Eastern Management Area Groundwater Sustainability Agency

Santa Ynez River Valley Groundwater Basin - Eastern Management Area Annual Report Water Year 2023

March 20, 2024

EMA

Santa Ynez River Valley Groundwater Basin
Eastern Management Area
Groundwater Sustainability Agency

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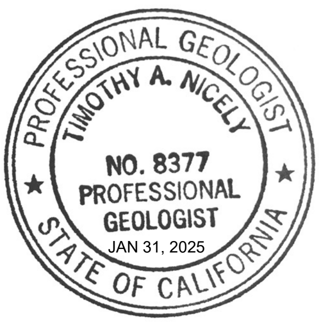
Santa Ynez River Valley Groundwater Basin
Eastern Management Area
Annual Report for Water Year 2023

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.



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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

This DRAFT Annual Report Water Year 2023 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 Annual Reports each year 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 Annual Report for the EMA documents conditions and progress towards implementing the Plan during water year 2023, which occurred between October 1, 2022, and September 30, 2023.

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 elevations within both principal aquifers have generally risen during water year 2023 relative to the previous spring in response to increased precipitation and reduced pumping but remain generally lower than the spring of 2018 elevations presented in the Plan. The groundwater elevations in the Paso Robles Formation representative monitoring wells have risen by an average of 4 feet between the spring of 2022 and 2023. During this period, water elevations in 5 of 14 Paso Robles Formation representative wells with water level data rose, but the degree of the water level rises of as much as 15 to 35 feet, have been greater than the degree of the water level declines. Between the fall of 2022 and 2023, the water levels in the representative Paso Robles Formation wells have risen even more, by an average of 11 feet. During this period, groundwater elevations in 11 of 14 representative wells rose[1].

Likewise, groundwater elevations in the representative Careaga Sand wells have risen during water year 2023 relative to the previous spring by an average of almost 3 feet, but generally remain lower than the spring 2018 elevations presented in the Plan. During the period between the fall of 2022 and 2023, groundwater elevations in the Careaga Sand representative wells have risen by more than 5 feet on average, with rises of as much as 28 feet. A single well of the 9 representative Careaga Sand wells declined by 19 feet during this period[2]..

During the spring of Water Year 2023, 62% of the representative wells within the Paso Robles Formation wells (8 of 13 with water level data) remained below the minimum threshold values, as shown on Table ES-1. In the Careaga Sand, the water elevations in all of the 9 representative Careaga Sand wells

were below the minimum threshold values in the spring of 2023.

Table ES-1. Progress Towards Sustainability

(Values represent percentage of representative wells below minimum threshold)

Water Year	Period	Paso Robles Formation Wells	Careaga Sand Wells
2019	Spring	0	0
2020	Spring	20	0
	Fall	55	N/A
2021	Spring	13	11
	Fall	50	22
2022	Spring	46	11
	Fall	62	33
2023	Spring	62	0
	Fall	50	22

The wells included in the representative monitoring network documented in the Plan are subject to change during Plan the implementation period. Specifically, one of the representative Paso Robles formation wells (-08P01) is no longer considered to be representative of the Paso Robles Formation and has been removed from the representative monitoring well network.

The water year type for Water Year 2023 was “wet.”

ES-3 Groundwater Extractions

The total annual volume of groundwater extracted from the two principal aquifers in the EMA during Water Year 2023 was approximately 12,900 acre-feet (AF). Table ES-2 summarizes the metered and estimated groundwater extractions by water use sector for recent water years for comparison.

[1] A single instance of an apparent groundwater elevation rise of 81 feet in one representative Paso Robles Formation well between the fall of 2022 and 2023 is attributed to an erroneous groundwater level measurement in the fall 2022 period, likely influenced by recent pumping.
[2] The reasons for the larger than average decline in this one well is not known.

Table ES-2. Groundwater Extractions by Water Use Sector

(Values in acre-feet)

Water Year	Municipal and Self-Reported Domestic	Mutual Water Companies	Rural Domestic	Agriculture	Total
2019	1,431	951	305	12,278	14,965
2020	1,880	957	307	11,812	14,956
2021	2,320	963	309	13,379	16,971
2022	2,516	969	311	13,264	17,060
2023	2,516	975	313	9,099	12,903

ES-4 Surface Water Supply

The total annual volume of surface water used in the EMA for Water Year 2023 was approximately 4,800 acre-feet (AF). The volume of surface water supply that was used in the EMA in Water Year 2023 is presented on Table ES-3. 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-3. 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[1]	Total River Wells	Total
2019	759	50	2,213	160	739	1,658	2,557	5,579
2020	745	315	1,740	148	567	1,566	2,281	5,081
2021	612	0	1,439	240	1,142	1,775	3,157	5,208
2022	590	0	544	270	1,632	1,478	3,380	4,514
2023	495	189	615	316	939	2,245	3,500	4,799

Notes

[1] Includes other river wells reported to the Santa Ynez River Water Conservation District.

ES-5 Change in Groundwater in Storage

As further described in Section 2.4.2 and Section 3.1 below, the current groundwater monitoring network for the Paso Robles Formation, the most extensive principal aquifer within the EMA, has less than ideal spatial distribution to adequately represent groundwater conditions throughout the Santa Ynez Uplands where this aquifer is present. Due to loss of access to several wells, the groundwater elevation monitoring network used for contouring groundwater elevations for both the Paso Robles Formation and Careaga Sand provided greater spatial coverage of the EMA in the past compared to the data available for the current water year. 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 2023 from the comparison of spring groundwater elevation contour maps from one year to the next. That is, the spring 2022 groundwater elevations for the Careaga Sand (Figure 10) were subtracted from the spring 2023 groundwater elevations (Figure 12) resulting in a map depicting the changes in groundwater elevations that occurred during the 2023 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 2023 is presented in Table ES-4. As shown, the volume of groundwater in storage increased by about 18,000 AFY during the wet Water Year 2023. While the overall volume of groundwater in storage has risen in Water Year 2023, the net volume of groundwater in storage has declined by approximately 5,152 AF since 2018 when the historical period presented in the Plan ended.

Table ES-4. 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
2019	3,047	996	4,043
2020	-1,662	-477	-2,139
2021	-12,737	-825	-13,562
2022	-10,983	-495	-11,478
2023	17,677	307	17,984

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 and awarded 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 2023 indicates recent rises in groundwater levels during the current water year, which have not yet risen in a majority of the wells to spring 2018 elevations presented in the Plan. The recent rise in groundwater elevations in most of the representative monitoring wells indicates an increase in total groundwater in storage, driven by the recent wet conditions and commensurate reduction of groundwater pumping.

Group 1 management actions have been started 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 groundwater elevations remain below the minimum thresholds in some representative wells, the number of wells falling below the minimum thresholds has not resulted in the observation of any undesirable results described in the Plan. 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 is monitored as part of implementation of the Plan. Ground surface elevations are estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR. The accuracy associated with the InSAR measurement and reporting methods is 0.1 feet (or 1.2 inches). A land surface elevation change of less than 0.1 feet is therefore within the noise of the data and indicates that no evidence of subsidence exists. Considering this, examination of the data between June 2015 and October 2023 show that no measurable land subsidence has occurred. The EMA GSA will continue to monitor and report annually on any subsidence.

Potential Groundwater Dependent Ecosystems (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 and will be assisted by DWR grant funds allocated toward this data gap project in the EMA. The extraordinary precipitation that occurred during the 2024 water year (to date) is expected to result in additional recovery of groundwater levels.

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.

The current water levels with the representative wells is presented relative to the minimum threshold values on Table ES-5.

Table ES-5. Summary of Water Levels in Representative Wells

(All elevations are in feet NAVD 88)

Representative Well ID	Principal Aquifer	Minimum Threshold	Spring 2022	Fall 2022	Spring 2023	Fall 2023
7N/31W-34M02	Careaga Sand	482	489	486	488	486
6N/31W-03A01	Careaga Sand	573	575	**568**	578	**568**
6N/31W-04A01	Careaga Sand	481	488	485	487	485
6N/31W-09Q02	Careaga Sand	446	469	463	469	**444**
6N/31W-10F01	Careaga Sand	463	468	466	474	467
6N/31W-11D04	Careaga Sand	502	**498**	**496**	510	516
6N/31W-16N07	Careaga Sand	377	392	391	393	402
6N/31W-xxxx	Careaga Sand	467	468	**462**	471	469
Solvang HCA	Careaga Sand	320	341	325	342	353
6N/29W-07L01	Paso Robles Formation	637	**610**	**599**	**625**	**610**
6N/29W-08P01 [1]	Paso Robles Formation	676	Dry	Dry	Dry	Dry
6N/29W-08P02	Paso Robles Formation	653	**640**	**630**	**639**	**631**
6N/30W-07G05	Paso Robles Formation	513	**514**	**510**	**510**	**506**
6N/30W-07G06	Paso Robles Formation	511	513	**500**	**509**	**505**
6N/30W-11G04	Paso Robles Formation	510	**494**	**459**	**505**	540
6N/31W-01P03	Paso Robles Formation	514	515	**505**	**511**	**509**
6N/31W-02K01	Paso Robles Formation	556	564	562	572	578
6N/31W-13D01	Paso Robles Formation	494	504	503	507	510
6N/31W-16B01	Paso Robles Formation	1,018	1,035	1,032	1,031	1,043
7N/30W-19H01	Paso Robles Formation	896	911	910	910	912
7N/30W-29D01	Paso Robles Formation	849	858	856	893	866
7N/30W-30M01 [2]	Paso Robles Formation	559	--1,2	Pumping	NM	NM
7N/30W-33M01	Paso Robles Formation	514	**513**	**495**	**509**	**498**
7N/31W-36L02	Paso Robles Formation	615	**604**	**592**	**603**	NM

Notes

Bolded values shaded in tan are below the minimum threshold value.
NM = Not Measured
NAVD 88 = North American Vertical Datum of 1988
1: Well -08P01 has been dry since issuance of the Plan and is not considered to be representative of the Paso Robles Formation. It has therefore been removed from the representative monitoring well network for water levels within this principal aquifer.
2: Water level data in Well -30M01 has been difficult to measure for many years. As shown, water level measurements have not been available for any period during water years 2022 and 2023.

SECTION 1: **Introduction**

This Annual Report for Water Year 2023 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) (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 each year 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 Annual Report presents the following required information about the EMA portion of the Basin managed in the Plan[3]:

(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.

Annual reports have been prepared in two prior reports to present the required elements for water years 2019 through 2022 (i.e., October 1, 2018 through September 31, 2022) after submission of the Plan. This Annual Report for the EMA documents conditions and progress towards implementing the Plan during water year 2023, which occurred between October 1, 2022, and September 30, 2023.

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. As described in the Plan, the Santa Ynez River area, including the river and associated underflow constitutes a surface water system within the EMA and other portions of the Basin.

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

[3] 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.
- **Section 5: Surface Water Supply (§ 356.2[b][3]).** Summary of the volume of surface water use that occurs in the EMA.
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- **Section 8: Progress toward Basin Sustainability (§ 356.2[c]).** A summary of management actions taken under the EMA Plan.
- **Section 9: References**.

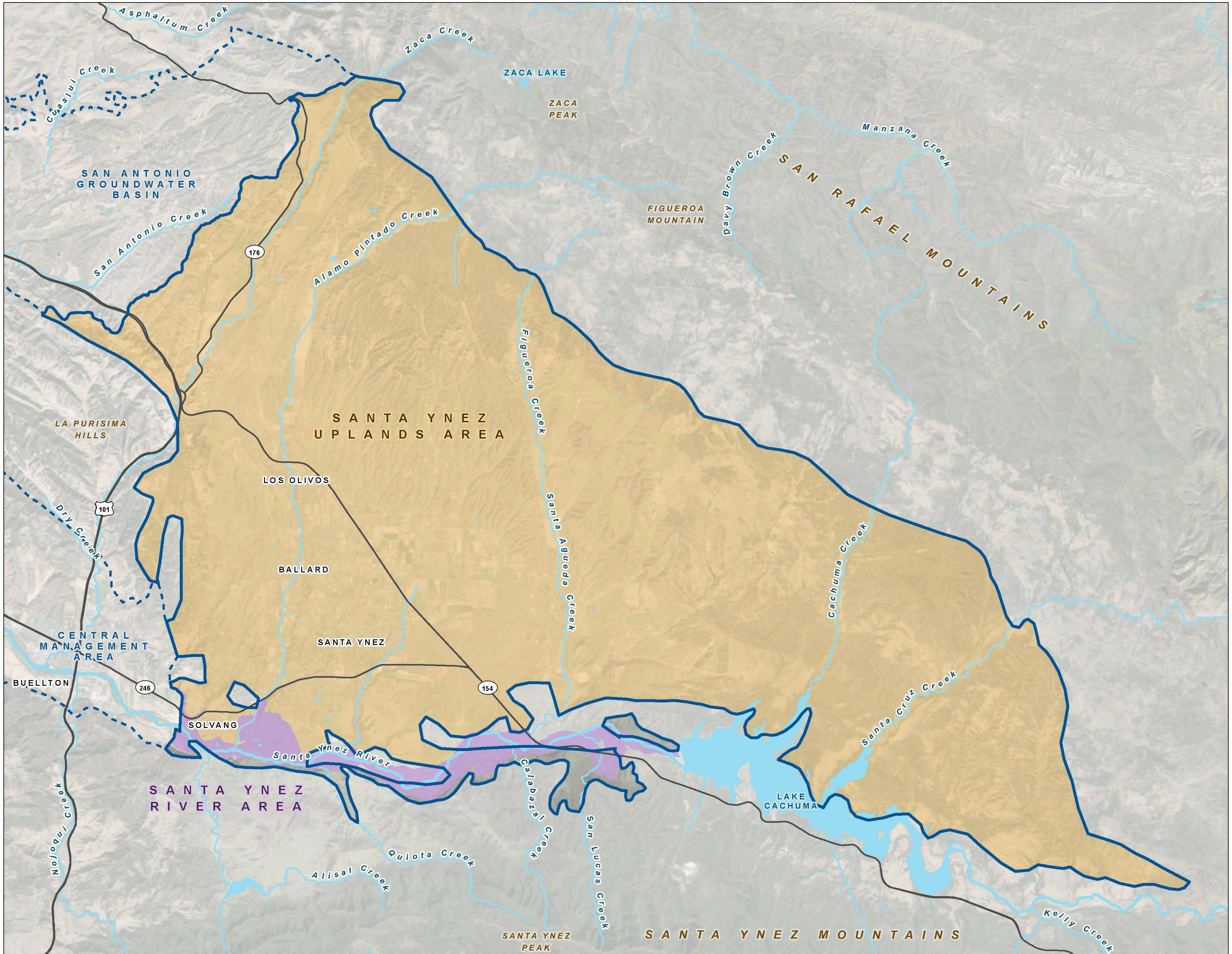

FIGURE 1

Santa Ynez River Valley Groundwater Basin Eastern Management Area

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area

LEGEND

- Santa Ynez Uplands Area (area covered by GSP)
- Santa Ynez River Area

All Other Features

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

NOTE

GSP: Groundwater Sustainability Plan

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0 5,000 10,000 15,000
Feet

Date: February 28, 2024
Data Sources: ESRI, USGS, Maxar 2019

GSI Water Solutions, Inc.

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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 2023. 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 constitutes a surface water system within the EMA and other portions of the Basin.

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.

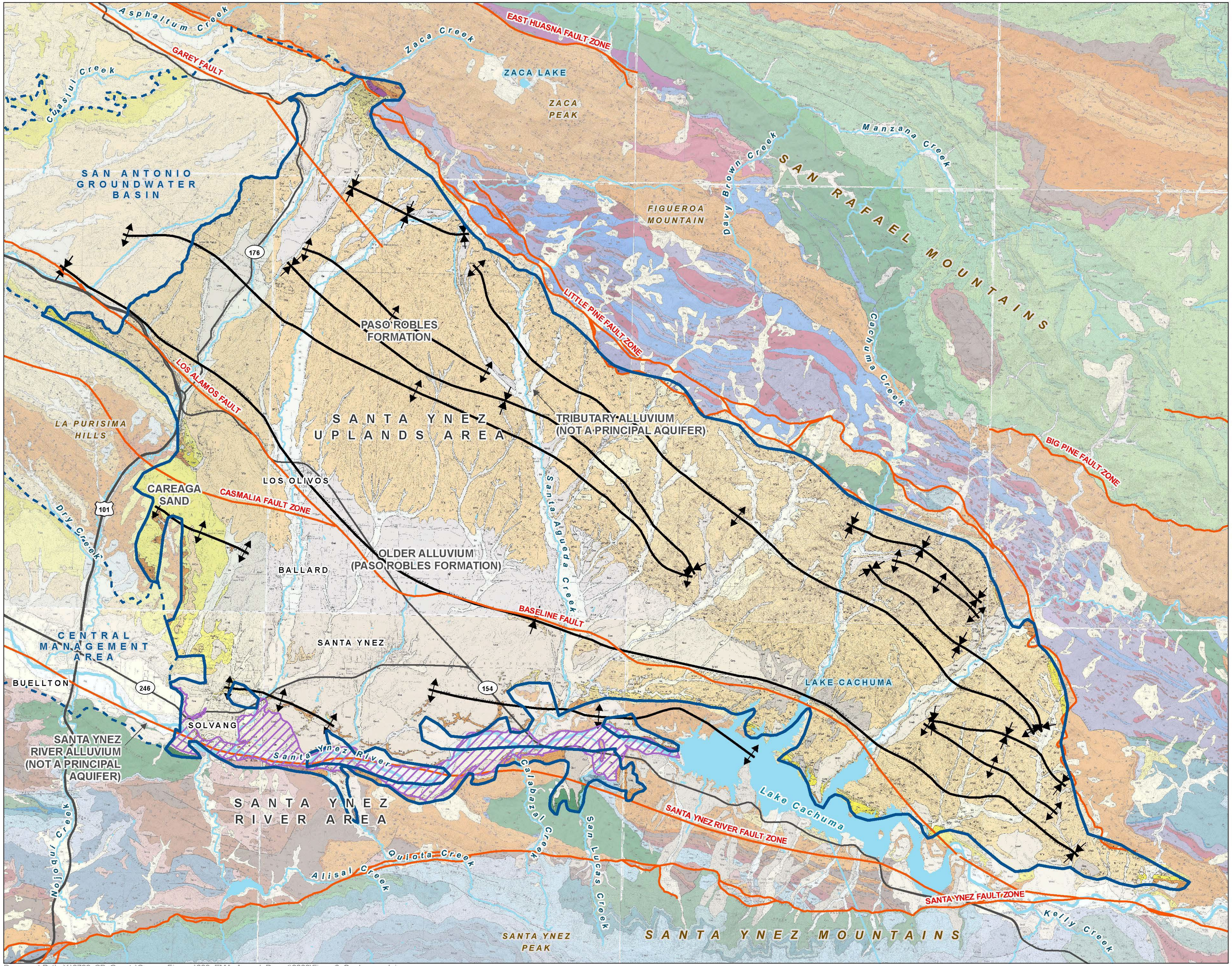

FIGURE 2

Geologic Map

Annual Report Water Year 2023 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

