



Eastern Management Area Groundwater Sustainability Agency

# Santa Ynez River Valley Groundwater Basin - Eastern Management Area Annual Report Water Year 2022

March 21, 2023



Prepared by:



**GSI Water Solutions, Inc.**

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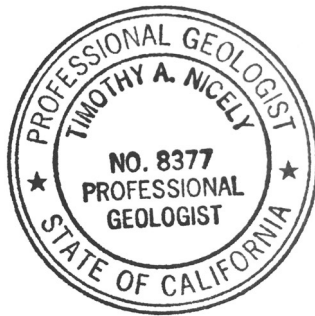
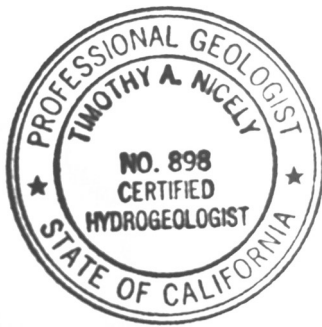
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# Santa Ynez River Valley Groundwater Basin

## Eastern Management Area

### Annual Report for Water Year 2022

This report was prepared by the staff of GSI Water Solutions, Inc. under the supervision of professionals whose signatures appear below. The findings or professional opinion were prepared in accordance with generally accepted professional engineering and geologic practice.



A handwritten signature in blue ink that reads "Timothy A. Nicely".

Tim Nicely, PG, CHg  
Supervising Hydrogeologist  
Project Manager

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## Abbreviations and Acronyms

AF	acre-feet
AFY	acre-feet per year
Basin	Santa Ynez River Valley Groundwater Basin
CGPS	Continuous Global Positioning System
COC	constituent of concern
COGG	California Oil, Gas, and Groundwater
DDW	Division of Drinking Water
DWR	California Department of Water Resources
EMA	Santa Ynez River Valley Groundwater Basin – Eastern Management Area
ET	evapotranspiration
ft/ft	feet per foot
GDE	groundwater-dependent ecosystem
gpm	gallons per minute
GSI	GSI Water Solutions, Inc.
HCM	hydrogeologic conceptual model
ID No. 1	Santa Ynez River Water Conservation District, Improvement District No. 1
ILRP	Irrigated Lands Regulatory Program
InSAR	Interferometric Synthetic Aperture Radar
MCL	maximum contaminant level
Plan	Groundwater Sustainability Plan
RMS	representative monitoring site
San Antonio Groundwater Basin	San Antonio Creek Valley Groundwater Basin
SGMA	Sustainable Groundwater Management Act
SMCL	secondary maximum contaminant level
SWP	State Water Project
SWRCB	State Water Resources Control Board
UNAVCO	University NAVSTAR Consortium

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## Executive Summary (§ 356.2[a])

### ES-1 Introduction

The Annual Report Water Year 2022 for the Santa Ynez River Valley Groundwater Basin (Basin), Eastern Management Area (EMA) has been prepared in accordance with the Sustainable Groundwater Management Act (SGMA) and related SGMA regulations.

Following adoption and submittal of the EMA Groundwater Sustainability Plan (Plan) (GSI, 2022) by January 31, 2022, the EMA Groundwater Sustainability Agency (EMA GSA) is required by Water Code Section 10728 to submit an Annual Report for the preceding water year (October 1 through September 30) to the California Department of Water Resources (DWR) by April 1 of the following year. This is the second Annual Report for the EMA, which documents conditions and progress towards implementing the Plan during water year 2022 (between October 1, 2021, and September 30, 2022).

This Annual Report includes the following sections:

- **Section 1: Introduction.** A brief background of the formation and activities of the EMA GSA and development and submittal of the Plan.
- **Section 2: Basin Setting and Monitoring Networks.** A summary of the basin setting, basin monitoring networks, and ways in which data are used for groundwater management.
- **Section 3: Groundwater Elevations.** A description of recent monitoring data with groundwater elevation contours for seasonal high and low groundwater elevations and representative hydrographs.
- **Section 4: Groundwater Extractions.** Compilation of metered, self-reported, and estimated groundwater extractions by land use sector and approximate locations of extraction.
- **Section 5: Surface Water Supply.** Summary of the volume of surface water use that occurs in the EMA.
- **Section 6: Total Water Use (§ 356.2[b][4]).** A presentation of total water use by source and sector.
- **Section 7: Change in Groundwater in Storage (§ 356.2[b][5]).** A description of the methodology and presentation of changes in groundwater in storage based on annual groundwater elevation differences.
- **Section 8: Progress toward Basin Sustainability (§ 356.2[c]).** A summary of management actions taken throughout the EMA toward sustainability of the EMA's Plan.
- **Section 9: References.**

### ES-2 Groundwater Elevations

Groundwater levels have declined from the spring 2018 levels presented in the Plan. The groundwater elevations in the Paso Robles Formation have declined during the 2022 water year: groundwater elevations in the Paso Robles Formation have declined by an average of 8 feet in the Paso Robles Formation wells between the spring of 2021 and 2022 based on review of the representative monitoring wells.

The groundwater elevations in the representative Careaga Sand wells have declined during water year 2022 by an average of 2 feet between the spring of 2021 and 2022.

The water year type for water year 2022 was “critical.”

## ES-3 Groundwater Extractions

The total annual volume of groundwater extracted in the EMA for water year 2022 was approximately 17,060 acre-feet (AF). Table ES-1 summarizes the metered and estimated groundwater extractions by water use sector for recent water years.

**Table ES-1. Groundwater Extractions by Water Use Sector**

(Values in acre-feet)

Water Year	Municipal and Self-Reported Domestic	Mutual Water Companies	Rural Domestic	Agriculture	Total
<b>2019</b>	1,431	951	305	12,278	14,965
<b>2020</b>	1,880	957	307	11,812	14,956
<b>2021</b>	2,320	963	309	13,379	16,971
<b>2022</b>	2,516	969	311	13,264	17,060

## ES-4 Surface Water Supply

The total annual volume of surface water used in the EMA for water year 2022 was approximately 4,500 acre-feet (AF). The volume of surface water supply that was used in the EMA in water year 2022 is presented on Table ES-2. Santa Ynez River Water Conservation District, Improvement District No. 1 (ID No. 1) imports water into the EMA via the Cachuma Project and the State Water Project (SWP). ID No. 1 does not receive its Cachuma Project water directly; instead, it receives additional SWP water through an Exchange Agreement with the South Coast members of the Cachuma Project. A portion of the SWP water is contractually committed for use by the City of Solvang. ID No.1 and the City of Solvang also produce surface water from the Santa Ynez River underflow for use in the Santa Ynez Uplands.

**Table ES-2. Surface Water Use**

(Values in acre-feet)

Water Year	City of Solvang	ID No. 1 Table A	ID No. 1 Exchange	Solvang River Wells	ID No. 1 River Wells	Other River Wells <sup>1</sup>	Total River Wells	Total
<b>2019</b>	759	50	2,213	160	739	1,658	2,557	5,579
<b>2020</b>	745	315	1,740	148	567	1,566	2,281	5,081
<b>2021</b>	612	0	1,439	240	1,142	1,775	3,157	5,208
<b>2022</b>	590	0	544	270	1,632	1,478	3,380	4,514

### Notes

<sup>1</sup> Includes other river wells reported to the Santa Ynez River Water Conservation District.

## ES-5 Change in Groundwater in Storage

The current groundwater monitoring network for the Paso Robles Formation, the most extensive principal aquifer within the EMA, does not have sufficient spatial distribution to adequately represent groundwater conditions throughout the Santa Ynez Uplands. Due to loss of access to several wells, the groundwater elevation monitoring network used for contouring groundwater elevations for both principal aquifers

provided greater spatial coverage of the EMA in water year 2018 compared to the data available for water year 2022. The EMA GSA is working to implement planned management actions to address the identified data gaps.

Because of this, the change in groundwater in storage within the Paso Robles Formation was calculated by using the water budget to estimate the total change in storage for both aquifers, and then removing the change in storage calculated for the Careaga Sand. The remaining change in storage was attributed to the Paso Robles Formation.

The change in groundwater in storage within the Careaga Sand was calculated for water year 2022 from the comparison of spring groundwater elevation contour maps from one year to the next. That is, the spring 2021 groundwater elevations for the Careaga Sand (Figure 10) were subtracted from the spring 2022 groundwater elevations (Figure 12) resulting in a map depicting the changes in groundwater elevations that occurred during the 2022 water year (Figure 16). The groundwater elevation change depicted on each map, along with a representative storage coefficient, is used to calculate the proportion of that change that is due to changes in groundwater in storage.

The total annual change of groundwater in storage for water year 2022 is presented in Table ES-3. As shown, the volume of groundwater in storage declined by about 11,500 AFY during the critical dry water year of 2022. Overall, since 2018, when the historical period presented in the Plan ended, an estimated net decrease of 23,100 AF of groundwater in storage has occurred.

**Table ES-3. Annual Estimated Change in Groundwater in Storage**

(Values in acre-feet)

Water Year	Change in Storage (Paso Robles Formation)	Change in Storage (Careaga Sand)	Total Annual Change in Storage
<b>2019</b>	3,047	996	4,043
<b>2020</b>	-1,662	-477	-2,139
<b>2021</b>	-12,737	-825	-13,562
<b>2022</b>	-10,983	-495	-11,478

## ES-6 Progress toward Basin Sustainability

To achieve the sustainability goal established by the EMA GSA before 2042, and avoid undesirable results as required by SGMA, several management actions will be implemented in the EMA. These management actions are focused primarily on filling identified data gaps, developing funding for EMA GSA operations and future EMA monitoring, registering and metering wells, reporting groundwater production, developing new and expanded existing water use efficiency programs, and implementing a groundwater pumping fee program. As described in the Plan (GSI, 2022), the EMA GSA has begun planning for Group 1 management actions. A grant application has been submitted for the Basin to assist in funding several Group 1 PMAs within the EMA, including:

- Address Data Gaps
  - Expand Monitoring Well Network in the EMA to Increase Spatial Coverage and Well Density

- Perform Video Surveys in Representative Wells That Currently Do Not Have Adequate Construction Records to Confirm Well Construction
- Review/Update Water Usage Factors and Crop Acreages
- Groundwater Pumping Fee Program
- Well Registration Program and Well Meter Installation Program

Relative to the most current conditions as reported in the Plan, this Annual Report for Water Year 2022 indicates continued declines in groundwater levels. Groundwater elevations have declined in most of the representative monitoring wells, indicating a decrease in total groundwater in storage, driven by the recent exceptionally dry period and continued pumping. Group 1 management actions are planned to address data gaps through improvement of the monitoring and data-collection networks, as well as program implementation for better measurement of groundwater pumping to promote water use efficiency and sustainable groundwater use.

While water levels have declined below minimum thresholds in some representative wells, the number of wells falling below the minimum thresholds has not resulted in the undesirable results that are described in the Plan because one of the criteria is that these conditions must occur “after 2 consecutive years of average and above-average precipitation” has not occurred. Group 1 management actions (as outlined in Section 6 of the Plan and summarized in the above bulleted list) are being planned and implementation is projected to result in improved conditions. If they do not and it is determined that groundwater pumping is contributing to undesirable results, additional management actions described in the Plan (e.g., Group 2 and 3) may be warranted. The effect of the management actions will be reviewed periodically, and additional Group 2 management actions and Group 3 projects may be considered and implemented as necessary to avoid undesirable results.

The EMA GSA is not charged with managing groundwater quality unless it can be shown that water quality degradation is caused by groundwater pumping in the EMA, or projects implemented by the EMA that degrades water quality. As described in the Plan, groundwater quality in the EMA is generally suitable for both drinking water and agricultural purposes (GSI, 2022). Potential degradation of groundwater quality caused by groundwater pumping or projects and management actions will be monitored as part of the EMA’s water quality monitoring network.

Land subsidence caused by groundwater extraction will be monitored as part of the Plan. Subsidence can be estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR. The accuracy associated with the InSAR measurement and reporting methods is of 0.1 feet (or 1.2 inches). A land surface change of less than 0.1 feet is therefore within the noise of the data and is equivalent to no evidence of subsidence. Considering this, examination of the data between June 2015 and October 2022 show that no measurable land subsidence has occurred. The EMA GSA will continue to monitor and report annually on any subsidence.

Potential GDEs associated with one of the principal aquifers were identified on the downstream ends of Alamo Pintado Creek and Zanja de Cota Creek where groundwater may be interconnected with surface water. As described in the Plan, the EMA GSA has proposed to install piezometers in the GDE areas to assess whether depletion of interconnected surface water is occurring and whether significant and unreasonable adverse impacts to GDEs or reductions in discharge of interconnected surface water to the Santa Ynez River may be occurring as a result of groundwater conditions. Planning for installation of the proposed piezometers is underway.

The planning is underway to implement projects and managements actions and to evaluate their effectiveness. It is anticipated that the projects and management actions will enable the EMA to sustainably manage groundwater and achieve sustainability goals as defined in the Plan.

## SECTION 1: Introduction

This Annual Report for Water Year 2022 for the Santa Ynez River Valley Groundwater Basin (Basin) - Eastern Management Area (EMA) has been prepared for the EMA Groundwater Sustainability Agency (GSA) in accordance with Sustainable Groundwater Management Act (SGMA) and related SGMA regulations (§ 356.2. Annual Reports) (Appendix A). Following adoption and submittal of the EMA Groundwater Sustainability Plan (Plan) on January 19, 2022, the EMA GSA is required by Water Code Section 10728 to submit an Annual Report for the most recently completed water year (October 1 through September 30) to the California Department of Water Resources (DWR) by April 1 of the following year. This Annual Report presents the following required information about the EMA portion of the Basin managed in the Plan<sup>1</sup>:

- (a) Groundwater elevation data.
- (b) Annual aggregated data identifying groundwater extraction for the preceding water year.
- (c) Surface water supply used for or available for use for groundwater recharge or in-lieu use.
- (d) Total water use.
- (e) Change in groundwater storage.

The prior Annual Report for the EMA presented the required elements for the water years 2019, 2020, and 2021 (i.e., October 1, 2018 through September 31, 2021) shortly after submission of the Plan. This Annual Report presents the required elements for the water year 2022, which occurred between October 1, 2021 and September 31, 2022.

### 1.1 Setting and Background

The Plan was prepared by GSI Water Solutions, Inc. (GSI, 2022), on behalf of and in cooperation with the EMA GSA. The Plan, and this Annual Report, discuss the area known as the EMA (Figure 1). The Basin covers 319 square miles (204,000 acres) within the entire Bulletin 118 Basin Boundary, of which the easternmost 150 square miles make up the EMA, geographically including the Santa Ynez Uplands and Santa Ynez River areas (DWR, 2018a). The Santa Ynez Uplands area includes the groundwater system that is subject to regulation under SGMA. The Santa Ynez River area, including the river and associated underflow that constitutes a surface water system, is managed under the jurisdiction of the California State Water Resources Control Board (SWRCB), and is not regulated under SGMA.

The EMA is bounded on the north and east by impermeable rocks of the San Rafael Mountains and on the northwest by the adjacent San Antonio Creek Valley Groundwater Basin (San Antonio Groundwater Basin). The entire Basin is bounded on the south by the Santa Ynez Mountains (Figure 1). Average precipitation ranges from 15 inches per year in the southern and central areas to about 24 inches per year in the higher elevations (Santa Barbara County, 2012). Several tributaries flow from the San Rafael Mountains and Santa Ynez mountains into the Santa Ynez River along the southern edge of the EMA. The Santa Ynez River flows west of Highway 154, past the communities of Solvang and Santa Ynez.

The Plan was developed by the EMA GSA, which consists of four member agencies:

- Santa Ynez River Water Conservation District

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<sup>1</sup> Added by Stats. 2014, Ch. 346, Sec. 3. (SB 1168) Effective January 1, 2015.



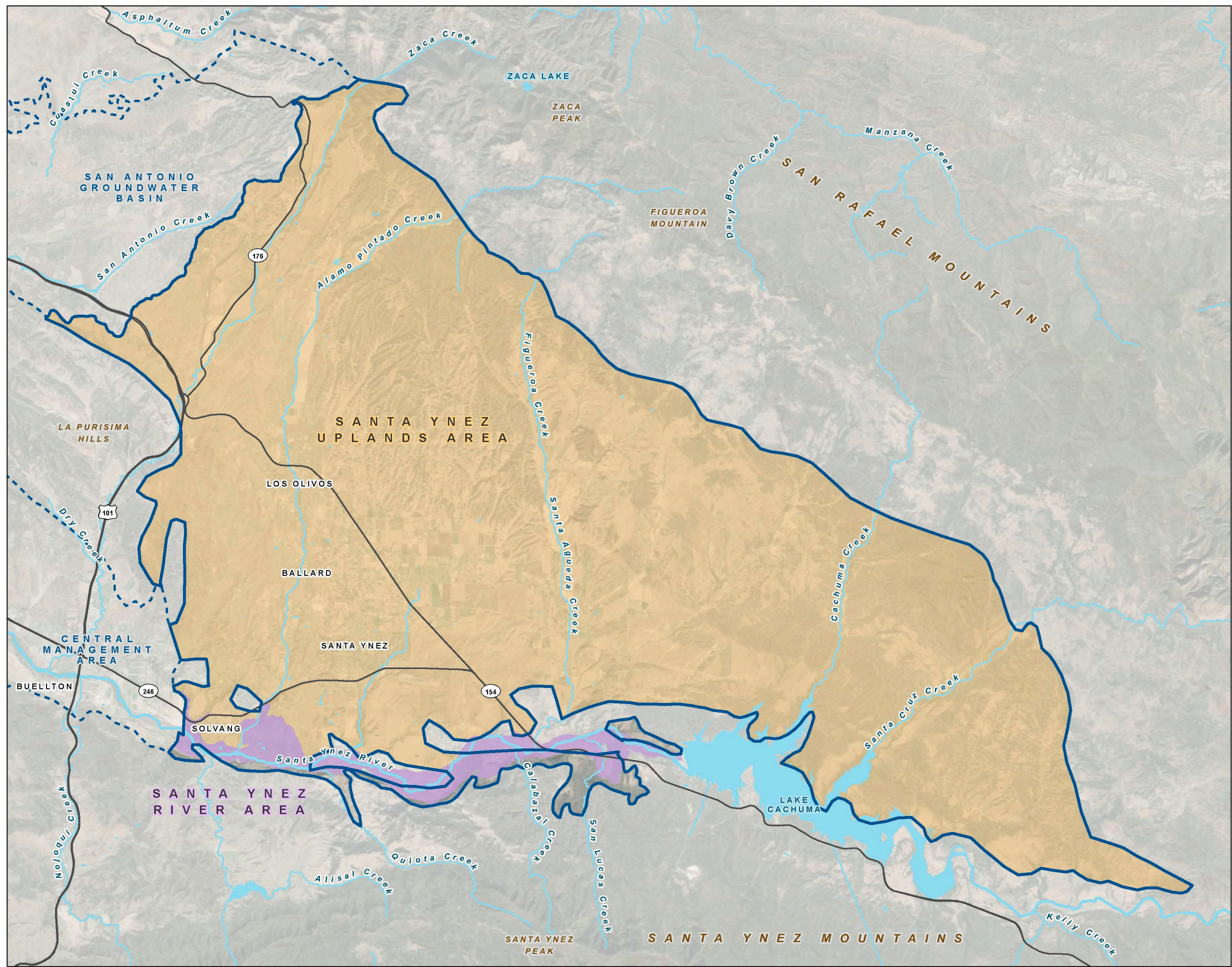
- Santa Barbara County Water Agency
- City of Solvang
- Santa Ynez River Water Conservation District, Improvement District No. 1 (ID No. 1)

## 1.2 Organization of This Report

The required contents of an Annual Report are provided in the SGMA regulations (§ 356.2) (Appendix A). Organization of the report is meant to follow the regulations, where possible, to assist in the review of the document. This Annual Report is organized as follows:

- **Section 1: Introduction.** A brief background of the formation and activities of the EMA GSA and development and submittal of the Plan.
- **Section 2: Basin Setting and Monitoring Networks.** A summary of the basin setting, basin monitoring networks, and the ways in which data are used for groundwater management.
- **Section 3: Groundwater Elevations (§ 356.2[b][1]).** A description of recent monitoring data with groundwater elevation contours for seasonal high and low groundwater elevations and representative hydrographs.
- **Section 4: Groundwater Extractions (§ 356.2[b][2]).** Compilation of metered, self-reported, and estimated groundwater extractions by land use sector and approximate locations of extraction.
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- **Section 7: Change in Groundwater in Storage (§ 356.2[b][5]).** A description of the methodology and presentation of changes in groundwater in storage based on annual groundwater elevation differences.
- **Section 8: Progress toward Basin Sustainability (§ 356.2[c]).** A summary of management actions taken under the EMA Plan.
- **Section 9: References.**

**FIGURE 1**  
**Santa Ynez River Valley**  
**Groundwater Basin**  
**Eastern Management Area**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area

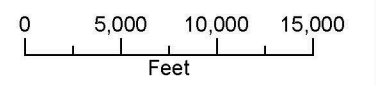
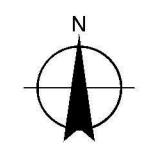


**LEGEND**

- Santa Ynez Uplands Area (area covered by GSP)
- Santa Ynez River
- All Other Features**
- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

**NOTE**

GSP: Groundwater Sustainability Plan



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar 2019

## SECTION 2: Basin Setting and Monitoring Networks

### 2.1 Introduction

This section provides a summary of the basin setting and the groundwater monitoring programs described in detail in the Plan, as well as any notable events affecting monitoring activities or the quality of monitoring results in the reported water year 2022. Much of the information in this Annual Report was excerpted from the Plan prepared by GSI (2022).

### 2.2 Basin Setting

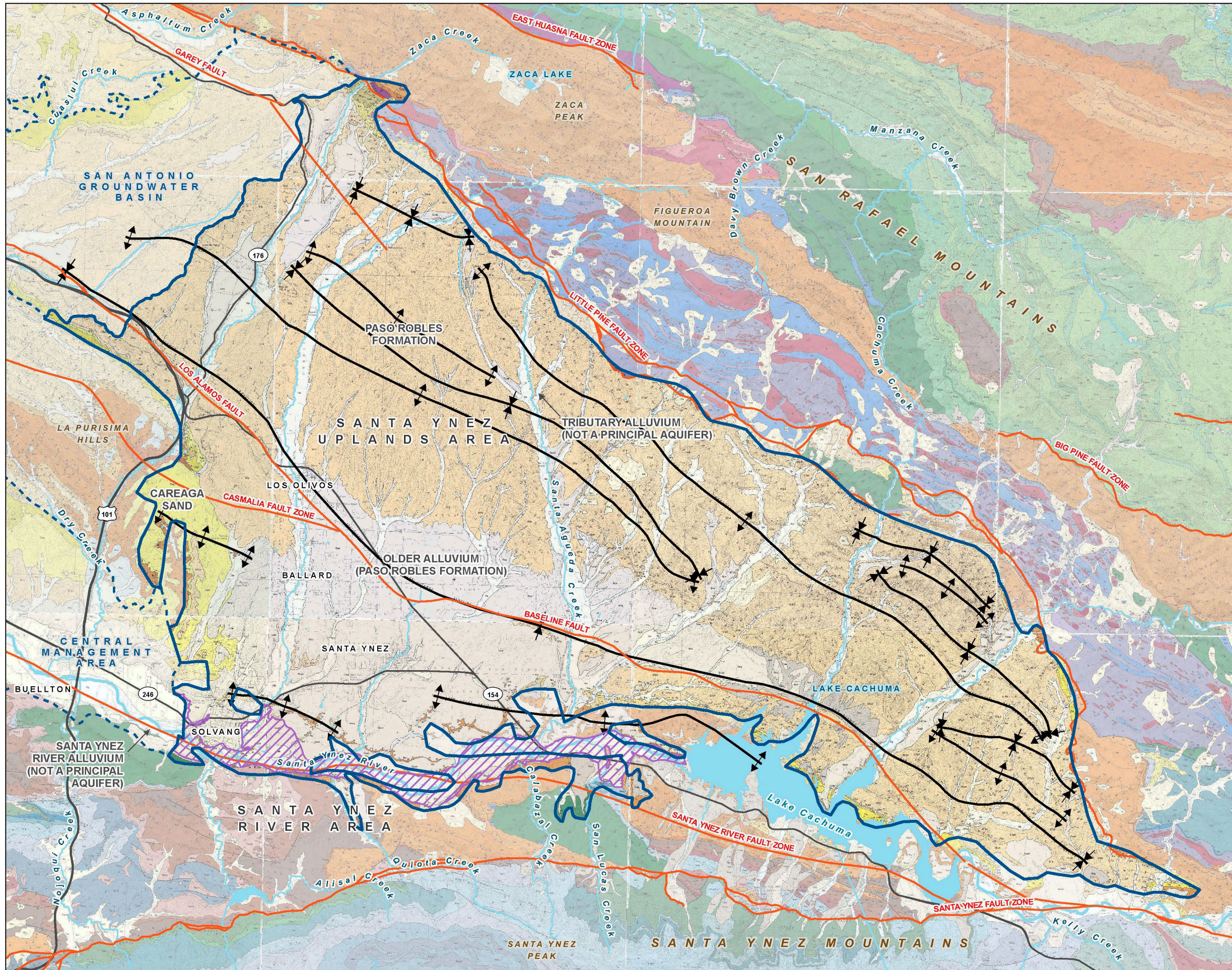
The Basin is located within the Santa Ynez River watershed in Santa Barbara County on California's central coast. The entire Basin is about 50 miles long and varies in width from about 4 to 7 miles. The Basin covers 319 square miles (204,000 acres) within the entire Bulletin 118 Basin Boundary, of which the easternmost 150 square miles make up the EMA, geographically including the Santa Ynez Uplands and Santa Ynez River areas (DWR, 2018a). The Santa Ynez Uplands area includes the groundwater system that is subject to regulation under SGMA, as presented on Figure 1. The Santa Ynez River area, including the river and associated underflow that constitutes a surface water system, is managed under the jurisdiction of the SWRCB and is not regulated under SGMA.

In the Santa Ynez Uplands, the principal aquifers are the Paso Robles Formation and Careaga Sand. The base of these water-bearing formations is an irregular surface formed as the result of folding, faulting, and erosion, which extends to a maximum depth of approximately 3,500 feet in some areas.
















The groundwater basin is generally bound by the mountains rimming the EMA as follows and presented on Figure 2:

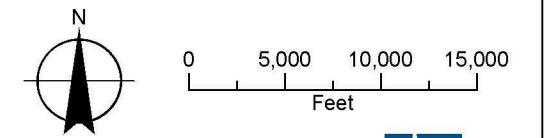
- The northern and eastern boundary of the EMA is defined by outcropping of impermeable bedrock of the San Rafael Mountains.
- The Santa Ynez Upland is separated from the Santa Ynez River area to the south by a ridge of impermeable bedrock. The Santa Ynez Mountains form the southern boundary of the entire EMA south of the Santa Ynez River.
- The boundary to the northwest is defined as the shared border with the San Antonio Groundwater Basin, which is a topographic watershed divide west of Zaca Creek Canyon, but not necessarily a geologic barrier to groundwater flow.
- The boundary to the west is formed in the Purisima Hills by impermeable consolidated bedrock underlying the Careaga Sand.

**FIGURE 2**  
**Geologic Map**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



**LEGEND**

-  Santa Ynez River Area
- Geology**
-  Tributary Alluvium, Qa
-  Santa Ynez River Alluvium, Qg
-  Older Alluvium, Qoa
-  Paso Robles Formation QTp
-  Careaga Sand, Tcag
-  Monterey Formation, Tm
- Geologic Structures**
-  Fault
- Fold Axes**
-  Anticline
-  Syncline
- All Other Features**
-  Eastern Management Area Bulletin 118 Boundary
-  Other Bulletin 118 Groundwater Basin Boundary
-  Major Road
-  Watercourse
-  Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar 2019



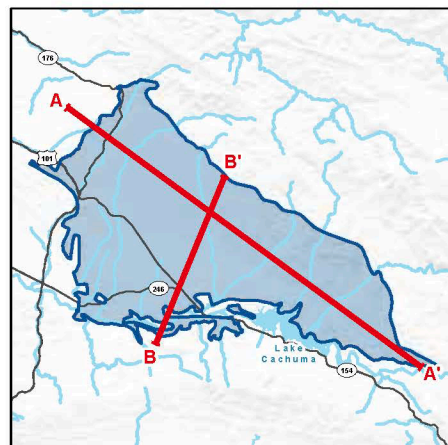
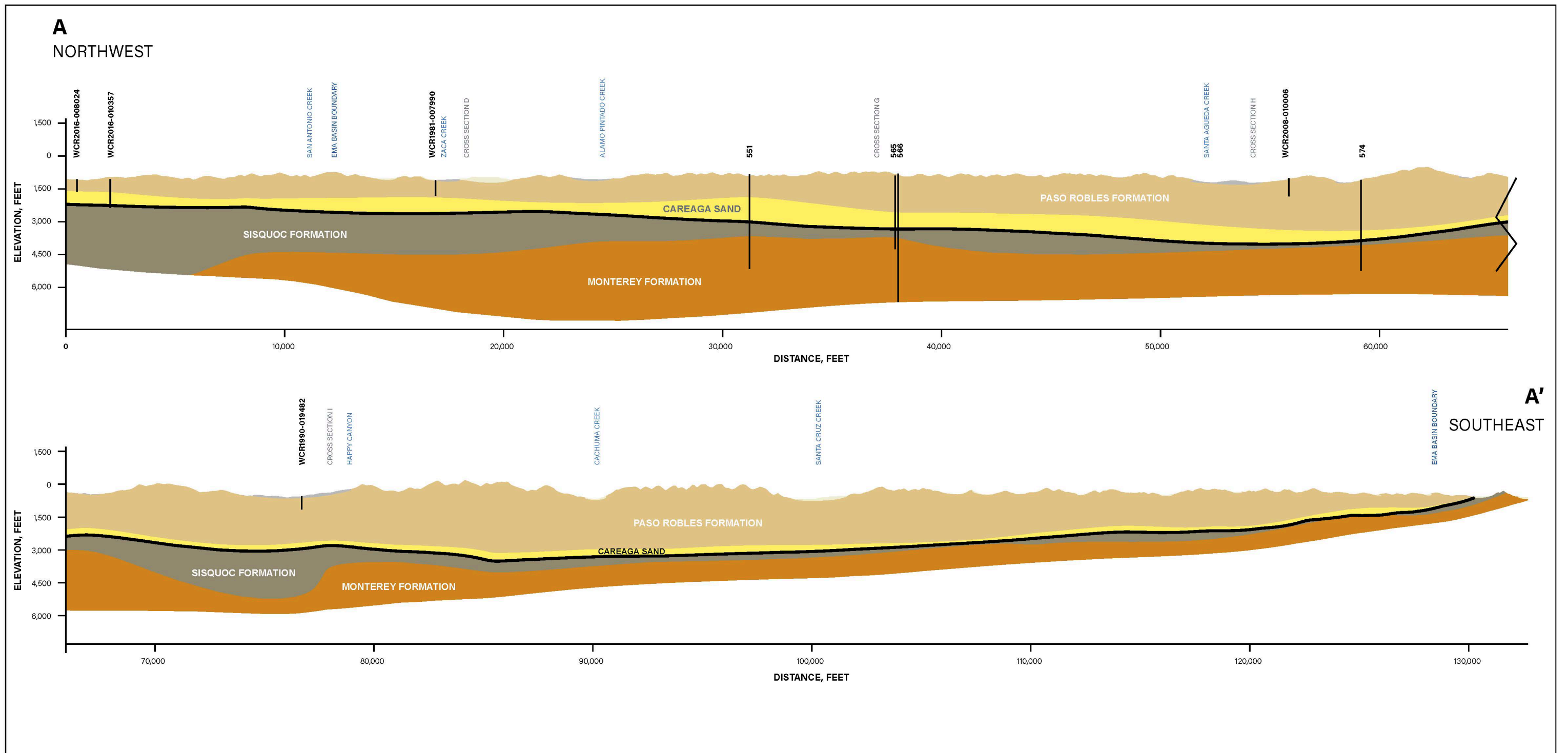
Two principal aquifers have been identified in the EMA: the Paso Robles Formation and the Careaga Sand, which are presented on Figure 3a and Figure 3b, respectively. The Paso Robles Formation and the Careaga Sand together extend to a depth of more than 1,500 feet below ground surface (bgs) on average in the EMA with a maximum thickness of up to 3,500 feet. Overlying these formations are the Quaternary-aged Older Alluvium (Qoa), which is derivative of the Paso Robles Formation, and is therefore composed of materials that are very similar to the Paso Robles Formation and extend to a thickness of as much as 150 feet. Because of this similarity, this Older Alluvium is managed as part of the Paso Robles Formation. Large exposures of the formation north and east of the valley receive direct infiltration of rainfall.

