subbasin (DWR 2018)

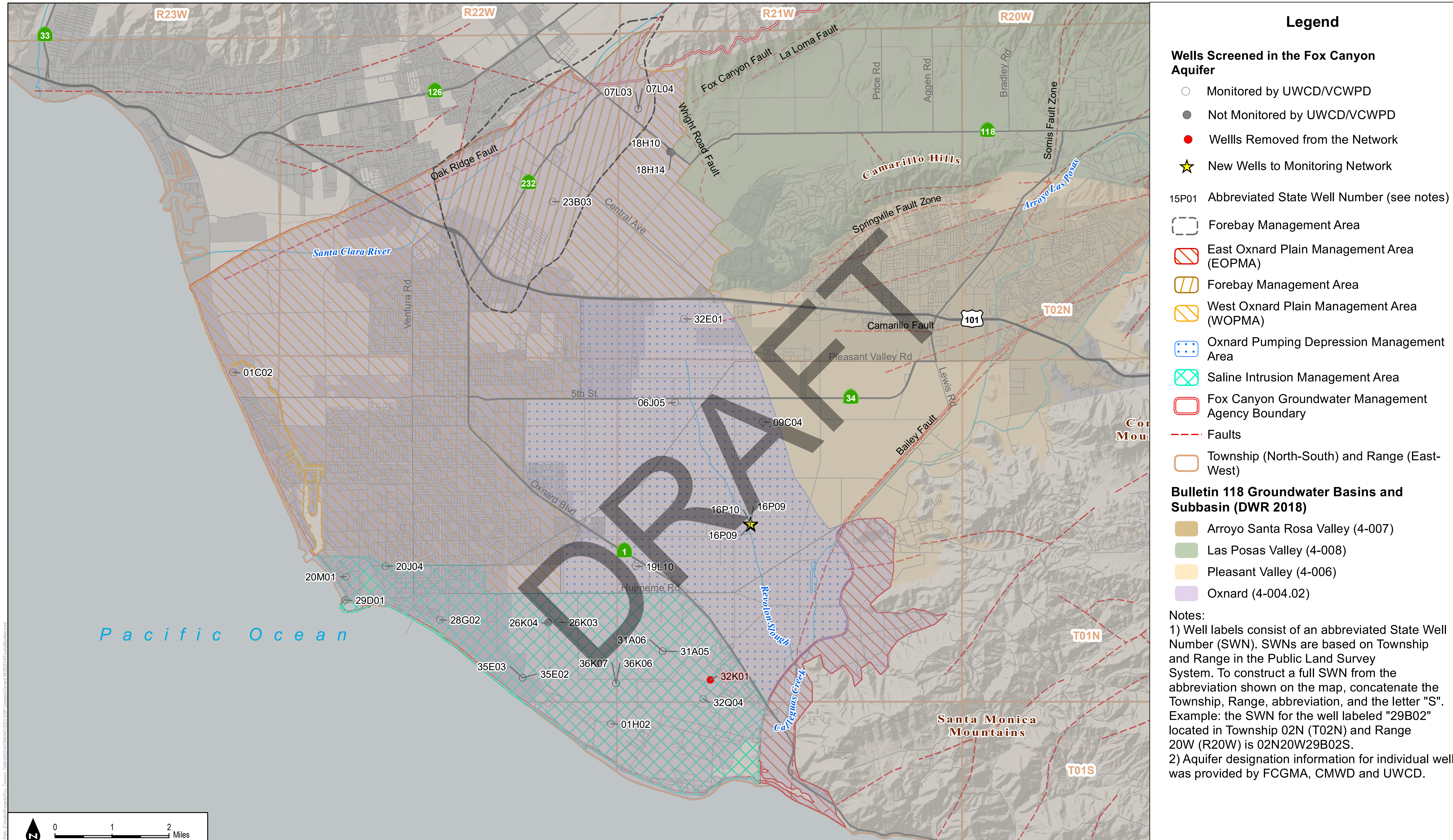
- Arroyo Santa Rosa Valley (4-007)
- Las Posas Valley (4-008)
- Pleasant Valley (4-006)
- Oxnard (4-004.02)

Notes:
1) Well labels consist of an abbreviated State Well Number (SWN). 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 "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE 7-3
Monitoring Network Wells Screened in the Hueneme Aquifer