N

0 5,000 10,000 15,000
Feet

Date: February 28, 2024
Data Sources: ESRI, USGS, Maxar 2019

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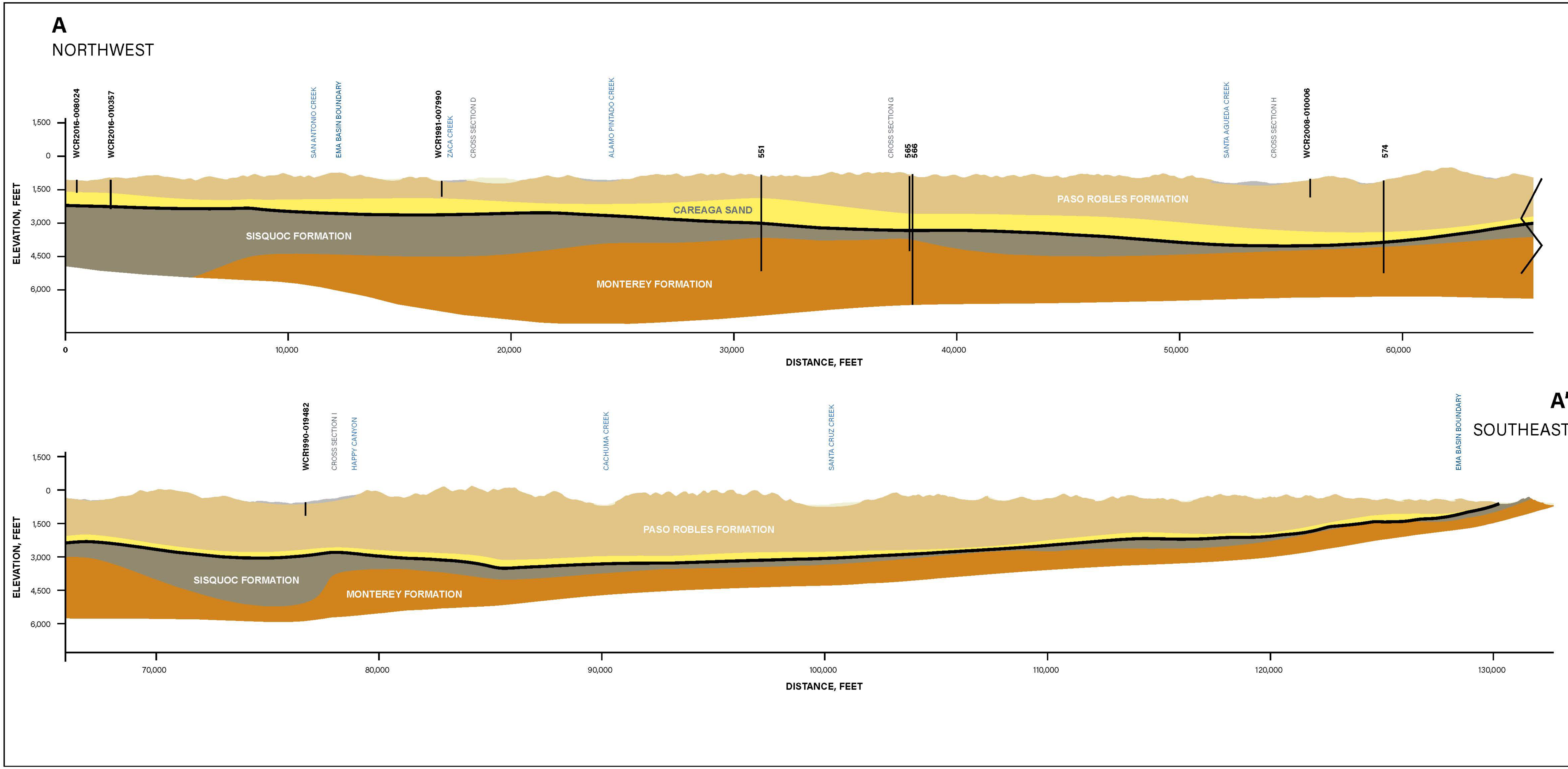
Two principal aquifers have been identified in the EMA: the Paso Robles Formation and the Careaga Sand, which are presented on Figure 3a and Figure 3b, respectively. The Paso Robles Formation and the Careaga Sand together extend to a depth of more than 1,500 feet below ground surface (bgs) on average 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.

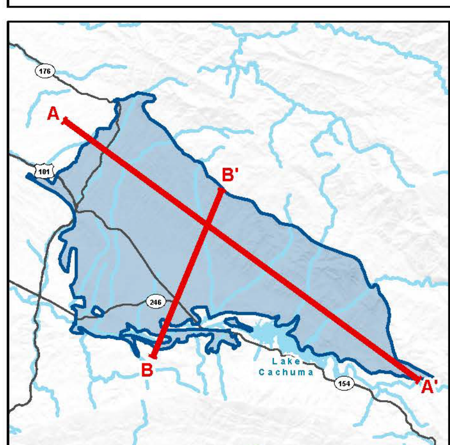
Vertical heterogeneity in the water-bearing properties of the Paso Robles Formation is the result of coarse-grained sediment beds that yield water freely to wells alternating with fine-grained beds that do not, where higher well yields are typically attributed to the wells that penetrate the coarse-grained 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 to 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 (Principal Aquifer) – Older Alluvium
- QTp (Principal Aquifer) – Paso Robles Formation
- Tca – Careaga Sand
- Basin Bottom
- Tsq (Principal Aquifer) – Sisquoc Formation
- Tm – Monterey Formation

FIGURE 3A

Cross Section A

Annual Report Water Year 2023 for the
Santa Ynez River Valley Groundwater Basin,
Eastern Management Area

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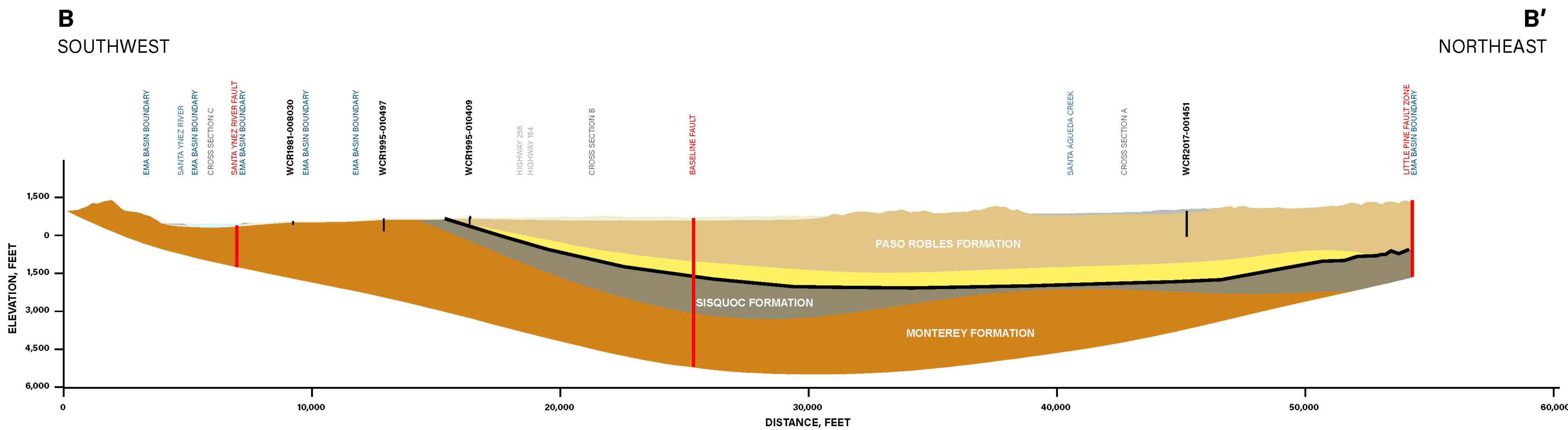

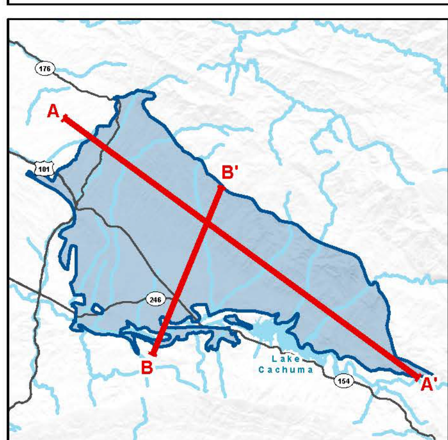

LEGEND

- Qa – Tributary Alluvium
- Qoa (Principal Aquifer) – Older Alluvium
- QTp (Principal Aquifer) – Paso Robles Formation
- Tca – Careaga Sand
- Basin Bottom
- Tsq (Principal Aquifer) – Sisquoc Formation
- Tm – Monterey Formation

FIGURE 3B

Cross Section B

Annual Report Water Year 2023 for the
Santa Ynez River Valley Groundwater Basin,
Eastern Management Area

GSI Water Solutions, Inc.

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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 water years 1951 through 2023 is 15.8 inches. 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:

Index = (0.40 * Current Year's precipitation) + (0.60 * 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[1]	Water Year Type[1]
2011	26.3	24.3	Wet
2012	12.0	17.7	Above Normal
2013	6.8	8.9	Critical
2014	7.9	7.5	Critical
2015	8.3	8.2	Critical
2016	10.0	9.3	Critical
2017	21.0	16.6	Above Normal
2018	7.9	13.1	Below Normal
2019	20.1	15.2	Above Normal
2020	15.1	17.1	Above Normal
2021	8.3	11.1	Dry
2022	10.2	9.4	Critical
2023	33+	39	Wet

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

[1] Defined in DWR, 2021 based on 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).

The period covered by the Plan included data through the end of water year 2018. Since that time, the five water years of 2019 through 2023 have included one wet year (2023), 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 are calculated differently by the 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 within Salsipuedes Creek. 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 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.

During the current water year, the entire basin was characterized as wet year.

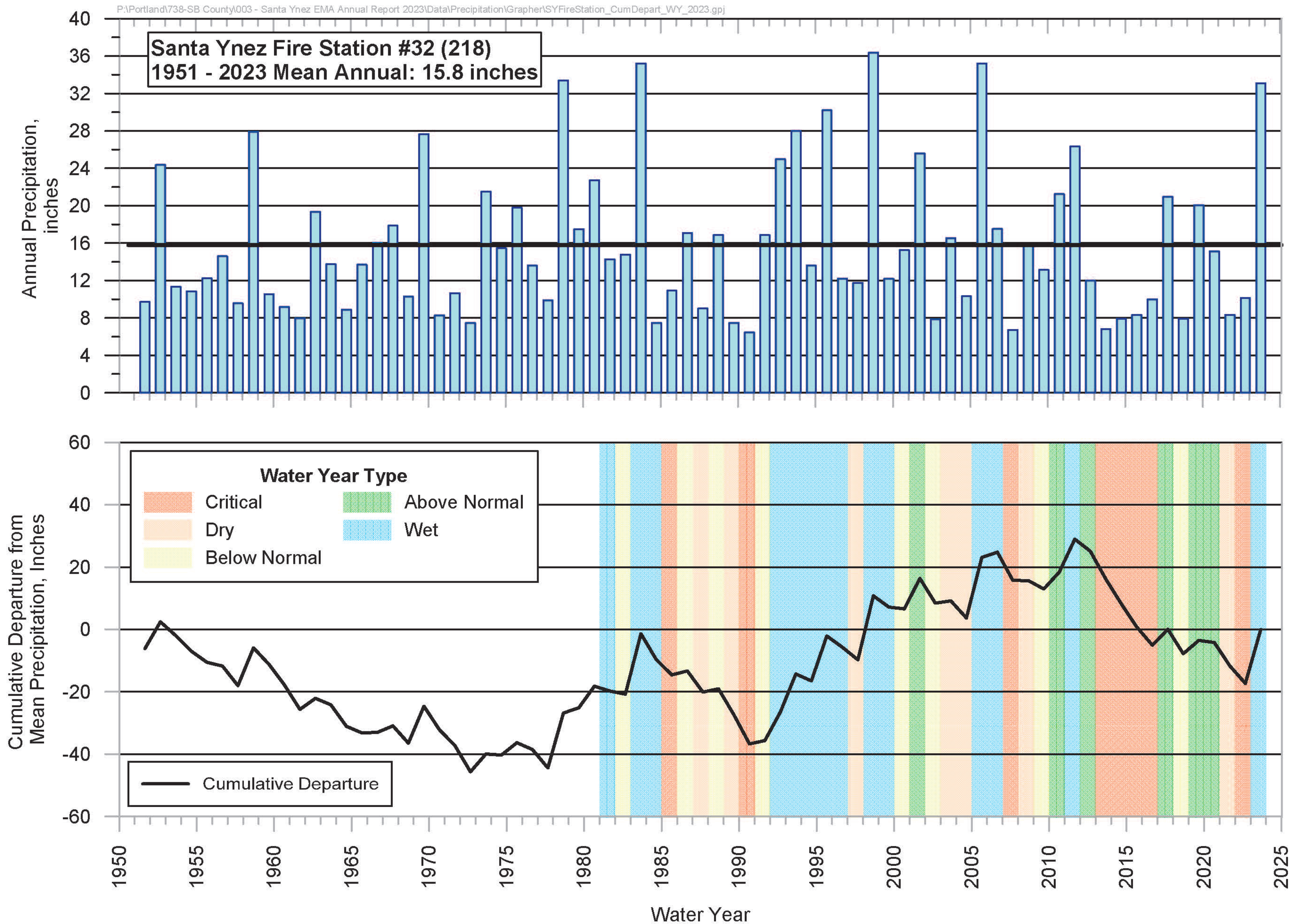

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FIGURE 4
Annual Precipitation and Water Year Type
Santa Ynez Fire Station
Santa Ynez River Valley Groundwater Basin, Eastern Management Area

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 indicating a significant and unreasonable depletion of supply if continued over the planning implementation horizon.
- Significant and unreasonable reduction of groundwater storage.
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
- Significant and unreasonable land subsidence that substantially interferes with surface land uses.
- Depletion of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the 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 well sites. The Plan identifies a 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.

The wells included in the representative monitoring network documented in the Plan are subject to change during Plan the implementation period. Specifically, one of the representative Paso Robles formation wells (-08P01) has been dry since issuance of the Plan while an adjacent well completed in the same formation has not. Therefore, this well is no longer considered to be representative of the Paso Robles Formation and has been removed from the representative monitoring well network. Additional discussion of proposed changes to the monitoring network is provided in this section.

Figure 5 displays the locations of the representative monitoring wells, and Appendix B includes a summary of information for each of the wells.

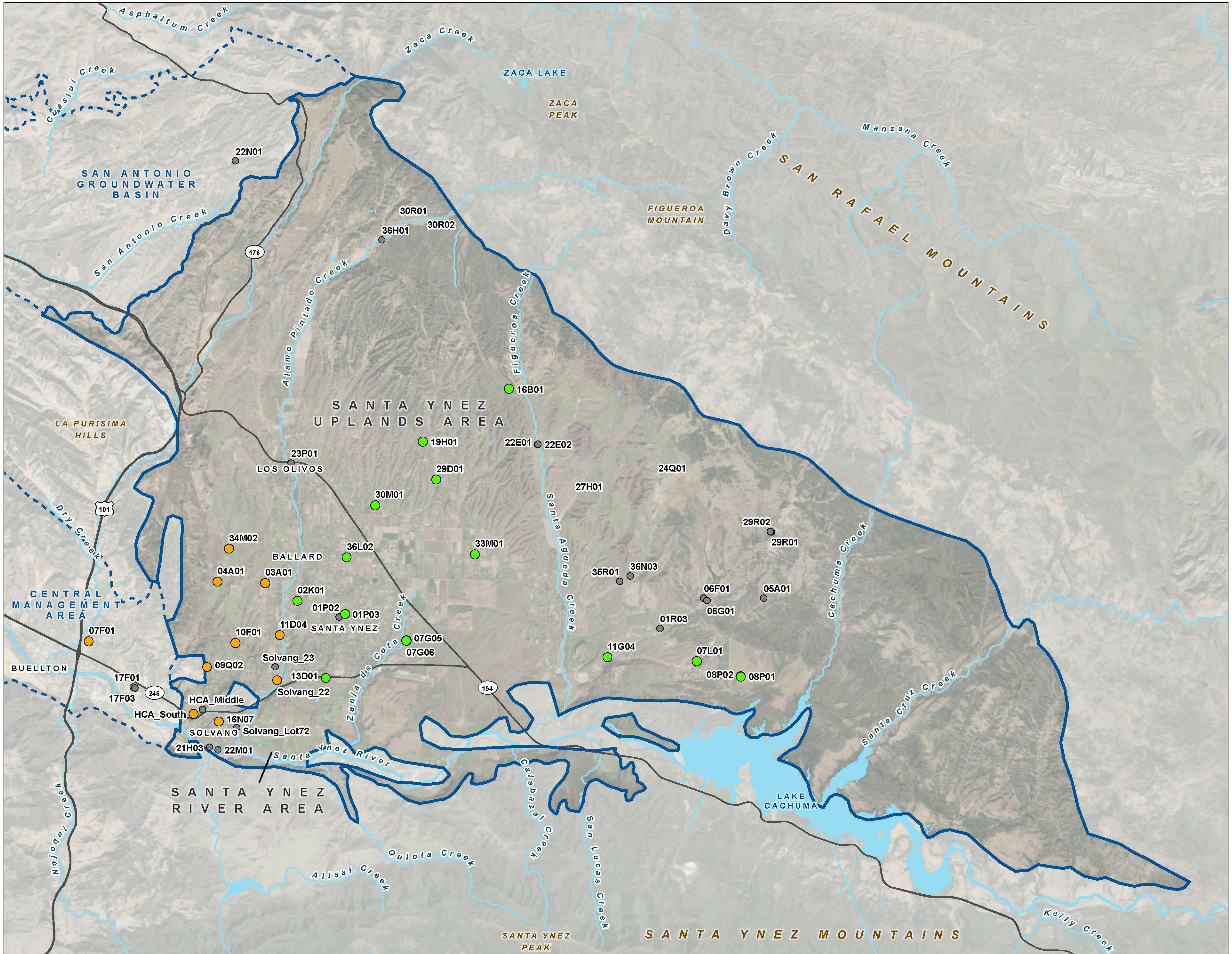


FIGURE 5

Groundwater Level Monitoring Network

Annual Report Water Year 2023
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: February 29, 2024
Data Sources: ESRI, USGS, Maxar 2020

GSI Water Solutions, Inc.

Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure5_Groundwater_Level_Monitoring_Network.mxd, iramos

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 including the area surrounding Santa Agueda Creek and Happy Canyon.

Efforts are underway to contact owners of wells in these areas to determine whether the wells can be included in the monitoring program. Including these wells into the groundwater level monitoring network would increase the accuracy of groundwater elevation throughout the EMA, identify 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.[4] 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.[5] 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 not yet 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 is monitored as part of implementation of the Plan. Land surface elevations in the EMA are measured 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

[4] The list of MCLs and SMCLs is available at https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.html. (Accessed January 12, 2022.)

[5] Description available at https://webapps.usgs.gov/cogg/. (Accessed January 12, 2022.)

satellite imagery data. Any presence of subsidence is 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 evidence that no subsidence has occurred. Examination of the data between June 2015 and October 2023 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 2023 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 March of 2023. 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 2022 to 2023.

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 been discontinued following 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 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 or more 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. Additional wells are monitored by the City of Solvang. As implementation of the Plan progresses, additional wells are being considered for addition to the monitoring network considering accessibility, location, well construction, and representative hydrograph signatures. Of the wells monitored, the locations of which are shown on Figure 5, 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 fall of 2022. Groundwater elevation contour maps are presented in this report for the spring and fall periods of 2022 and 2023 for comparison.
- 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 period of spring 2022 through spring of 2023.
- A description of the seasonal variability in groundwater conditions is provided in the groundwater elevation maps between the spring and fall of 2023.
- 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 both the northwestern and eastern portions 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.

Groundwater elevations within both principal aquifers have generally risen during water year 2023 relative to the previous spring in response to increased precipitation and reduced pumping but remain generally lower than the spring of 2018 elevations presented in the Plan. The groundwater elevations in the Paso Robles Formation representative monitoring wells have risen by an average of 4 feet between the spring of 2022 and 2023. During this period, water elevations in 5 of 14 Paso Robles Formation representative wells with water level data rose, but the degree of the water level rises of as much as 15 to 35 feet, have been greater than the degree of the water level declines.