Vertical heterogeneity in the water-bearing properties of the Paso Robles Formation is the result of coarse-grained beds of sediments that yield water freely to wells alternating with fine-grained beds that do not, where higher well yields are typically attributed to the wells that penetrate the coarse-grained lenses. Production from wells completed in this formation can range between less than 100 gallons per minute (gpm) to as much as 1,500 gpm, depending largely on length of the aquifer perforated by individual wells. With that, considerable variability is known to exist within the formation throughout the EMA. Whereas the upper part consists of relatively coarse-grained materials typical of alluvial fan deposits, the lower part of the complexly folded Paso Robles Formation is finer-grained. The coarser-grained upper portions of the Paso Robles Formation yield groundwater to wells at higher flow rates than the underlying portions. Fine-grained zones act as local confining beds and are likely the cause of the localized artesian conditions that were historically reported in some wells screened within the Paso Robles Formation in Happy Canyon and along Alamo Pintado Creek.

In the Santa Ynez Uplands, the Careaga Sand is approximately 800 feet thick on average and varies between 200 and 900 feet. There are large exposures of the formation in the Purisima Hills along the western edge of the EMA. However, because the lateral extent of the Careaga Sand aquifer is limited relative to that of the Paso Robles Formation, fewer wells are completed in the Careaga Sand than in the overlying Paso Robles Formation. In the EMA, wells completed in the Careaga Sand produce between 12 and 325 gpm.

The primary components of groundwater recharge to the aquifers are mountain front recharge, streamflow percolation, deep percolation of direct precipitation, and agricultural irrigation return flow.

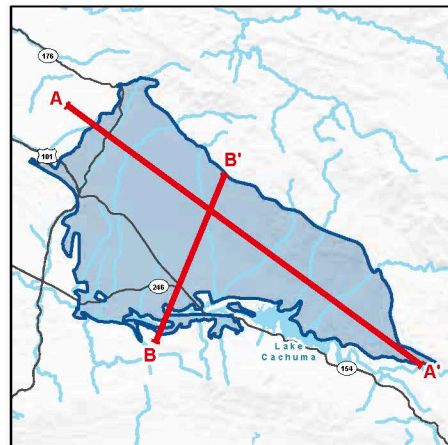
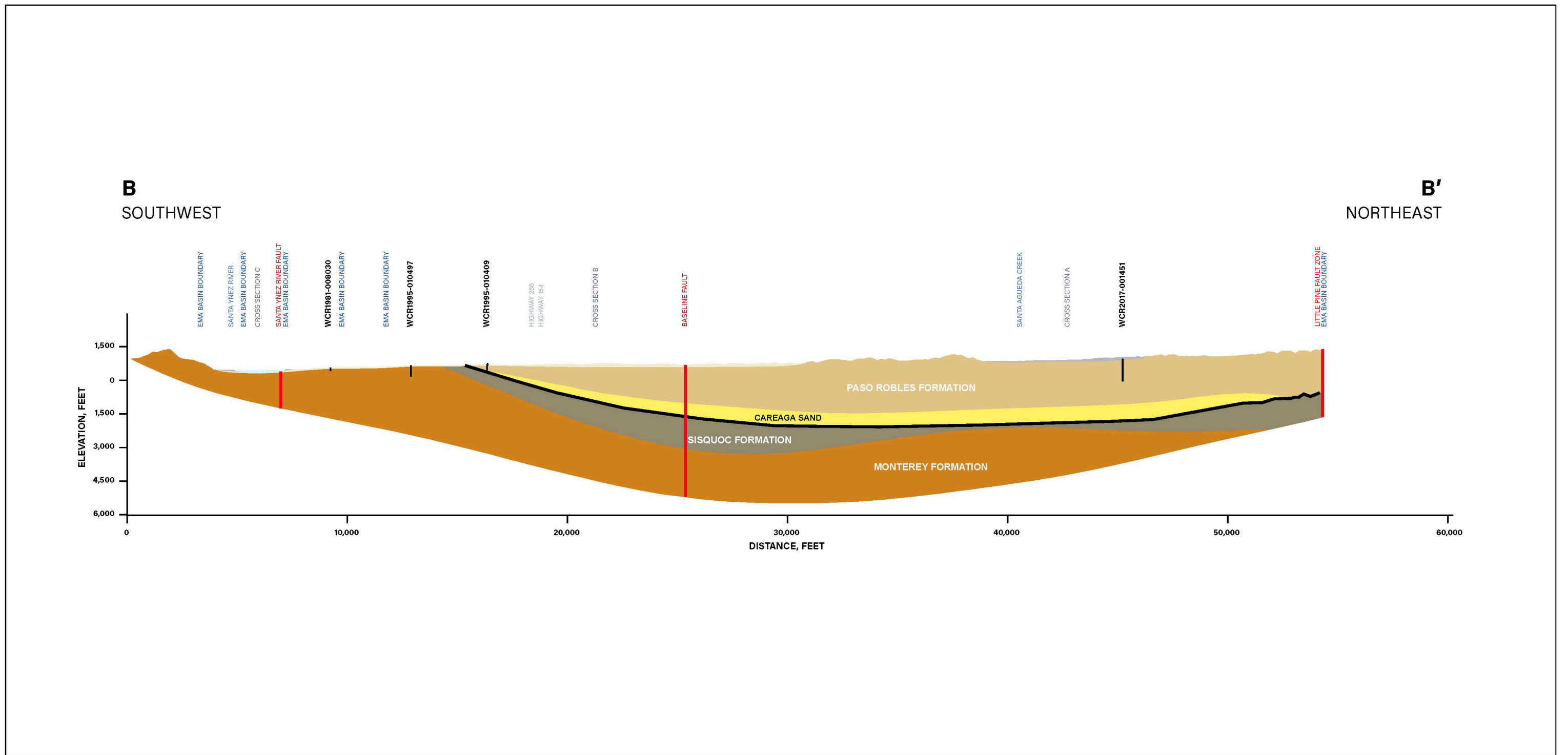
Natural groundwater discharge areas in the EMA include springs and seeps, some groundwater discharge to surface water, and evapotranspiration (ET) by phreatophytes. The largest component of groundwater discharge is pumping of groundwater from wells. The regional direction of groundwater flow in both principal aquifers is generally from the north to the south-southwest.



- LEGEND**
- Qa – Tributary Alluvium
  - Qoa – Older Alluvium
  - QTp – Paso Robles Formation
  - Tca – Careaga Sand
  - Basin Bottom
  - Tsq – Siquoc Formation
  - Tm – Monterey Formation

**FIGURE 3A**  
**Cross Section A**  
Annual Report Water Year 2022 for the  
Santa Ynez River Valley Groundwater Basin,  
Eastern Management Area





- LEGEND**
- Qa – Tributary Alluvium
  - Qoa – Older Alluvium
  - QTp – Paso Robles Formation
  - Tca – Careaga Sand
  - Basin Bottom
  - Tsq – Sisquoc Formation
  - Tm – Monterey Formation

**FIGURE 3B**  
**Cross Section B**  
Annual Report Water Year 2022 for the  
Santa Ynez River Valley Groundwater Basin,  
Eastern Management Area



## 2.3 Precipitation and Climatic Periods

Annual precipitation recorded at the Santa Ynez Fire Station #32 (Santa Barbara County Station No. 218 gauge), cumulative departure from average annual precipitation, and water year type are presented in Figure 4. The long-term average annual precipitation for 1951 through 2022 is 15.6 inches per water year. Water year types were identified using DWR guidance (DWR, 2021), which principally considers the rainfall that fell during the current water year, as well as the rainfall during the prior water year. The water year index presented on Table 1 is calculated in accordance with DWR's guidance, which is:

$$\text{Index} = (0.40 * \text{Current Year's precipitation}) + (0.60 * \text{Previous Year's Precipitation}).$$

Water years are categorized according to the following designations, which are determined in comparison to rank of each year to the preceding 29 years, as shown on Table 1:

- Wet (greater than 70 percent)
- Above normal (50 to 70 percent)
- Below normal (30 to 50 percent)
- Dry (15 to 30 percent)
- Critical (less than 15 percent)

**Table 1. Santa Ynez River Valley Groundwater Basin Water Year Types**

Water Year	Annual Precipitation (inches)	Water Year Index <sup>1</sup>	Water Year Type <sup>1</sup>	Climatic Condition <sup>2</sup>
<b>2011</b>	26.3	24.3	Wet	Neutral/Variable
<b>2012</b>	12.0	17.7	Above Normal	Dry
<b>2013</b>	6.8	8.9	Critical	Dry
<b>2014</b>	7.9	7.5	Critical	Dry
<b>2015</b>	8.3	8.2	Critical	Dry
<b>2016</b>	10.0	9.3	Critical	Dry
<b>2017</b>	21.0	16.6	Above Normal	Dry
<b>2018</b>	7.9	13.1	Below Normal	Dry
<b>2019</b>	20.1	15.2	Above Normal	Dry
<b>2020</b>	15.1	17.1	Above Normal	Dry
<b>2021</b>	8.3	11.1	Dry	Dry
<b>2022</b>	10.2	9.4	Critical	Dry

Notes The water years shaded according to the designations determined in comparison of each year to the preceding 29 years.

Wet
Above Normal
Below Normal
Dry
Critical

<sup>1</sup> Defined in DWR, 2021. <sup>2</sup> Defined using the cumulative departure from mean annual precipitation measured at the Santa Ynez Fire Station #32 (Santa Barbara County Station No. 218 gauge) (see Section 3.3 of the Plan).

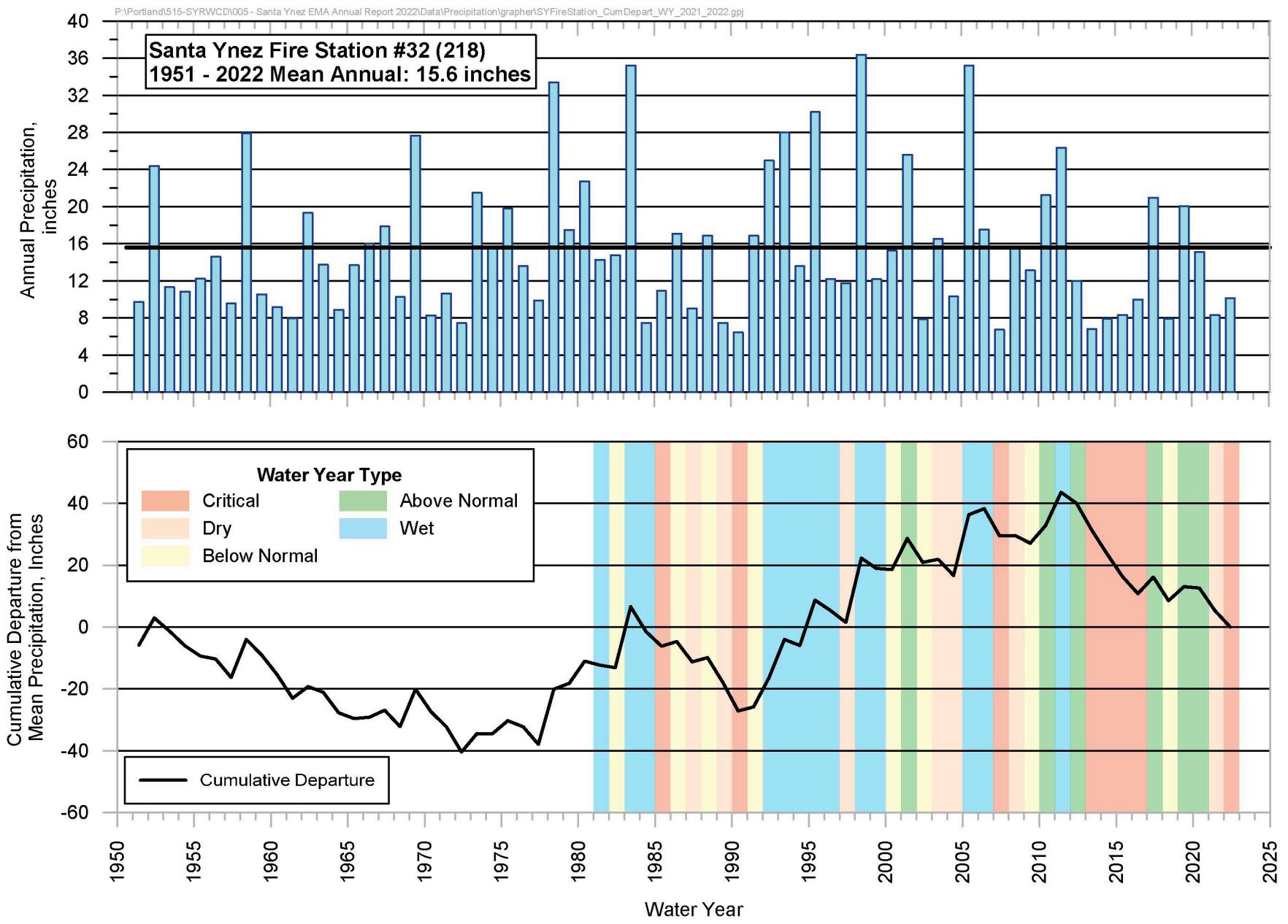


In addition to the year-by-year water year type, the longer-term climatic condition, which consists of historical wet-dry cycles, were also identified by GSI and presented in Table 1 by evaluating trends in the cumulative departure from mean annual precipitation measured at the Santa Ynez Fire Station #32 (Santa Barbara County Station No. 218 gauge).

The period covered by the Plan included data through the end of water year 2018. Since that time, the four water years of 2019 through 2022 have included two above normal years (2019 and 2020), one dry year (2021) and one critical year (2022) according to DWR water year calculations. The water year types identified by GSI methods show that the overall climactic trend has been dry, beginning in 2012.

The Plan refers to periods of “average and above-average precipitation” as one portion of the criterion used to determine whether lowering of groundwater levels is likely to cause undesirable results within the EMA. The “average and above-average precipitation” conditions presented in the Plan are represented by the “wet” and “above normal” water year types presented on Table 1 and graphically on Figure 4.

The water year types are calculated differently by the three management agencies within the Basin. The Western Management Area and Central Management Area are currently using a method similar to the 2019 SWRCB Water Rights Order 2019-0148 for the Cachuma Project, which is based on surface flows. The EMA is using the SGMA Water Year Type Dataset method based on precipitation data (DWR, 2021). The water year types from the two methods exhibit a reasonably robust match, though, during some years, slight differences in water year type designation exist. Both methods were selected in coordination with the entire Basin and were chosen based on the management needs of each management area. Both methods are focused on the same basin-wide sustainability goal.



**FIGURE 4**  
Annual Precipitation and Water Year Type  
Santa Ynez Fire Station  
in the Eastern Management Area of the Santa Ynez Subbasin

## 2.4 Groundwater Elevation Monitoring (§ 356.2[b])

This section provides a brief description of the groundwater monitoring programs and monitoring results.

### 2.4.1 Groundwater Elevation Monitoring Locations

The Plan summarized the existing groundwater monitoring network and protocol for including a subset of these wells into the Representative Monitoring Network. Under SGMA, the monitoring networks are required to be developed to provide sufficient data quality, frequency, and spatial distribution to characterize groundwater and interconnected surface water, and to evaluate changing aquifer conditions in response to implementation of the Plan. The monitoring networks developed in the Plan support efforts to:

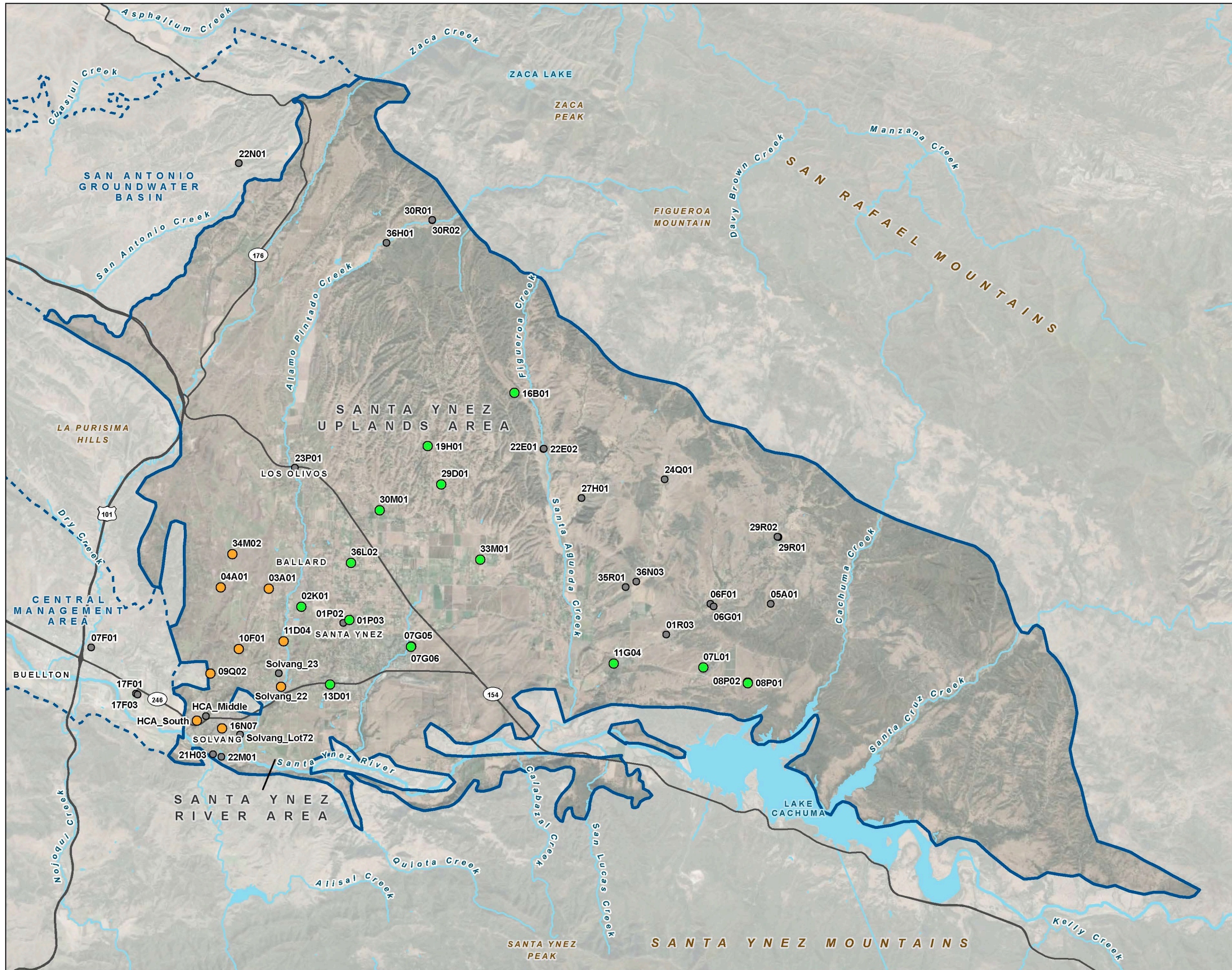
- Monitor changes in groundwater conditions and demonstrate progress toward achieving measurable objectives and avoiding undesirable results as defined in the Plan.
- Quantify annual changes in groundwater storage.
- Monitor status of the beneficial uses and users of groundwater.

Monitoring networks have been developed for each of the five sustainability indicators applicable to the EMA in relation to groundwater pumping and implementation of the Plan:

- Chronic lowering of groundwater levels
- Reduction of groundwater in storage
- Degraded water quality
- Land subsidence
- Depletion of interconnected surface water

Monitoring for the first two sustainability indicators (chronic lowering of water levels and reduction of groundwater in storage) is being implemented using the same representative monitoring sites (wells). The Plan identifies an existing network of 24 representative wells for water level monitoring (GSI, 2022). Of these, 15 wells are screened solely in the Paso Robles Formation, and 9 wells are screened solely in the Careaga Sand. Figure 5 displays the representative monitoring wells, and Appendix B includes a summary of information for each of the wells.

**FIGURE 5**  
**Groundwater Level Monitoring Network**  
 Annual Report Water Year 2022  
 for the Santa Ynez River Valley Groundwater Basin,  
 Eastern Management Area



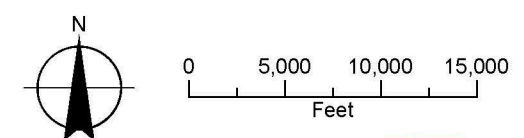
**LEGEND**

**Representative Well (by screened aquifer)**

- Careaga Sand
- Paso Robles Formation
- Monitored by Santa Barbara County Water Agency

**All Other Features**

- Eastern Management Area Basin Boundary
- Major Road
- ~ Watercourse
- ~ Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar 2020



## 2.4.2 Monitoring Data Gaps

Although the existing groundwater level monitoring network satisfies the well density guidelines cited in the DWR best management practice guidance for monitoring networks (DWR, 2016a and 2016b), two low-density areas have been identified within the EMA where the addition of monitoring wells would improve the understanding of groundwater conditions discussed in this section (see Figure 4-2 in GSI, 2022). The first area includes northwestern portions of the Santa Ynez Uplands from Los Olivos to the northern boundary of the Basin and EMA, including the northern reaches of Zaca Creek and Alamo Pintado Creek. The second area is in the Paso Robles Formation in the central portion of the EMA, generally between Santa Agueda Creek and Happy Canyon.

An effort will be made to contact owners of wells in these areas to determine whether the wells can be included in the monitoring program. Including these additional wells in the groundwater level monitoring network would increase the accuracy of groundwater elevation trends and enhance efforts to sustainably manage the EMA.

## 2.5 Additional Monitoring

Evaluation of the water quality sustainability indicator will be achieved through existing groundwater quality monitoring networks, including the SWRCB Division of Drinking Water (DDW) public supply well water quality program and the SWRCB Irrigated Lands Regulatory Program (ILRP). As noted above, the EMA GSA is not charged with managing groundwater quality unless it can be shown that water quality degradation is caused by groundwater pumping in the EMA, or the EMA GSA implements a project that degrades water quality. Constituents of concern (COCs) identified in the Plan are based on regulatory standards (i.e., maximum contaminant levels [MCLs] and secondary MCLs [SMCLs]) for drinking water established by the SWRCB DDW and the U.S. Environmental Protection Agency.<sup>2</sup> For agricultural uses, COCs are based on basin water quality objectives presented in the *Water Quality Control Plan for the Central Coastal Basin* (RWQCB, 2019).

There are 56 wells from the existing monitoring programs within the groundwater quality monitoring network, of which 26 are municipal and public water system drinking water supply wells from the SWRCB's Groundwater Ambient Monitoring and Assessment database. The remainder of the wells were either agricultural and/or domestic wells from the ILRP database. Well construction information is unknown for the ILRP wells.

According to the California Department of Conservation, Geologic Energy Management Division's online Well Finder, or WellSTAR, tool, the Zaca Oil Field is the only oil and gas field located within or adjacent to the EMA. The U.S. Geological Survey, in cooperation with the SWRCB, initiated the California Oil, Gas, and Groundwater (COGG) Program in 2015.<sup>3</sup> The objective of the COGG Program is to determine whether groundwater quality may be adversely impacted by nearby oil and gas development activities (Davis et al., 2018). For the current water year, it was determined that reports are available from the COGG Program relevant to the EMA. When results from the COGG Program are available for review, the EMA GSA will consider these findings as part of the overall groundwater quality monitoring program.

Land subsidence caused by groundwater extraction will be monitored as part of implementation of the Plan. Land subsidence in the EMA is estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR and by the University NAVSTAR Consortium (UNAVCO) Continuous Global Positioning System (CGPS) Station near the Santa Ynez Airport. InSAR measures ground elevation using microwave satellite imagery data. Subsidence can be estimated using Interferometric Synthetic Aperture Radar (InSAR)

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<sup>2</sup> The list of MCLs and SMCLs is available at [https://www.waterboards.ca.gov/drinking\\_water/certlic/drinkingwater/Chemicalcontaminants.html](https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.html). (Accessed January 12, 2022.)

<sup>3</sup> Description available at <https://webapps.usgs.gov/cogg/>. (Accessed January 12, 2022.)

data provided by DWR. The accuracy associated with the InSAR measurement and reporting methods is of 0.1 feet (or 1.2 inches). A land surface change of less than 0.1 feet is therefore within the noise of the data and is equivalent to no evidence of subsidence. Considering this, examination of the data between June 2015 and October 2022 show that no measurable land subsidence has occurred. The EMA GSA will continue to monitor and report annually on any subsidence in the EMA.

Available data to date indicate that (1) land subsidence rates have not exceeded rates observed from 2015 through 2022 at the UNAVCO CGPS station near Santa Ynez and thus, the minimum threshold has not been exceeded; and (2) land subsidence that causes significant and unreasonable damage to groundwater supply or land uses (including agricultural, residential, rural residential, and town buildings), or infrastructure, and property interests has not been documented. The EMA will annually assess subsidence using the UNAVCO CGPS and InSAR data provided by DWR. UNAVCO CGPS and InSAR data are included shown on Figure D-1 in Appendix D.

The interconnected surface water monitoring network will consist of (yet to be installed) piezometers in the potential groundwater-dependent ecosystem (GDE) areas identified in the Plan within the distal ends of Alamo Pintado Creek and Zanja de Cota Creek. These piezometers will be used to assess whether depletion of interconnected surface water is occurring and whether significant and unreasonable adverse impacts to GDEs or reductions in discharge of interconnected surface water may be occurring as a result of groundwater conditions. As described in the Plan, the EMA GSA will use groundwater levels within these forthcoming monitoring wells as a proxy for evaluating the minimum threshold in the Plan for depletion of interconnected surface waters.

## SECTION 3: Groundwater Elevations (§ 356.2[b][1])

### 3.1 Introduction

This section describes groundwater elevations in the EMA beginning in October of 2021,. For the current Annual Report, groundwater elevation maps have been prepared for each of the two principal aquifers during the spring and fall periods of water year 2021 to 2022.

These maps present the most up-to-date seasonal conditions in the Paso Robles Formation and the Careaga Sand. The monitoring data has been reviewed for quality and an appropriate timeframe has been selected to represent conditions in the spring and fall of each year. The data used to represent groundwater conditions are based on the best-available groundwater elevation data for the two principal aquifers, even though some well construction information is incomplete or unavailable for some of the wells. Consequently, a careful review of the data was conducted prior to uploading this data to the DWR's Monitoring Network Module, which replaces the California Statewide Groundwater Elevation Monitoring program.

The groundwater elevation contour maps were generated based on data collected by Santa Barbara County Water Agency, ID No. 1, and City of Solvang staff. Notably, the number of wells in the Representative Monitoring Network for both principal aquifers has decreased since 2018. Monitoring of several wells completed within the Careaga Sand in the northwestern portion of the EMA adjacent to the San Antonio Groundwater Basin has not been conducted since 2018 due to a denial of access by the well owners. Likewise, two wells completed within the Paso Robles Formation that were monitored through 2018 as presented in the Plan are no longer available for monitoring. The reduction in the number of wells monitored in each of the principal aquifers in recent years has proportionally reduced the accuracy of our understanding of groundwater conditions, which in turn affects the accuracy of the estimated change in groundwater in storage. The EMA GSA is undertaking efforts to add additional monitoring wells to address these identified data gaps.

### 3.2 Seasonal High and Low (Spring and Fall) (§ 356.2[b][1][A])

Groundwater elevation data from all available monitoring wells completed in the principal aquifers were used to create the groundwater elevation contour maps to assess seasonal variability in each principal aquifer. To maintain consistency with the Plan and represent conditions that can be easily compared from year to year, this Annual Report attempts to use the same set of wells included in the monitoring network described in the Plan.

Approximately 34 wells are measured by Santa Barbara County Water Agency staff on behalf of the GSA in the spring and fall periods, as access to the wells is available. As implementation of the Plan progresses, additional wells will be added considering accessibility, location, well construction, and representative hydrograph signatures. Of these, a total of 15 wells within the Paso Robles Formation and 9 within the Careaga Sand have been identified as representative monitoring sites (RMSs) for the purpose of monitoring sustainability indicators.

In accordance with the SGMA regulations, the following information is presented in this report based on available data:

- Groundwater elevation contour maps are presented with the seasonal high and seasonal low groundwater conditions. Groundwater conditions were described in the prior Annual Report through the spring of 2021. Notably, the fall 2021 water level measurements were collected in October 2021, which is not included in the 2021 water year; and therefore, not presented in the prior Annual Report. Therefore, groundwater elevation contour maps are presented in this report for periods of fall 2021, spring 2022, and fall 2022.
- A map depicting the change in groundwater elevation for the preceding water year is provided. Change in groundwater elevation maps are presented in this report for the most recent period of spring 2021 through spring of 2022.
- A description of the seasonal variability in groundwater conditions is provided in the groundwater elevation maps between the spring and fall of 2022.
- Hydrographs for the representative wells (RMSs) are presented in Appendix C.

### 3.2.1 Paso Robles Formation Groundwater Elevation Contours

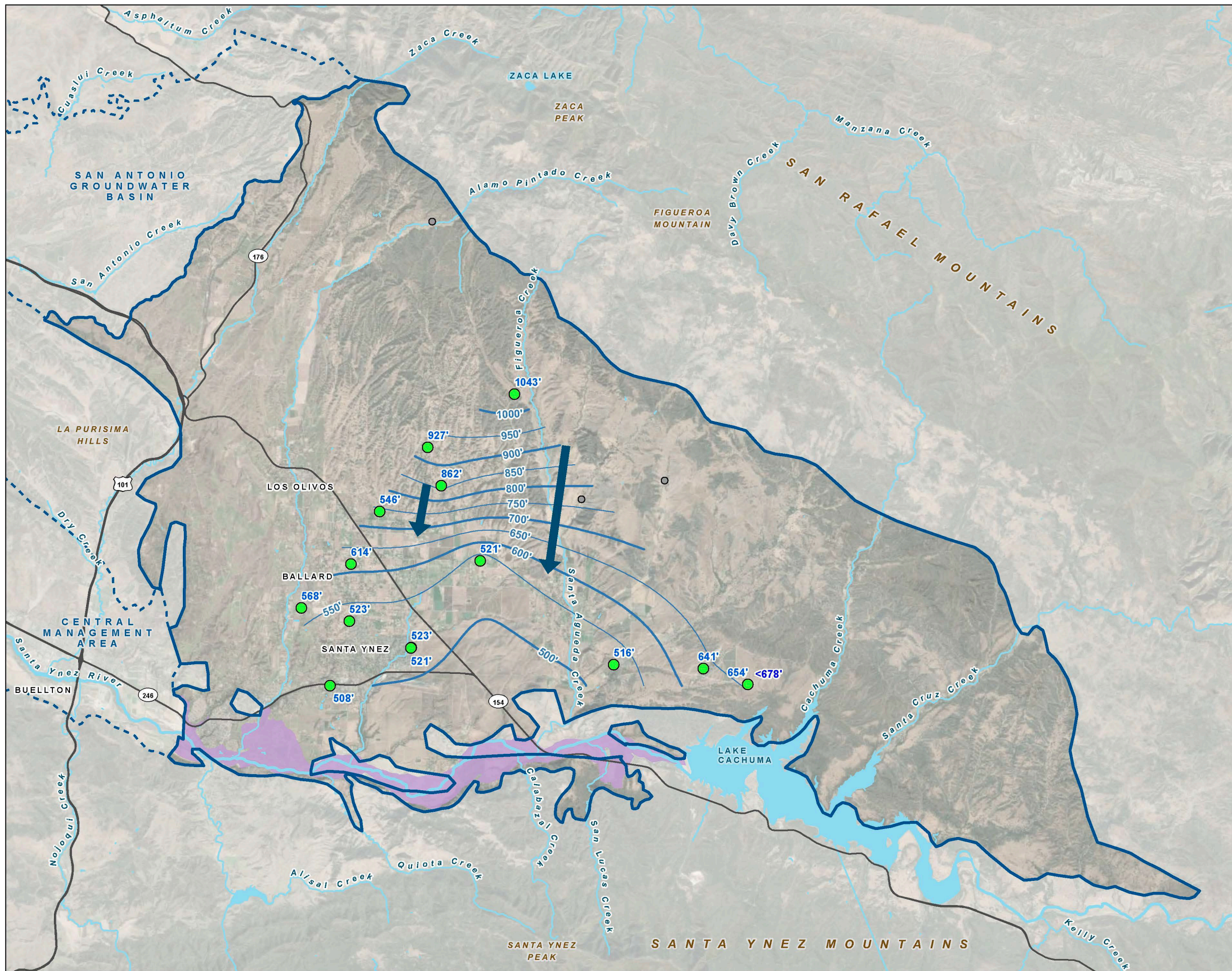
Groundwater elevation contour maps provide information about the spatial variations, yearly and seasonal fluctuations, trends in groundwater conditions, groundwater flow directions, and horizontal groundwater gradients. The seasonal low groundwater elevations typically occur in the fall. In general, the spring groundwater conditions are represented by March to May measurements and fall conditions are represented by October measurements. For consistency with the Plan, best attempts were made to use the same well data sets for preparing groundwater contouring as available. Notably, many wells used to characterize groundwater conditions presented in the Plan are no longer available to be monitored in the northwestern portion of the EMA and therefore the area of the groundwater contours is limited to the area with water elevation data, as presented on the figures.