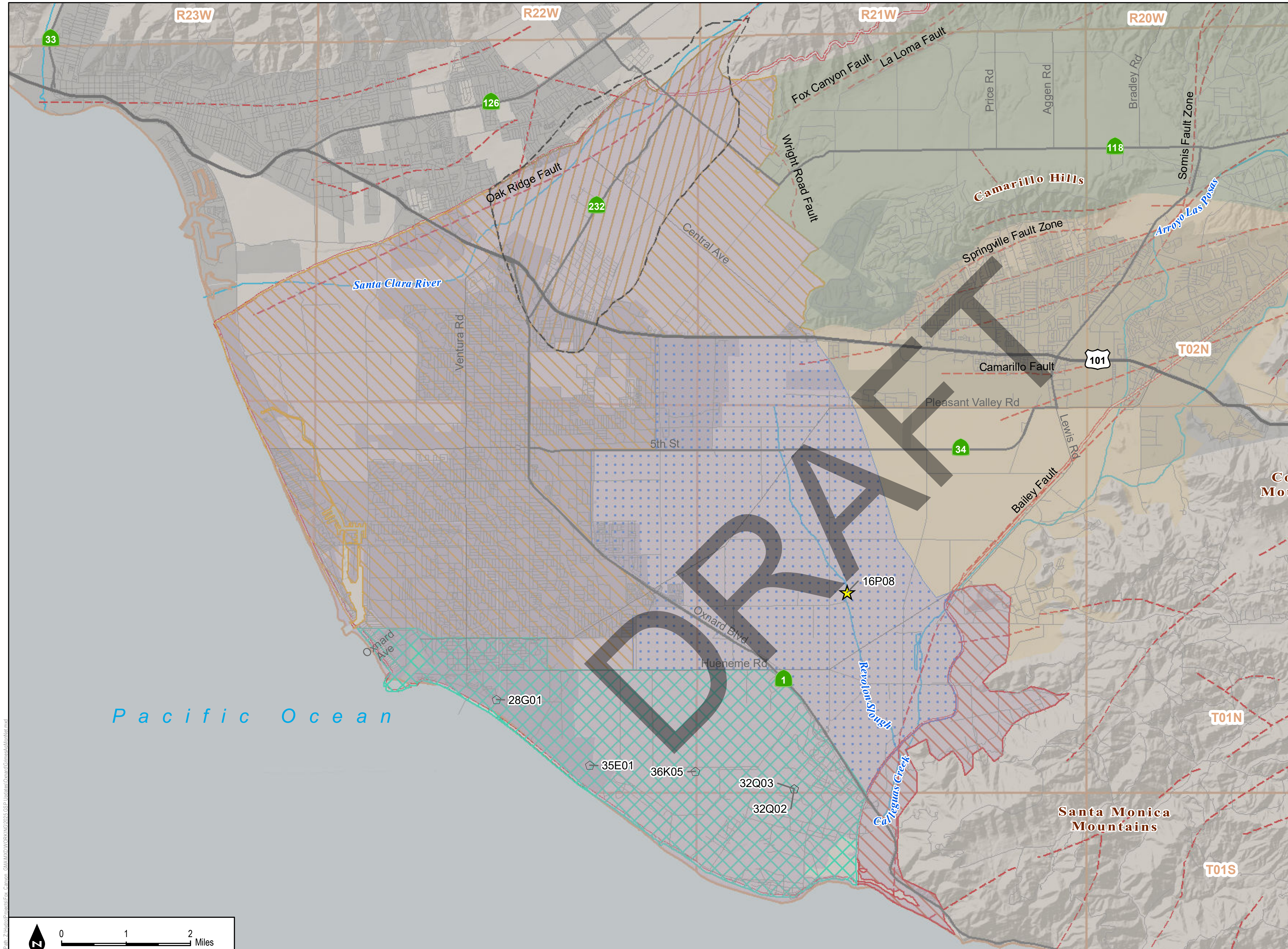


SOURCE: DWR; Ventura County; UWCD; CMWD

DUDEK

FIGURE 7-4

Monitoring Network Wells Screened in the Fox Canyon Aquifer



Legend

Wells Screened in the Grimes Canyon Aquifer

- Monitored by UWCD
- New Wells to Monitoring Network
- 15P01 Abbreviated State Well Number (see notes)
- Forebay Management Area
- East Oxnard Plain Management Area (EOPMA)
- Forebay Management Area
- West Oxnard Plain Management Area (WOPMA)
- Oxnard Pumping Depression Management Area
- Saline Intrusion Management
- Fox Canyon Groundwater Management Agency Boundary
- Faults
- Township (North-South) and Range (East-West)

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 abbreviated State Well Number (SWN). 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 "29B02" located in Township 02N (T02N) and Range 20W (R20W) is 02N20W29B02S.
2) Aquifer designation information for individual wells was provided by FCGMA, CMWD and UWCD.

DUDEK

SOURCE: DWR; Ventura County; UWCD; CMWD

FIGURE

Monitoring Network Wells Screened in the Grimes Canyon Aquifer