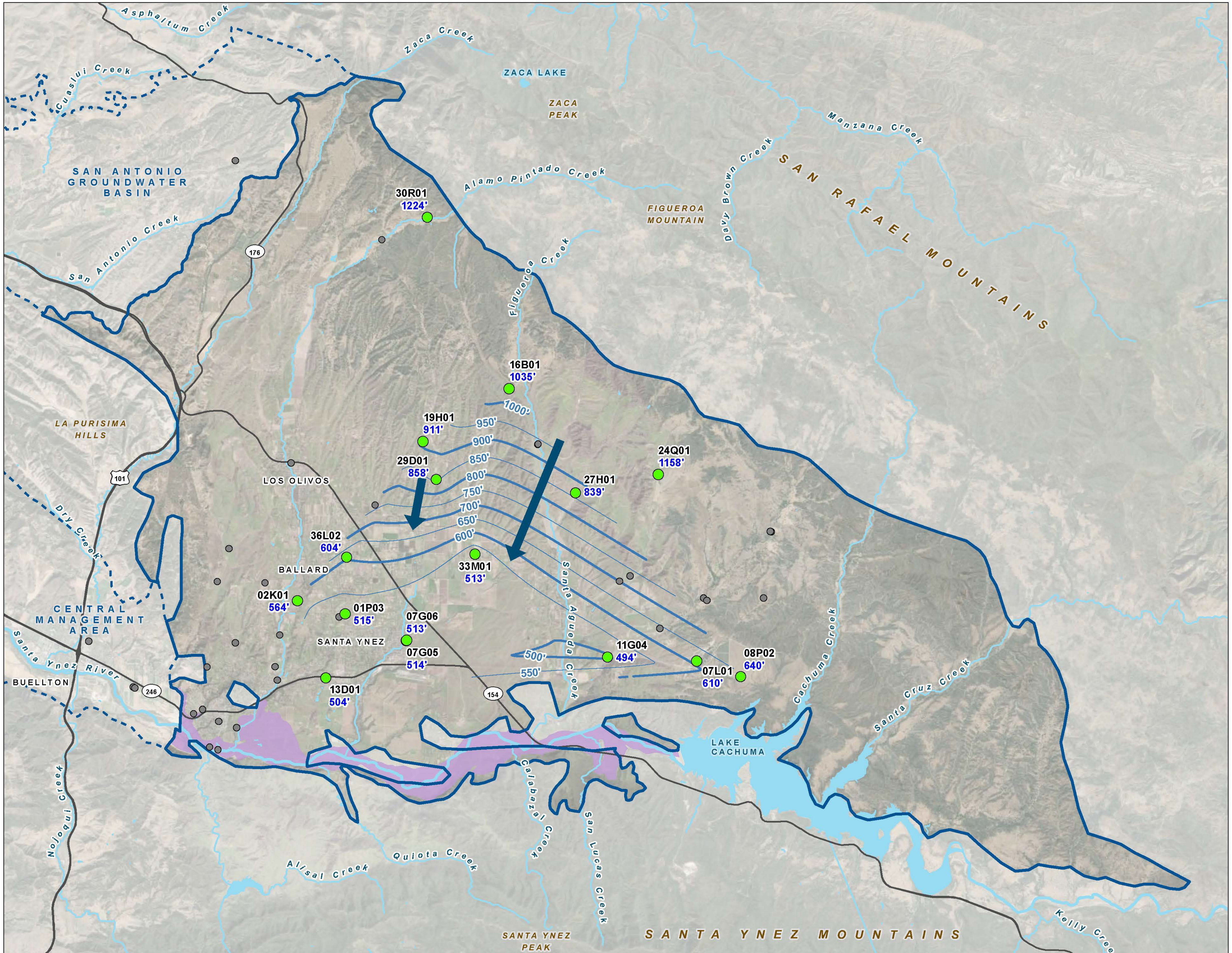
Between the fall of 2022 and 2023, the water levels in the representative Paso Robles Formation wells have risen even more, by an average of 11 feet. During this period, groundwater elevations in 11 of 14 representative wells rose[6].

[6] A single instance of an apparent groundwater elevation rise of 81 feet in one representative Paso Robles Formation well between the fall of 2022 and 2023 is attributed to an erroneous groundwater level measurement in the fall 2022 period, likely influenced by recent pumping.

FIGURE 6

Paso Robles Formation Groundwater Elevation Contours, Spring 2022

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



LEGEND

Paso Formation Groundwater Elevation, Spring 2023

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

Representative Well (by screened aquifer)

- Paso Robles Formation Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

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 7, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure6_Paso_GW_Contours_Spring2022.mxd, iramos

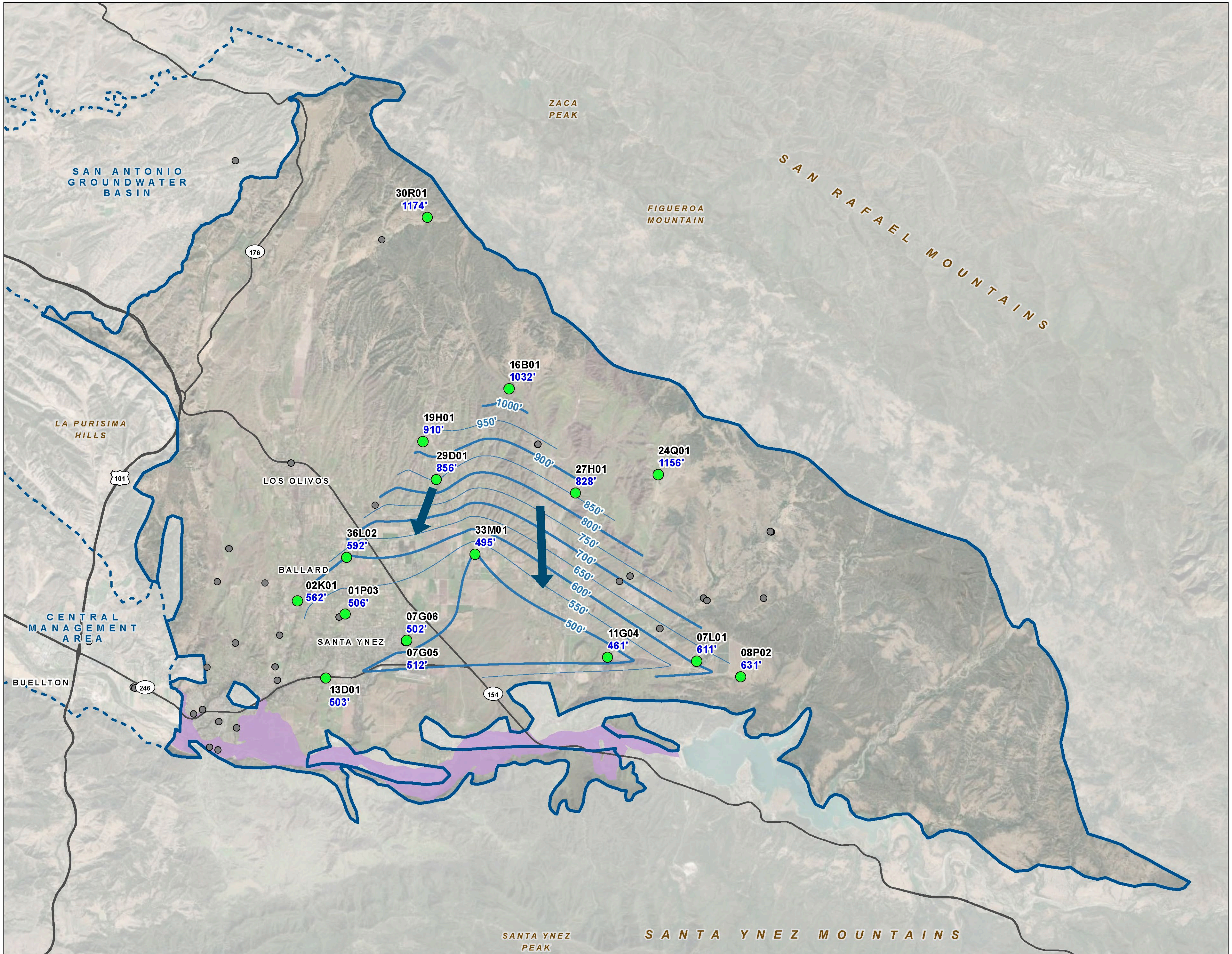


FIGURE 7

Paso Robles Formation Groundwater Elevation Contours, Fall 2022

Annual Report Water Year 2023 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

Representative Well (by screened aquifer)

- Paso Formation Well
  Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

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 7, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure7_Paso_GW_Contours_Fall2022.mxd, iramos

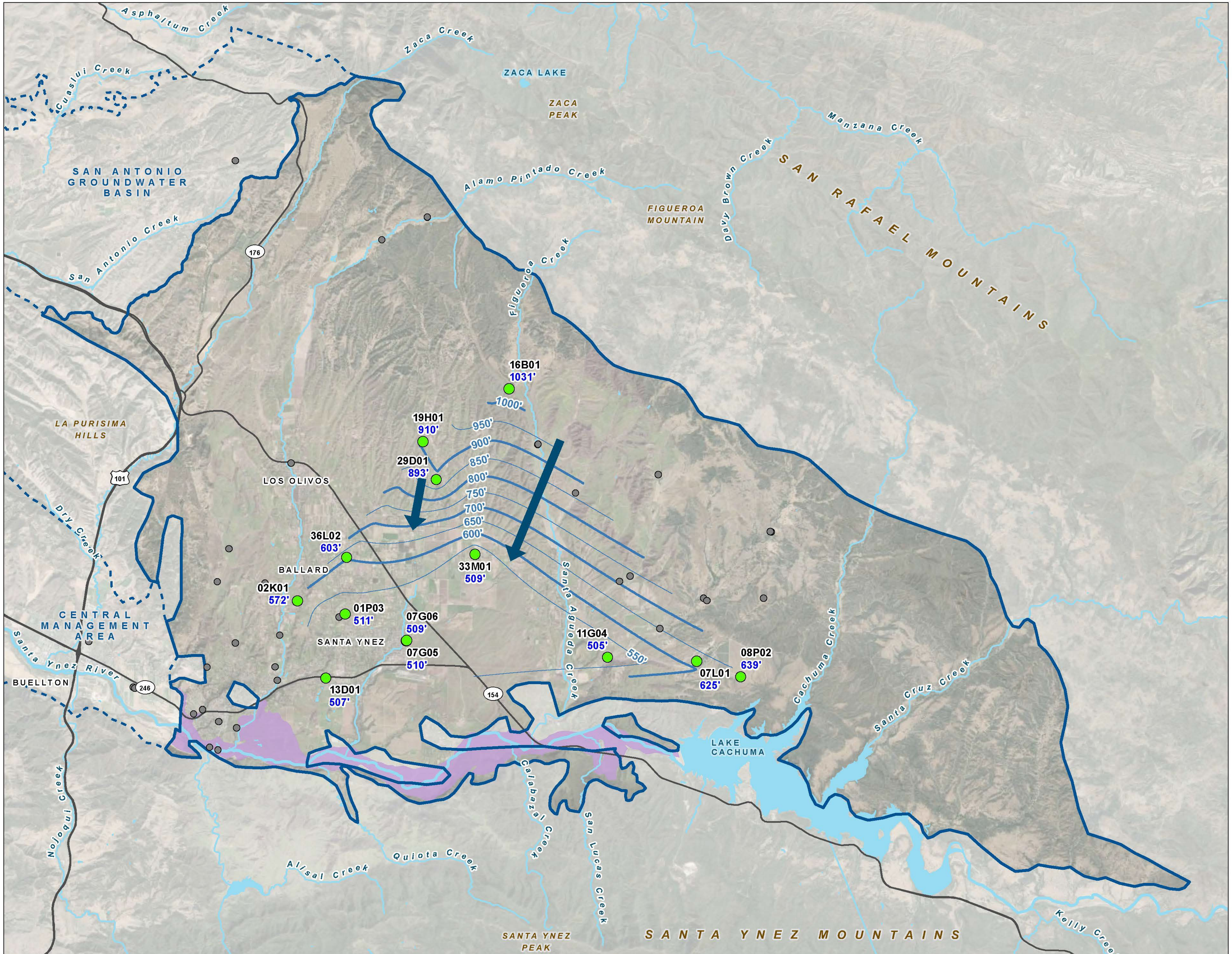


FIGURE 8

Paso Robles Formation Groundwater Elevation Contours, Spring 2023

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area

LEGEND

Paso Formation Groundwater Elevation, Spring 2023

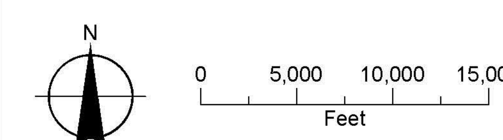
- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area

Representative Well (by screened aquifer)

- Paso Robles Formation
  Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

All Other Features

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



Date: March 1, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

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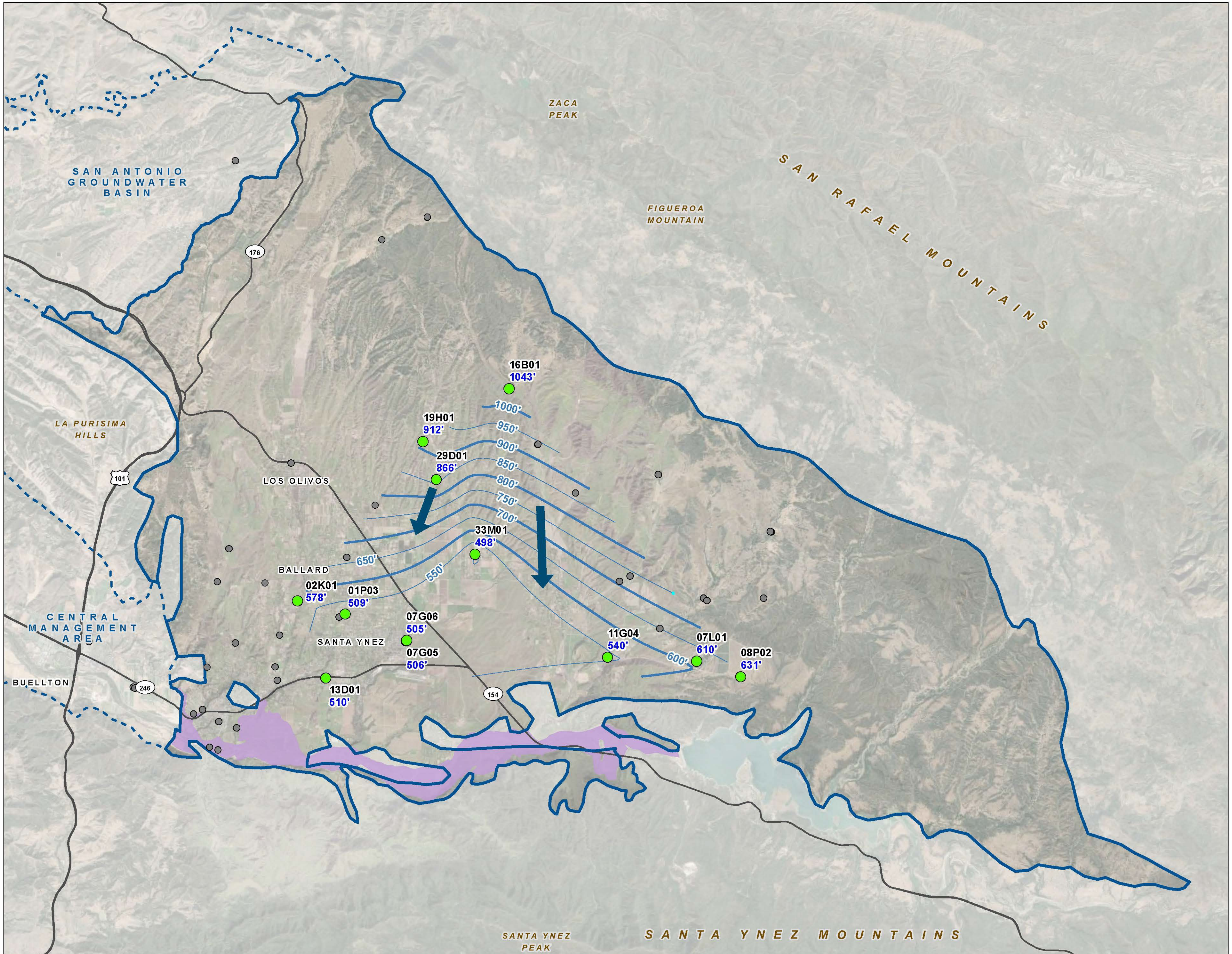
FIGURE 9

Paso Robles Formation Groundwater Elevation Contours, Fall 2023

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



LEGEND

Paso Formation Groundwater Elevation, Fall 2023
- Major
- Minor
- Groundwater Flow Direction
- Santa Ynez River Area

Representative Well (by screened aquifer)
- Paso Formation Well
  Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

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 1, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure9_Paso_GW_Contours_Fall2023.mxd, iramos

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 2023 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 during the period between the fall of 2022 and 2023, the water levels have risen by an average of 12 feet. During this period, groundwater elevations in 11 of the 12 representative wells with water level data rose.[7]

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 2023 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 is 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.

Groundwater elevations in the representative Careaga Sand wells have risen during water year 2023 relative to the previous spring by an average of almost 3 feet, but generally remain lower than the spring 2018 elevations presented in the Plan. During the period between the fall of 2022 and 2023, groundwater elevations have risen by more than 5 feet on average, with rises of as much as 28 feet. A single well declined by 19 feet during this period[2].

Groundwater elevations in the Caraga Sand during the spring and fall of 2023 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 Careaga Sand wells of approximately 2 feet in 2023.

[7] A single instance of an apparent groundwater elevation rise of 81 feet in one well between the fall of 2022 and 2023 is attributed to an erroneous groundwater level measurement in the fall 2022 period, likely influenced by recent pumping.

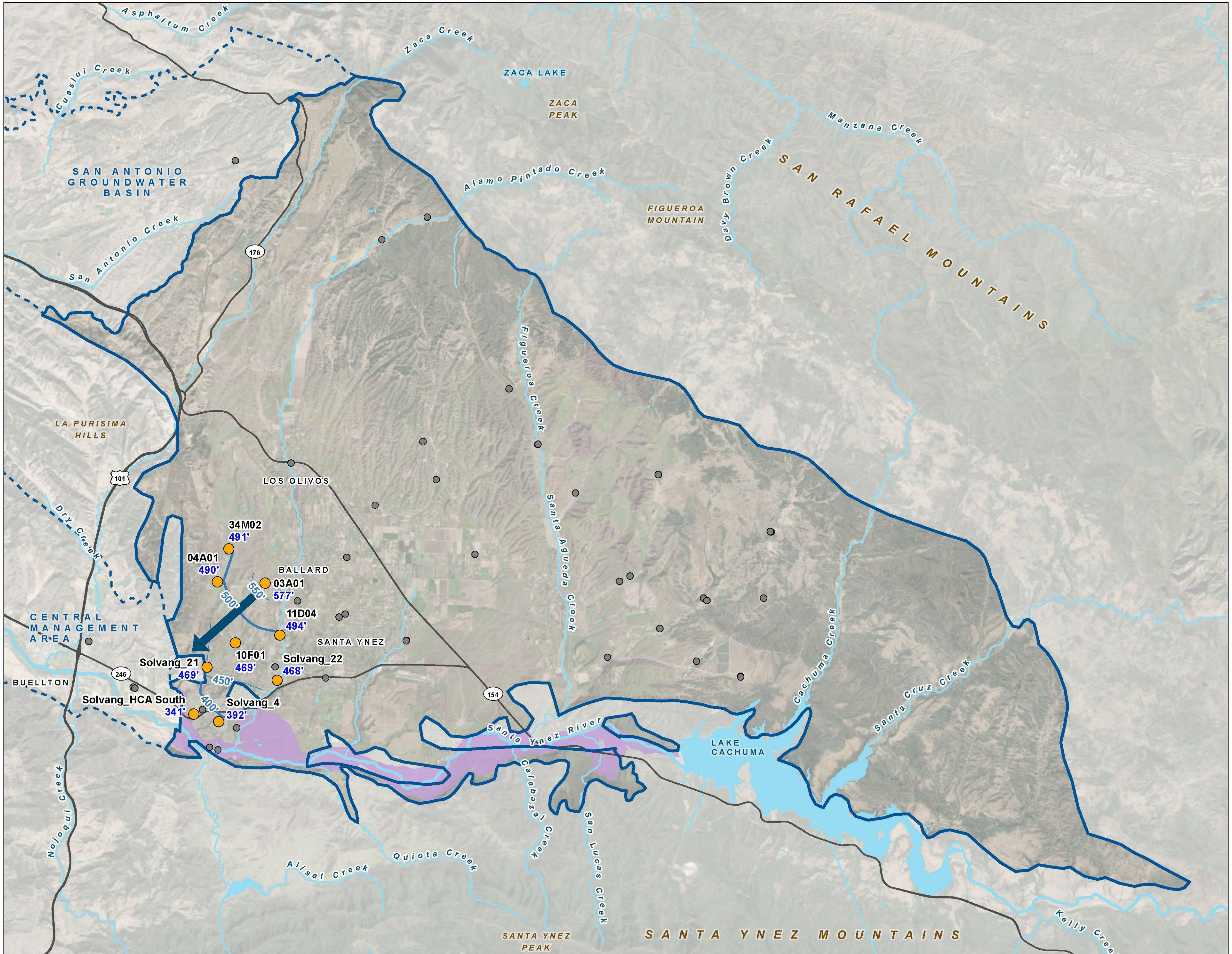


FIGURE 10

Careaga Sand Groundwater Elevation Contours, Spring 2022

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area

LEGEND

Careaga Sand Groundwater Elevation, Spring 2023

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

Representative Well (by screened aquifer)