Overall, groundwater in the Paso Robles Formation continues to flow towards the south and southwest from the San Rafael Mountains as presented on Figure 6 through Figure 9, and which is consistent with the Plan. The horizontal groundwater gradients during these periods are relatively unchanged from year to year and range between 0.02 feet per foot (ft/ft) throughout most of the Santa Ynez Uplands to approximately 0.05 ft/ft in limited areas.

During water year 2022, the groundwater elevations in individual wells have varied in response to precipitation and pumping. Groundwater levels have declined from the spring 2018 levels presented in the Plan. The groundwater elevations in the Paso Robles Formation have declined by an average of 8 feet in the Paso Robles Formation wells between the spring of 2021 and 2022 based on review of the representative monitoring wells.



**FIGURE 6**  
**Paso Robles Formation**  
**Groundwater Elevation Contours,**  
**Spring 2021**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



**LEGEND**

**Paso Formation Groundwater Elevation, Spring 2021**

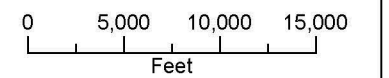
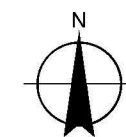
- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area

**Paso Formation Wells**

- Representative Well  
Water Level Elevaton (feet)
- Other Well  
Water Level Elevaton (feet)

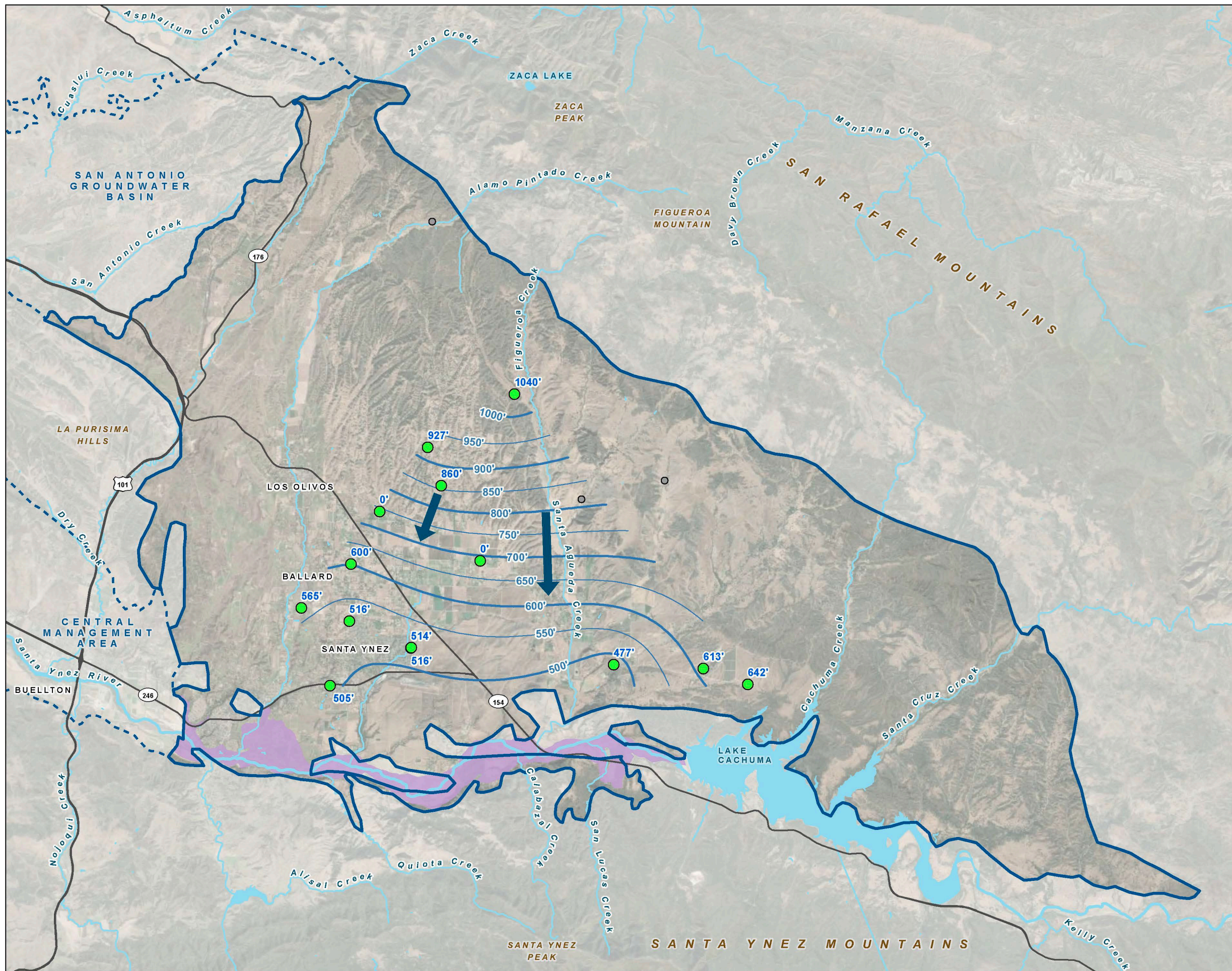
**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.

**FIGURE 7**  
**Paso Robles Formation**  
**Groundwater Elevation Contours,**  
**Fall 2021**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



**LEGEND**

**Paso Formation Groundwater Elevation, Fall 2021**

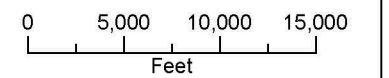
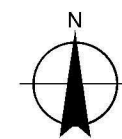
- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area

**Paso Formation Wells**

- Representative Well  
Water Level Elevaton (feet)
- Other Well  
Water Level Elevaton (feet)

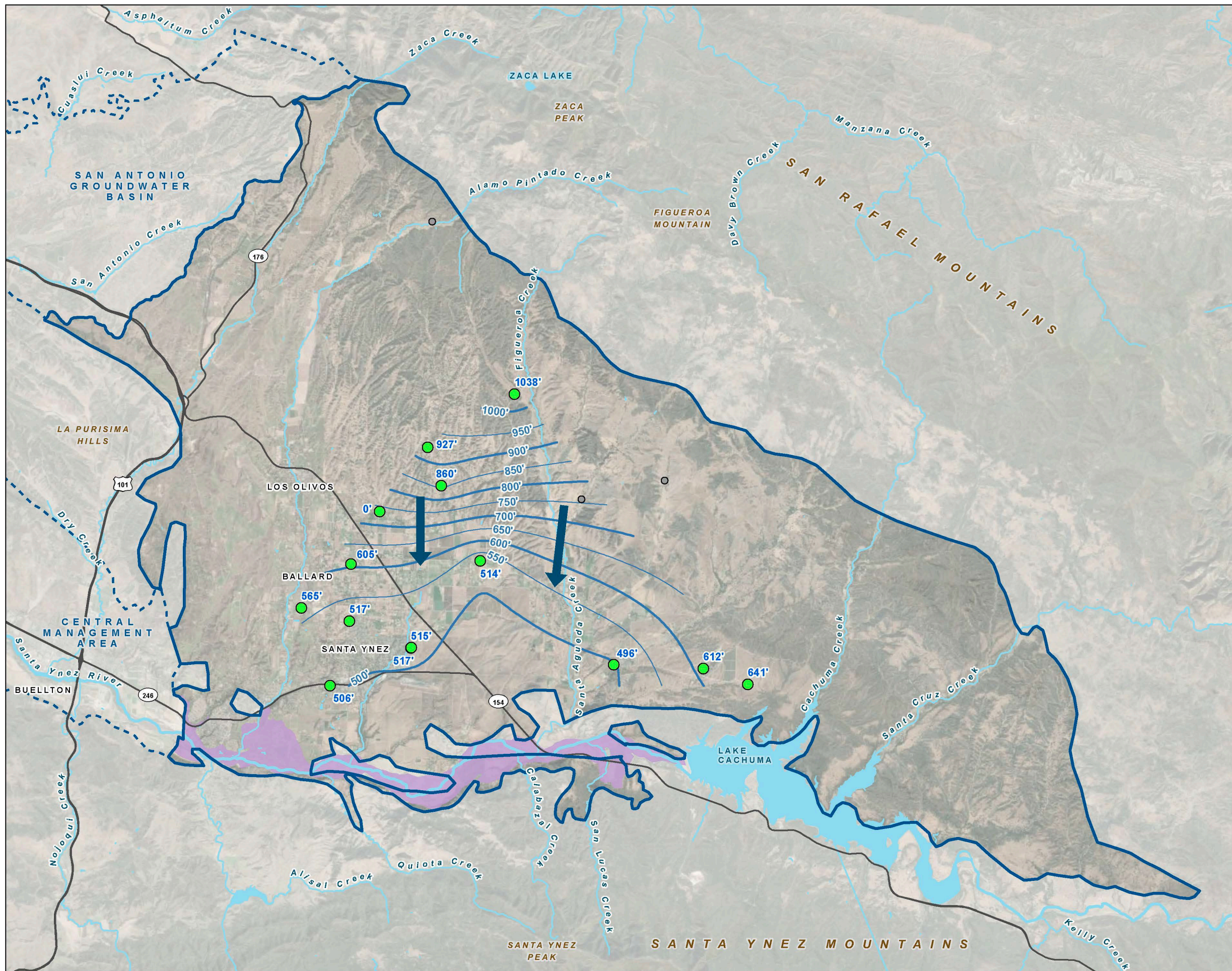
**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.

**FIGURE 8**  
**Paso Robles Formation**  
**Groundwater Elevation Contours,**  
**Spring 2022**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



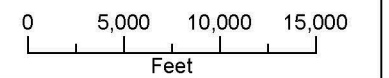
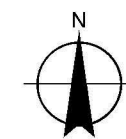
**LEGEND**

**Paso Formation Groundwater Elevation, Spring 2022**

- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area
- Paso Formation Wells**
- Representative Well  
Water Level Elevaton (feet)
- Other Well  
Water Level Elevaton (feet)

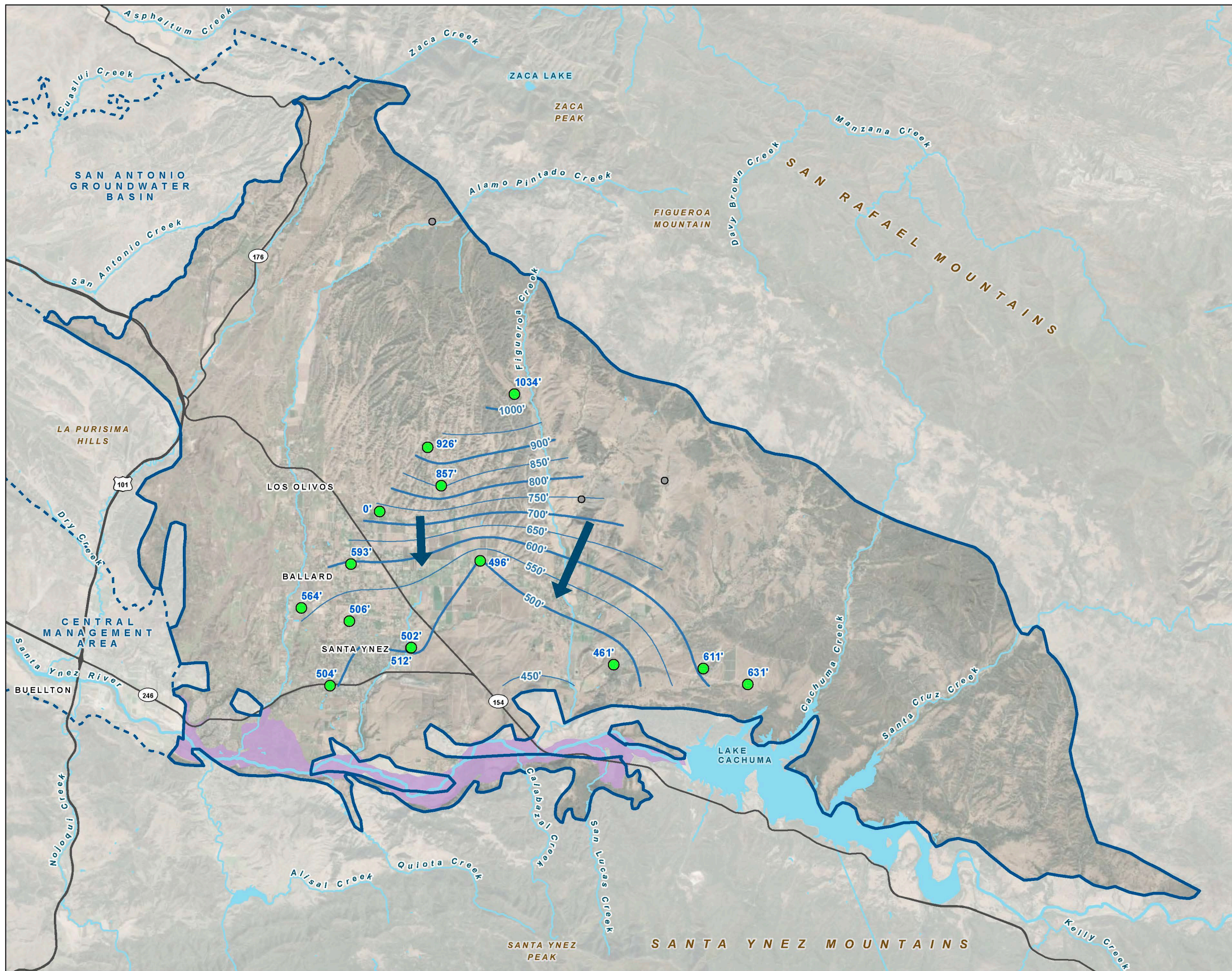
**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.

**FIGURE 9**  
**Paso Robles Formation**  
**Groundwater Elevation Contours,**  
**Fall 2022**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



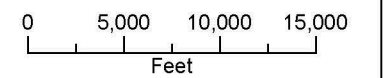
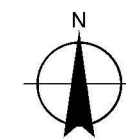
**LEGEND**

**Paso Formation Groundwater Elevation, Fall 2022**

- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area
- Paso Formation Wells**
- Representative Well  
Water Level Elevaton (feet)
- Other Well  
Water Level Elevaton (feet)

**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.

Groundwater conditions in the EMA in the fall are usually lower than in the spring in response to lower rainfall and increased pumping needed to satisfy irrigation demand in the warmer summer and early fall months. Groundwater elevations in the Paso Robles Formation during the spring and fall of 2022 are presented as Figure 8 and Figure 9, respectively. A comparison of these maps, along with consideration of the groundwater elevation hydrographs included in Appendix C, indicate that groundwater levels tended to be lower in the fall than in the spring by an average of 9 feet with a range between 1 to 4 feet to as much as 34 feet. This seasonal change is similar to the annual change that has occurred when groundwater levels have declined an average of 8 feet between the spring of 2021 and 2022.

### 3.2.2 Careaga Sand Aquifer Groundwater Elevation Contours

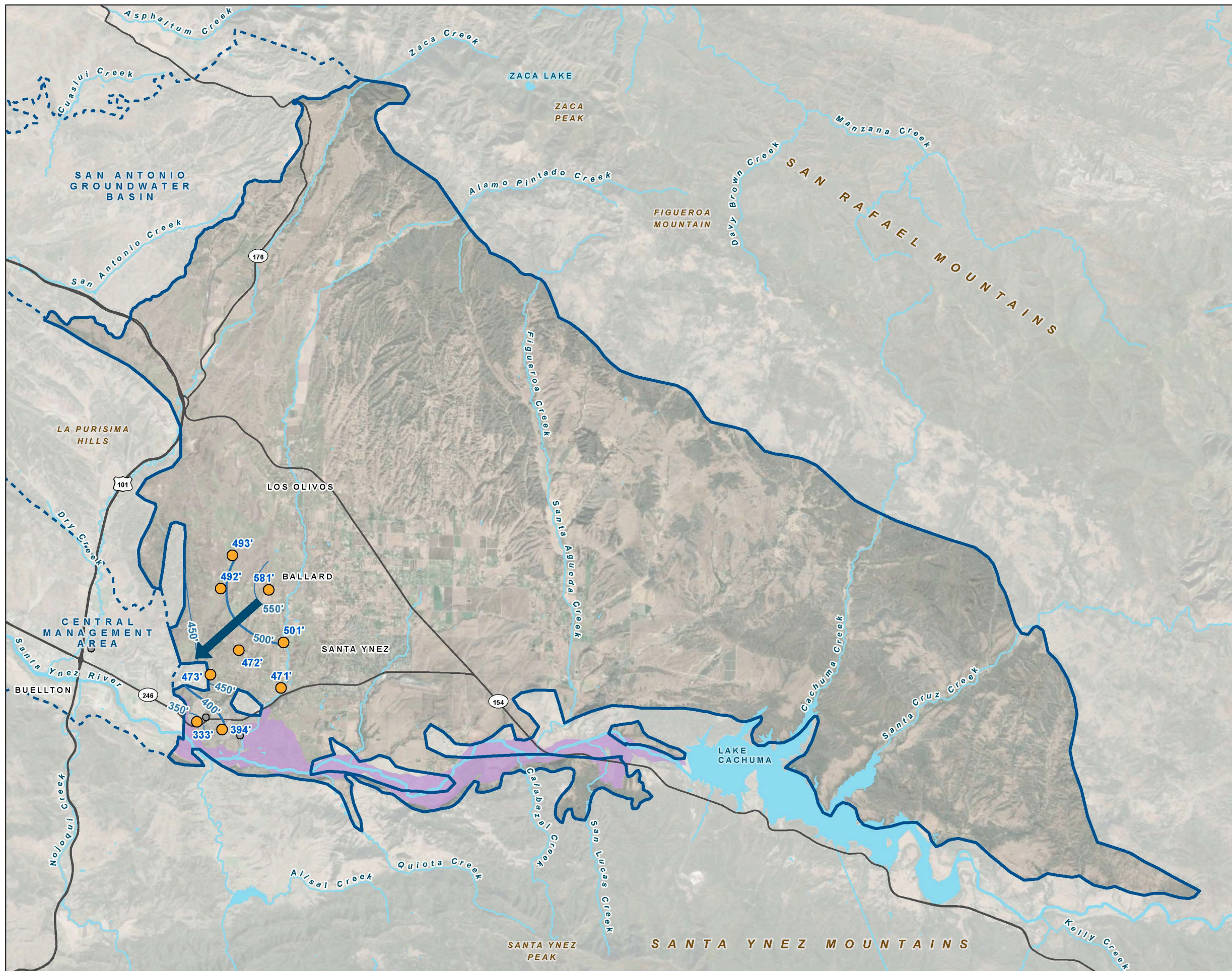
Contour maps were prepared for the groundwater elevations within the Careaga Sand for the spring and fall periods. These contour maps from the spring period represent the seasonal high groundwater levels. As in the Paso Robles Formation, the seasonal low groundwater elevations within the Careaga Sand aquifer typically occur in the fall, though to a lesser degree than within the Paso Robles Formation.

Overall, groundwater in the Careaga Sand continues to flow towards the southwest in the area below the communities of Ballard, Santa Ynez, and Solvang as presented on Figure 10 through Figure 13, and consistent with contours presented in the Plan. The horizontal groundwater gradients during these periods are relatively unchanged from those presented in the Plan and range between 0.01 and 0.02 ft/ft.

The groundwater elevations in the representative Careaga Sand wells have declined during water year 2022 by an average of 2 feet between the spring of 2021 and 2022.

Groundwater elevations in the Careaga Sand during the spring and fall of 2022 are presented as Figure 12 and Figure 13, respectively. A comparison of these maps, along with consideration of the groundwater elevation hydrographs included in Appendix C, indicate that groundwater levels tend to be lower in the fall than in the spring, with an average seasonal decline in the representative wells of 5 feet. The groundwater elevations in the representative Careaga Sand wells have declined during water year 2022 by an average of 2 feet between the spring of 2021 and 2022.

**FIGURE 10**  
**Careaga Sand**  
**Groundwater Elevation Contours,**  
**Spring 2021**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



**LEGEND**

**Careaga Sand Groundwater Elevation, Spring 2021**

- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area

**Careaga Sand Formation Wells**

- Representative Well  
Water Level Elevaton (feet)
- Other Well  
Water Level Elevaton (feet)

**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

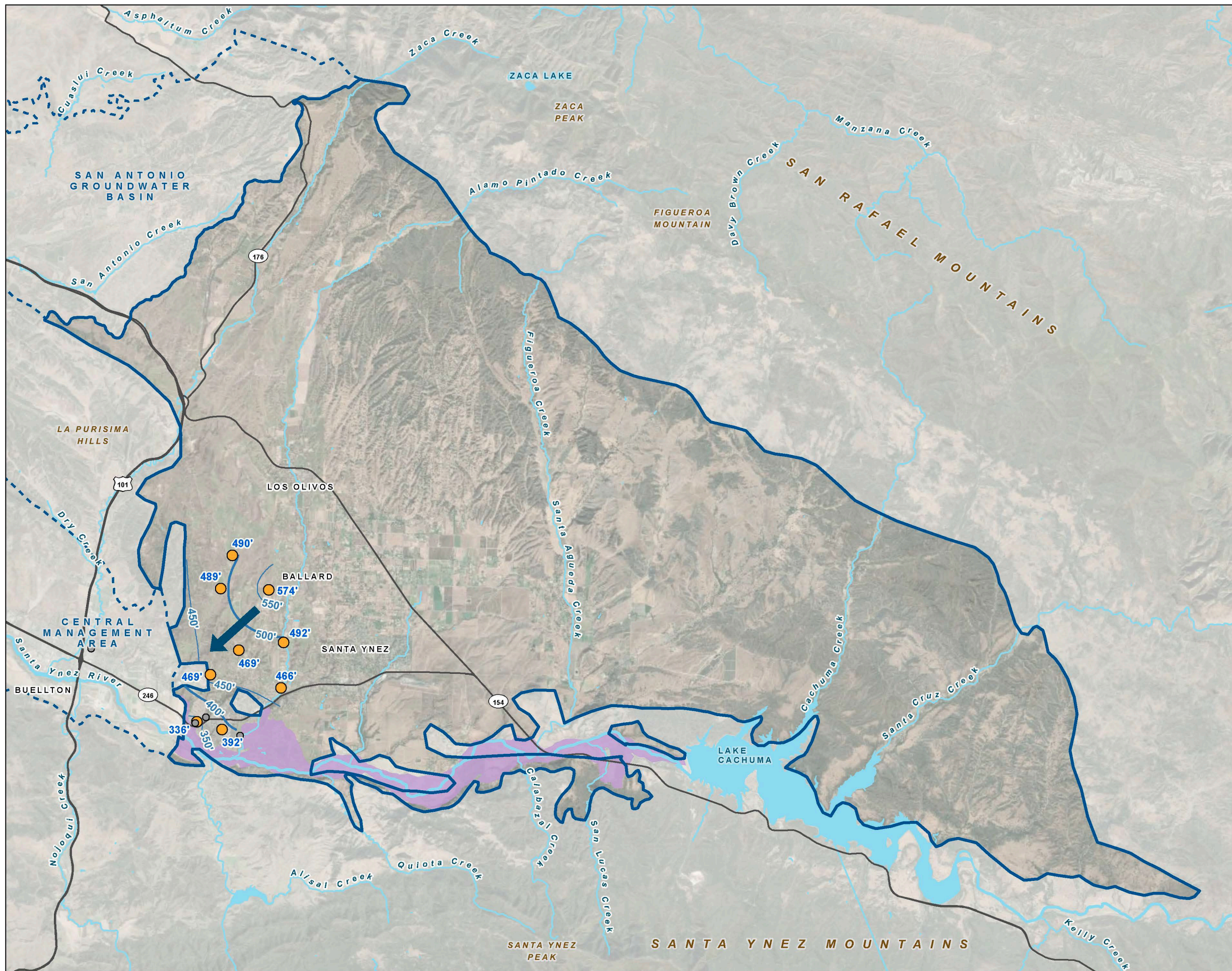
N

0 5,000 10,000 15,000  
Feet

**GSI**  
Water Solutions, Inc.

Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020)

**FIGURE 11**  
**Careaga Sand**  
**Groundwater Elevation Contours,**  
**Fall 2021**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



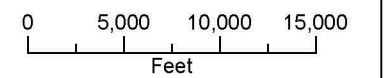
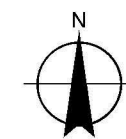
**LEGEND**

**Careaga Sand Groundwater Elevation, Fall 2021**

- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area
- Representative Well  
Water Level Elevaton (feet)
- Other Well  
Water Level Elevaton (feet)

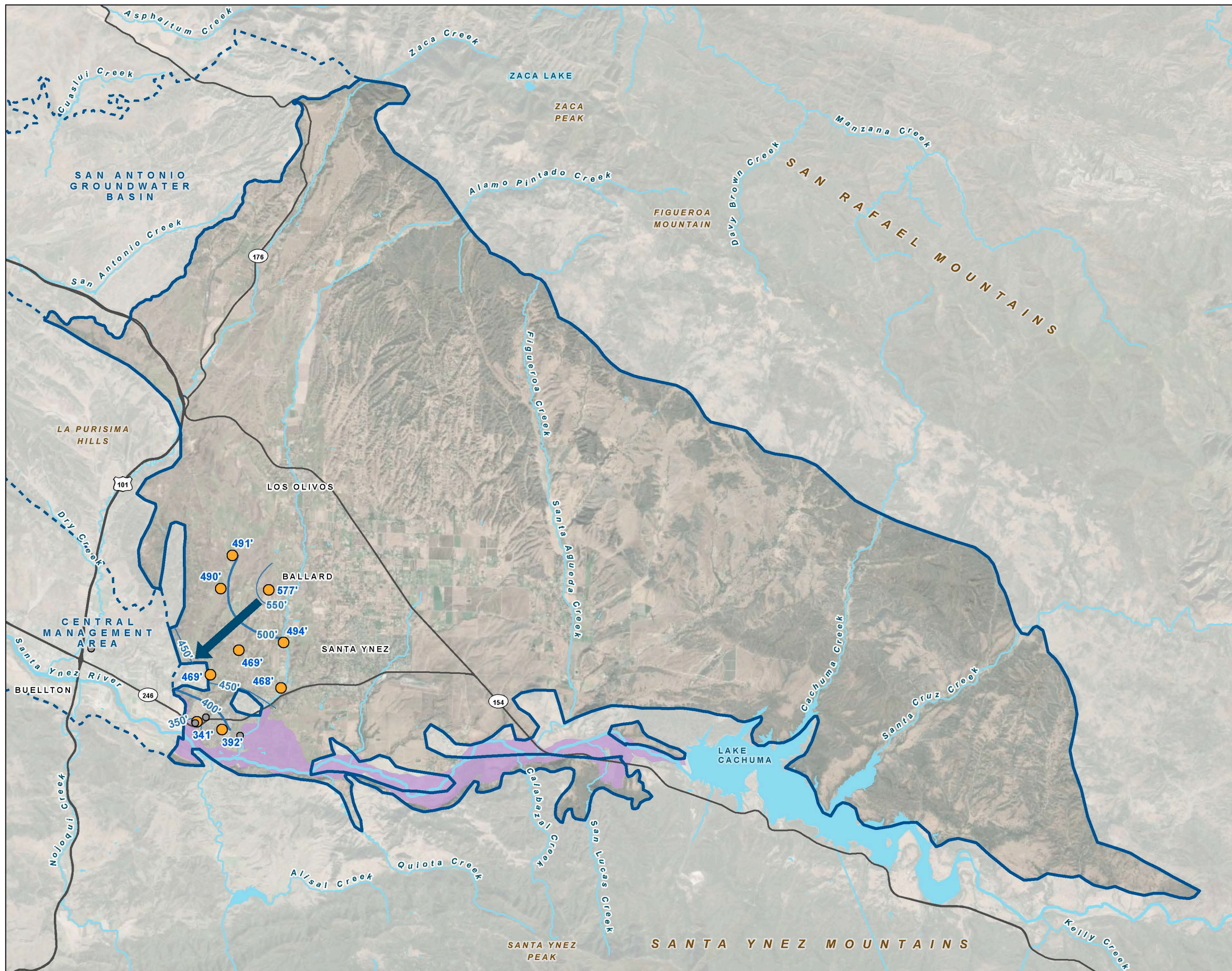
**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.

**FIGURE 12**  
**Careaga Sand**  
**Groundwater Elevation Contours,**  
**Spring 2022**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



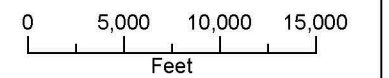
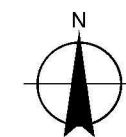
**LEGEND**

**Careaga Sand Groundwater Elevation, Spring 2022**

- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area
- Representative Well
- Water Level Elevaton (feet)
- Other Well
- Water Level Elevaton (feet)

**All Other Features**

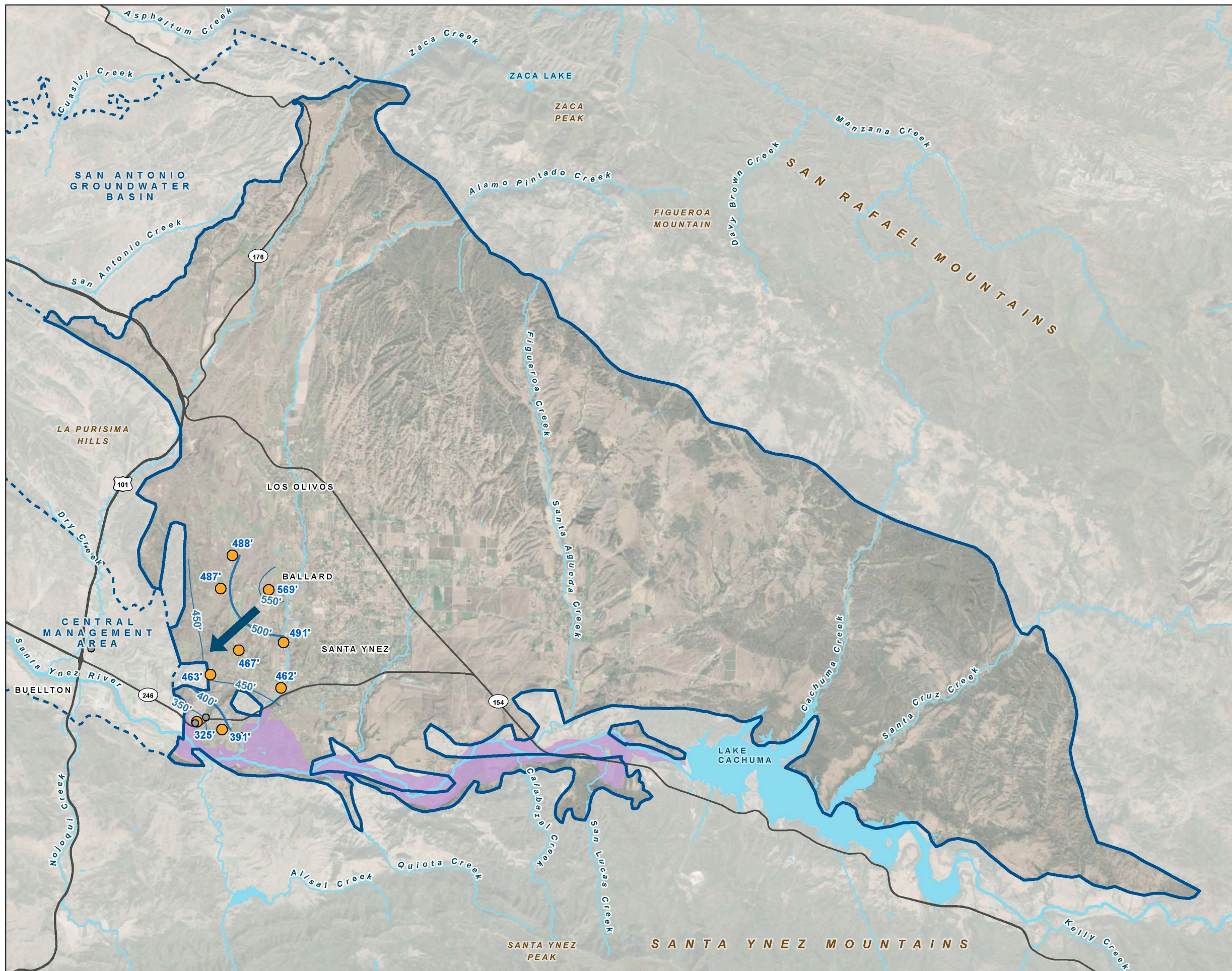
- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.