- Careaga Sand
  Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

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 7, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure10_Careaga_GW_Contours_Spring2022.mxd, iramos

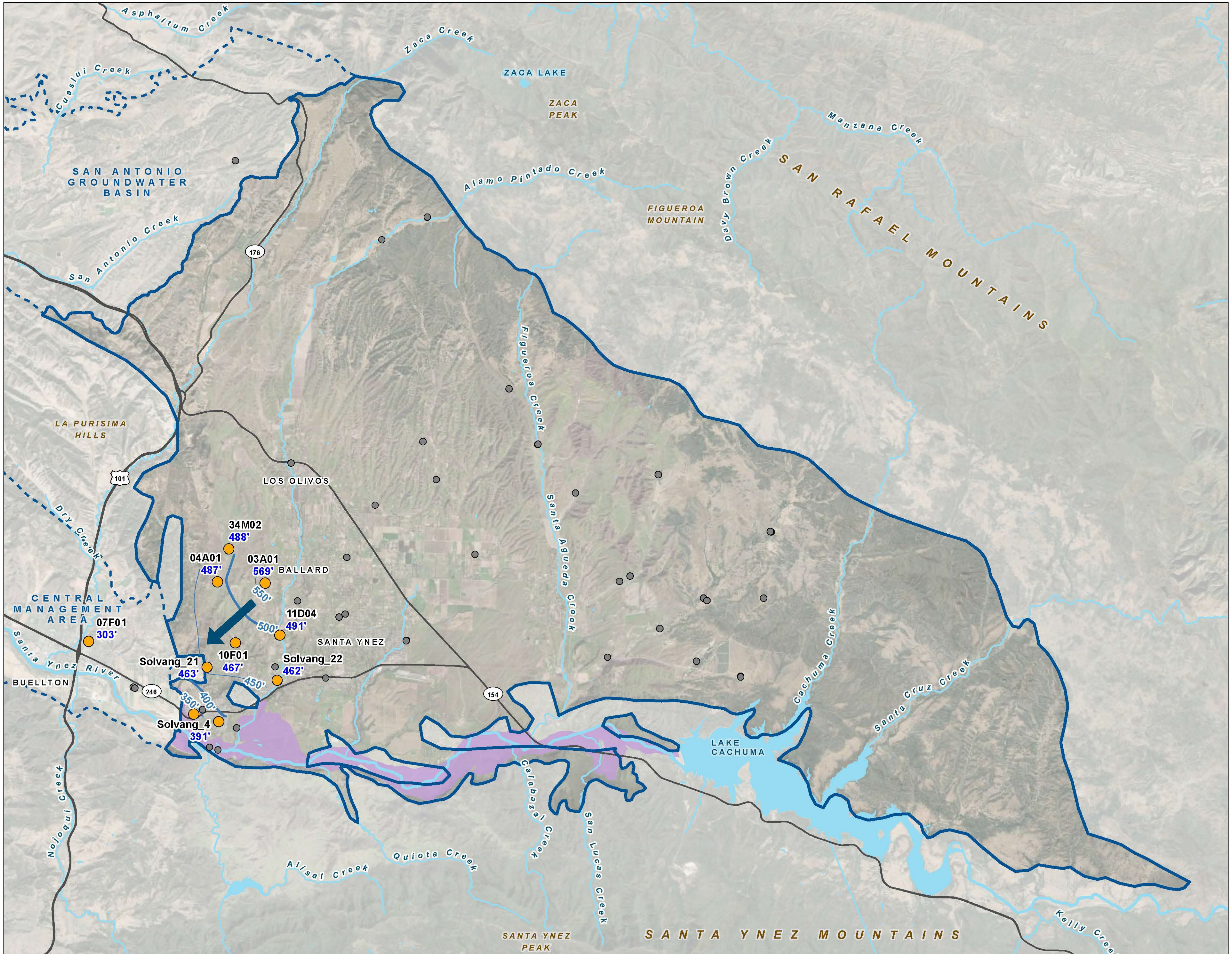


FIGURE 11

Careaga Sand Groundwater Elevation Contours, Fall 2022

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area

LEGEND

Careaga Sand Groundwater Elevation, Spring 2023

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

Representative Well (by screened aquifer)

- Careaga Sand
  Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

All Other Features

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

Date: March 7, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

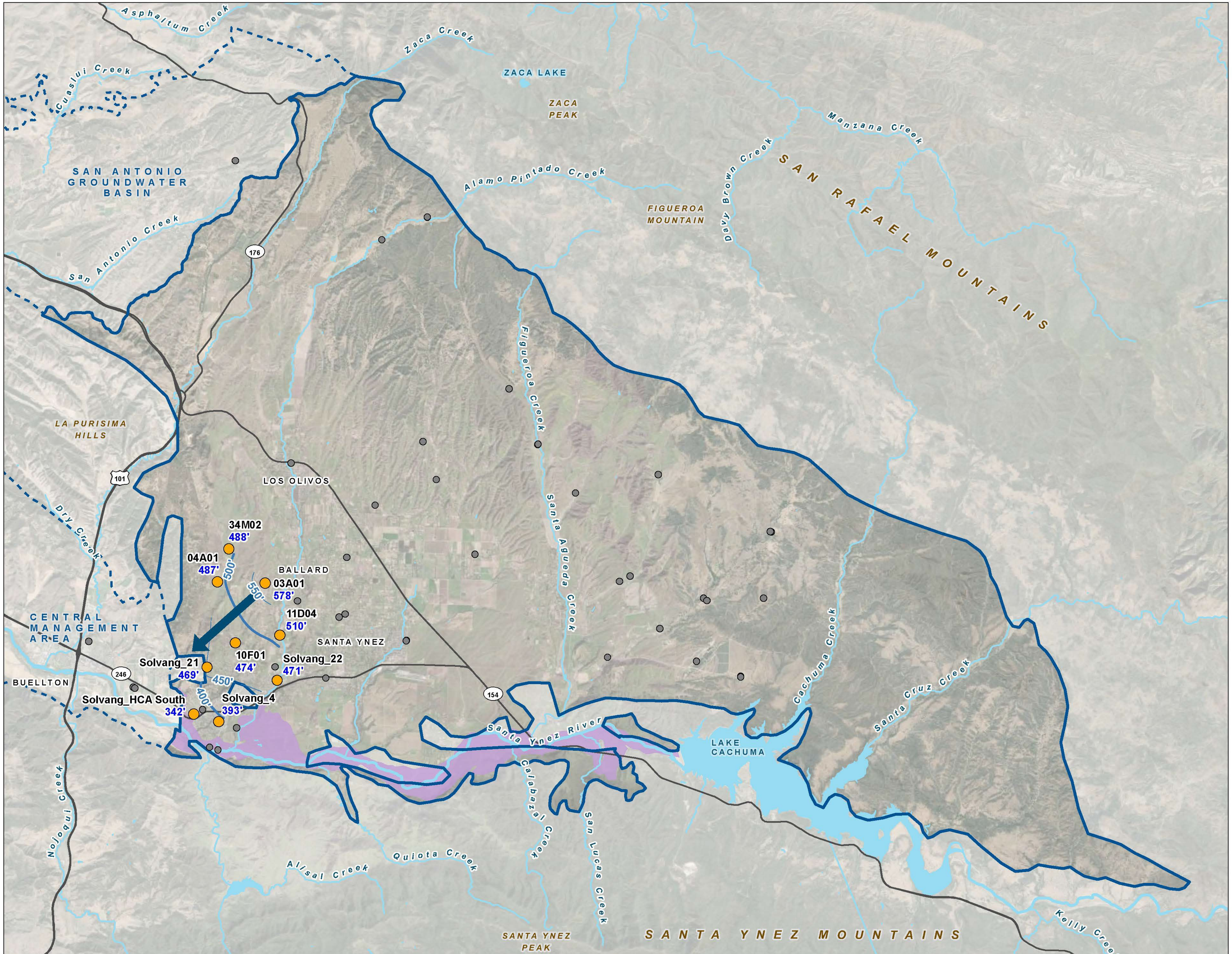
GSI Water Solutions, Inc.

Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure11_Careaga_GW_Contours_Fall2022.mxd, iramos

FIGURE 12

Careaga Sand Groundwater Elevation Contours, Spring 2023

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



LEGEND

Careaga Sand Groundwater Elevation, Spring 2023

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

Representative Well (by screened aquifer)

- Careaga Sand
  Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

All Other Features

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

Date: March 4, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

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Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure12_Careaga_GW_Contours_Spring2023.mxd, iramos

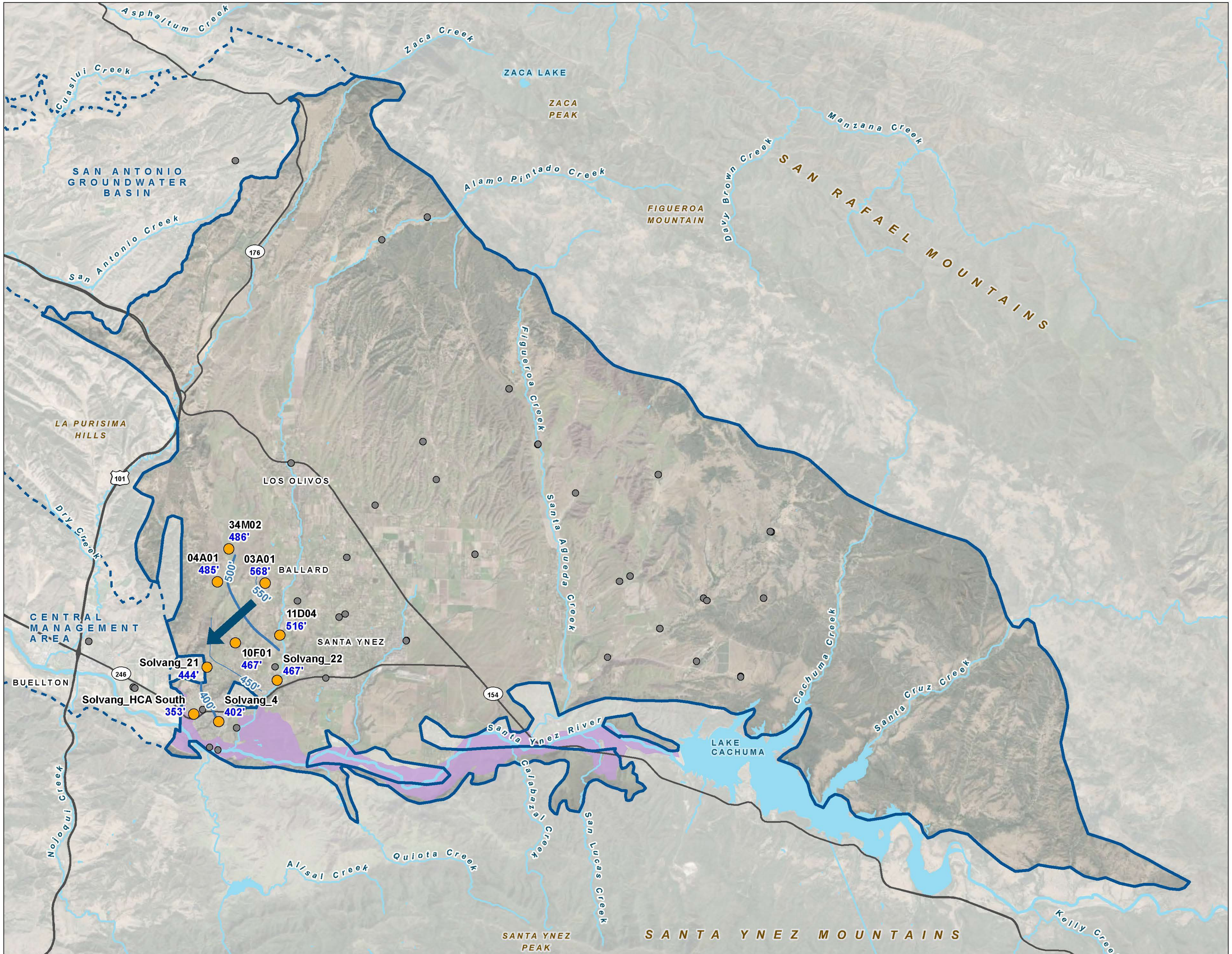

FIGURE 13

Careaga Sand Groundwater Elevation Contours, Fall 2023

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area

LEGEND

Careaga Sand Groundwater Elevation, Spring 2023

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

Representative Well (by screened aquifer)

- Careaga Sand
  Water Level Elevaton (feet NAVD 88)
- Monitored by Santa Barbara County Water Agency

All Other Features

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

Date: March 4, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

Document Path: Y:\0738_SB_County\Source_Figures\003_EMA_Annual_Report\2023\Figure13_Careaga_GW_Contours_Fall2023.mxd, iramos

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[8].

Of the 15 representative wells in the Paso Robles Formation hydrographs presented in Appendix C, water levels were able to be measured in 13 wells. A total of 8 of the 13 wells with water level data, or 62 percent, exhibited groundwater elevations below the minimum threshold in the Paso Robles Formation as of the spring of 2023. None of the nine wells completed in the Careaga Sand exhibited groundwater elevations below the minimum threshold in the spring of 2023.

[8] The minimum threshold values presented in this annual report have been corrected based on changes to the reference point elevations. The rationale for determining minimum thresholds remain unchanged from those described in the Plan (based on spring 2018 groundwater elevations).

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 2023. 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 several 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
2019	Above Normal	298	948	186	951	2,382
2020	Above Normal	621	970	289	957	2,837
2021	Dry	795	1,069	456	963	3,284
2022	Critical	1,001	1,046	430	969	3,485
2023	Wet	948	1,298	270	975	3,491

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 2023, approximately 74 percent of the estimated total groundwater extraction was used to supply agriculture in the EMA. This year, agricultural water demand for the areas both inside and outside of the SYRWCD boundaries was estimated based the OpenET ensemble methods[9]. The self-reported

[9] 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 'ETo'. 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. 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).

pumping volumes were based on data provided by SYRWCD and were used in part for the preparation of the Plan for the EMA. These self-reported data constitute a primary source of groundwater use within the two adjacent management areas in the basin in lieu of reliable production derived from calibrated flow meters. These methods are “self-reported” from landowners based primarily on estimates of planted acreages and crop-specific water duty factors provided by SYRWCD in their Groundwater Production Information and Instructions pamphlet (SYRWCD, 2010).

Aside from self-reported data, agricultural groundwater extraction was estimated with the use of 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 method of this technology uses an “ensemble model” derived from Landsat satellite data to produce ET data and ultimately field-scale water use 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 was developed as a collaboration between National Aeronautics and Space Administration, the Desert Research Institute, and the Environmental Defense Fund. The method provides monthly crop water use for a defined area at the field scale. The OpenET data is being used throughout the state where calibrated flow meters are not widely available 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 use of calibrated flow meters from each well completed in a principal aquifer to each irrigated field or landowner parcel would provide higher quality data than the OpenET method.

The use of OpenET data and analysis methods have been refined considerably in the past several years. Together, these methods may help address concerns about potential errors in agricultural water use estimation that could occur, 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.

Crop water demands that are met from precipitation were considered in the analysis by subtracting the volume of rain received on a monthly time-step. Monthly and annual applied irrigation volumes were estimated based on crop-specific irrigation efficiency factors. 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 a portion of this water percolates back to groundwater.

Based on these methods the estimated agricultural groundwater production for Water Year 2023 is approximately 9,100 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
2023	Wet	9,099

Notably, estimated groundwater extraction in the Santa Ynez Uplands for agricultural use during wet Water Year 2023 was considerably lower than the prior water year (critical), likely due to considerable amount of precipitation that fell during the water year, which partially satisfied crop water demands.

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 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 2023 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 2023.

Table 5. Rural Domestic Groundwater Extractions

Water Year	Water Year Type	Rural Domestic (acre-feet)
2019	Above Normal	305
2020	Above Normal	307
2021	Dry	309
2022	Critical	311
2023	Wet	313

4.5 Total Groundwater Extraction Summary

The total estimated annual volume of groundwater extracted in the EMA for Water Year 2023 was 12,333 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
2019	Above Normal	1,431	951	305	12,278	14,965
2020	Above Normal	1,880	957	307	11,812	14,956
2021	Dry	2,320	963	309	13,379	16,971
2022	Critical	2,516	969	311	13,264	17,060
2023	Wet	1,946	975	313	9,099	12,333
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 2023 are presented on Figure 14 in terms of acre-feet per square mile.

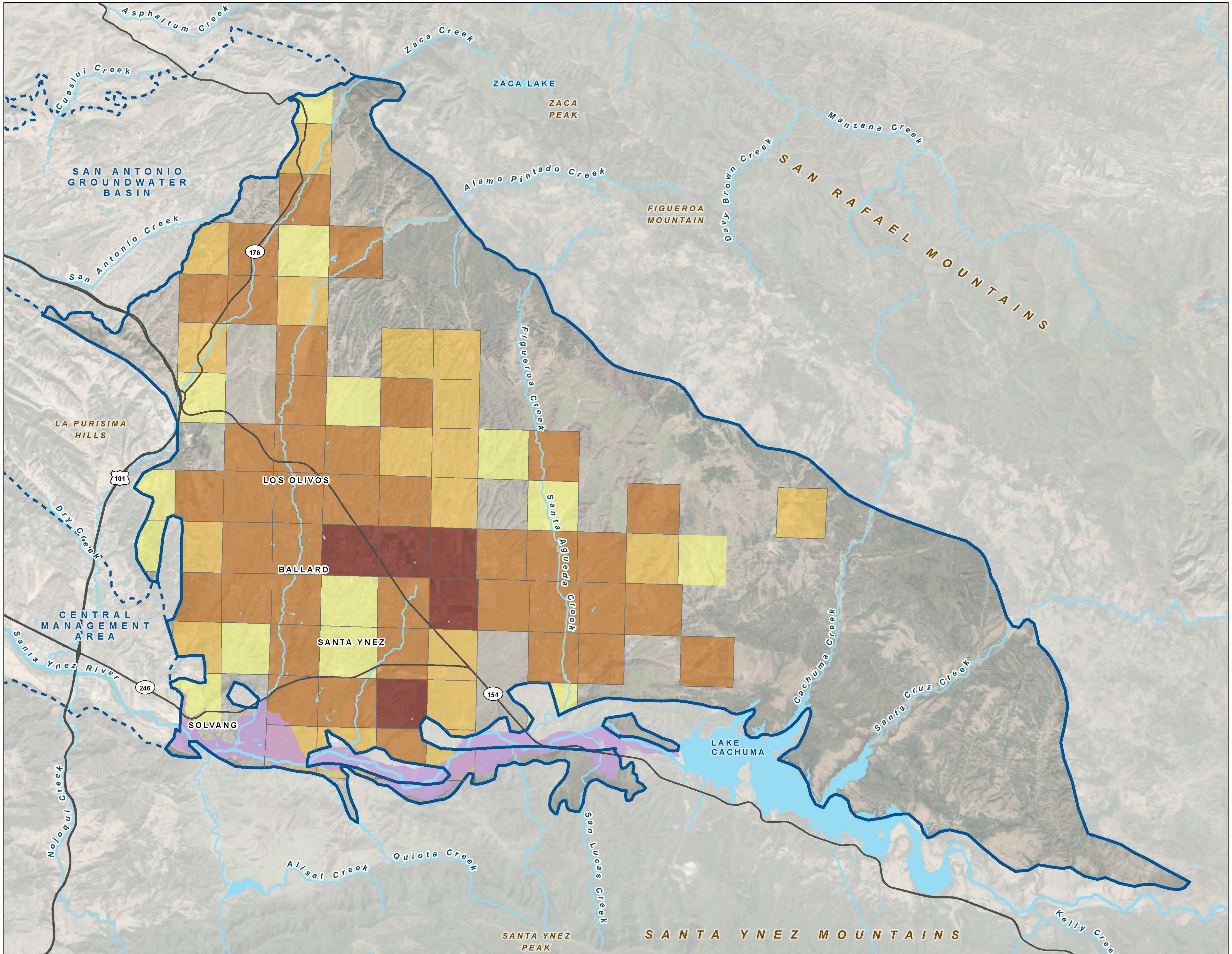

FIGURE 14

Location and Volume of Groundwater Extractions, Water Year 2023

Annual Report Water Year 2023 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 6, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

GSI Water Solutions, Inc.