**FIGURE 13**  
**Careaga Sand**  
**Groundwater Elevation Contours,**  
**Fall 2022**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



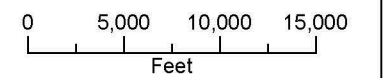
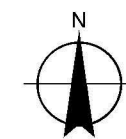
**LEGEND**

**Careaga Sand Groundwater Elevation, Fall 2022**

- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area
- Representative Well
- Water Level Elevaton (feet)
- Other Well
- Water Level Elevaton (feet)

**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.

### 3.3 Hydrographs (§ 356.2[b][1][B])

Groundwater elevation hydrographs are used to evaluate groundwater behavior in each principal aquifer. Changes in groundwater elevation in the EMA can result from many influencing factors, which may include changing hydrologic trends, seasonal variations in precipitation, varying groundwater extractions, changing inflows and outflows, and influence from localized pumping. Climatic variation can be one of the most significant factors affecting groundwater elevations over time. For this reason, the hydrographs also display water year type categorized as wet, above normal, below normal, dry, or critical (Figure 4).

Groundwater elevation hydrographs and an associated location map for the 15 representative wells completed in the Paso Robles Formation and 9 wells completed within the Careaga Sand are presented in Appendix C. The locations of the other wells that are monitored by Santa Barbara County Water Agency, but are not considered to be representative of a single principal aquifer, are presented in Figure C-1 at the beginning of Appendix C. The hydrographs include available well construction data and measurable objectives and minimum thresholds for groundwater elevations that were developed during the preparation of the Plan.

As described in the Plan, the measurable objectives at the RMSs were selected as the groundwater levels measured during the spring of 2012, and minimum thresholds were set relative to spring of 2018 groundwater elevations.

Of the 15 representative wells in the Paso Robles Formation hydrographs presented in Appendix C, only 6 of the 15 wells exhibit groundwater elevations below the minimum threshold as of the spring of 2022. Likewise, only a single (1) of the nine wells completed in the Careaga Sand exhibited groundwater elevations below the minimum threshold in the spring of 2022.

## SECTION 4: Groundwater Extractions (§ 356.2[b][2])

### 4.1 Introduction

This section presents the metered and estimated groundwater extractions from the EMA for water year 2022. The metered and estimated groundwater extractions from the EMA for the last few water years are included in the tables for comparison. The types of groundwater extraction described in this section include municipal (Table 2), agricultural (Table 3), and rural domestic (Table 5). Each of following subsections includes a description of the method of measurement and a qualitative level of accuracy for each estimate. The level of accuracy is rated on a qualitative scale of low, medium, and high. The annual groundwater extraction volumes for all water use sectors are shown in Table 6.

### 4.2 Municipal Metered and Other Self-Reported Well Production Data

Metered groundwater pumping extraction data are from the City of Solvang and ID No. 1. Table 2 presents these metered data, the self-reported data provided by pumpers within the SYRWCD, and estimated extraction data for mutual water companies. The accuracy rating of the metered production data from Solvang and ID No. 1 is high, while the accuracy rating of the self-reported production data from pumpers within SYRWCD and from mutual water companies is considered medium due to the lack of quantified production data (flow meters). As with many of the tables, data from the prior two water years are included for comparison.

**Table 2. Municipal and Other Self-Reported Groundwater Extractions**

(Values in acre-feet)

Water Year	Water Year Type	ID No. 1	Self-Reported to SYRWCD	City of Solvang	Mutual Water Companies	Total
<b>2019</b>	Above Normal	298	948	186	951	2,382
<b>2020</b>	Above Normal	621	970	289	957	2,837
<b>2021</b>	Dry	795	1,069	456	963	3,284
<b>2022</b>	Critical	1,001	1,046	430	969	3,446

#### Notes

ID No. 1 = Santa Ynez River Water Conservation District, Improvement District No. 1

SYRWCD = Santa Ynez River Water Conservation District

### 4.3 Estimate of Agricultural Extraction

During water year 2022, approximately 78 percent of the total groundwater extraction was used to supply agriculture in the EMA. This year, agricultural water demand within the SYRWCD was not estimated based on self-reported pumping volumes as in years past, which are estimated based on planted acreages and crop-specific water duty factors specified in SYRWCD's Groundwater Production Information and Instructions pamphlet (SYRWCD, 2010).

Instead, the agricultural groundwater extraction for crop water uses for the areas both inside and outside of the SYRWCD boundaries was estimated based the OpenET ensemble model<sup>4</sup>. OpenET provides satellite-based estimates of the total amount of water that is transferred from the land surface to the atmosphere through the process of evapotranspiration (ET). The OpenET ensemble model uses Landsat satellite data to produce ET data at a spatial resolution of 30 meters by 30 meters (0.22 acres per pixel). Additional inputs include gridded weather variables such as solar radiation, air temperature, humidity, wind speed, and precipitation (OpenET, 2023).

The OpenET method is a National Aeronautics and Space Administration collaboration with the Desert Research Institute and the Environmental Defense Fund running atop a Google Earth Engine, which provides monthly crop water use for a defined area (here the field scale). The OpenET data is being used throughout the state as part of an open-source groundwater accounting platform, freely available, to help GSAs manage the transition to sustainable supplies. The accuracy of these OpenET data are considered to be medium.

The adoption of OpenET data may help address concerns about potential errors in agricultural water use estimation that could occur based on rough estimations of pumping based on acreage estimates and assumed Water Use factors, including the variability of actual water use during variable hydrology (water year type), and any water applied outside of the typical crop need or for frost control. ET associated with precipitation events were removed from the analysis by subtracting the volume of rain received on a monthly time-step. Applied irrigation volumes were estimated based on estimated irrigated crop ET volumes using crop specific irrigation efficiency factors. The resulting volumes are summed by water year, which then represent estimated water year annual agricultural groundwater extraction. Deficit irrigation is captured in the satellite-based method through the measurement of actual ET. Groundwater extractions for frost protection are captured to the extent that the produced water results in increased ET. It is assumed that the remainder of the water produced for frost protection remains within the EMA and percolates back to groundwater. The results of this method are summarized in Table 3.

Based on these methods both inside and outside of the SYRWCD boundaries the estimated agricultural groundwater extractions for water year 2022 were approximately 13,300 AFY, as presented in Table 3.

**Table 3. Agricultural Irrigation Groundwater Extractions**

Water Year	Water Year Type	Agricultural Demand (acre-feet)
2019	Above Normal	12,278
2020	Above Normal	11,812
2021	Dry	13,379
2022	Critical	13,264

<sup>4</sup> OpenET uses reference ET data calculated using the American Society of Civil Engineers (ASCE) Standardized Penman-Monteith equation for a grass reference surface, and usually notated as 'ET<sub>o</sub>'. For California, OpenET uses Spatial CIMIS meteorological datasets generated by the California DWR to compute ASCE grass reference ET. OpenET provides ET data from multiple satellite-driven models, and also calculates a single "ensemble value" from those models. The models currently included are ALEXI/DisALEXI, eeMETRIC, geeSEBAL, PT-JPL, SIMS, and SSEBop. More information about these models can be found at: <https://openetdata.org/methodologies/>. All of the models included in the OpenET ensemble have been used by government agencies with responsibility for water use reporting and management in the western U.S., and some models are widely used internationally (OpenET, 2023).

Notably, the groundwater extraction in the Santa Ynez Uplands for agricultural use during water year 2022 was similar to the prior water year.

## 4.4 Rural Domestic Groundwater Extraction

Rural domestic groundwater extractions in the EMA were estimated using the methods described below. Rural domestic pumping is defined as all domestic pumping occurring outside of SYRWCD's jurisdiction not associated with a small public water system. Rural domestic pumping was calculated by conducting an aerial survey to identify land parcels with home sites in the area outside the SYRWCD in 2018. The 2018 domestic demand for each of these parcels was estimated using variable demand factors based on parcel acreage, as specified in Tetra Tech 2010 (Table 4). The calculated 2018 rural domestic demand was then adjusted through 2022 using a compilation of census data for nearby communities.

**Table 4. Rural Domestic Demand Factors Based on Lot Size**

Lot Size (acres)	Annual Water Use (acre-feet per year per lot)
0.16	0.14
0.5	0.52
1	0.82
5	0.98
10	1.15

NoteSource: Tetra Tech, 2010

These groundwater extraction components were estimated based on an aerial survey and published estimated water demand based on parcel size. Consequently, the accuracy of this groundwater budget component is considered medium. Table 5 includes the calculated rural domestic groundwater demand for water year 2022.

**Table 5. Rural Domestic Groundwater Extractions**

Water Year	Water Year Type	Rural Domestic (acre-feet)
<b>2019</b>	Above Normal	305
<b>2020</b>	Above Normal	307
<b>2021</b>	Dry	309
<b>2022</b>	Critical	311

## 4.5 Total Groundwater Extraction Summary

The total estimated annual volume of groundwater extracted in the EMA for water year 2022 was 17,060 acre-feet (AF), as shown on Table 6. As required, the table presents the total metered and estimated water use by sector and indicates the method of measure and associated level of accuracy.

**Table 6. Groundwater Extractions by Water Use Sector**

(Values in acre-feet)

Water Year	Water Year Type	Municipal and Self-Reported Domestic	Mutual Water Companies	Rural Domestic	Agriculture	Total
<b>2019</b>	Above Normal	1,431	951	305	12,278	14,965
<b>2020</b>	Above Normal	1,880	957	307	11,812	14,956
<b>2021</b>	Dry	2,320	963	309	13,379	16,971
<b>2022</b>	Critical	2,516	969	311	13,264	17,060
Method of Measure	NA	Provided by ID No. 1 (metered), City of Solvang (metered), and SYRWCD (user reported)	Estimated based on population data	Estimated based on population data	OpenET	NA
Level of Accuracy	NA	High (metered) / Low (user reported)	Medium	Medium	Medium (OpenET)	NA

### Notes

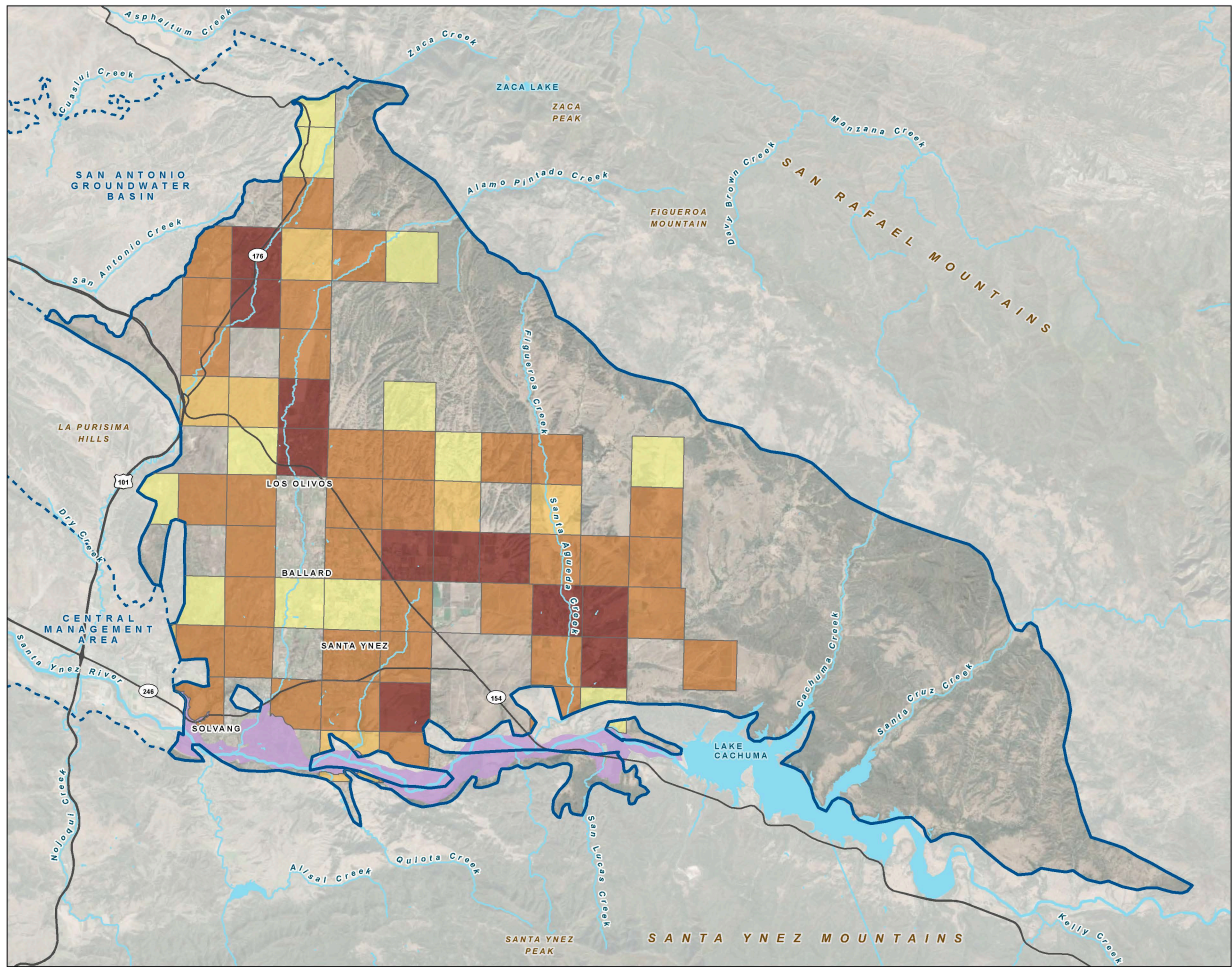
ID No. 1 = Santa Ynez River Water Conservation District, Improvement District No. 1

NA = not applicable

SYRWCD = Santa Ynez River Water Conservation District

The locations of these extractions were based on the known locations of metered pumping from the municipal users, estimates of pumping from rural domestic users, and agricultural land use spatial data. Together, the spatial distribution of these extractions during the most recent water year in 2022 are presented on Figure 14 in terms of AF per square mile.

**FIGURE 14**  
**Location and Volume of**  
**Groundwater Extractions,**  
**Water Year 2021 to 2022**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



**LEGEND**

- Santa Ynez River Area

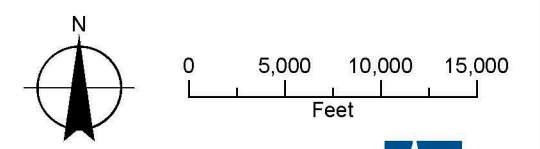
**Groundwater Extraction by Section**

**Acre Feet**

- 25 - 50
- 50 - 100
- 100 - 500
- 500 - 1555

**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020) Water Solutions, Inc.

## SECTION 5: Surface Water Supply (§ 356.2[b][3])

This section provides a summary of the surface water supplies used within the EMA during water year 2022. ID No. 1 imports water into the EMA via the Cachuma Project and the State Water Project (SWP). ID No. 1 does not receive its Cachuma Project water directly; instead, in addition to its own entitlement of SWP supplies, it also receives an amount of SWP water through an Exchange Agreement with the South Coast members of the Cachuma Project, whereby ID No.1 provides its Cachuma Project water to the South Coast in exchange for an equivalent amount of SWP water from the South Coast agencies. As a member agency of the Central Coast Water Authority (CCWA), ID No. 1 has a Table A allocation of 2,000 acre-feet per year (AFY) and a 200 AF drought buffer of imported SWP water. Of that amount, 1,500 AFY are contractually committed for use by the City of Solvang. The drought buffer effectively increases the amount of water to be delivered in the event that overall deliveries are reduced by a given percentage. ID No.1 and the City of Solvang also produce surface water from the Santa Ynez River underflow for use in the Santa Ynez Uplands.

In addition to imported water sources, users within the EMA extract water from the Santa Ynez River Alluvium for municipal, domestic, industrial, and agricultural uses, including water used for urban landscape irrigation. Pumping data from this area of the EMA are provided by the City of Solvang, ID No. 1, and from SYRWCD as “self-reported” pumping data from well owners within SYRWCD. The river well production data from ID No. 1, Solvang, and the other self-reported pumping records aggregate uses together into the SYRWCD categories of (1) agricultural; (2) “other” water, which includes municipal, industrial, small public water systems, and domestic use; and (3) “special” irrigation water, which refers to urban landscape and golf course irrigation. These pumping volumes have been compiled on a water year basis and are reported annually on a July-through-June fiscal year basis in SYRWCD’s annual reports, which have been prepared for 43 years.

Pumping volumes provided by the City of Solvang and ID No. 1 are from metered pumping and are considered highly reliable and accurate. Likewise, some of the self-reported pumping data provided by SYRWCD annual reports are also from metered pumping records and are similarly accurate. A large portion of the self-reported SYRWCD pumping data is estimated from self-reported records using crop-specific water duty factors provided by SYRWCD for its water use estimates and annual reports. These pumping estimates based on self-reported records are of medium accuracy, due to the uncertainty of standardized crop water duty factors and reliability of self-reporting. The total annual volume of surface water used in the EMA for water year 2022 was approximately 4,500 acre-feet (AF), as presented on Table 7.



**Table 7. Surface Water Use**

(Values in acre-feet)

Water Year	City of Solvang	ID No. 1 Table A	ID No. 1 Exchange	Solvang River Wells	ID No. 1 River Wells	Other Reported River Wells <sup>1</sup>	Total Reported River Wells	Total
<b>2019</b>	759	50	2,213	160	739	1,658	2,557	5,579
<b>2020</b>	745	315	1,740	148	567	1,566	2,281	5,081
<b>2021</b>	612	0	1,439	240	1,142	1,775	3,157	5,208
<b>2022</b>	590	0	544	270	1,632	1,478	3,380	4,514
Method of Measure	Metered	Metered	Metered	Metered	Metered	User Reported	Metered/Reported	NA
Level of Accuracy	High	High	High	High	High	Medium	High/Medium	NA

**Notes**<sup>1</sup> Includes wells within Santa Ynez River Water Conservation District Zone A

ID No. 1 = Santa Ynez River Water Conservation District, Improvement District No. 1

NA = not applicable

## SECTION 6: Total Water Use (§ 356.2[b][4])

This section summarizes the total estimated annual groundwater and surface water used to meet municipal, agricultural, and rural domestic demands within the EMA. For the water year 2022, the quantification of total water use was completed from reported metered municipal water production and metered surface water delivery, SYRWCD reported groundwater and river well pumping within its boundaries, and estimates of agricultural and rural water demand outside of SYRWCD. Table 8 presents the total metered and estimated water use in the EMA by source and water use sector. The method of measurement and a qualitative level of accuracy for each estimate is rated on a scale of low, medium, and high.

**Table 8. Total Water Use**

(Values in acre-feet)

Water Year	Water Year Type	Groundwater Use	Surface Water Use	Total
<b>2019</b>	Above Normal	14,965	5,579	20,544
<b>2020</b>	Above Normal	14,956	5,081	20,037
<b>2021</b>	Dry	16,971	5,208	22,179
<b>2022</b>	Critical	17,060	4,514	21,574
Method of Measure	NA	Metered, User Reported, and Estimated	Metered/User Reported	NA
Level of Accuracy	NA	High (metered) to Low (user reported)	High to Medium	NA

**Notes**

NA = not applicable

## SECTION 7: Change in Groundwater in Storage (§ 356.2[b][5])

### 7.1 Introduction

This section presents an overview of the estimated change in groundwater in storage within the two principal aquifers in the EMA. The annual changes in groundwater in storage have been estimated using two methods based on the availability of data. Where groundwater elevation data are sufficient and spatially distributed from year to year, the change in storage estimate used these data. However, where these data are lacking in the Santa Ynez Uplands, the change in storage was estimated using the inflow and outflow components from the water budget described in the Plan.

### 7.2 Annual Changes in Groundwater in Storage (§ 356.2[b][5][A])

The current groundwater monitoring network for the Paso Robles Formation does not have sufficient spatial distribution to adequately represent groundwater conditions for the entire aquifer throughout the Santa Ynez Uplands. While the groundwater elevation monitoring network used for contouring groundwater elevations for water year 2018 for both principal aquifers provided sufficient spatial coverage of the EMA in 2018, the monitoring network was not sufficient for water year 2022 for the Paso Robles Formation. This is in part due to the loss of access to several groundwater wells in the adjacent San Antonio Groundwater Basin and wells within the EMA. The wells in the San Antonio Groundwater Basin, which is in hydraulic communication with the EMA, have historically been used to define groundwater conditions in that area in both basins.

The groundwater elevation changes depicted on the maps presented in this section are used, along with the storage coefficient, to calculate the proportion of that change that is due to groundwater in storage. The portion of void space in the aquifer that can be utilized for groundwater storage is represented by an aquifer storage coefficient, which is similar to porosity and is a unitless factor that is multiplied by the total volume change between water years.

#### 7.2.1 Paso Robles Formation

The relatively limited extent of the groundwater elevation contours within the Paso Robles Formation is evident in the spring of 2021 (Figure 8) and the spring of 2022 (Figure 10). Although the existing groundwater level monitoring network satisfies the DWR's well density guidance in the portion of the basin that wells are currently accessible, there are two areas identified within the EMA both in the northwest and the eastern portion of the EMA, where the addition of monitoring wells would improve the hydrogeologic conceptual model (HCM) as discussed in the Plan. Because the accuracy of using this method is dependent on the lateral extent of the water level data, the accuracy associated with using this method for the Paso Robles Formation is considered low. Since 2018, the understanding of water level conditions in the Paso Robles Formation has been hindered by the loss of at least one well in the adjacent San Antonio Groundwater Basin, one within Los Olivos and one near Happy Canyon. The EMA GSA is working to address these identified data gaps.

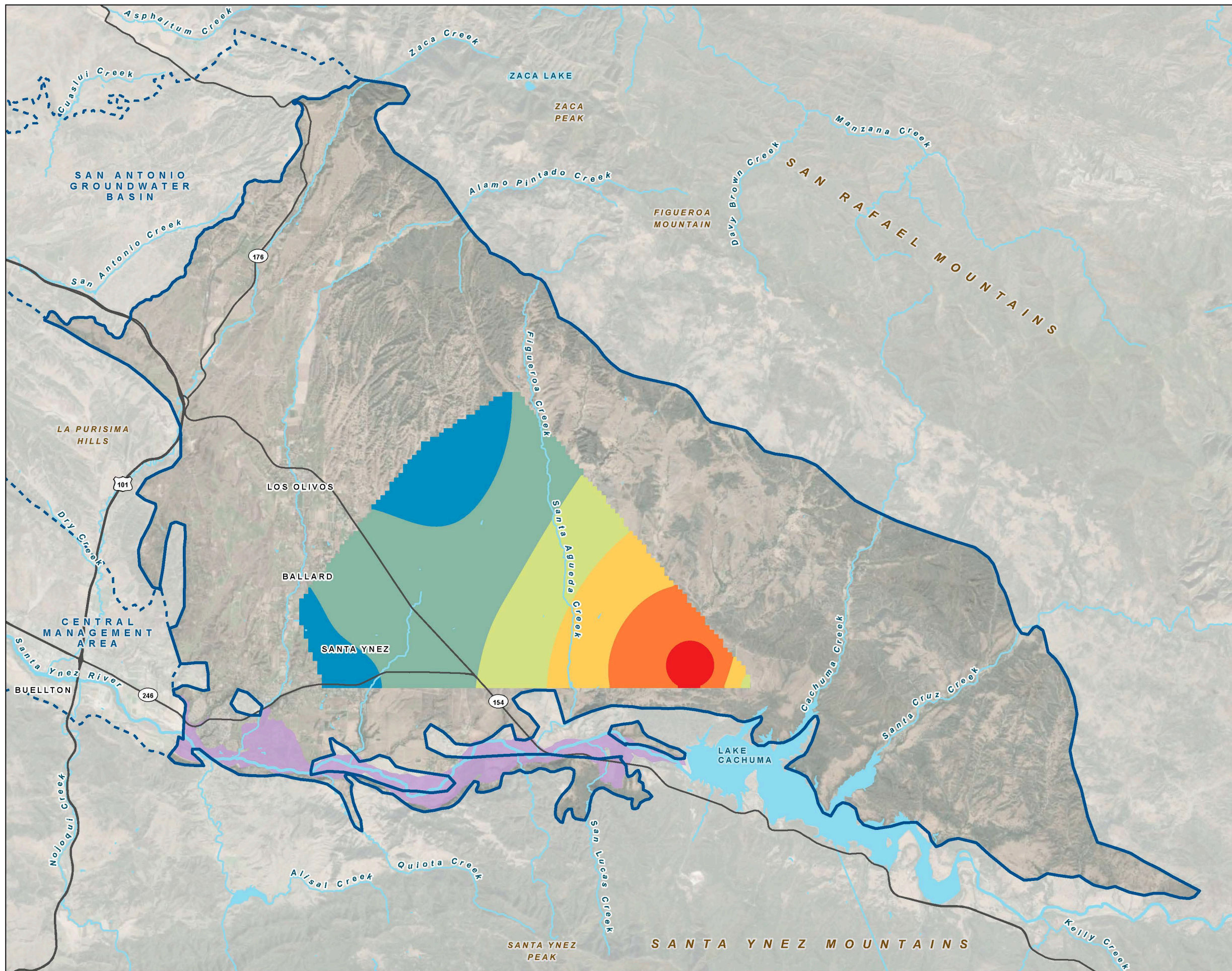
Nonetheless, the change in storage can be inferred for a portion of the Paso Formation using the change in groundwater elevation map between the spring of 2021 and 2022 presented on Figure 15. The red and orange areas those where the change in groundwater in storage was the greatest. The change in storage map generated by this method is not considered representative of groundwater conditions throughout the entire EMA and therefore was not used to calculate the change in groundwater in storage. Instead, the change in storage within the Paso Robles Formation was estimated based on the overall water budget (for both aquifers) and the change in storage in the Careaga Sand, described below. The remainder of the change in storage, which did not occur in the Careaga Sand, occurred in the Paso Robles Formation.

### 7.2.2 Careaga Sand

Changes in groundwater in storage within the Careaga Sand for water year 2022 were derived by comparing spring groundwater elevation contour maps from one year to the next. For example, the spring 2022 groundwater elevations for the Careaga Sand (Figure 12) were subtracted from the spring 2021 groundwater elevations (Figure 10), resulting in a map depicting the changes in groundwater elevations that occurred during the 2022 water year as Figure 16. The red and orange areas are those where the change in groundwater in storage was the greatest.

The change in groundwater elevation map for water year 2022 within the Careaga Sand (Figure 16), a critical precipitation year, shows declines in groundwater elevation of between 2 and 6 feet in most of the area, with limited areas of greater decline of up to 8 feet. Again, areas with the greatest declines in water levels reflect the areas with the greatest reduction of groundwater in storage.

**FIGURE 15**  
**Paso Robles Formation**  
**Change of Groundwater Elevation,**  
**Spring 2021 to Spring 2022**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



**LEGEND**

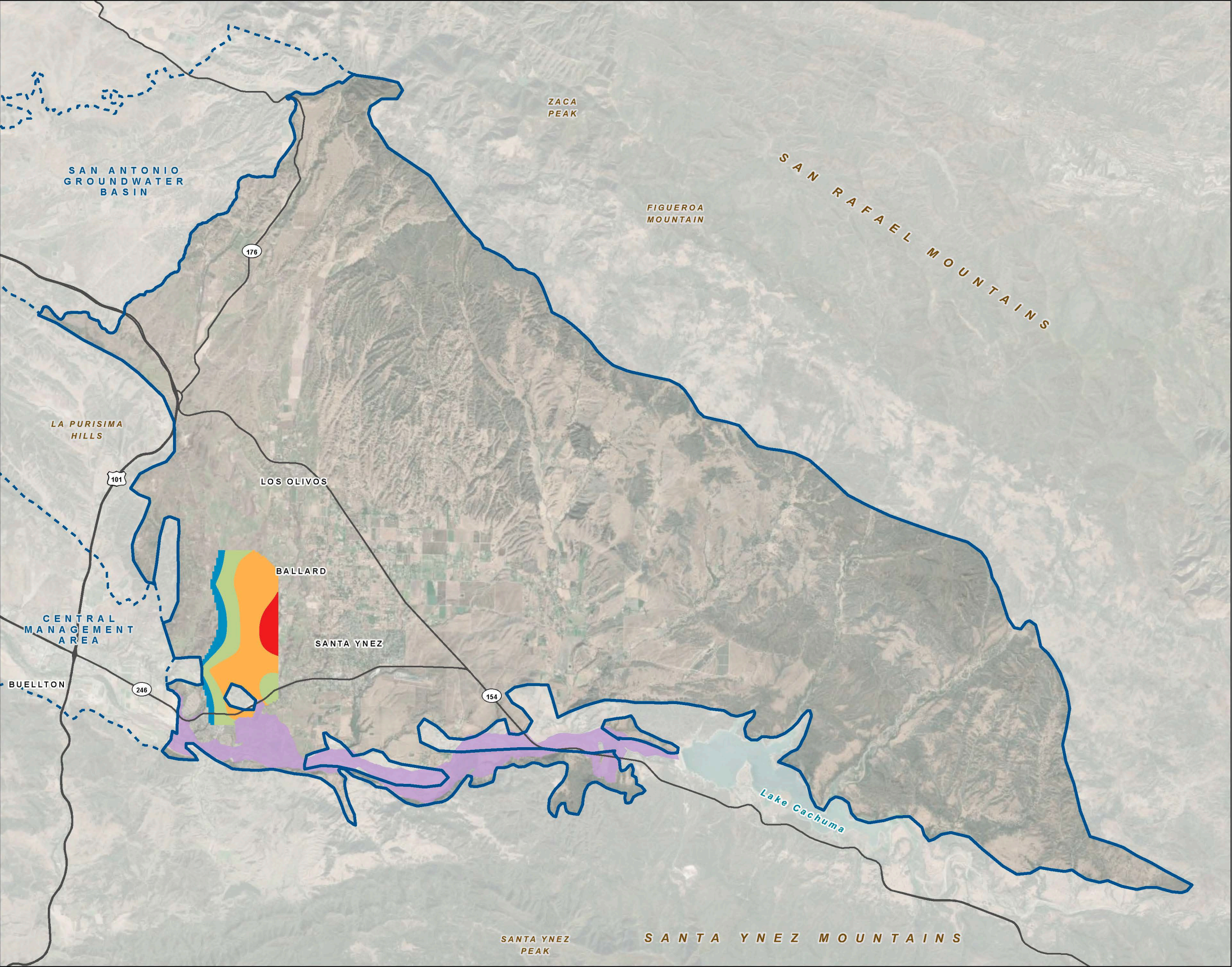
- Santa Ynez River Area
- Change in Groundwater Elevation**
- 5 to 0
- 10 to -5
- 15 to -10
- 20 to -15
- 25 to -20
- 30 to -25
- All Other Features**
- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

N

0    5,000    10,000    15,000  
Feet

Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar Imagery (2020)

**FIGURE 16**  
**Careaga Sand**  
**Change of Groundwater Elevation,**  
**Spring 2021 to Spring 2022**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area



**LEGEND**

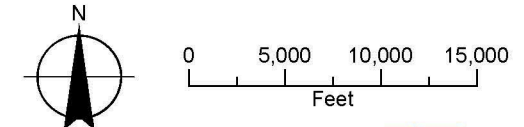
- Santa Ynez River Area

**Change in Groundwater Elevation**

- 2 to 0
- 4 to -2
- 6 to -4
- 8 to -6

**All Other Features**

- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody



Document Path: Y:\0515\_Santa\_Ynez\_River\_WCD\Source\_Figures\EMA\_Annual\_Report\2022\Figure16\_Careaga\_WLE\_Change\_Spring22\_21.mxd, wkimmon

### 7.3 Annual and Cumulative Change in Groundwater in Storage Calculations (§ 356.2[b][5][B])

Together with the change in storage for the Paso Robles Formation calculated by the water budget method and the change in storage calculation for the Careaga Sand based on changes in groundwater elevations, the EMA-wide annual change of groundwater in storage for both principal aquifers for water year 2022 are presented in Table 9.

The volume of groundwater in storage declined by 11,500 AFY during the critical year of 2022 with only 10.2 inches of rainfall (5.4 inches below normal). This annual storage decline in 2022 is approximately 2,000 AFY less than the annual change in storage that was experienced in the EMA during each of the peak drought years of 2013 through 2016.

**Table 9. Annual Estimated Change in Groundwater in Storage**

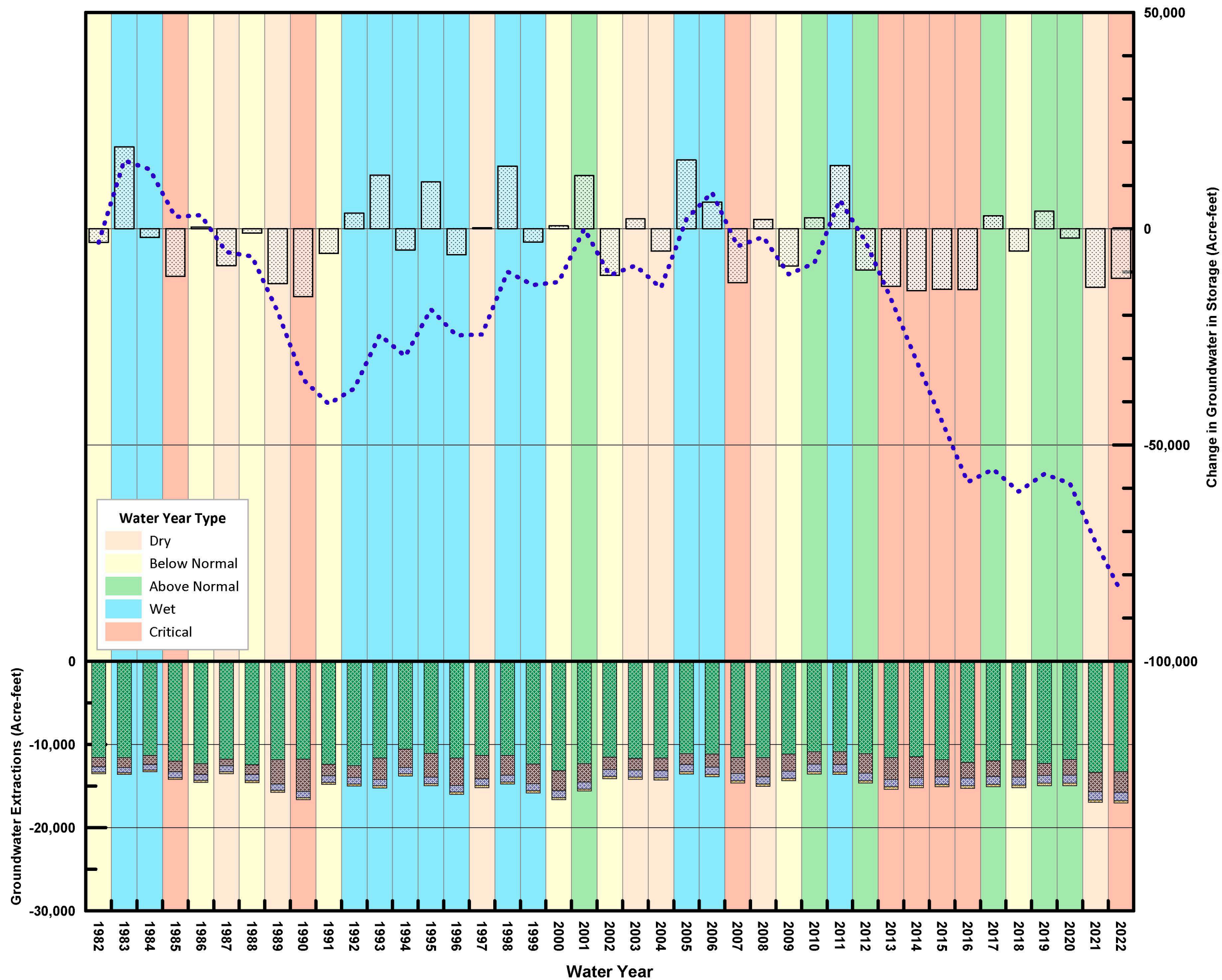
(Values in acre-feet)

Water Year	Water Year Type	Change in Storage (Paso Robles Formation)	Change in Storage (Careaga Sand)	Total Annual Change in Storage
<b>2019</b>	Above Normal	3,047	996	4,043
<b>2020</b>	Above Normal	-1,662	-477	-2,139
<b>2021</b>	Dry	-12,737	-825	-13,562
<b>2022</b>	Critical	-10,983	-495	-11,478

Overall, since 2018, when the historical period presented in the Plan ended, a net decrease of 23,100 AFY of groundwater has occurred. The annual and cumulative change in groundwater in storage since 1981 are presented on Figure 17, which includes the period since January of 2015.

**Figure 17**  
**Cumulative Change in**  
**Groundwater in Storage**

Santa Ynez River Valley Groundwater  
 Basin - Eastern Management Area  
 Annual Report Water Year 2022





## SECTION 8: Progress toward Basin Sustainability (§ 356.2[c])

### 8.1 Introduction

This section summarizes several management actions that are being implemented in the EMA to attain sustainability and avoid undesirable results. These management actions are focused primarily on developing funding for EMA GSA operations and future EMA monitoring, filling identified data gaps, registering and metering wells, reporting metered production, implementing a pumping fee program, and developing new and expanding existing water use efficiency programs for implementation within the EMA.

As described in the Plan (GSI, 2022), the need for projects and management actions is based on groundwater conditions, including the following:

- The amount of groundwater pumping in the EMA is greater than the estimated sustainable yield, and declining groundwater levels have been documented.
- Water budgets indicate that the amount of groundwater in storage is in decline and will continue to decline in the future as a result of pumping in the EMA during dry and critical conditions.

To mitigate continued declines in groundwater levels in the EMA, achieve the sustainability goal before 2042, and avoid undesirable results as required by SGMA regulations, the EMA will benefit from increased rainfall, improved water use efficiency, an overall reduction in aggregate groundwater pumping over the implementation period, and/or an increase in supply. The following section describes the actions that are being initiated now that the Plan has been adopted and submitted to DWR.

Potential management actions and potential future projects are categorized into three groups:

- The management actions included in Group 1 will be initiated within 1 year of GSP adoption by the EMA GSA.
- The Group 2 management actions and Group 3 projects may be considered for implementation in the future as conditions in the Basin dictate and the effectiveness of the other management actions are assessed.

### 8.2 Group 1 Management Actions and Group 3 Projects under Development

Group 1 management actions that are in the planning stages include the following:

1. Address Data Gaps
  - Expand Monitoring Well Network in the EMA to Increase Spatial Coverage and Well Density,
  - Perform Video Surveys in Representative Wells That Currently Do Not Have Adequate Construction Records to Confirm Well Construction
  - Review/Update Water Usage Factors and Crop Acreages
2. Groundwater Pumping Fee Program
3. Well Registration Program and Well Meter Installation Program

## 8.3 Summary of Progress toward Meeting Basin Sustainability

Relative to the conditions as reported in the Plan, this Annual Report for 2022 indicates continued declines in groundwater levels. Groundwater elevations have declined in the representative monitoring wells, resulting in a decrease in total groundwater in storage driven by exceptionally dry hydrology during water year 2022 and by pumping. Based on the rainfall conditions over the last 20 years, drought is the predominant factor leading to groundwater declines. Group 1 management actions are planned to address data gaps through improvement of the monitoring and data-collection networks, as well as program implementation for better measurement of groundwater pumping and to promote water use efficiency and sustainable groundwater use.

While water levels have declined below minimum thresholds in some representative wells, the number of wells with water levels falling below the minimum thresholds has not resulted in the undesirable results described in the Plan because one of the criteria is that these conditions must occur “after 2 consecutive years of average and above-average precipitation” has not occurred. Group 1 management actions (as outlined in Section 6 of GSI, 2022 and summarized above) are being planned and implementation of these actions are projected to improve conditions. If they do not and it is determined that undesirable results are occurring, additional management actions described in the Plan (e.g., Group 2 and 3) may be warranted. The effect of the management actions will be reviewed periodically, and additional Group 2 management actions and Group 3 projects may be considered and implemented as necessary to ensure sustainable groundwater management.

The EMA GSA is not charged with managing groundwater quality unless it can be shown that water quality degradation is caused by groundwater pumping in the EMA, or the EMA GSA implements a project that degrades water quality. As described in the Plan, groundwater quality in the EMA is generally suitable for both drinking water and agricultural purposes (GSI, 2022). Potential degradation of groundwater quality caused by groundwater pumping or implementation of projects and management actions will be monitored as part of the EMA’s water quality monitoring network.

Land subsidence caused by groundwater extraction will be monitored as part of the Plan. Subsidence can be estimated using InSAR data provided by DWR. Minor subsidence has been observed in the EMA using InSAR data provided by DWR for June 2015 through October 2022. These data show that an average subsidence of approximately 0.018 feet per year has occurred in certain parts of the Basin over the period of record. This is a minor rate of subsidence that does not exceed the minimum threshold value and is relatively insignificant and not a major concern for the EMA. The EMA GSA will continue to monitor and report annually on any subsidence.

Potential GDEs associated with one of the principal aquifers were identified on the downstream ends of Alamo Pintado Creek and Zanja de Cota Creek where groundwater may be interconnected with surface water. As described in the Plan, the EMA GSA has proposed to install piezometers in the GDE areas to assess whether depletion of interconnected surface water is occurring and whether significant and unreasonable adverse impacts to GDEs or reductions in discharge of interconnected surface water to the Santa Ynez River may be occurring as a result of groundwater conditions. Planning for installation of the proposed piezometers is underway.

The planning is underway to implement projects and managements actions and to evaluate their effectiveness. It is anticipated that the projects and management actions will enable the EMA to sustainably manage groundwater and achieve sustainability goals as defined in the Plan.

## SECTION 9: References

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## APPENDIX A

Sustainable Groundwater Management Act Groundwater  
Sustainability Plan Regulations for Annual Reports

## **ARTICLE 7. Annual Reports and Periodic Evaluations by the Agency**

### **§ 356. Introduction to Annual Reports and Periodic Evaluations by the Agency**

This Article describes the procedural and substantive requirements for the annual reports and periodic evaluation of Plans prepared by an Agency.

Note: Authority cited: Section 10733.2, Water Code.

Reference: Section 10733.2, Water Code.

### **§ 356.2. Annual Reports**

Each Agency shall submit an annual report to the Department by April 1 of each year following the adoption of the Plan. The annual report shall include the following components for the preceding water year:

(a) General information, including an executive summary and a location map depicting the basin covered by the report.

(b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan:

(1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows:

(A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions.

(B) Hydrographs of groundwater elevations and water year type using historical data to the greatest extent available, including from January 1, 2015, to current reporting year.

(2) Groundwater extraction for the preceding water year. Data shall be collected using the best available measurement methods and shall be presented in a table that summarizes groundwater extractions by water use sector, and identifies the method of measurement (direct or estimate) and accuracy of measurements, and a map that illustrates the general location and volume of groundwater extractions.

(3) Surface water supply used or available for use, for groundwater recharge or in-lieu use shall be reported based on quantitative data that describes the annual volume and sources for the preceding water year.

(4) Total water use shall be collected using the best available measurement methods and shall be reported in a table that summarizes total water use by water use sector, water source type, and identifies the method of measurement (direct or estimate) and accuracy of measurements. Existing water use data from the most recent Urban Water Management Plans or Agricultural Water Management Plans within the basin may be used, as long as the data are reported by water year.

(5) Change in groundwater in storage shall include the following:

(A) Change in groundwater in storage maps for each principal aquifer in the basin.

(B) A graph depicting water year type, groundwater use, the annual change in groundwater in storage, and the cumulative change in groundwater in storage for the basin based on historical data to the greatest extent available, including from January 1, 2015, to the current reporting year.

(c) A description of progress towards implementing the Plan, including achieving interim milestones, and implementation of projects or management actions since the previous annual report.

Note: Authority cited: Section 10733.2, Water Code.

Reference: Sections 10727.2, 10728, and 10733.2, Water Code.

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## APPENDIX B

Summary of Representative Well Data

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**Table B-1. Representative Groundwater Level Monitoring Network – Paso Robles Formation Wells**

Representative Well ID	Well Use	Well Depth (ft)	Screen Interval(s) (ft bgs)	Ground Elevation (ft NAVD 88)	Reference Point Elevation (ft NAVD 88)	First Date Measured	Last Date Measured	Years
6N/29W-07L01	Agricultural	—	—	868.9	870.7	1960	2022	63
6N/29W-08P01	Domestic	—	210 (top)	915.2	915.4	1934	2019	86
6N/29W-08P02	Domestic	—	—	896.0	897.0	1966	2022	57
6N/30W-07G05	Municipal	166	—	604.3	606.7	1962	2022	61
6N/30W-07G06	Municipal	566	305 to 410	602.3	604.3	1962	2022	61
6N/30W-11G04	Agricultural	400	130 to 390	681.1	683.1	2010	2022	13
6N/31W-01P03	Municipal	505	195 to 490	633.1	634.7	1967	2022	56
6N/31W-02K01	Domestic	—	—	619.6	620.8	1942	2022	81
6N/31W-13D01	Domestic	152	—	625.1	626.6	1941	2022	82
7N/30W-16B01	Agricultural	—	—	1,066.4	1,069.3	1950	2022	73
7N/30W-19H01	Agricultural	—	—	1,090.1	1,105.9	1954	2022	69
7N/30W-29D01	Agricultural	—	—	917.8	919.3	1905	2022	118
7N/30W-30M01	Agricultural	—	—	806.5	807.5	1905	2019	115
7N/30W-33M01	Agricultural	349	150 to 340	764.3	764.7	1954	2022	69
7N/31W-36L02	Domestic	—	—	722.6	723.6	1942	2022	81

**Notes**

— = no data available

? = Unknown

bgs = below ground surface

ft = foot or feet

NAVD 88 = North American Vertical Datum of 1988

**Table B-2. Representative Groundwater Level Monitoring Network – Careaga Sand Wells**

Representative Well ID	Well Use	Well Depth (ft)	Screen Interval(s) (ft bgs)	Ground Elevation (ft NAVD 88)	Reference Point Elevation (ft NAVD 88)	First Date Measured	Last Date Measured	Years
7N/31W-34M02	Agricultural	—	—	671.1	673.1	2014	2022	9
6N/31W-03A01	Domestic	—	—	738.5	740.0	1963	2022	60
6N/31W-04A01	Domestic	259	—	601.1	603.1	1956	2022	67
6N/31W-09Q02	Municipal	550	250 to 540	756.9	754.0	2011	2022	12
6N/31W-10F01	Agricultural	265	—	555.6	556.7	1966	2022	57
6N/31W-11D04	Agricultural	447	93 (top)	565.3	560.6	1955	2022	68
6N/31W-16N07	Municipal	145	99 to 127	479.3	478.2	2011	2022	12
6N/31W-xxxx <sup>1</sup>	Municipal	329	190 to 325	503.2	500.9	2011	2022	12
Solvang HCA <sup>1</sup>	Municipal	490	180 to 470	398.0	402.8	2011	2022	12

**Notes**

<sup>1</sup> The State Well Number for these wells is not known at this time.

— = no data available

? = Unknown

bgs = below ground surface

ft = foot or feet

NAVD 88 = North American Vertical Datum of 1988

**Table B-3. Representative Well Water Elevations – Paso Robles Formation Wells**

(All elevations are in feet NAVD 88)

Representative Well ID	Minimum Threshold	Spring 2021	Fall 2021	Spring 2022	Fall 2022
6N/29W-07L01	639	641	<b>613</b>	<b>612</b>	<b>611</b>
6N/29W-08P01	676	—	Dry	Dry	Dry
6N/29W-08P02	654	654	<b>642</b>	<b>641</b>	<b>631</b>
6N/30W-07G05	515	523	516	517	<b>512</b>
6N/30W-07G06	513	521	514	515	<b>502</b>
6N/30W-11G04	512	516	<b>477</b>	<b>496</b>	<b>461</b>
6N/31W-01P03	516	523	516	517	<b>506</b>
6N/31W-02K01	557	568	565	565 <sup>1</sup>	564
6N/31W-13D01	495	508	505	506	504
7N/30W-16B01	1,021	1,043	1,040	1,038	1,034
7N/30W-19H01	912	927	927	927	926
7N/30W-29D01	850	862	860	860	857
7N/30W-30M01	559	<b>546</b>	-- <sup>1</sup>	-- <sup>1, 2</sup>	Pumping
7N/30W-33M01	514	521	Pumping	<b>514</b>	<b>496</b>
7N/31W-36L02	616	<b>614</b>	<b>600</b>	<b>605</b>	<b>593</b>

**Notes****Bolded** values are below the minimum threshold value.<sup>1</sup> Nearby Pumping<sup>2</sup> Replacement well nearby measured

— = no data available

NAVD 88 = North American Vertical Datum of 1988

**Table B-4. Representative Well Water Elevations – Careaga Sand Wells**

(All elevations are in feet NAVD 88)

Representative Well ID	Minimum Threshold	Spring 2021	Fall 2021	Spring 2022	Fall 2022
7N/31W-34M02	484	493	490	491	488
6N/31W-03A01	573	581	574	577	<b>569</b>
6N/31W-04A01	483	492	489	490	487
6N/31W-09Q02	446	473	469	469	463
6N/31W-10F01	464	472	469	469	467
6N/31W-11D04	502	<b>501</b>	<b>492</b>	<b>494</b>	<b>491</b>
6N/31W-16N07	377	394	392	392	391
6N/31W-xxxx	467	471	<b>466</b>	468	<b>462</b>
Solvang HCA	320	333	336	341	325

**Notes**

**Bolded** values are below the minimum threshold value.

NAVD 88 = North American Vertical Datum of 1988

**Table B-5. Other County Water Agency/City of Solvang-Monitored Well Water Elevations**

(All elevations are in feet NAVD 88)

Well ID	Aquifer	Spring 2021	Fall 2021	Spring 2022	Fall 2022
6N/29W-05A01	Tributary Alluvium	Dry	Dry	--	Dry
6N/29W-06F01	Tributary Alluvium	830	Pumping	828	823
6N/29W-06G01	Tributary Alluvium	829	826	827	826
7N/30W-22E01	Tributary Alluvium	911	910	911	Pumping
8N/31W-36H01	Tributary Alluvium	1,130	1,128	1,144	1,128
6N/31W-17F01 <sup>1</sup>	Santa Ynez River Alluvium	326	Dry	326	Dry
6N/31W-17F03 <sup>1</sup>	Santa Ynez River Alluvium	Pumping	Pumping	327	324
6N/31W-21H03 <sup>1</sup>	Santa Ynez River Alluvium	359	360	360	360
6N/31W-22M01 <sup>1</sup>	Santa Ynez River Alluvium	359	361	360	362
6N/30W-01R03	Tributary Alluvium / Paso Robles Formation	Pumping	Pumping	600	584
7N/30W-24Q01	Tributary Alluvium / Paso Robles Formation	1,161	Pumping	1,158	1,156
7N/30W-27H01	Tributary Alluvium / Paso Robles Formation	837	829	839	828
8N/30W-30R01	Tributary Alluvium / Paso Robles Formation	1,226	1,174 <sup>2</sup>	1,224	1,174
8N/30W-30R02	Tributary Alluvium / Paso Robles Formation	Pumping	Pumping	1,198	1,161
6N/31W-01P02	Paso Robles Formation	Discontinued	--	--	--
7N/29W-29R01	Paso Robles Formation	Discontinued	--	--	--
7N/29W-29R02	Paso Robles Formation	Discontinued	--	--	--
7N/30W-22E02	Paso Robles Formation	Pumping	674	Obstructed	Pumping/Obstructed
7N/30W-35R01	Paso Robles Formation	Obstructed	--	--	--
7N/30W-36N03	Paso Robles Formation	Obstructed	--	--	--

Well ID	Aquifer	Spring 2021	Fall 2021	Spring 2022	Fall 2022
7N/31W-23P01	Paso Robles Formation	Destroyed	--	--	--
8N/31W-22N01	Paso Robles Formation	--	--	--	--
Solvang_23	Paso Robles Formation / Careaga Sand	474	475	--	--
6N/31W-07F01	Careaga Sand	309	304	308	Pumping
HCA_Middle	Careaga Sand	409	408	--	--
Solvang_Lot72	Careaga Sand	398	395	--	--

**Notes**

<sup>1</sup> These wells are in the Santa Ynez EMA, but are in the Santa Ynez River area not managed under the auspices of SGMA

<sup>2</sup> Nearby pumping

-- = no data available

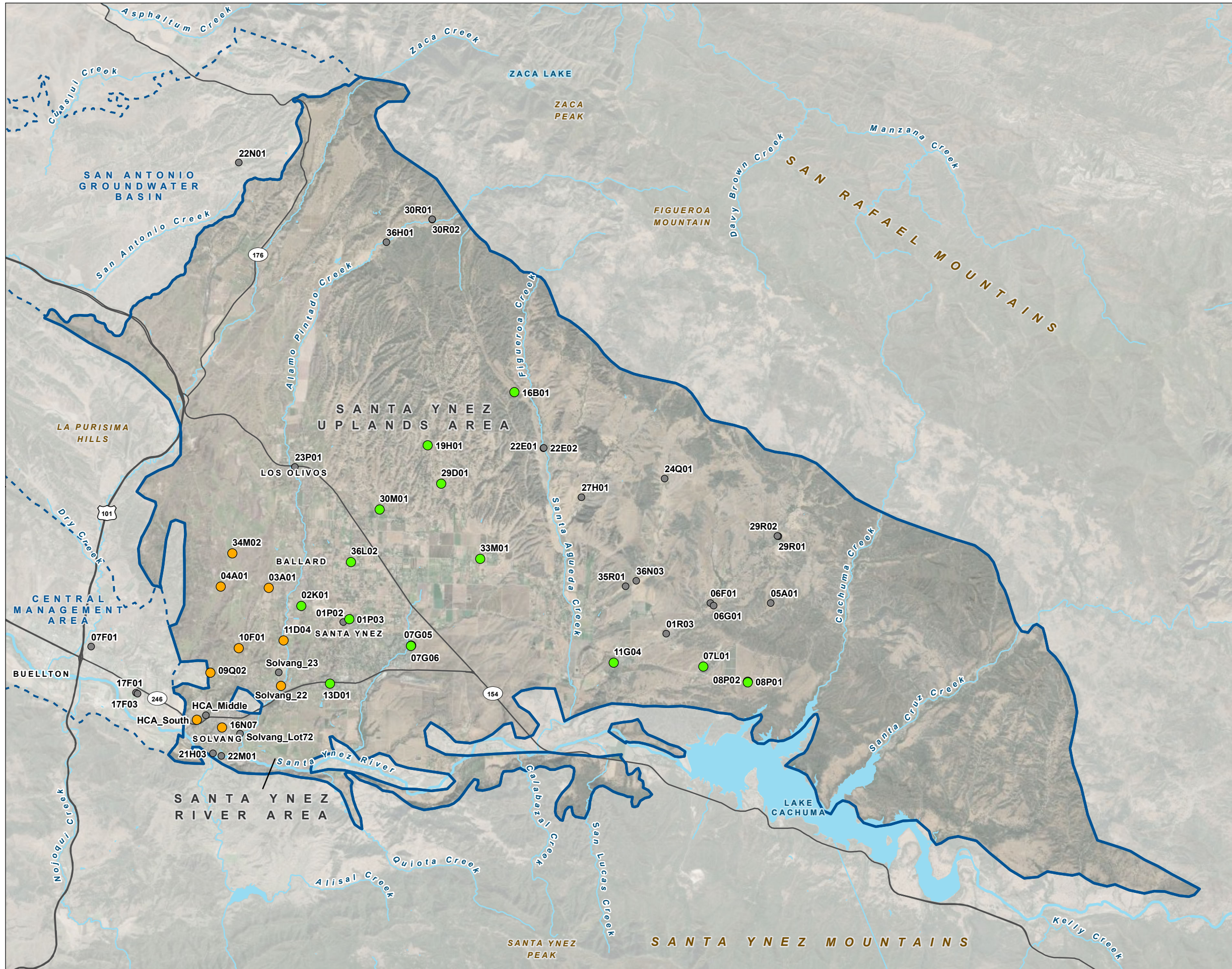
NAVD 88 = North American Vertical Datum of 1988



## APPENDIX C

Representative Monitoring Site Hydrographs

**FIGURE C-1**  
**Groundwater Level Monitoring Network**  
 Annual Report Water Year 2022  
 for the Santa Ynez River Valley Groundwater Basin,  
 Eastern Management Area



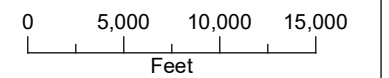
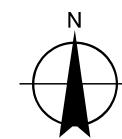
**LEGEND**

**Representative Well (by screened aquifer)**

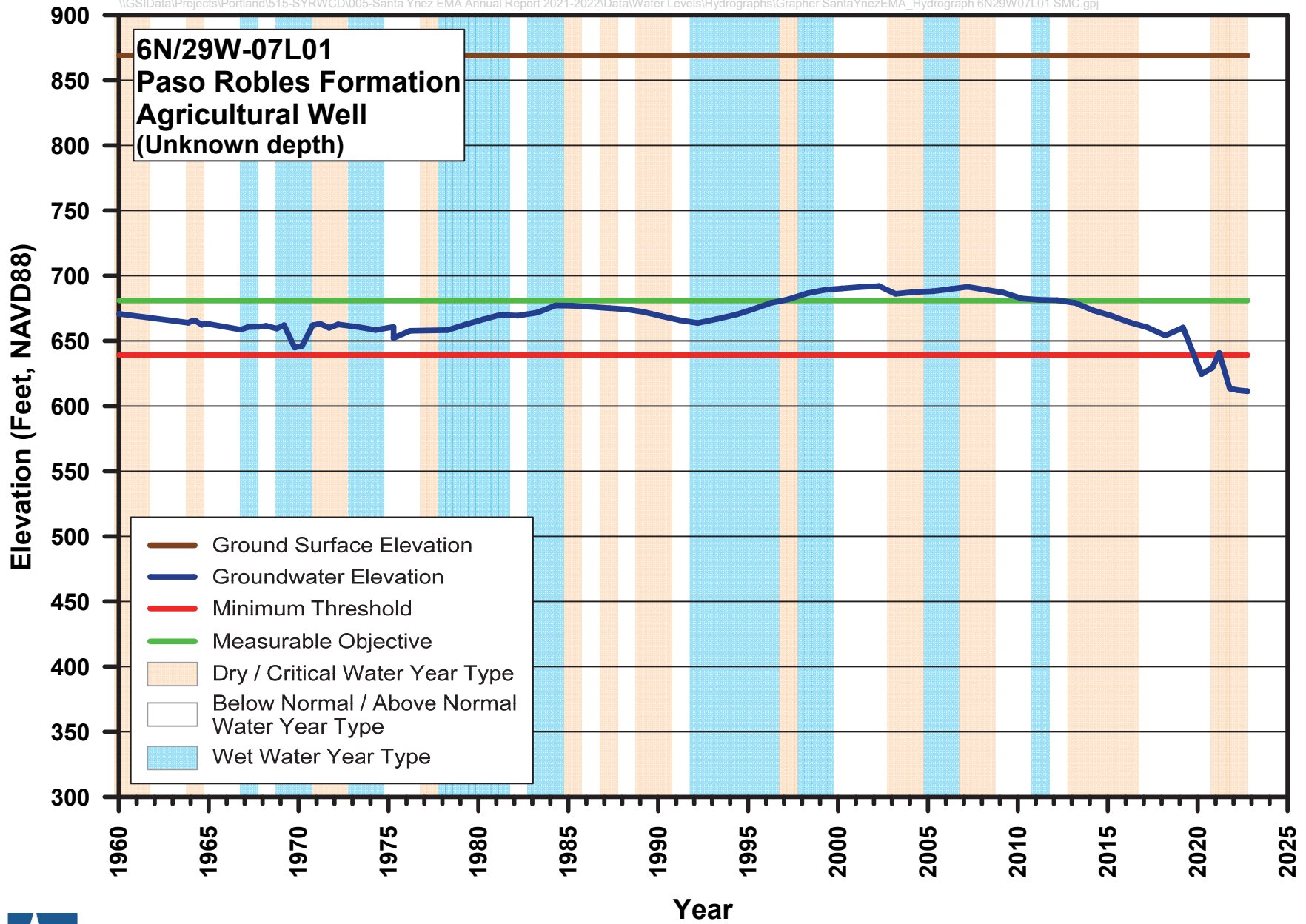
- Careaga Sand
- Paso Robles Formation
- Monitored by Santa Barbara County Water Agency