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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 2023. 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. As documented by DWR, the availability of Table A supplies is highly variable and projected to decrease over time. 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. 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 2023 was approximately 4,800 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[1]	Total Reported River Wells	Total
2019	759	50	2,213	160	739	1,658	2,557	5,579
2020	745	315	1,740	148	567	1,566	2,281	5,081
2021	612	0	1,439	240	1,142	1,775	3,157	5,208
2022	590	0	544	270	1,632	1,478	3,380	4,514
2023	495	189	615	316	939	2,245	3,500	4,799
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

[1] 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 2023, the quantification of estimated 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 of approximately 17,100 AFY. 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
2019	Above Normal	14,965	5,579	20,544
2020	Above Normal	14,956	5,081	20,037
2021	Dry	16,971	5,208	22,179
2022	Critical	17,060	4,514	21,574
2023	Wet	12,333	4,799	17,132
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 relied on these data. However, because 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])

As discussed in Section 2.4.2 and Section 3.1 above, the current groundwater monitoring network for the Paso Robles Formation has less than ideal 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 used for Water Year 2023 declined in 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 Creek Valley Groundwater Basin, may be 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 limited extent of the groundwater elevation contours within the Paso Robles Formation is evident in the spring of 2023 (Figure 8) and the fall of 2023 (Figure 9). 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, a robust understanding of water level conditions in the EMA's principal aquifers have been hindered by the loss of at least one well in the adjacent San Antonio Groundwater Basin (which may be hydraulically connected), one within Los Olivos, and one near Happy Canyon. The EMA GSA is currently 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 2022 and 2023 presented on Figure 15.. 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. 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 2023 were derived by comparing spring groundwater elevation contour maps from one year to the next. Specifically, the spring 2023 groundwater elevations for the Careaga Sand (Figure 12) were subtracted from the spring 2022 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 change in groundwater elevation map for Water Year 2023 within the Careaga Sand (Figure 16), a wet year, shows rises in groundwater elevation of almost 3 feet, with limited areas of slight decline of less than 1 foot.

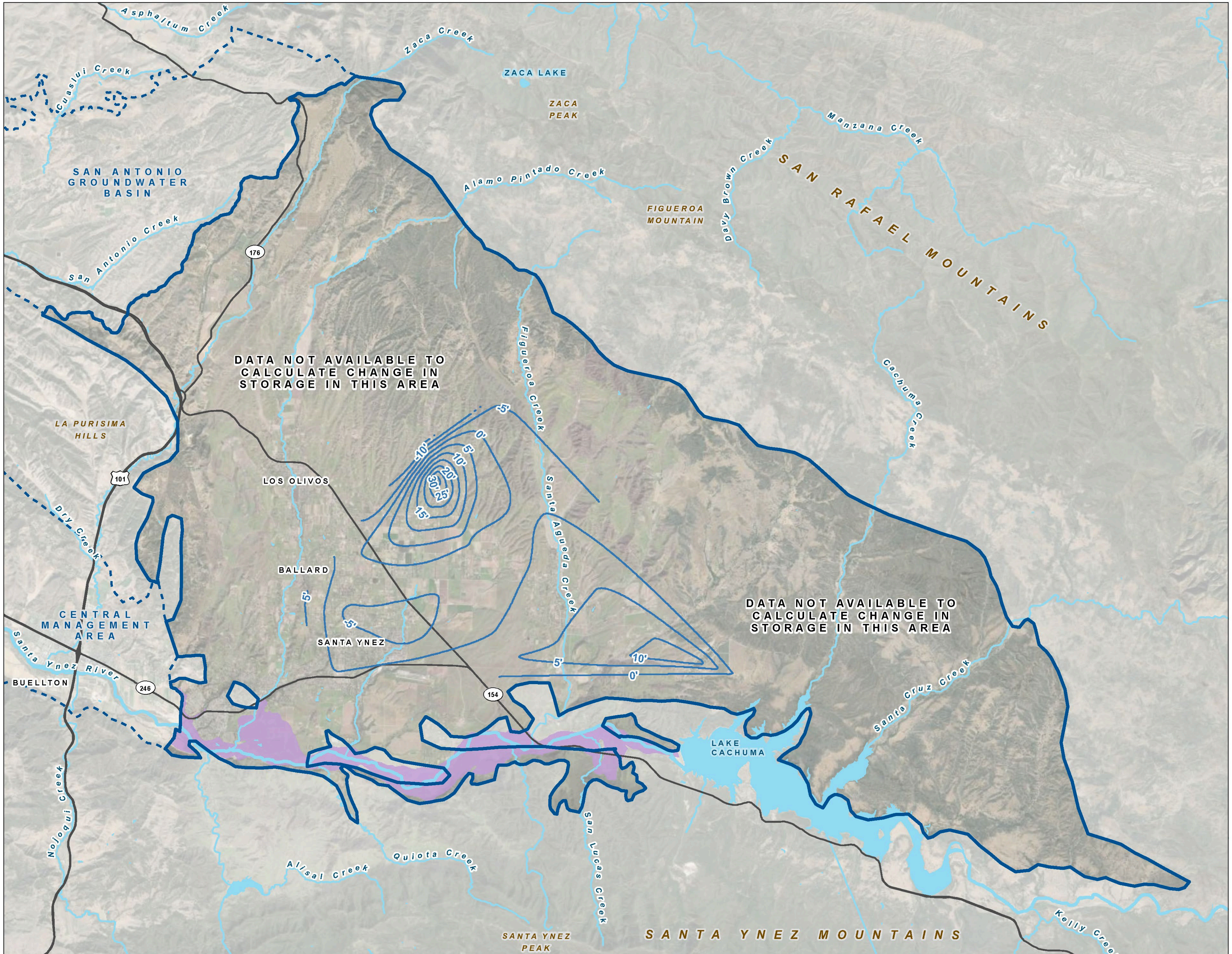

FIGURE 15

Paso Robles Formation Change of Groundwater Elevation, Spring 2022 to Spring 2023

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area

Date: March 20, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

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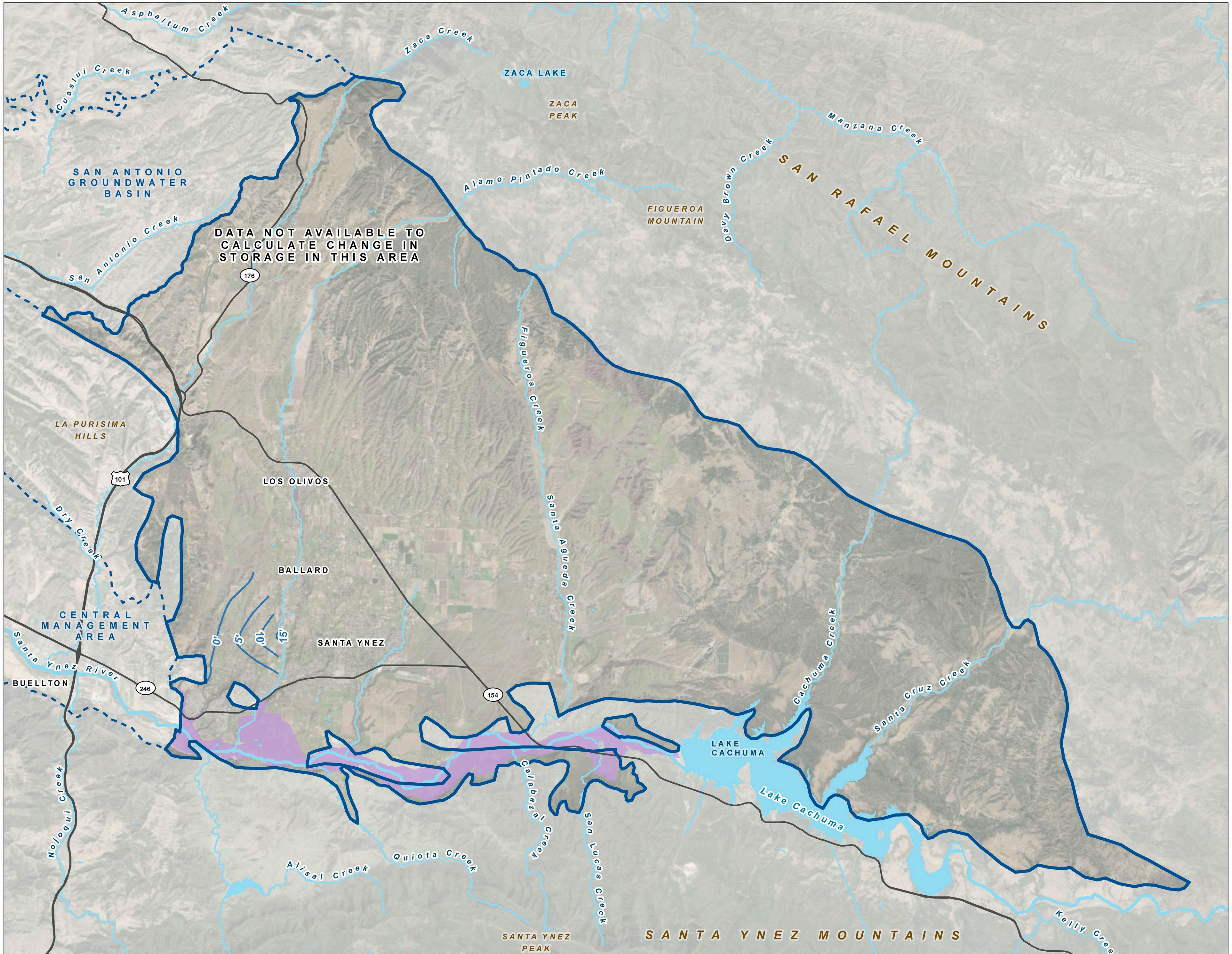
FIGURE 16

Careaga Sand Change of Groundwater Elevation, Spring 2022 to Spring 2023

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



LEGEND

- Santa Ynez River Area
- Change in Groundwater Elevation

All Other Features

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

N

0 5,000 10,000 15,000 Feet

GSI Water Solutions, Inc.

Date: March 20, 2024
Data Sources: ESRI, USGS, Maxar Imagery (2020)

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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 2023 are presented in Table 9.

The volume of groundwater in storage increased by approximately 18,000 AFY during the wet year of 2023, when rainfall exceed 200 percent of average. This annual increase in groundwater in storage during water year 2023 approximates similar increases in storage that occurred in similarly wet years with greater than 30 inches of rain, including water years 1998, 1983, and 2005. The five wettest water years on record since 1981 are, in descending order: 1998, 1983, 2005, 2023, and 1995. During these wettest years the average increase in groundwater in storage was approximately 15,600 AFY. The maximum historical increase in groundwater in storage of 19,000 AFY occurred in 1983, when 35.2 inches of rain fell.

Table 9. Annual Estimated Change in Groundwater in Storage

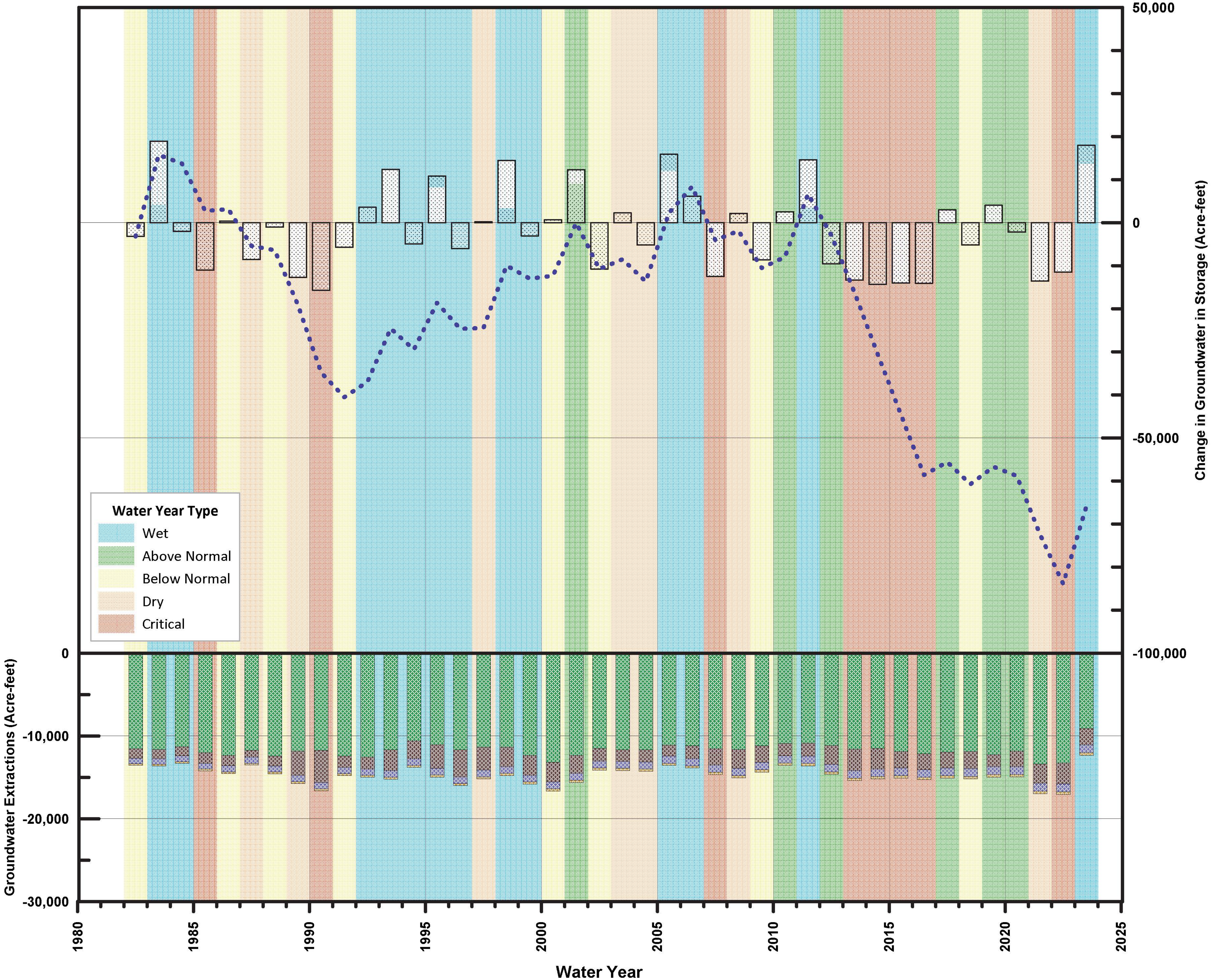
(Values in acre-feet)

Water Year	Water Year Type	Change in Storage (Paso Robles Formation)	Change in Storage (Careaga Sand)	Total Annual Change in Storage
2019	Above Normal	3,047	996	4,043
2020	Above Normal	-1,662	-477	-2,139
2021	Dry	-12,737	-825	-13,562
2022	Critical	-10,983	-495	-11,478
2023	Wet	17,677	307	17,984

While the overall volume of groundwater in storage has risen in Water Year 2023, the net volume of groundwater in storage has declined by approximately 5,152 AF since 2018 when the historical period presented in the Plan ended. The annual and cumulative change in groundwater in storage since 1981 is 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 2023



Legend

- Cumulative Change of Groundwater in Storage
- Annual Change of Groundwater in Storage
- Agricultural Pumping
- Municipal and Self-Reported Domestic Pumping
- Mutual Water Companies
- Rural Domestic
- wet8
- critical5

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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 maintain 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 average amount of groundwater pumping in the EMA is greater than the estimated sustainable yield, and an overall trend of declining groundwater levels has been documented.
- Water budgets prepared for every annual report indicate that the amount of groundwater in storage is generally in decline and may 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 and maintain the sustainability goal within the implementation period and planning horizon, and avoid undesirable results as required by SGMA, 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 have been initiated now that the Plan has been submitted to and approved by DWR.

Potential management actions and potential future projects are categorized into three groups as documented in the Plan:

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

8.2 Group 1 Management Actions and Group 3 Projects under Development

Group 1 management actions that are in being planned 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 reported in the Plan, this Annual Report for 2023 indicates that groundwater levels have risen relative to the prior year but have not risen to the elevations of the Spring 2018 period as presented in the Plan. The recent rise in groundwater elevations in most of the representative monitoring wells indicates an increase in total groundwater in storage, driven by the recent wet conditions and commensurate reduction of groundwater 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 groundwater elevations remain below the minimum thresholds in some representative wells, the number of wells falling below the minimum thresholds has not resulted in the observation of any undesirable results described in the Plan. 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, as warranted 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 2023. 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.

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.

APPENDIX B

Summary of Representative Well Data

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	—	—	869	871	1960	2023	63
6N/29W-08P01	Domestic	—	210 (top)	896	897	1934	2019	85
6N/29W-08P02	Domestic	—	—	896	897	1966	2023	57
6N/30W-07G05	Municipal	166	—	604	607	1962	2023	61
6N/30W-07G06	Municipal	566	305 to 410	602	604	1962	2023	61
6N/30W-11G04	Agricultural	400	130 to 390	681	683	2010	2023	13
6N/31W-01P03	Municipal	505	195 to 490	633	635	1967	2023	56
6N/31W-02K01	Domestic	—	—	620	621	1942	2023	81
6N/31W-13D01	Domestic	152	—	625	627	1941	2023	82
7N/30W-16B01	Agricultural	—	—	1,066	1,090	1950	2023	73
7N/30W-19H01	Agricultural	—	—	1,090	1,106	1954	2023	69
7N/30W-29D01	Agricultural	—	—	918	919	1905	2023	118
7N/30W-30M01	Agricultural	—	—	807	808	1905	2019	114
7N/30W-33M01	Agricultural	349	150 to 340	764	765	1954	2023	69
7N/31W-36L02	Domestic	—	—	723	724	1942	2023	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	673	2014	2023	9
6N/31W-03A01	Domestic	—	—	739	740	1963	2023	60
6N/31W-04A01	Domestic	259	—	601	603	1956	2023	67
6N/31W-09Q02	Municipal	550	250 to 540	757	754	2011	2023	12
6N/31W-10F01	Agricultural	265	—	556	557	1966	2023	57
6N/31W-11D04	Agricultural	447	93 (top)	565	567	1955	2023	68
6N/31W-16N07	Municipal	145	99 to 127	479	478	2011	2023	12
6N/31W-xxxx[1]	Municipal	329	190 to 325	503	501	2011	2023	12
Solvang HCA[1]	Municipal	490	180 to 470	398	403	2011	2023	12

Notes

[1] 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 2022	Fall 2022	Spring 2023	Fall 2023
6N/29W-07L01	637	**610**	**599**	**625**	**610**
6N/29W-08P01	676	Dry	Dry	Dry	Dry
6N/29W-08P02	653	**640**	**630**	**639**	**631**
6N/30W-07G05	513	514	**510**	**510**	**506**
6N/30W-07G06	511	513	**500**	**509**	**505**
6N/30W-11G04	510	**494**	**459**	**505**	540
6N/31W-01P03	514	515	**505**	**511**	**509**
6N/31W-02K01	556	564	562	572	578
6N/31W-13D01	494	504	503	507	510
7N/30W-16B01	1,018	1,035	1,032	1,031	1,043
7N/30W-19H01	896	911	910	910	912
7N/30W-29D01	849	858	856	893	866
7N/30W-30M01	559	--1, 2	Pumping	NM	NM
7N/30W-33M01	514	**513**	**495**	**509**	**498**
7N/31W-36L02	615	**604**	**592**	**603**	NM

Notes

Bolded values are below the minimum threshold value.

[1] Nearby Pumping

[2] Replacement well nearby measured

— = no data available

NAVD 88 = North American Vertical Datum of 1988

NM = Not measured

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

(All elevations are in feet NAVD 88)

Representative Well ID	Minimum Threshold	Spring 2022	Fall 2022	Spring 2023	Fall 2023
7N/31W-34M02	484	489	486	488	486
6N/31W-03A01	572	575	**568**	578	**568**
6N/31W-04A01	481	488	485	487	485
6N/31W-09Q02	446	469	463	469	**444**
6N/31W-10F01	463	468	466	474	467
6N/31W-11D04	502	**498**	**496**	510	516
6N/31W-16N07	377	392	391	393	402
6N/31W-xxxx	467	468	**462**	471	469
Solvang HCA	320	341	325	342	353

Notes

Bolded values are below the minimum threshold value.

NM = Not Measured

NAVD 88 = North American Vertical Datum of 1989

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 2022	Fall 2022	Spring 2023	Fall 2023
6N/29W-05A01	Tributary Alluvium	--	Dry	1,174	1,169
6N/29W-06F01	Tributary Alluvium	828	823	830	828
6N/29W-06G01	Tributary Alluvium	827	826	828	828
7N/30W-22E01	Tributary Alluvium	911	Pumping	912	912
8N/31W-36H01	Tributary Alluvium	1,144	1,128	1,167	1,141
6N/31W-17F01[1]	Santa Ynez River Alluvium	326	Dry	331	325
6N/31W-17F03[1]	Santa Ynez River Alluvium	327	324	324	327
6N/31W-21H03[1]	Santa Ynez River Alluvium	360	360	--	--
6N/31W-22M01[1]	Santa Ynez River Alluvium	360	362	--	--
6N/30W-01R03	Tributary Alluvium / Paso Robles Formation	600	584	601	--
7N/30W-24Q01	Tributary Alluvium / Paso Robles Formation	1,158	1,156	1,158	1,154
7N/30W-27H01	Tributary Alluvium / Paso Robles Formation	839	828	Pumping	841
8N/30W-30R01	Tributary Alluvium / Paso Robles Formation	1,224	1,174	1,242	1,216
8N/30W-30R02	Tributary Alluvium / Paso Robles Formation	1,198	1,161	--	--
6N/31W-01P02	Paso Robles Formation	--	--	--	--
7N/29W-29R01	Paso Robles Formation	--	--	--	--
7N/29W-29R02	Paso Robles Formation	--	--	--	--
7N/30W-22E02	Paso Robles Formation	Obstructed	Pumping/Obstructed	--	--
7N/30W-35R01	Paso Robles Formation	--	--	--	--
7N/30W-36N03	Paso Robles Formation	--	--	--	--
7N/31W-23P01	Paso Robles Formation	--	--	--	--
8N/31W-22N01	Paso Robles Formation	--	--	--	--
Solvang_23	Paso Robles Formation / Careaga Sand	--	--	--	--
6N/31W-07F01	Careaga Sand	308	Pumping	308	307
HCA_Middle	Careaga Sand	--	--	--	--
Solvang_Lot72	Careaga Sand	--	--	--	--

Notes

[1] These wells are in the Santa Ynez River alluvium area of the Santa Ynez EMA the

[2] Nearby pumping

— = no data available

NAVD 88 = North American Vertical Datum of 1988

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APPENDIX C

Representative Monitoring Site Hydrographs

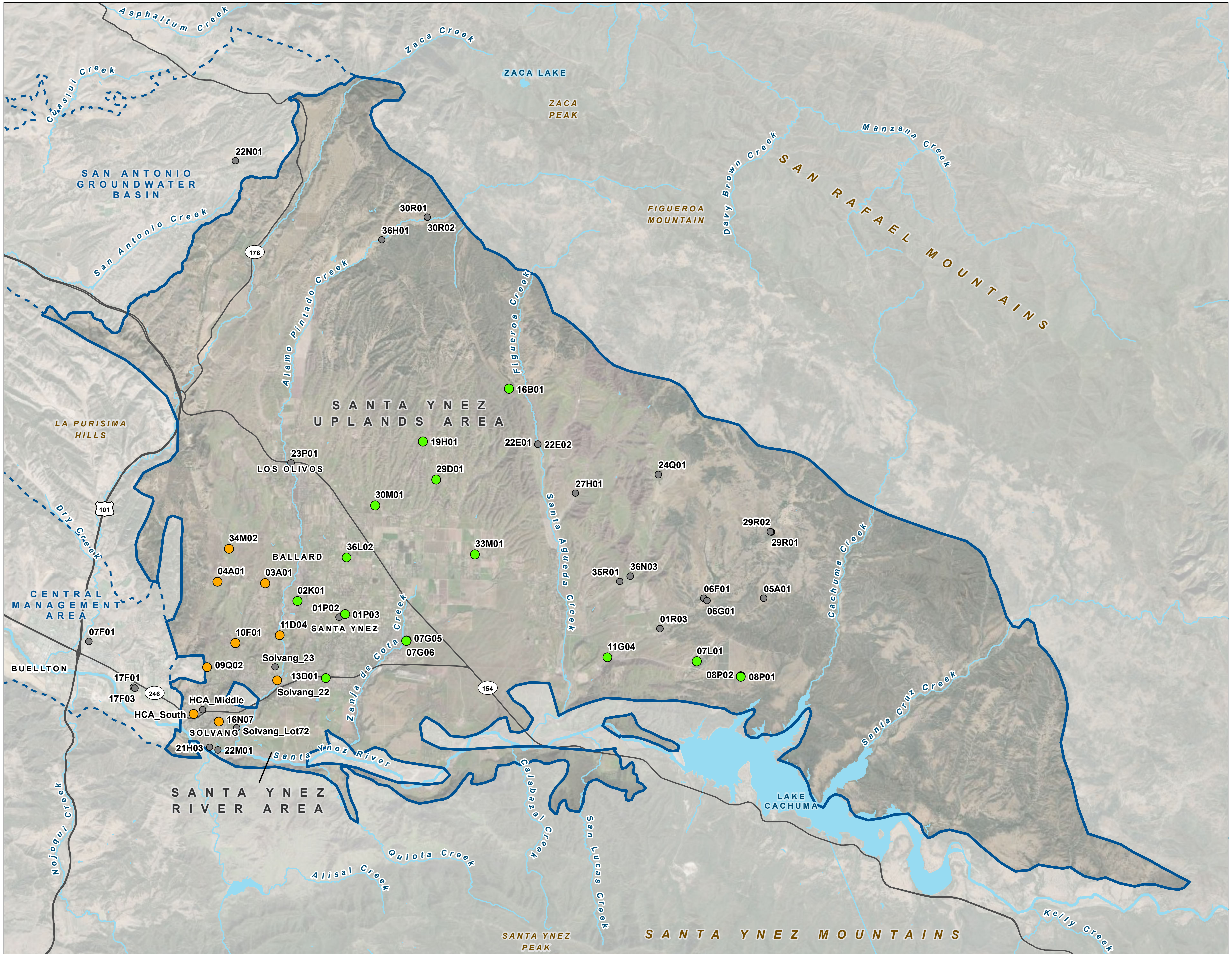

FIGURE 5

Groundwater Level Monitoring Network

Annual Report Water Year 2023 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

N

0 5,000 10,000 15,000
Feet

Date: February 19, 2024
Data Sources: ESRI, USGS, Maxar 2020

GSI Water Solutions, Inc.

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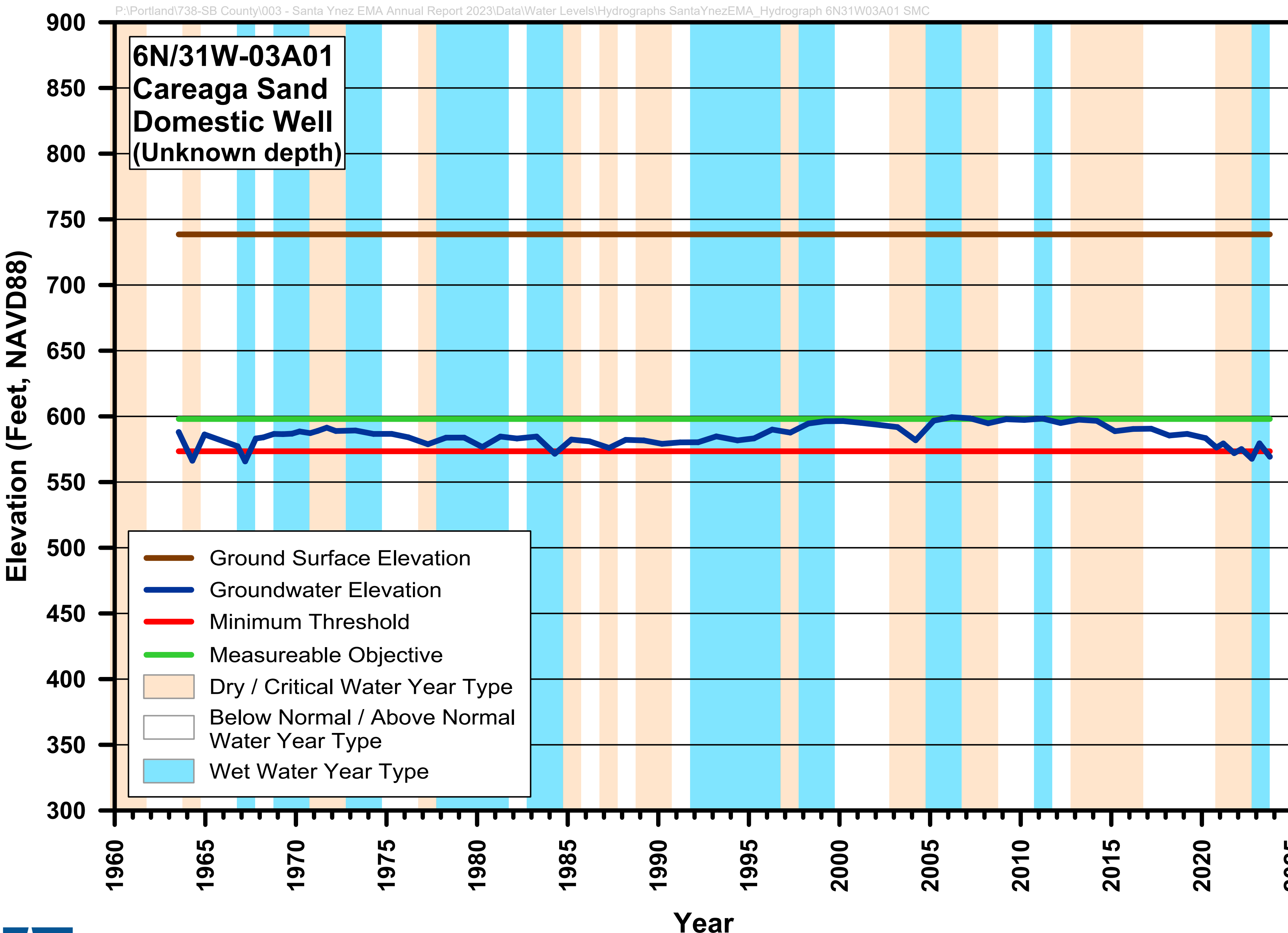

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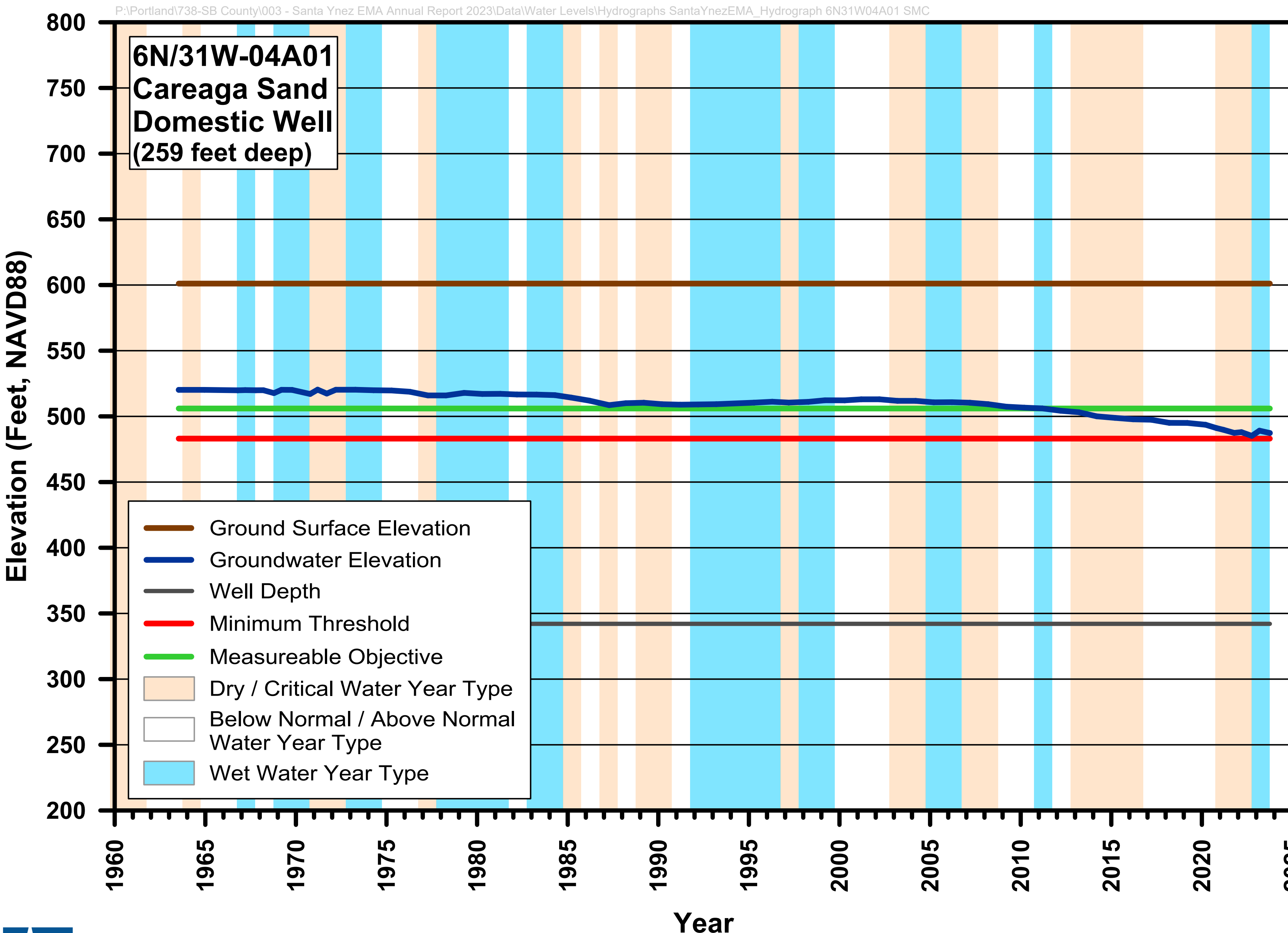
Groundwater Elevation Hydrograph
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



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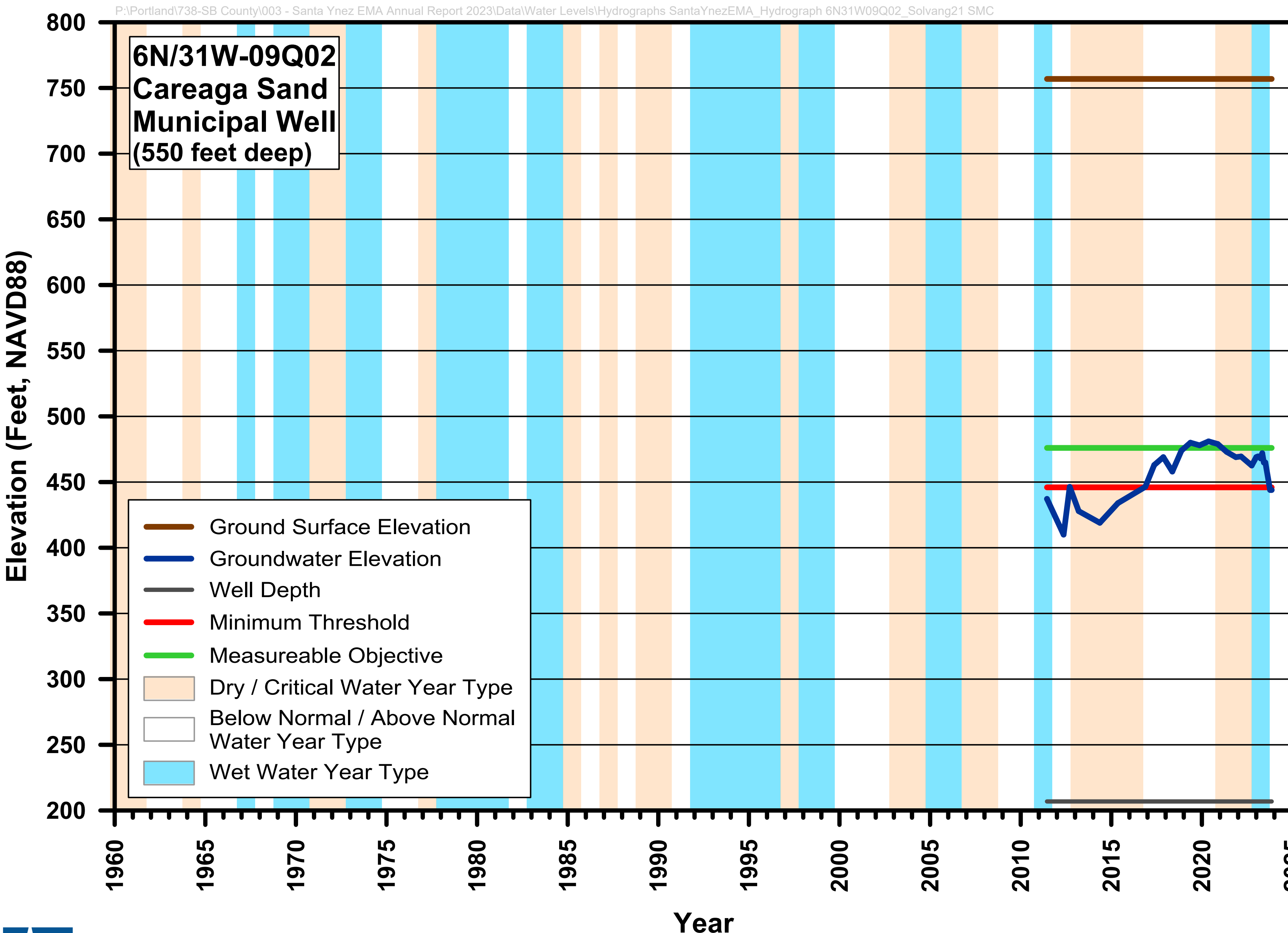
Groundwater Elevation Hydrograph