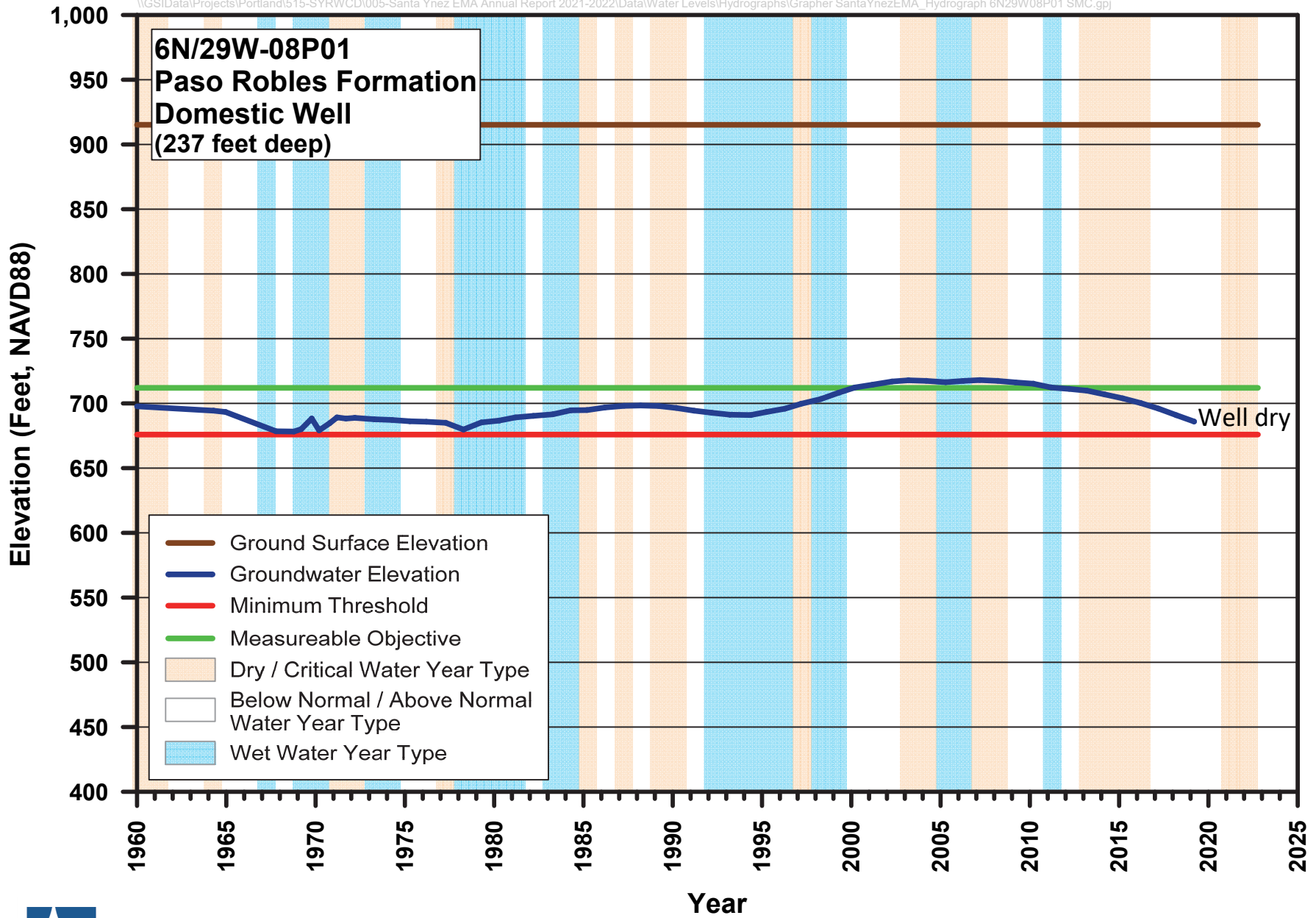
**All Other Features**

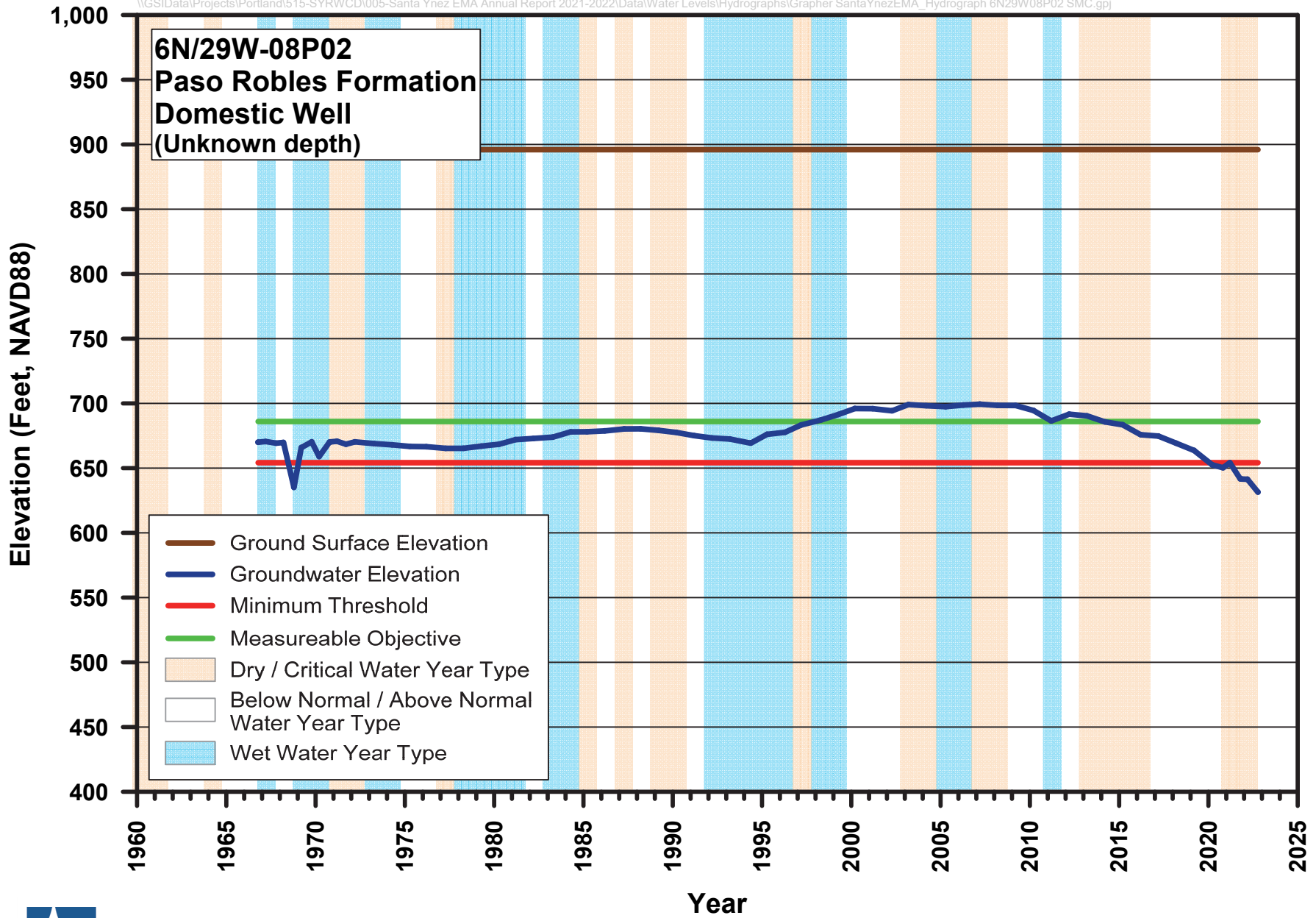
- Eastern Management Area Basin Boundary
- Major Road
- ~ Watercourse
- ~ Waterbody

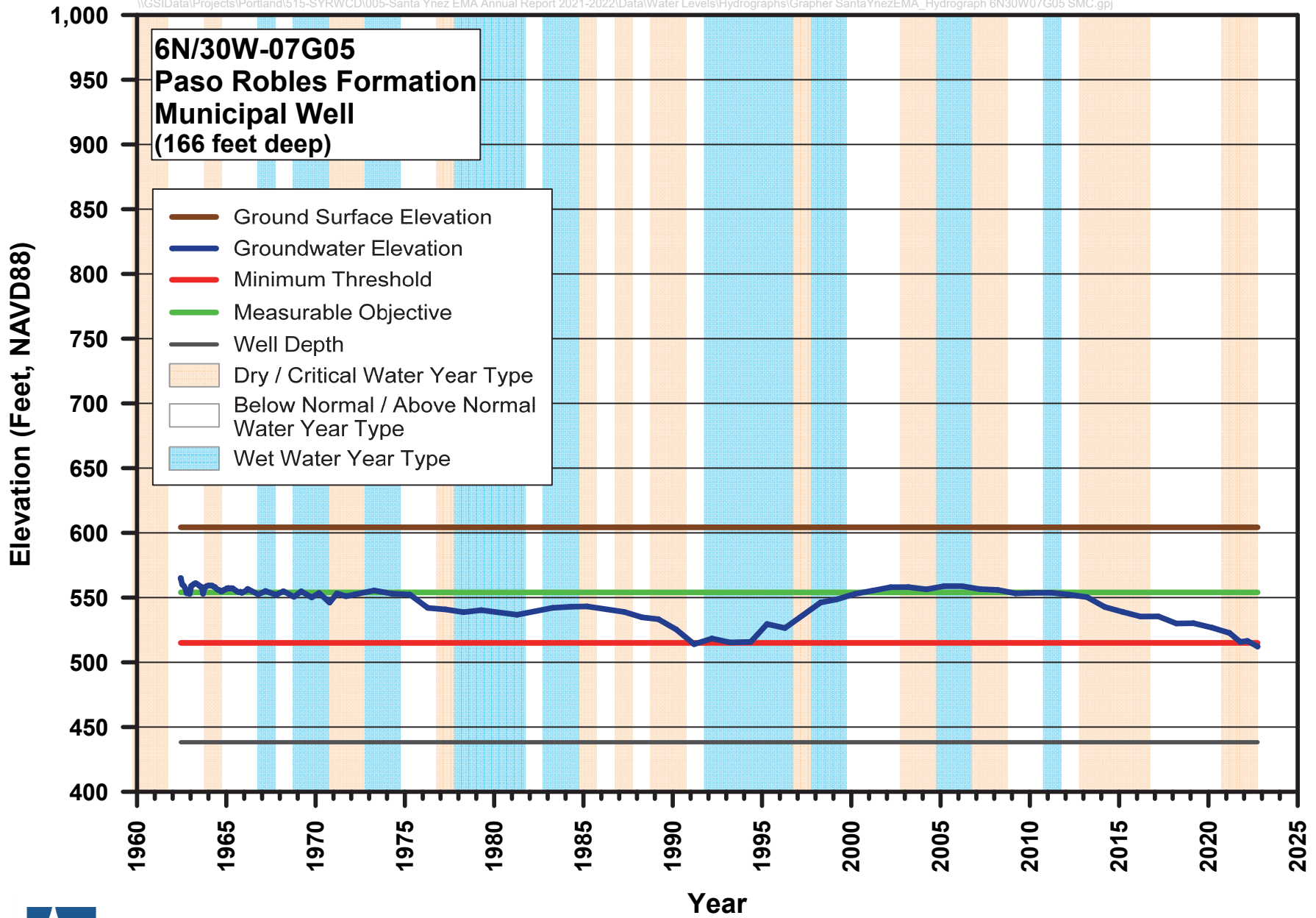


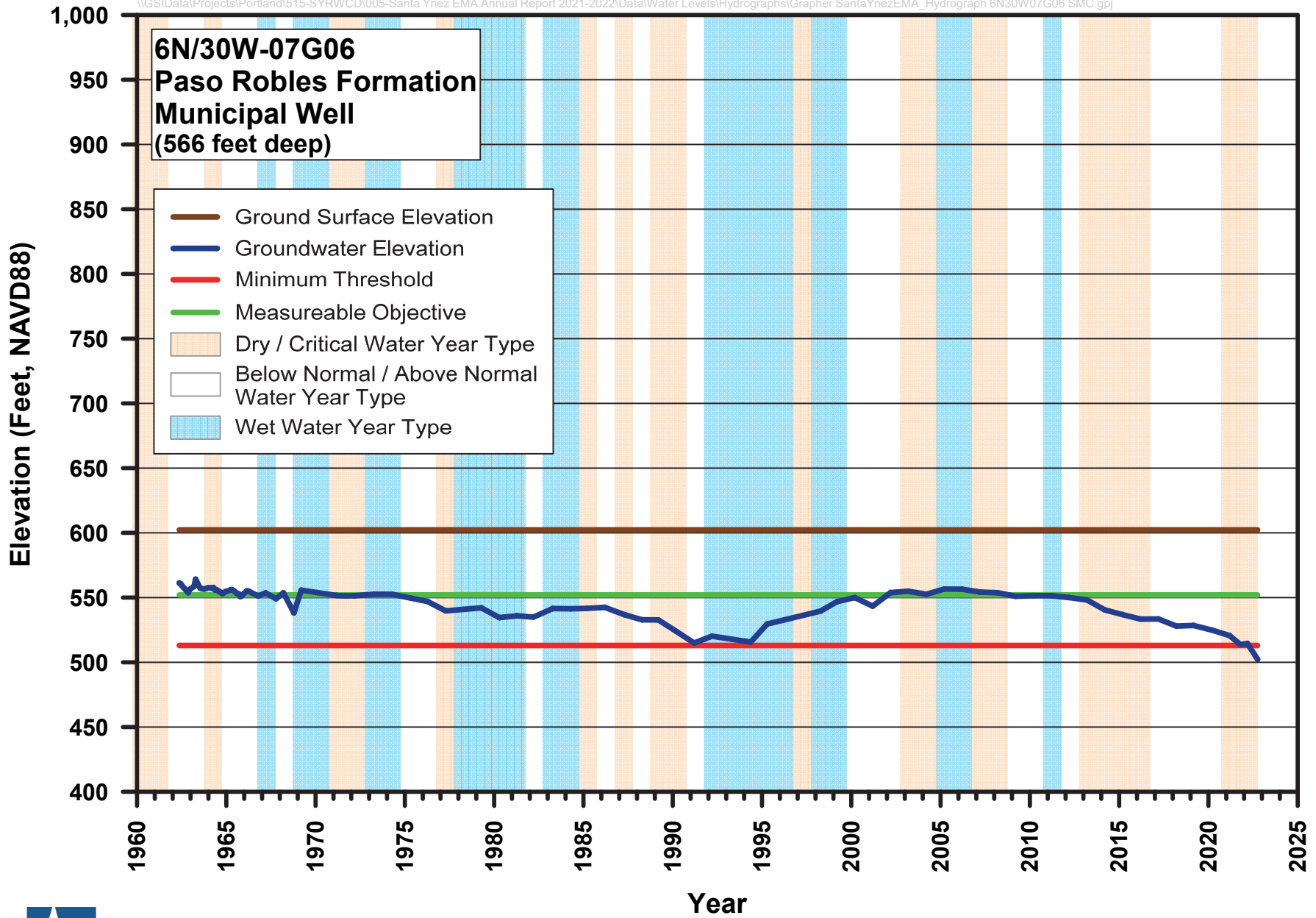
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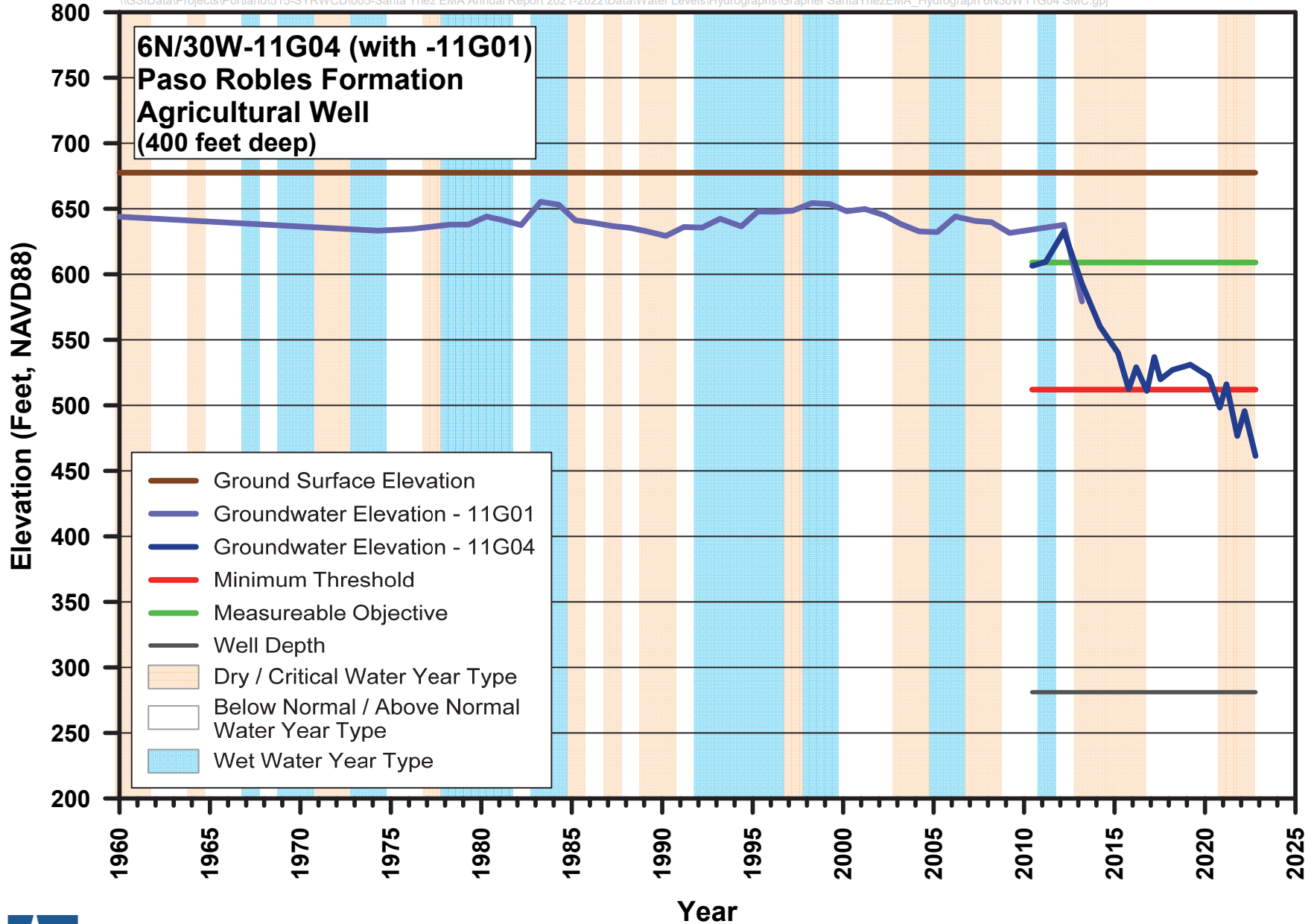