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



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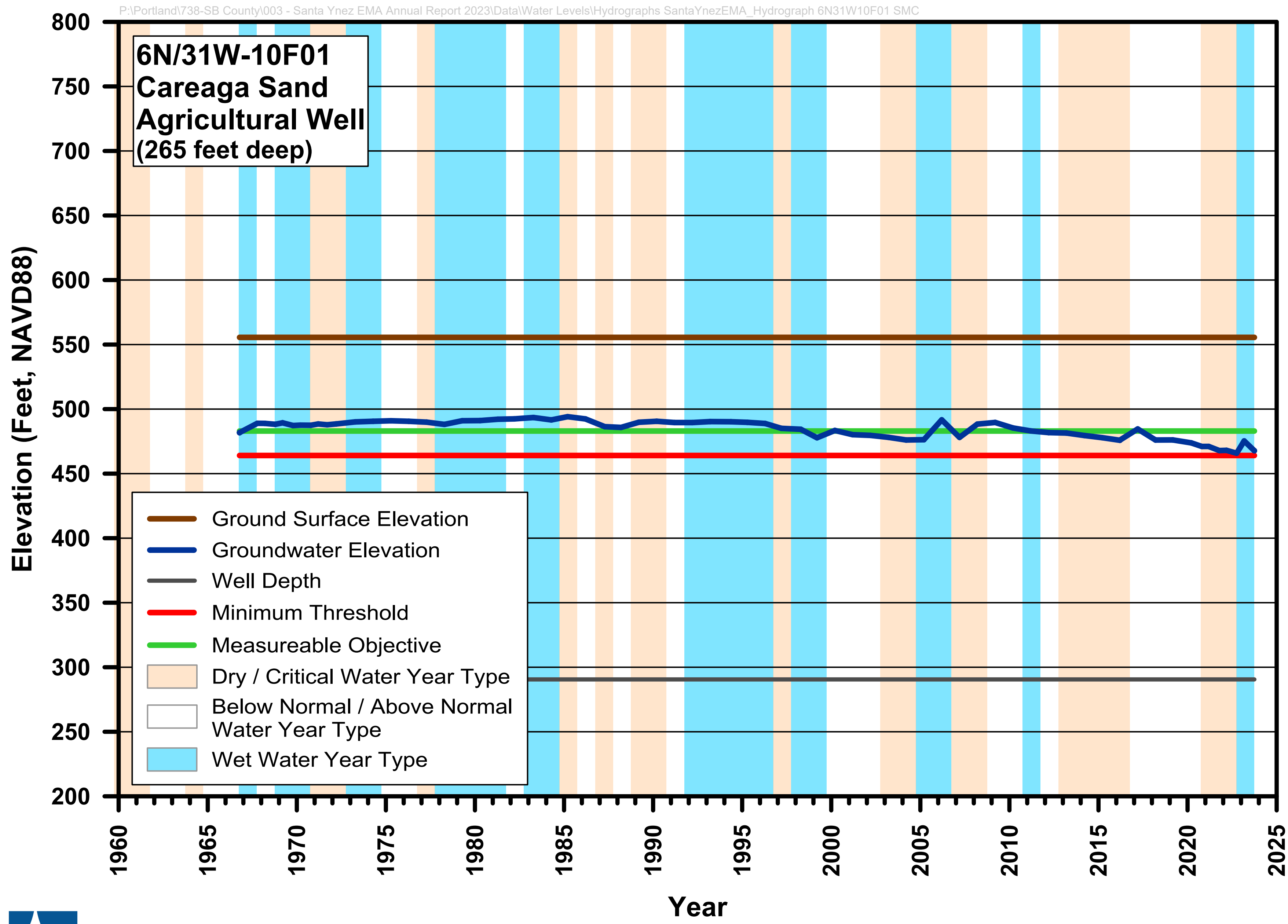

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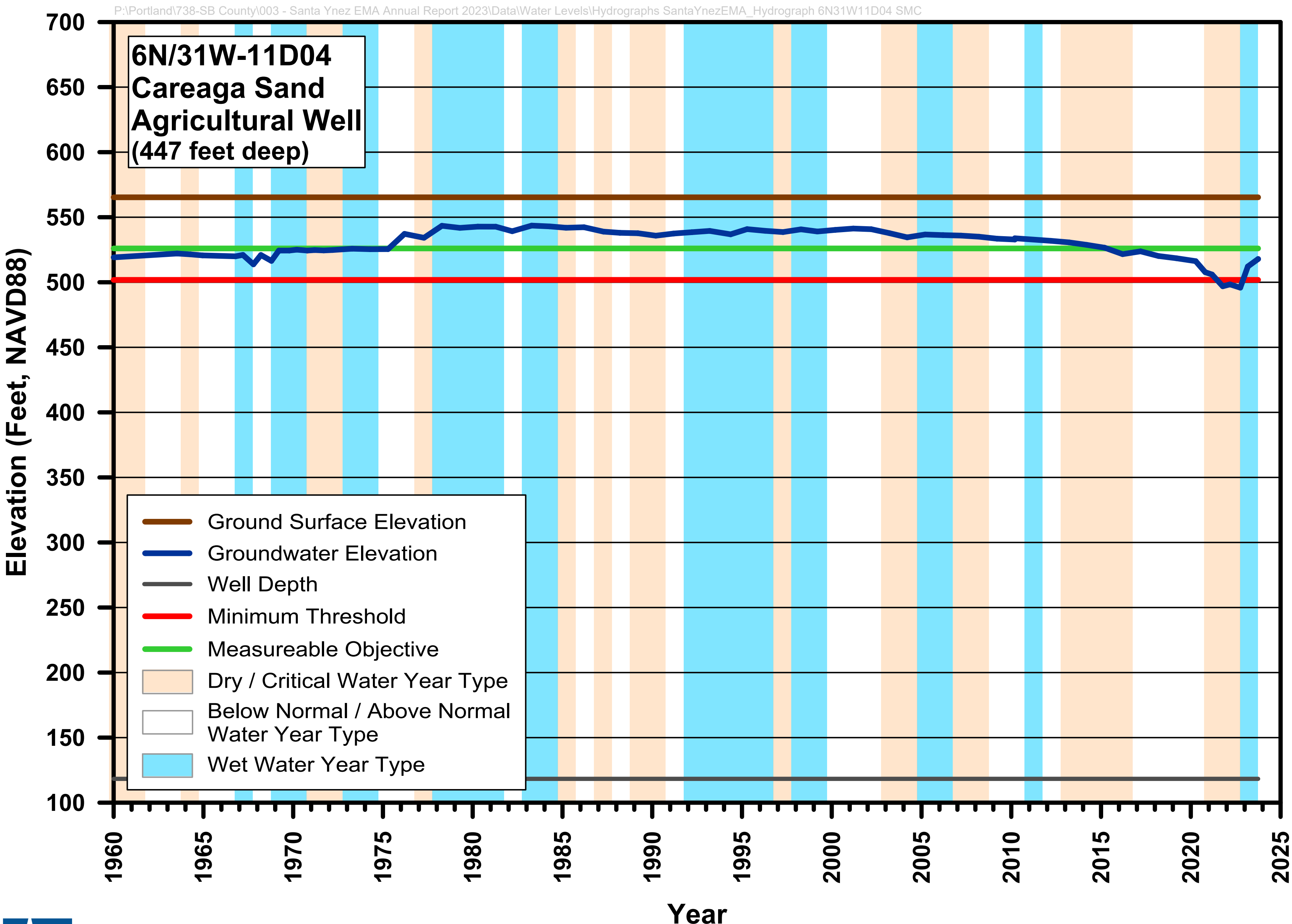
Groundwater Elevation Hydrograph

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



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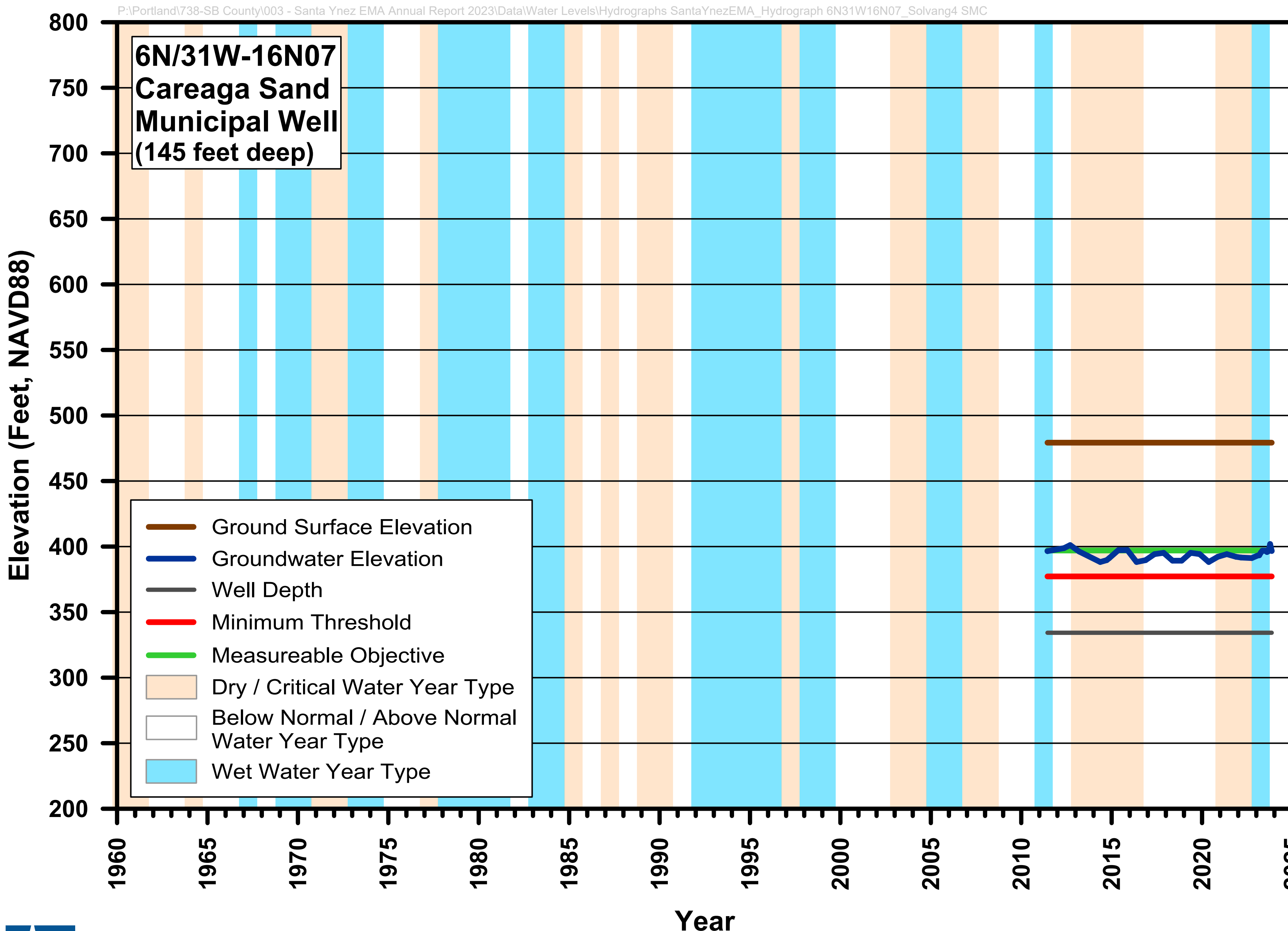
Groundwater Elevation Hydrograph
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



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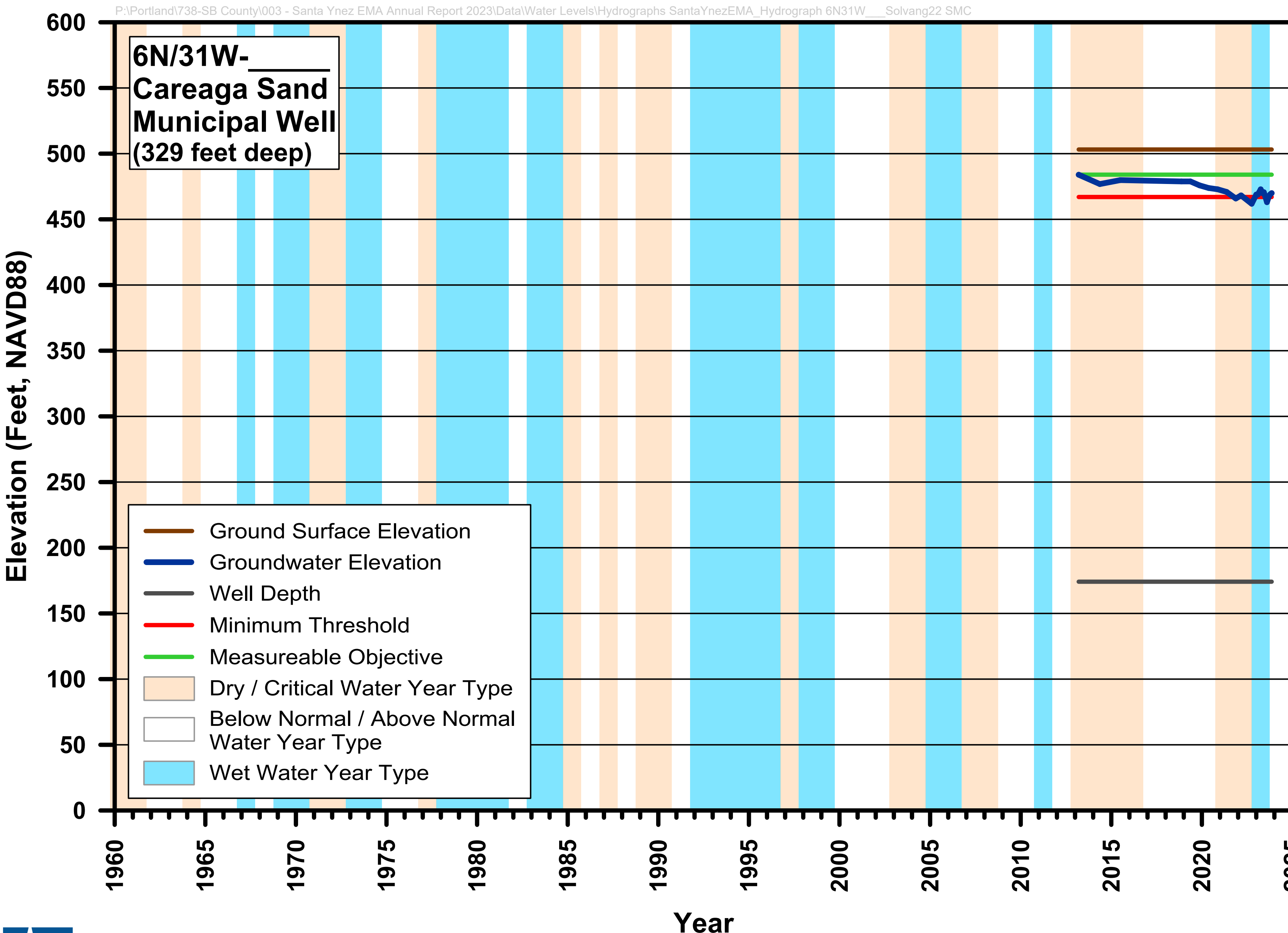

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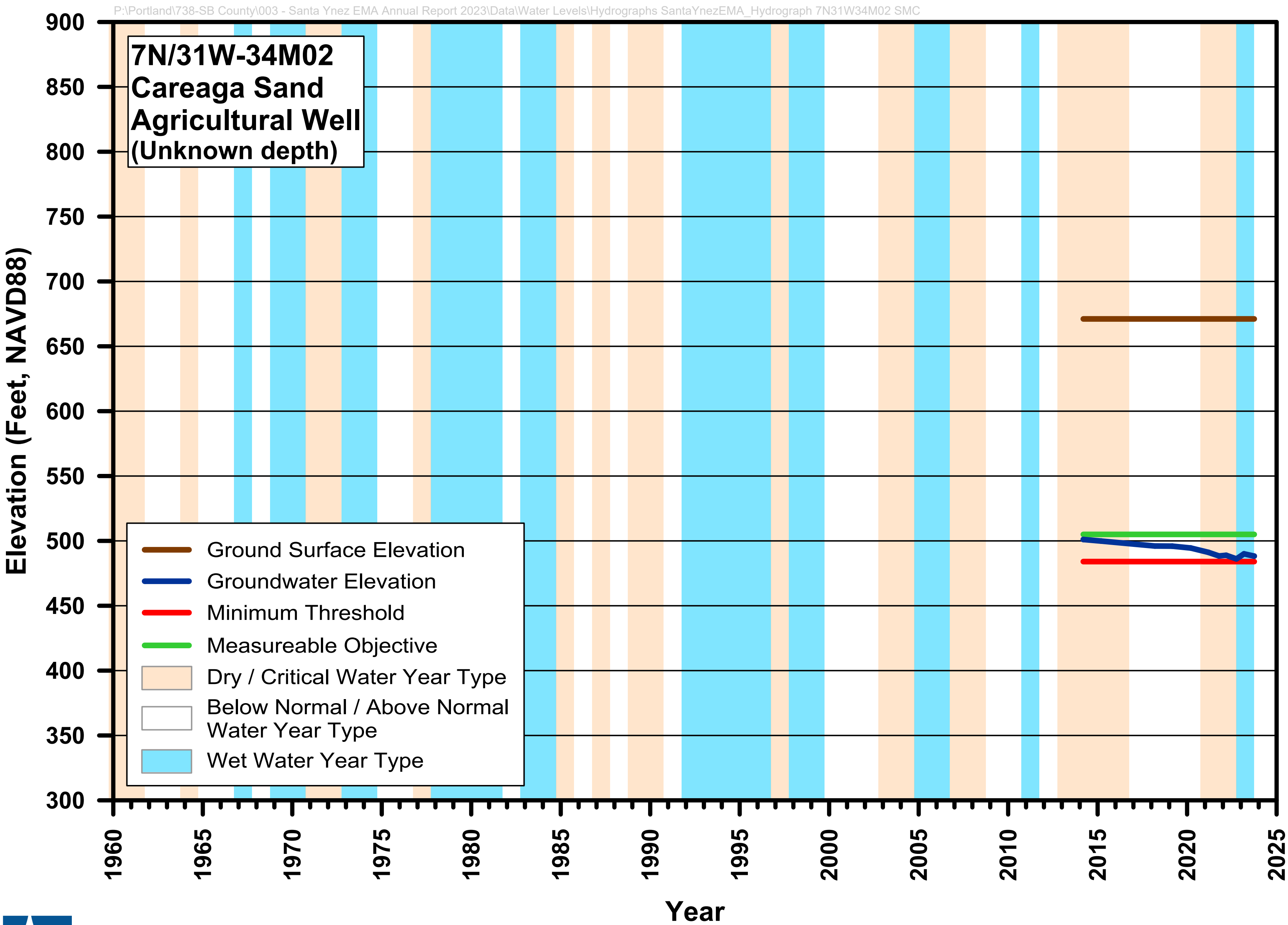

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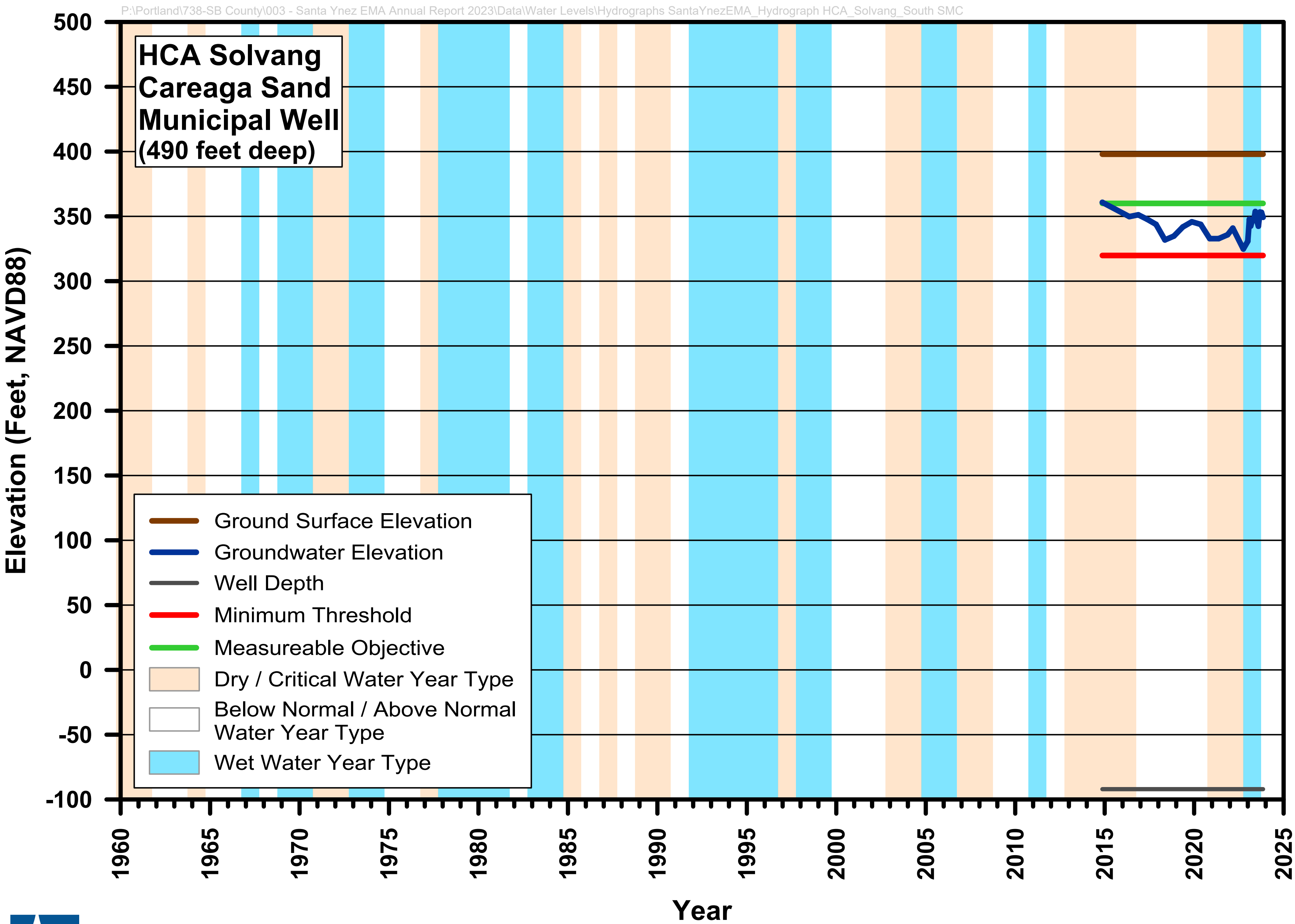