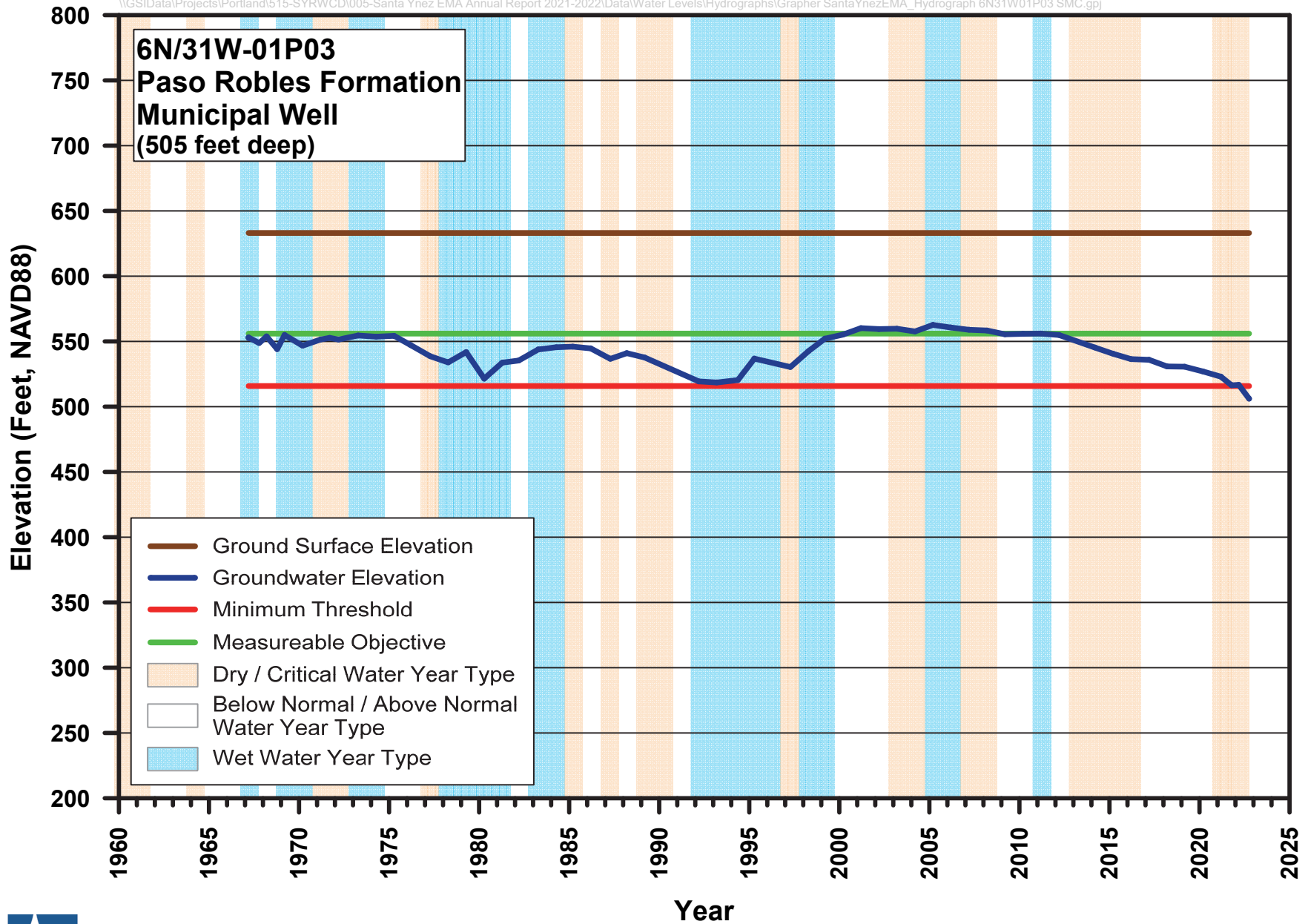


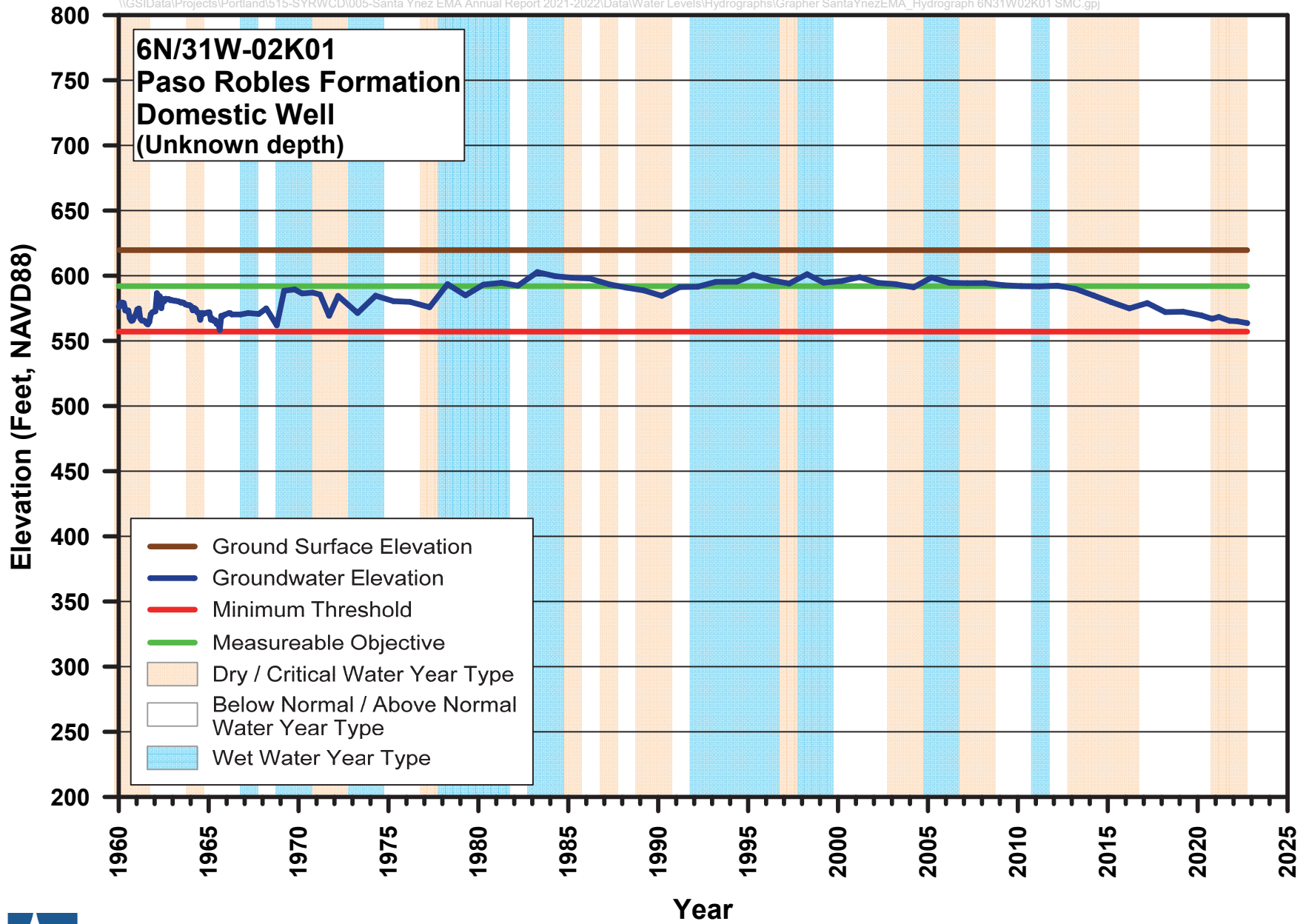


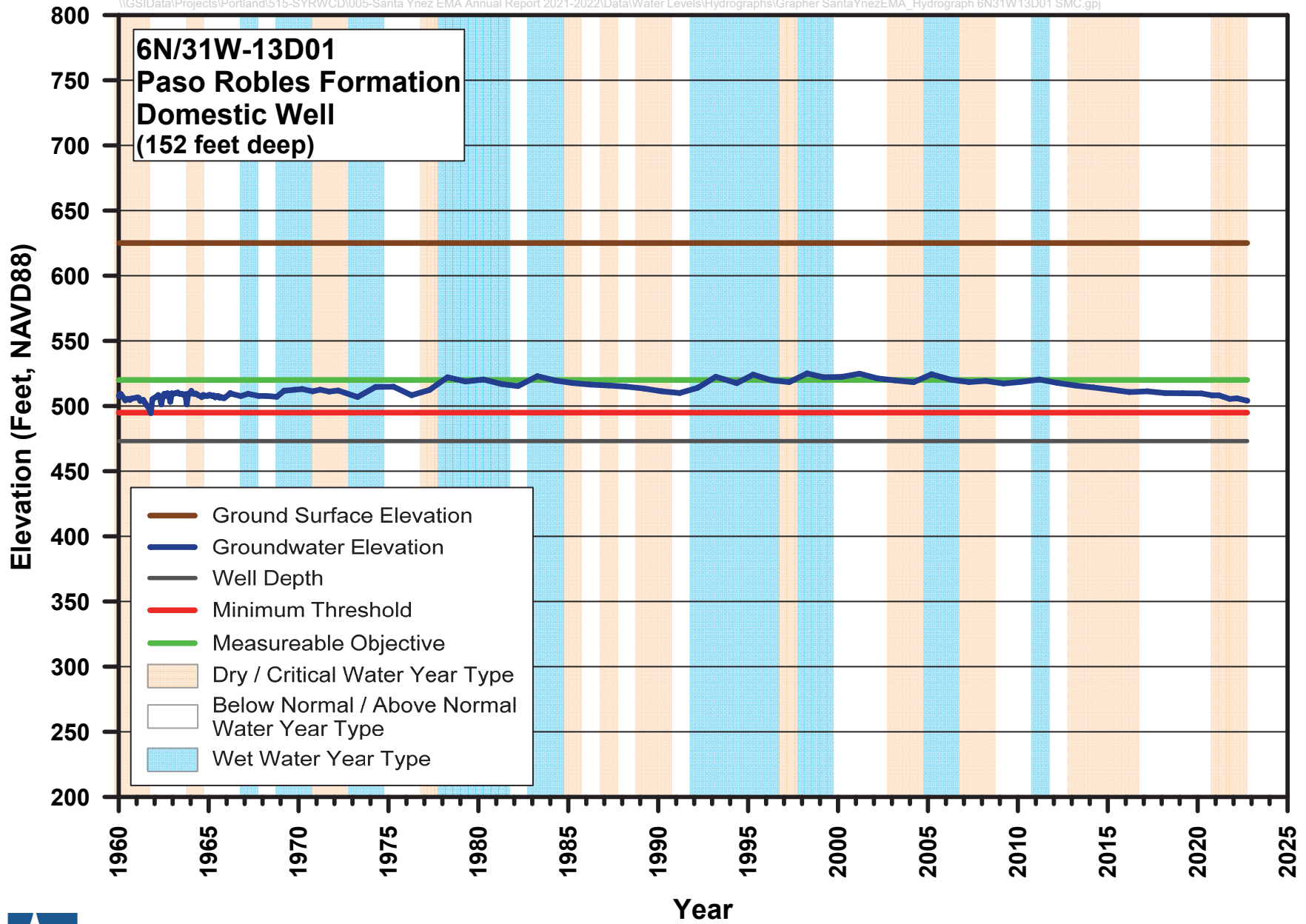


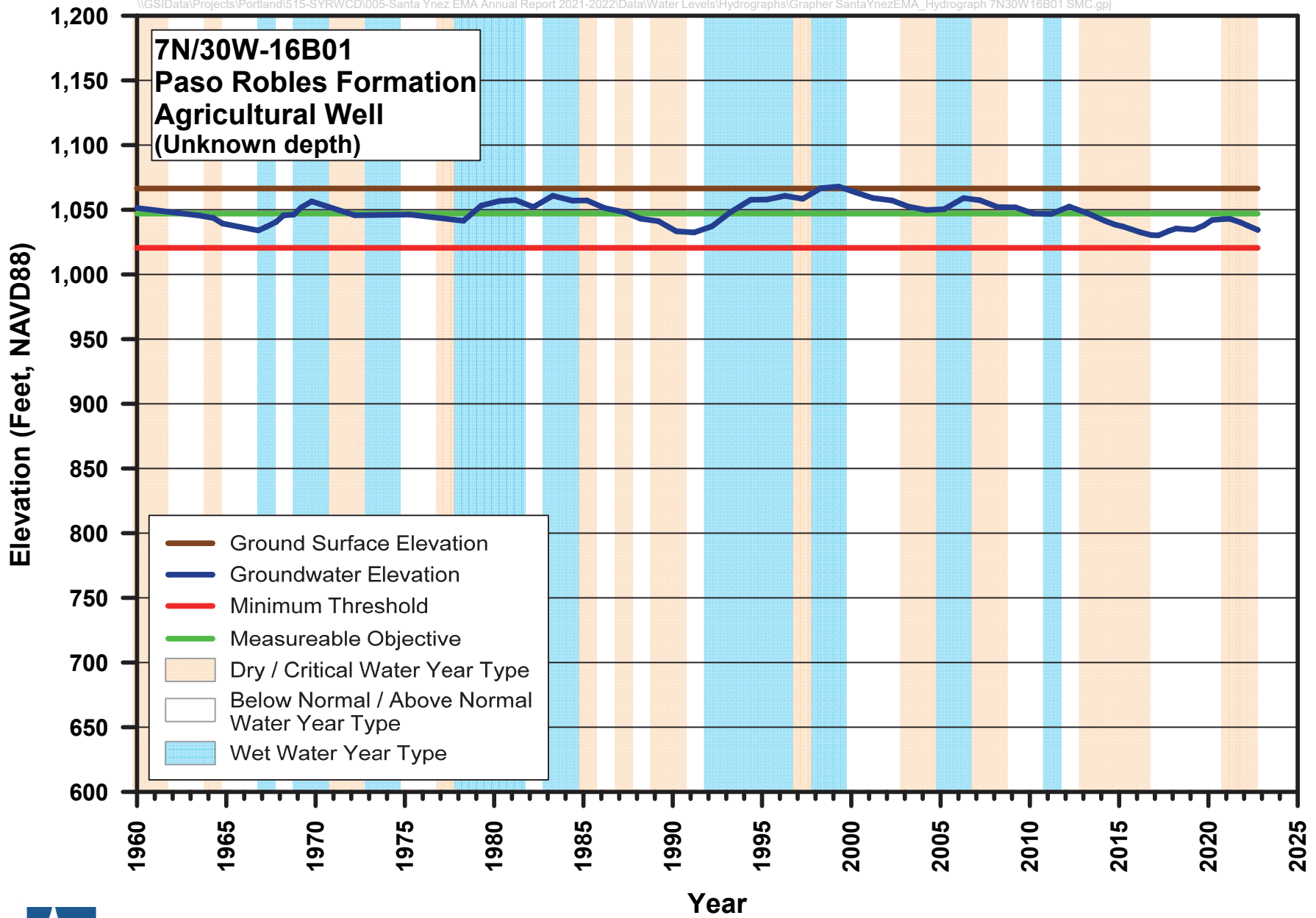


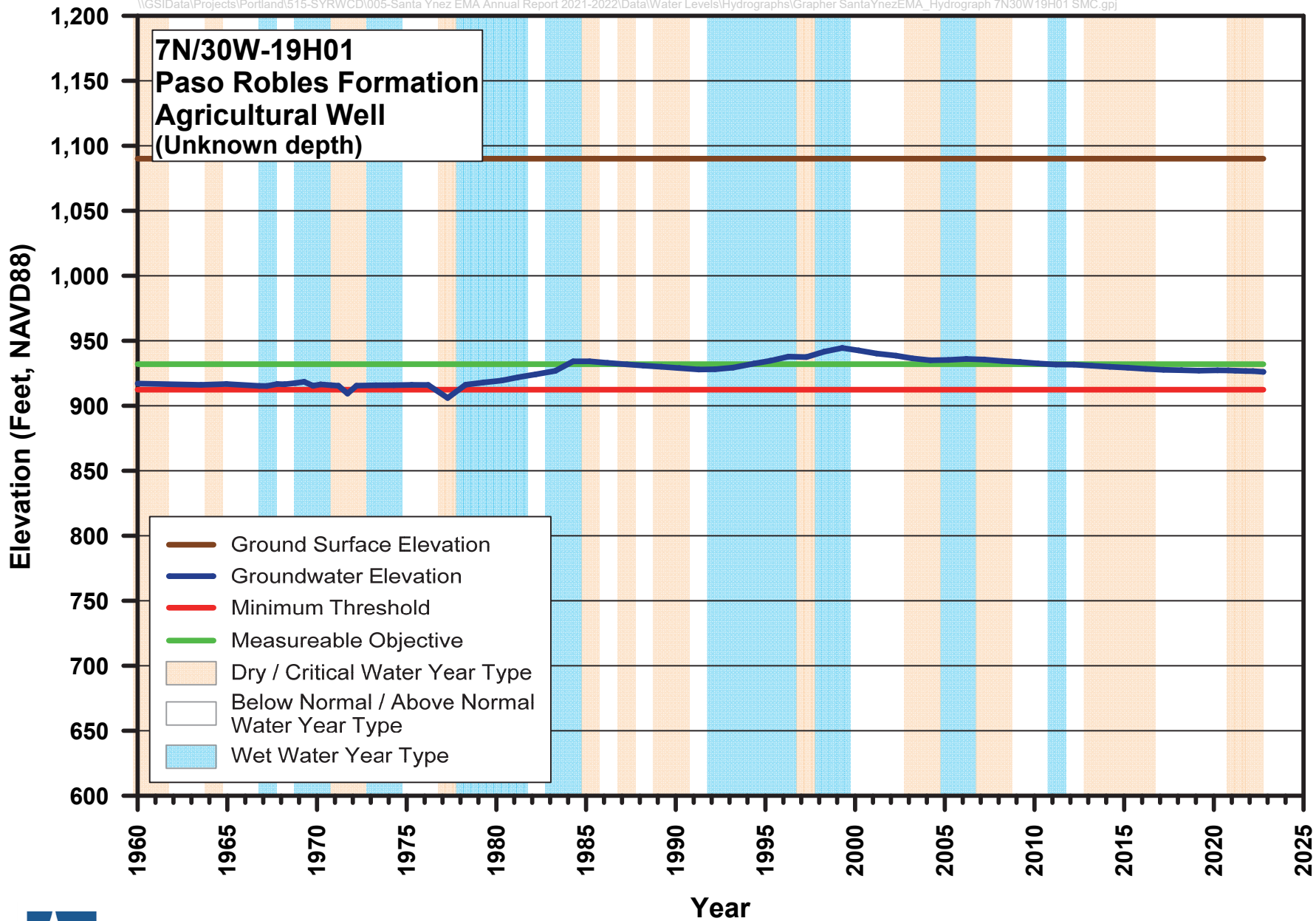


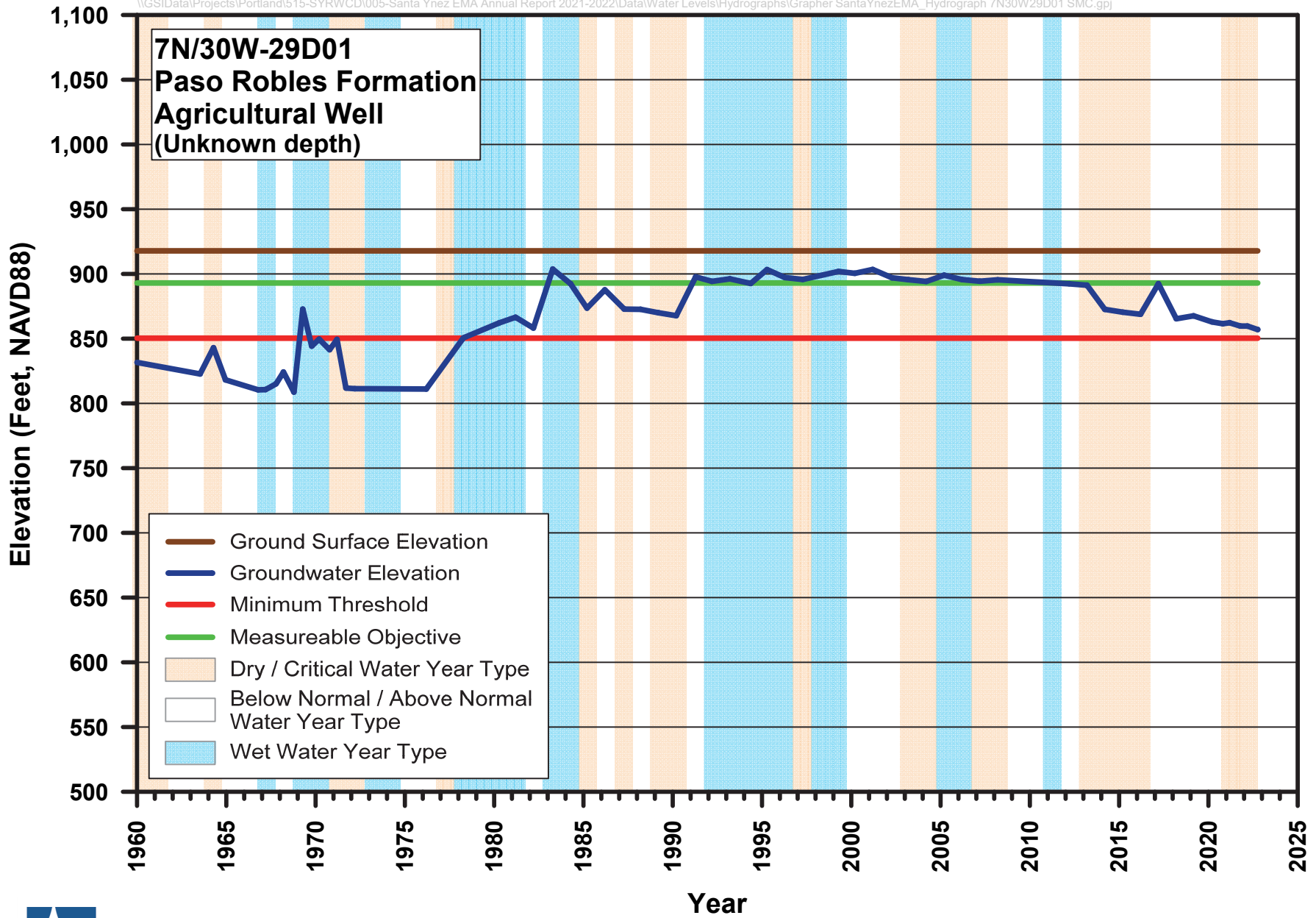


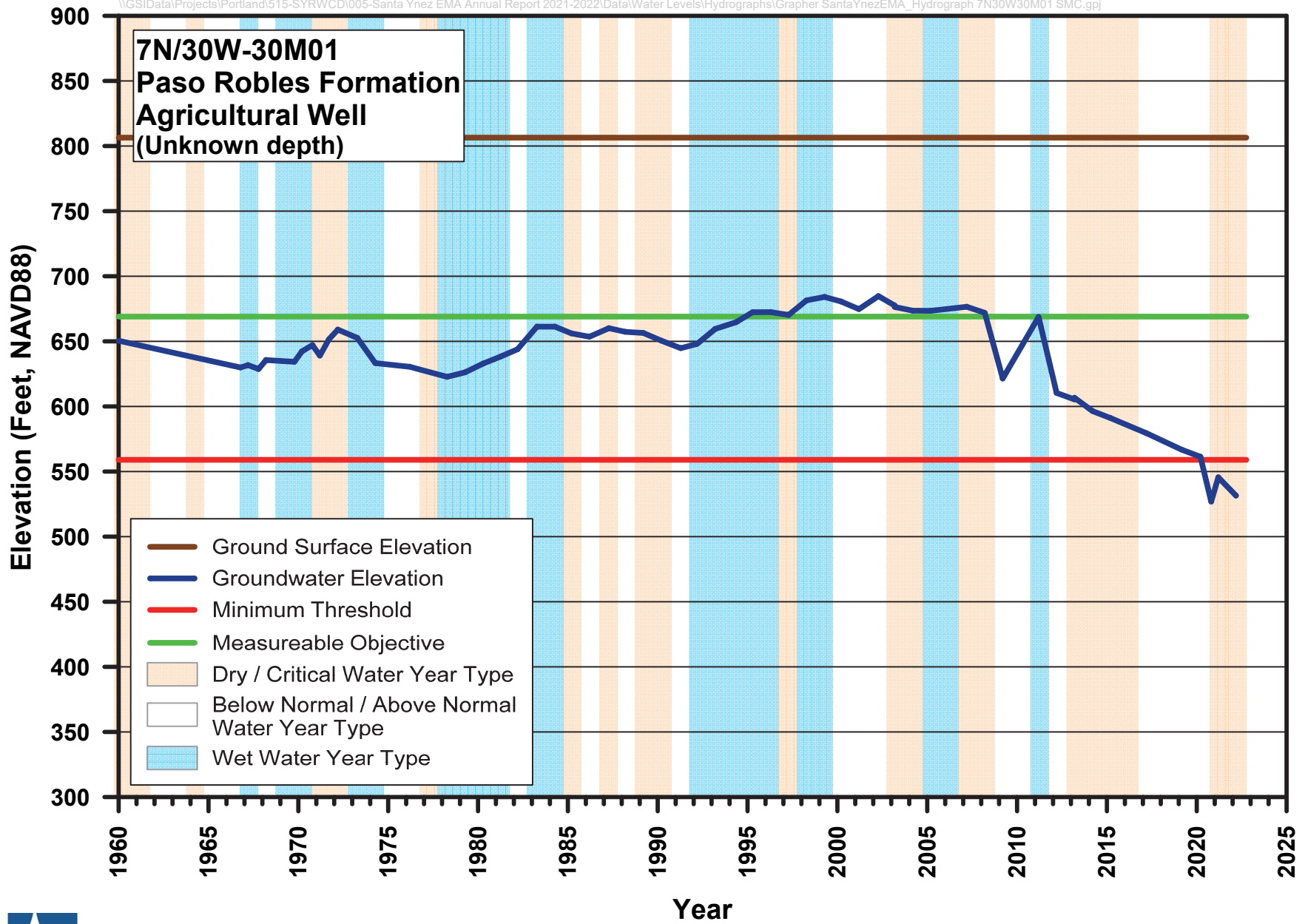


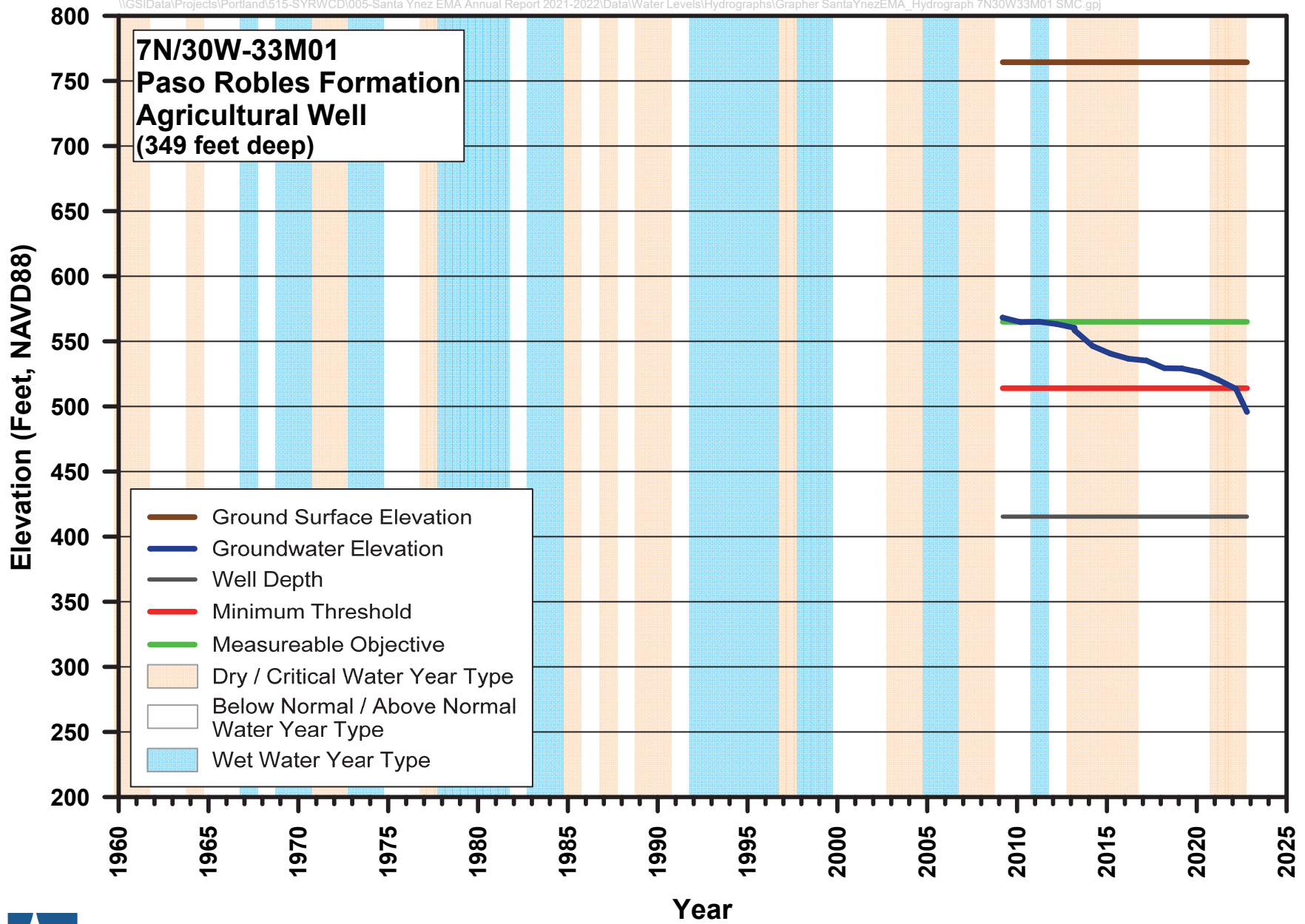




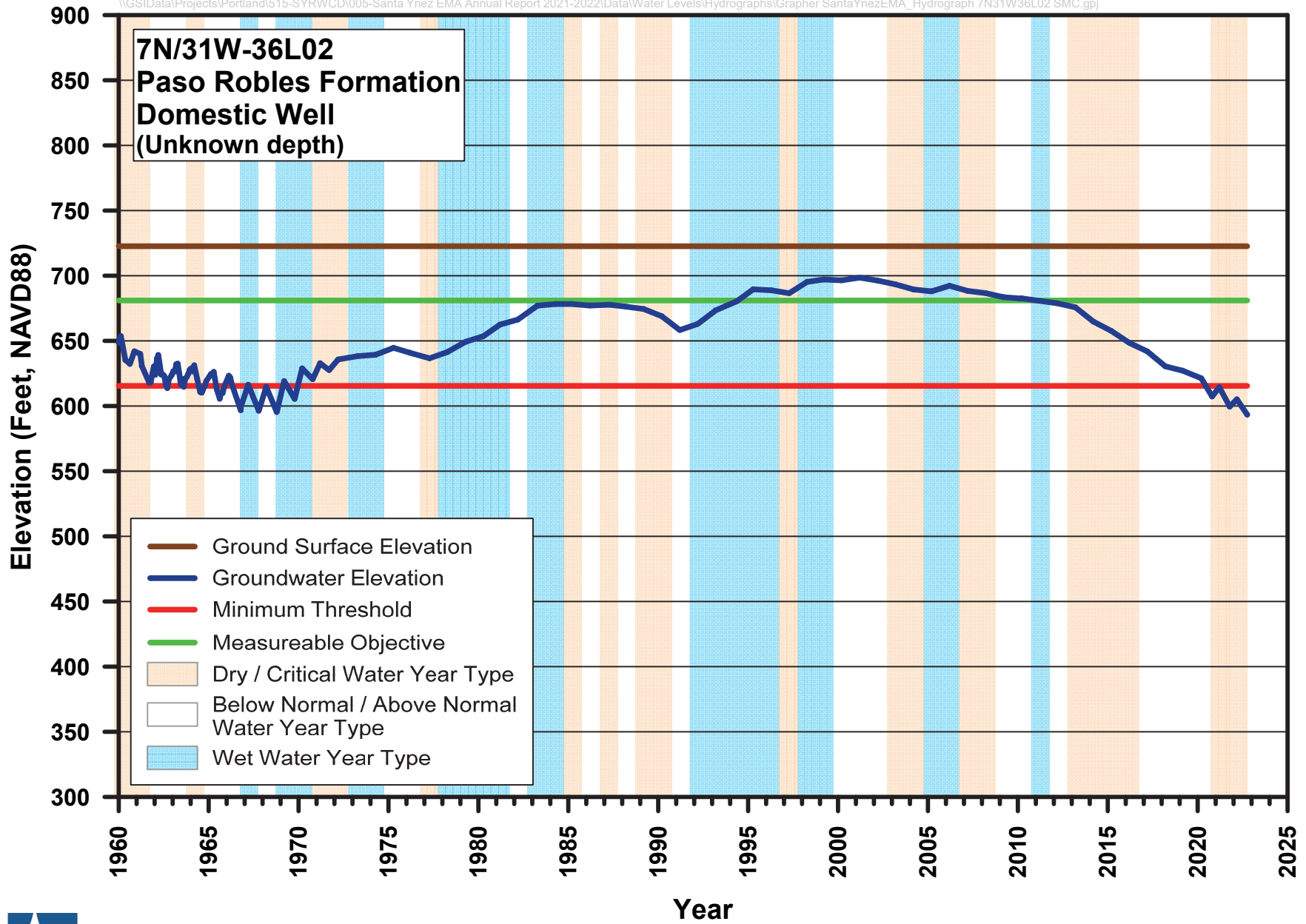


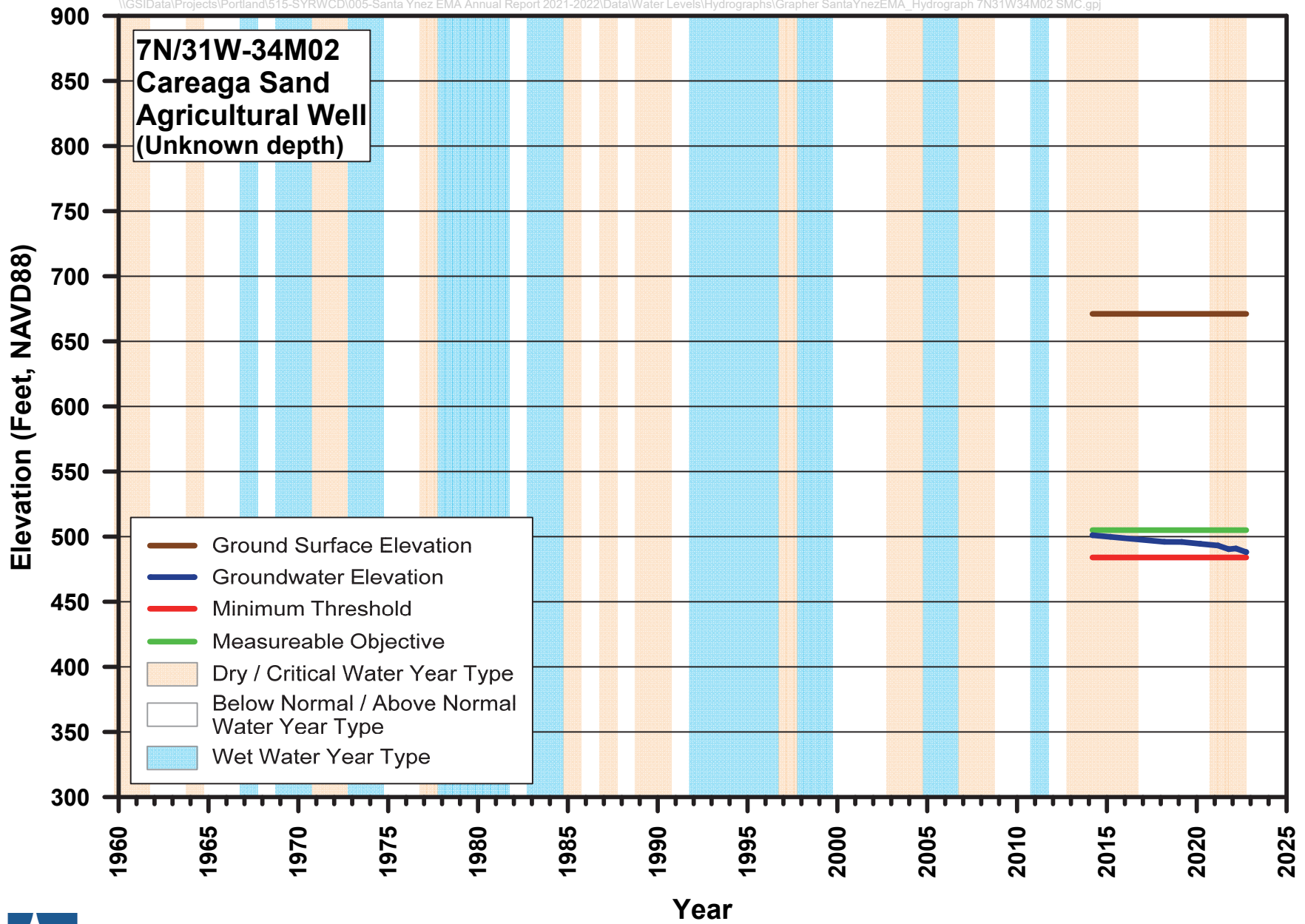


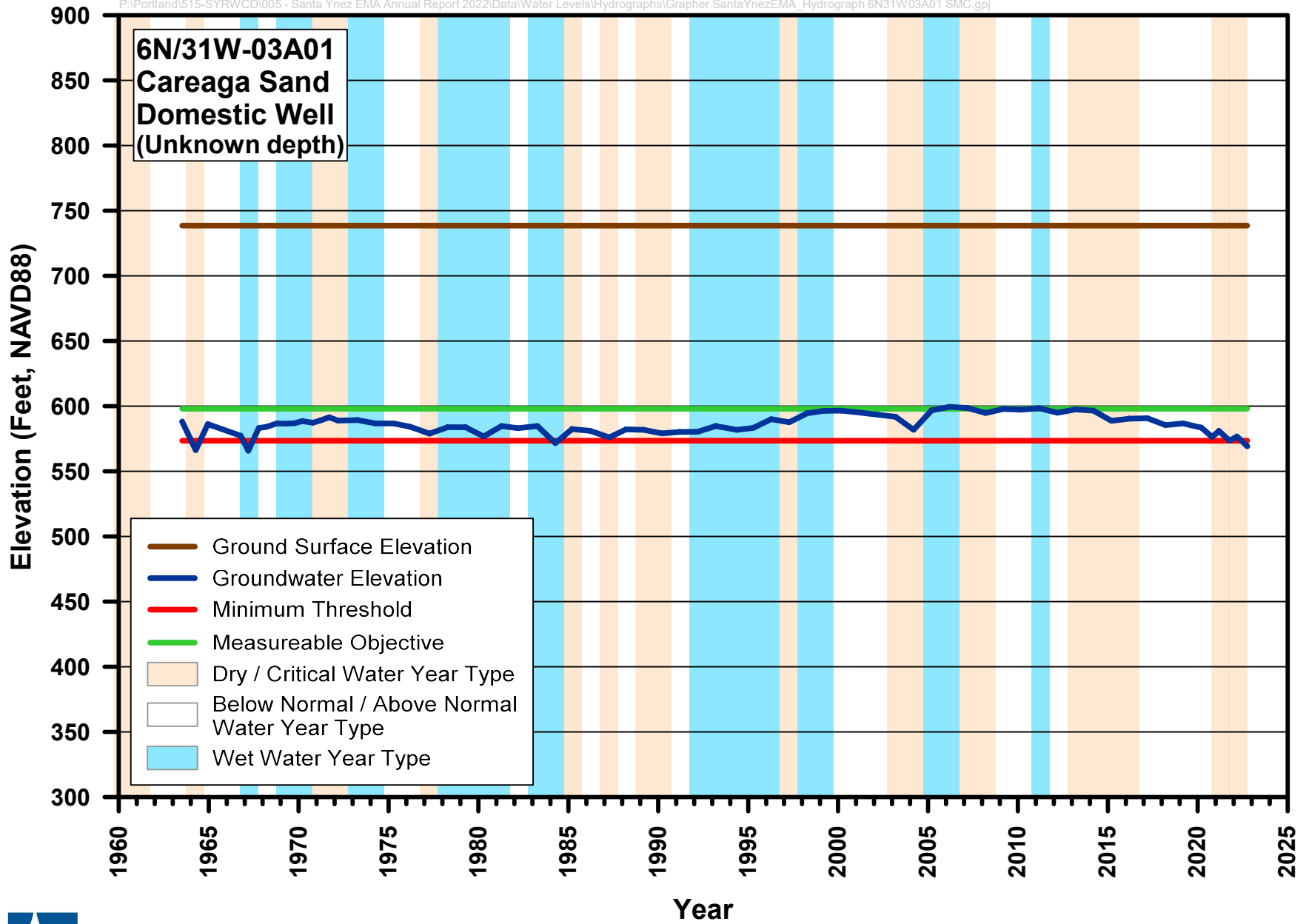


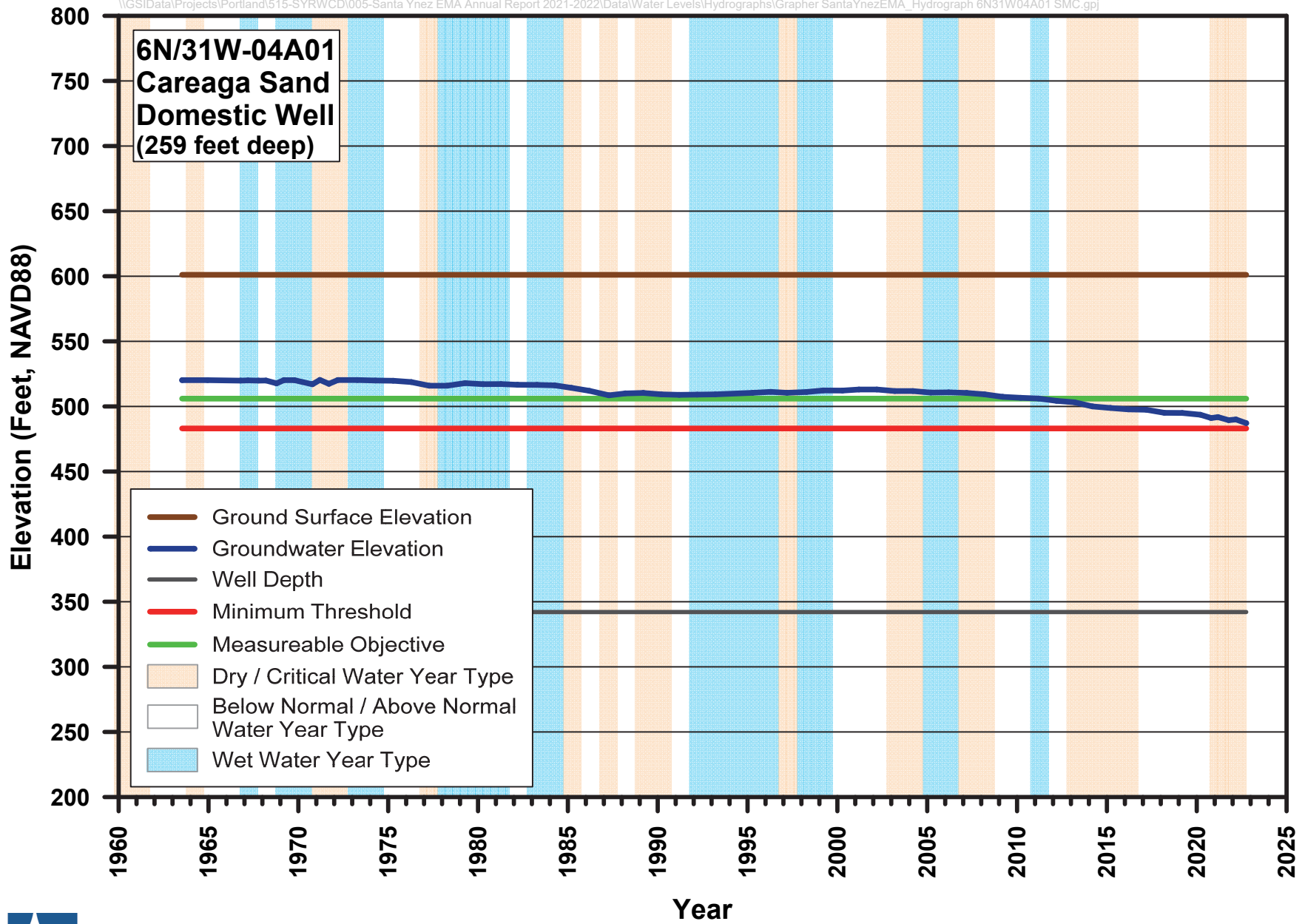


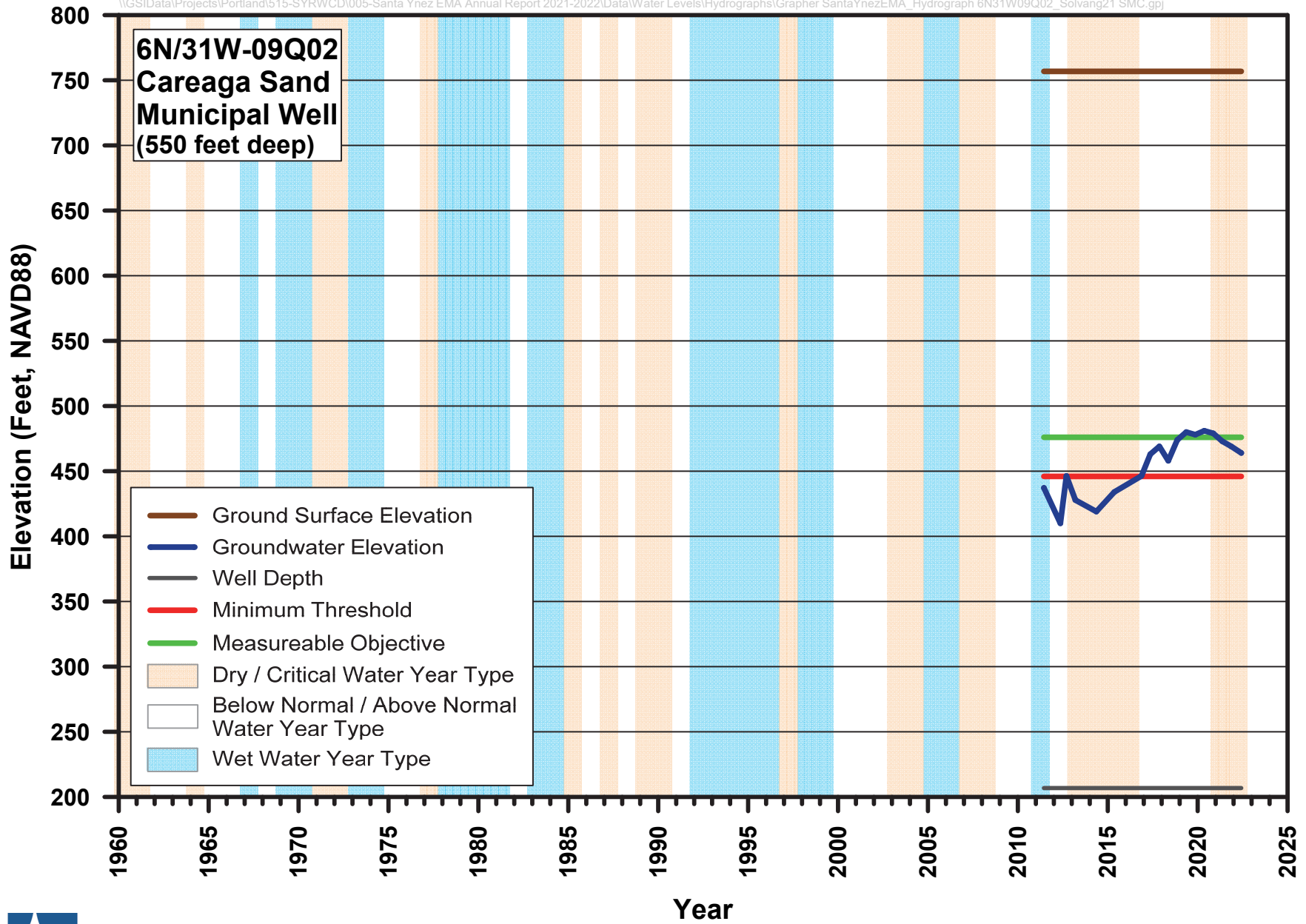


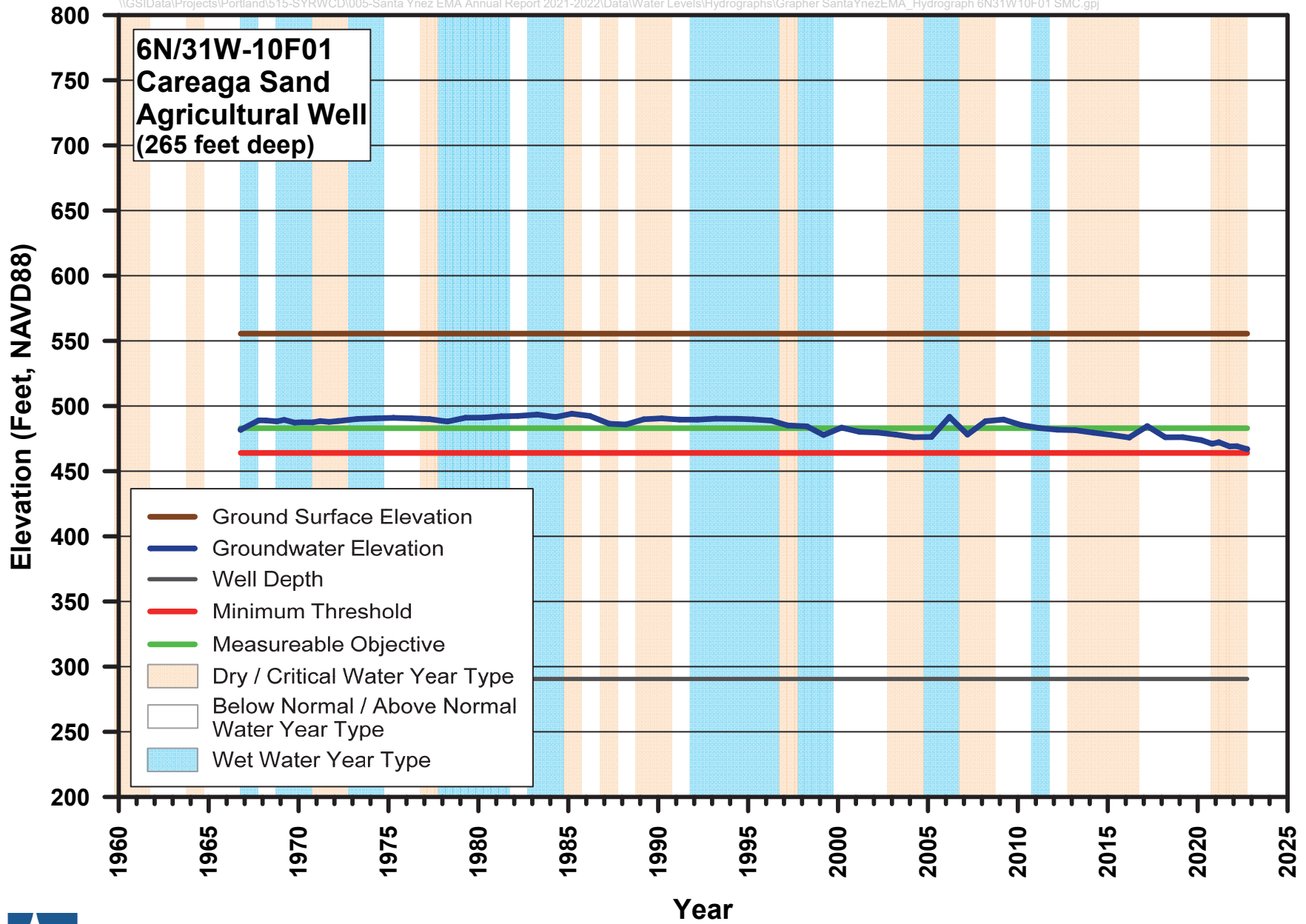


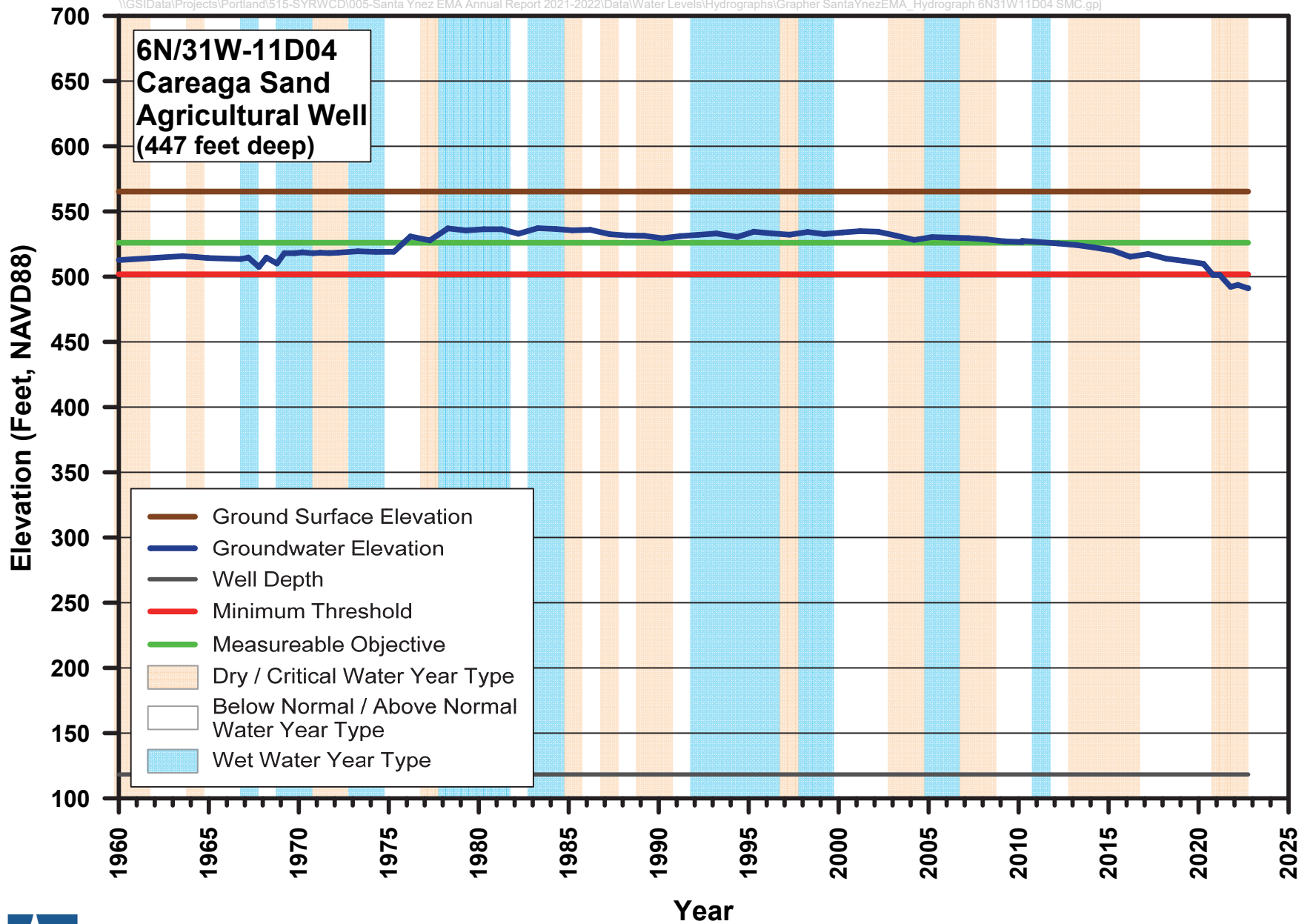


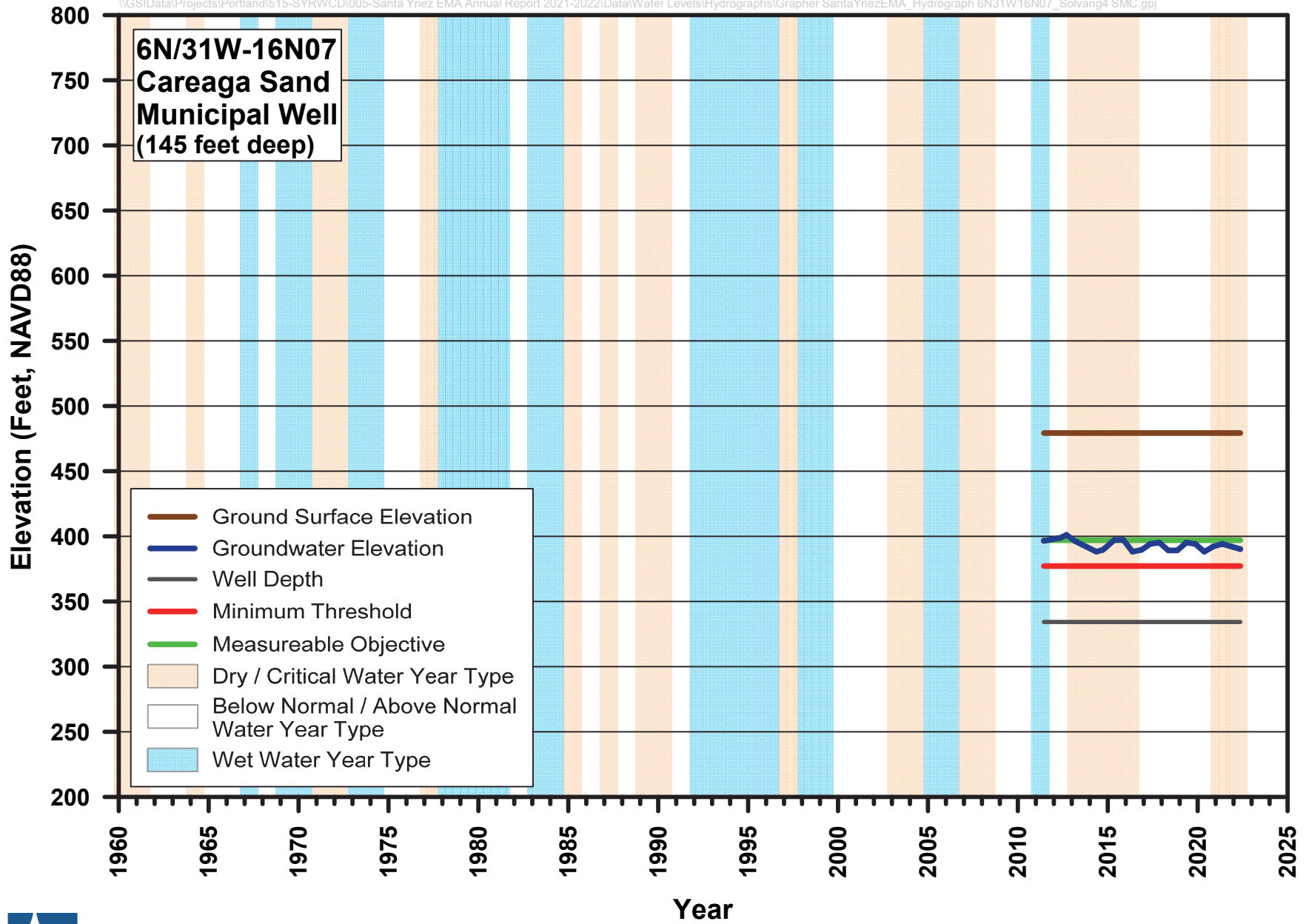




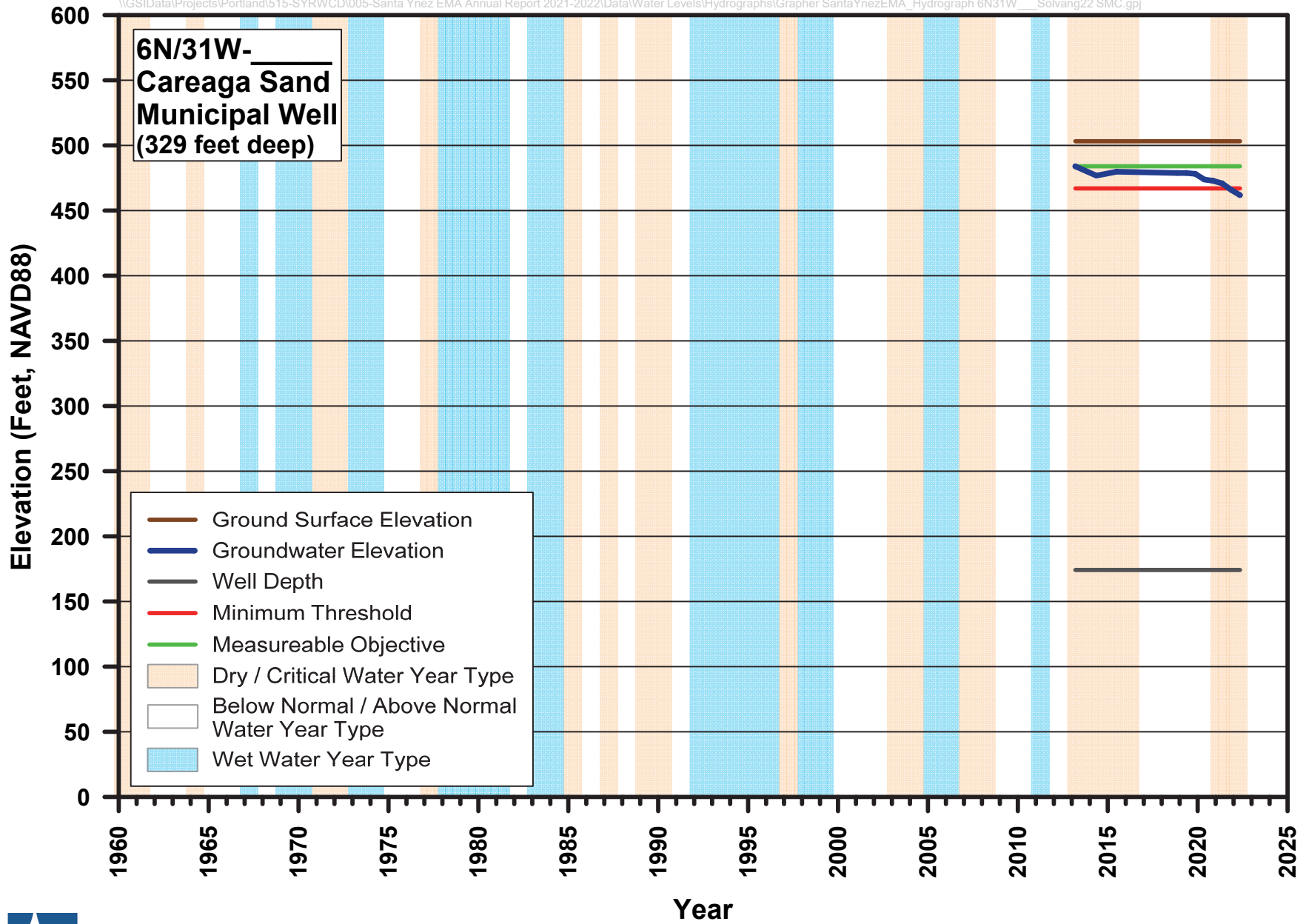


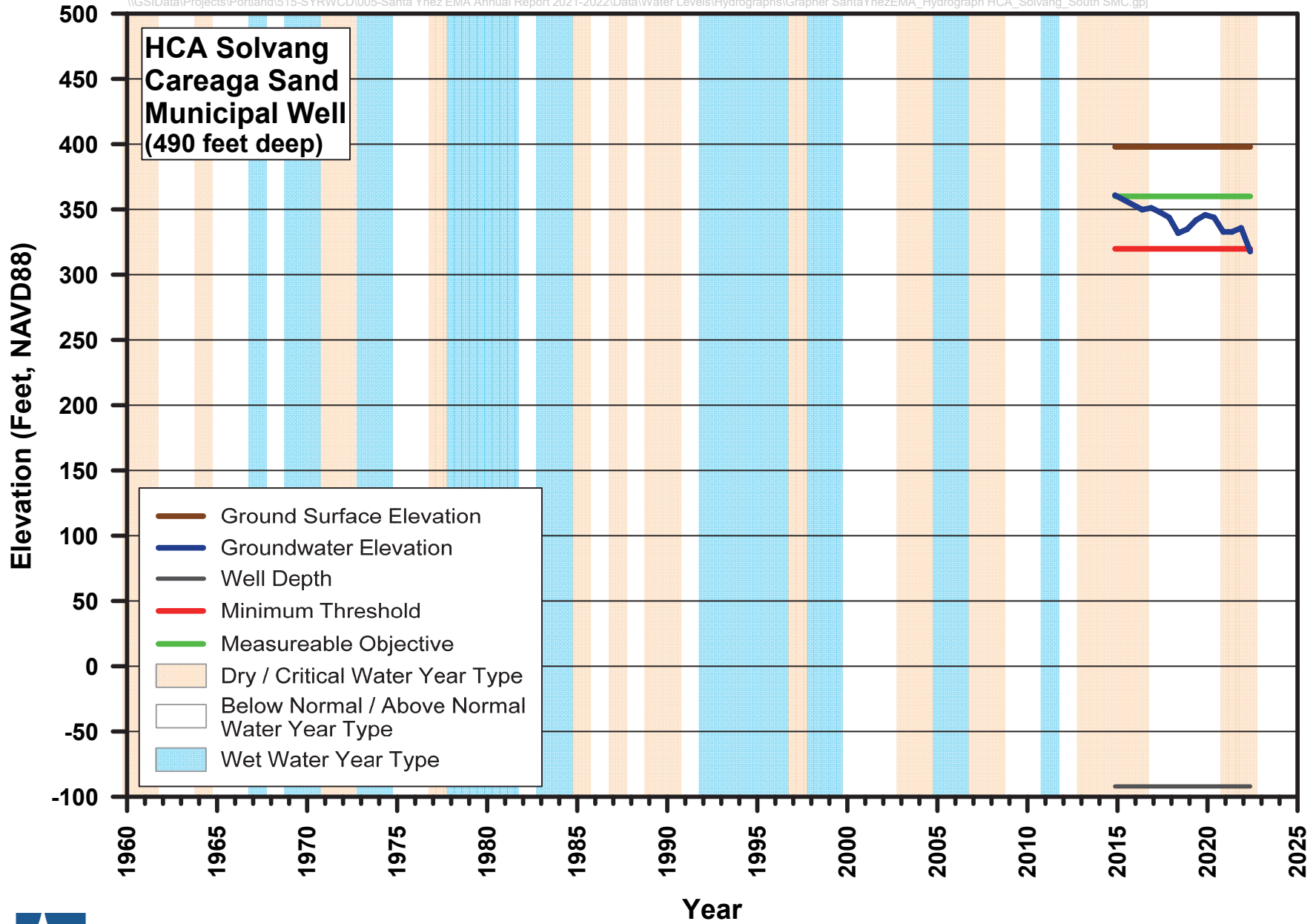






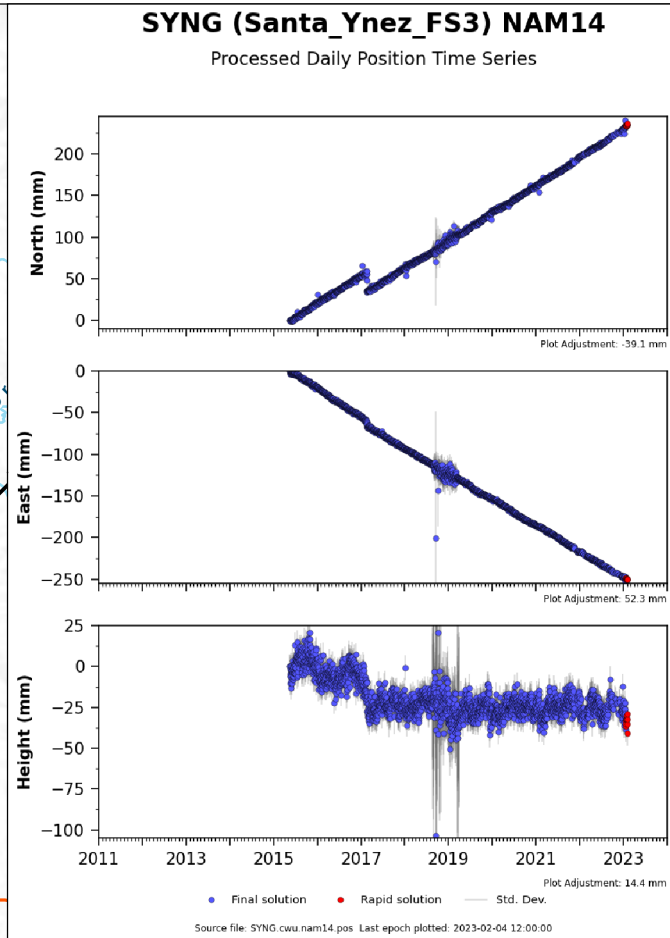
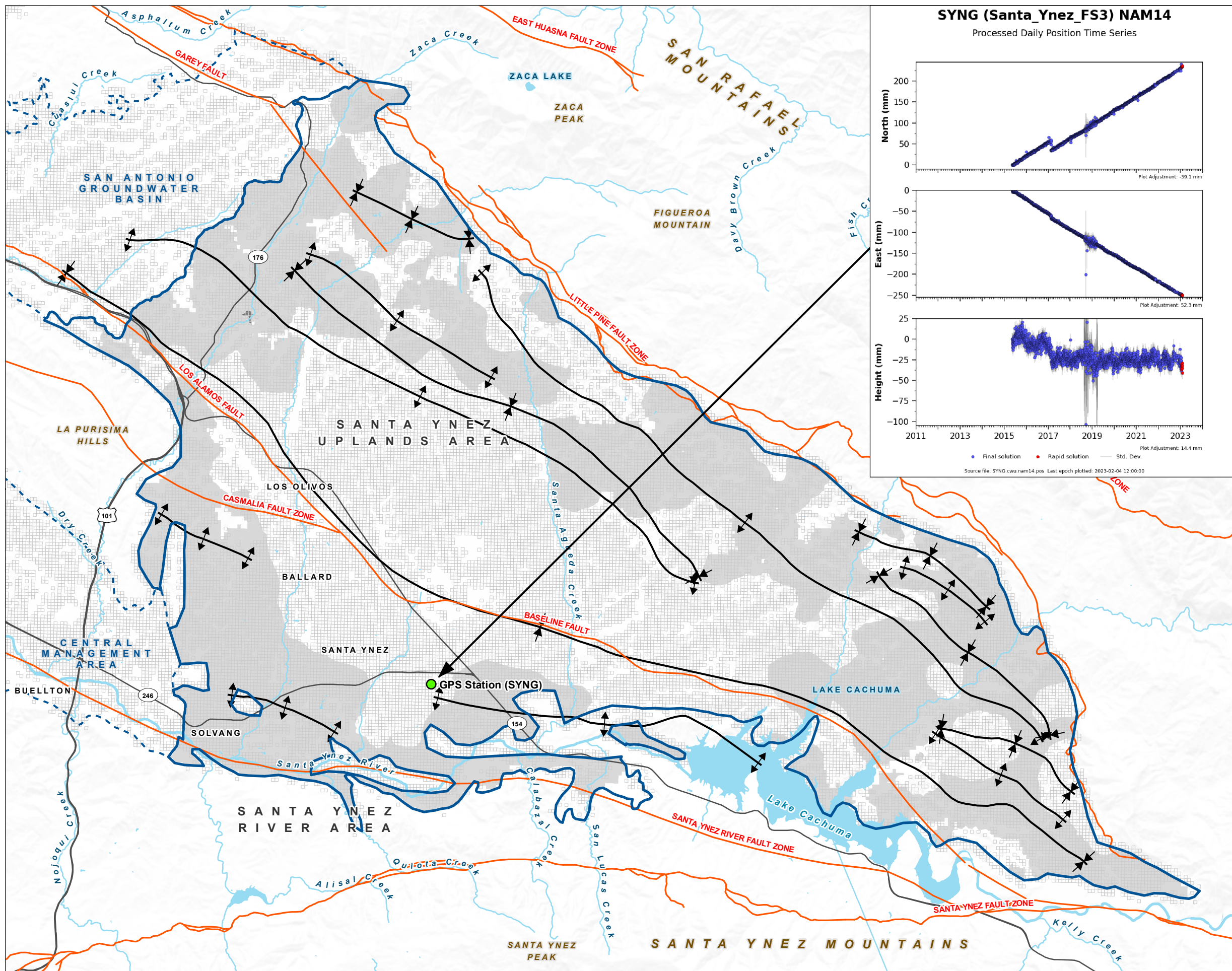






## APPENDIX D

Land Subsidence Data



**FIGURE D-1**  
**Land Subsidence**  
 Annual Report Water  
 Year 2022  
 for the Santa Ynez River Valley  
 Groundwater Basin,  
 Eastern Management Area

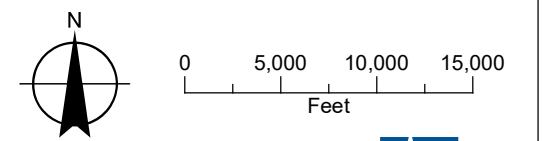
**LEGEND**

- Vertical Displacement Point Data Location Q4 2022
- GPS Station SYNG
- Interpolated InSAR Raster of Cumulative Displacement, 6/13/2015 - 10/1/2022**
- Vertical Displacement (InSAR)*
- 0.0 to 0.09
- 0.1 to 0.11 (max)
- Geologic Structures**
- Fault
- Fold Axes**
- ↕ Anticline
- ↕ Syncline
- All Other Features**
- Eastern Management Area Bulletin 118 Boundary
- Other Bulletin 118 Groundwater Basin Boundary
- Major Road
- Watercourse
- Waterbody

**NOTES**

InSAR accuracy for the period shown is 0.1 feet.  
 InSAR results less than this value are not considered to be evidence of actual subsidence

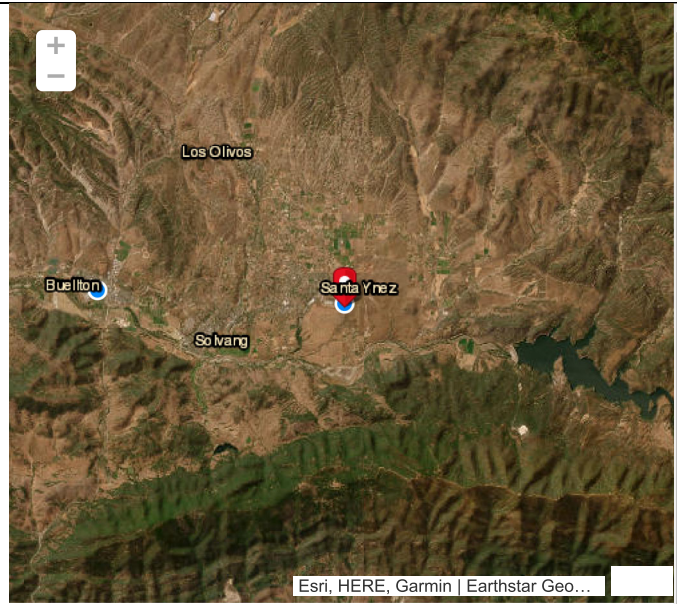
Areas outside of the InSAR point data grid do not have raw data.



Date: March 9, 2023  
 Data Sources: ESRI, USGS, Maxar 2019

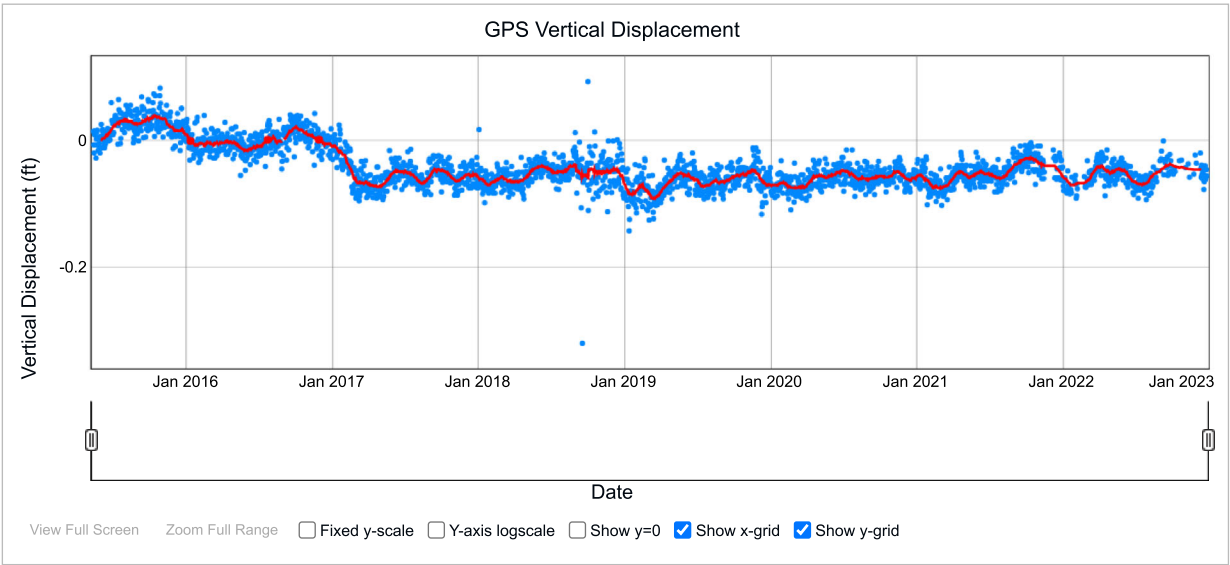
### GPS Station ID: SYNG

**Station ID:** SYNG  
**Latitude:** 34.60723222  
**Longitude:** -120.0695593  
**HR Name:** Central Coast  
**Basin:** 3-015 SANTA YNEZ RIVER VALLEY  
**Sub Basin:** 3-015 SANTA YNEZ RIVER VALLEY  
**Start Date:** 31-May-2015  
**End Date:** 12-Dec-2022  
**POR Vertical Displacement:** -0.047 ft.



GPS Data

**Date:** (hover to see values)  
 — Vertical Displacement: — Vertical Displacement 31 Day Ave:



CSV   Excel   Search:

Date	Vertical Displacement (ft)	Vertical Displacement 31-Day Ave (ft)
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