Groundwater Elevation Hydrograph

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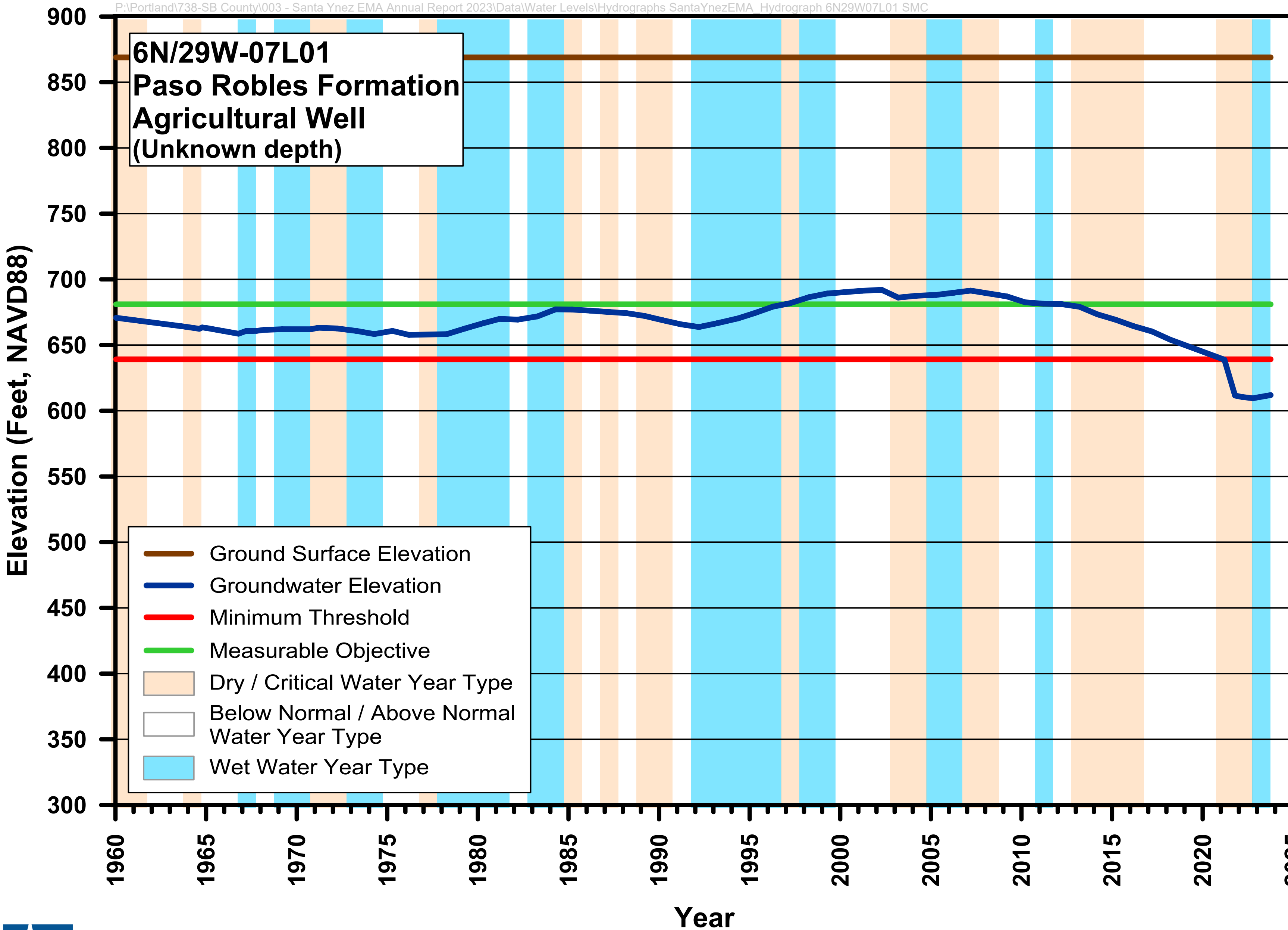

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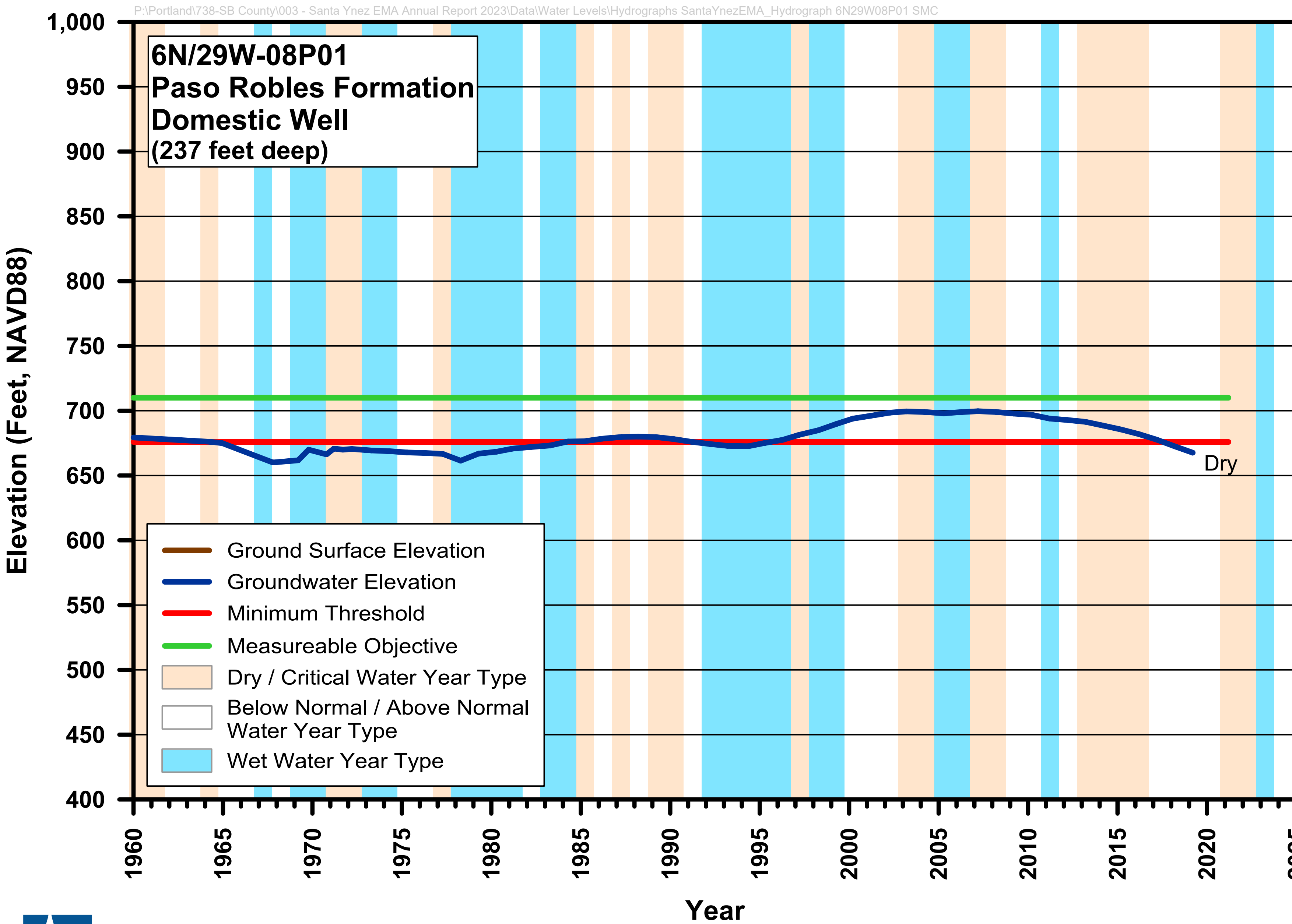

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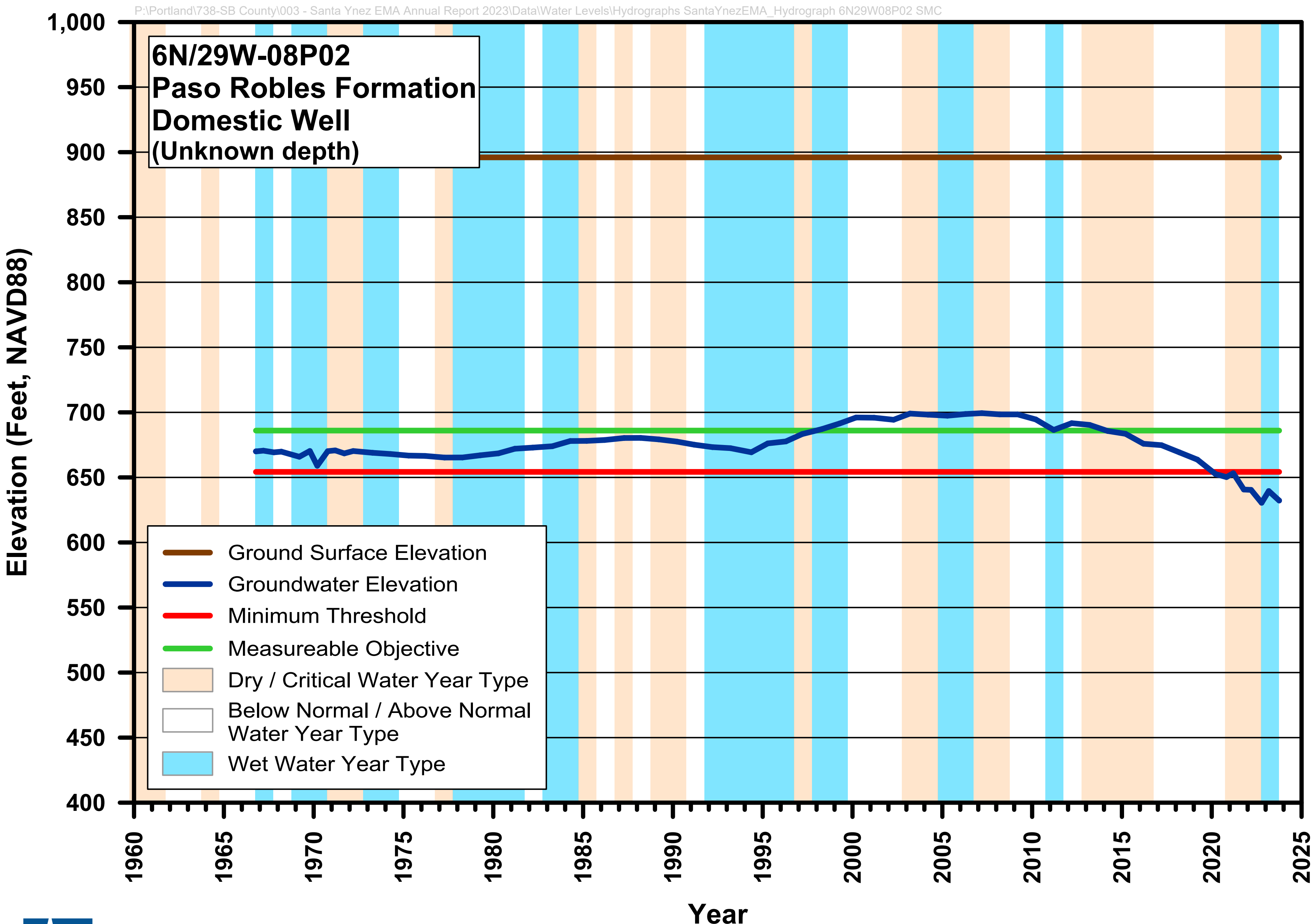

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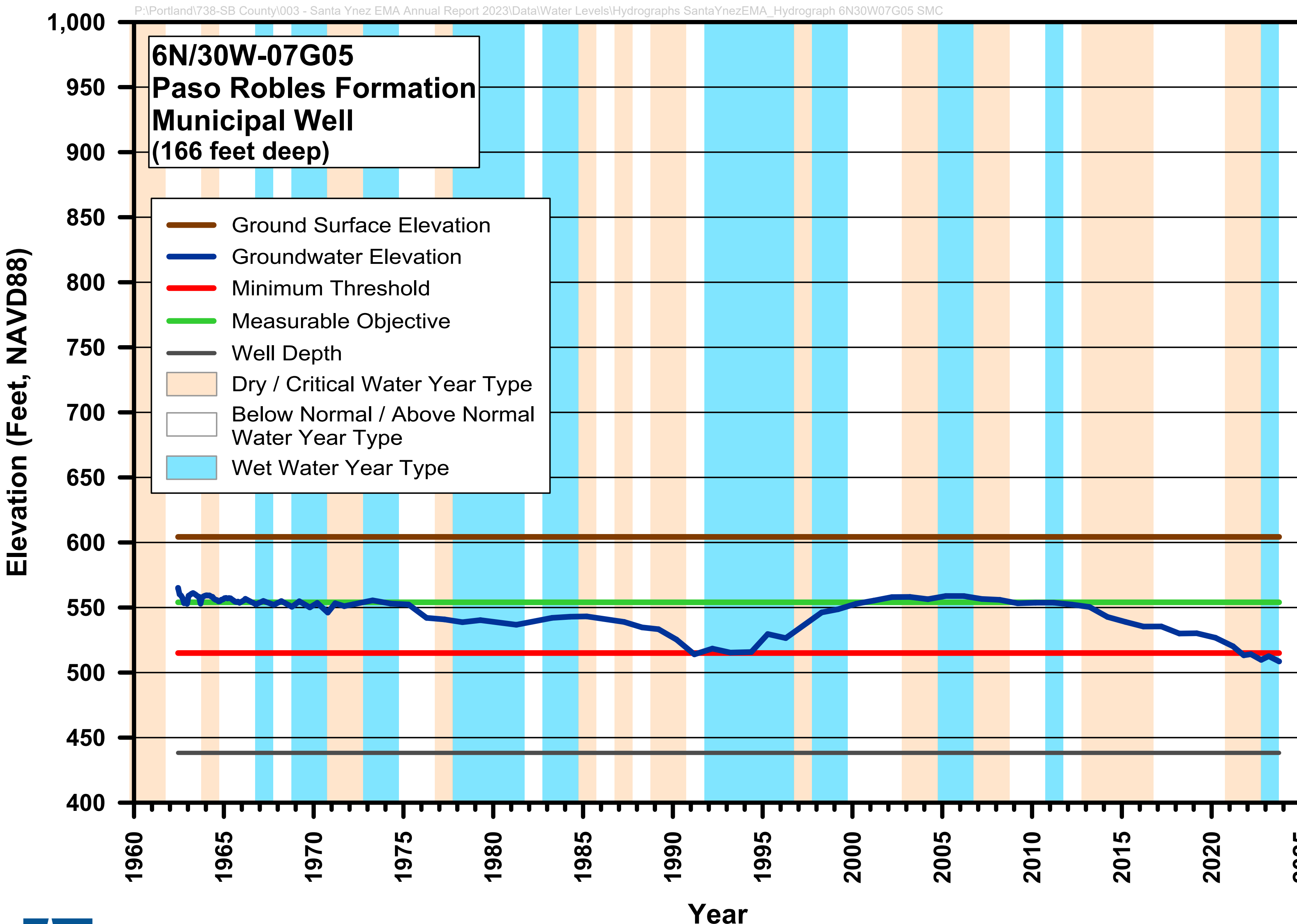
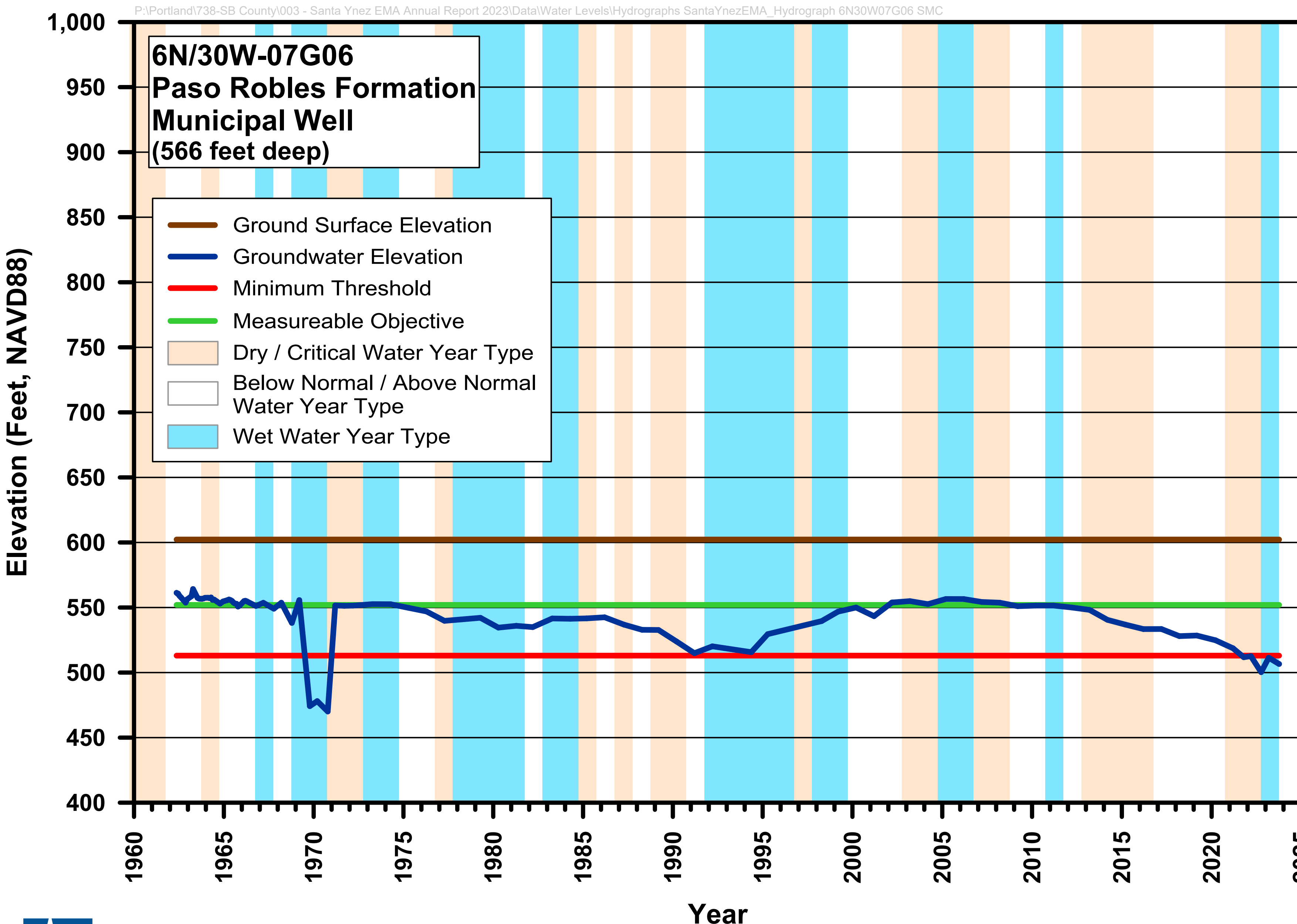
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



Groundwater Elevation Hydrograph

Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



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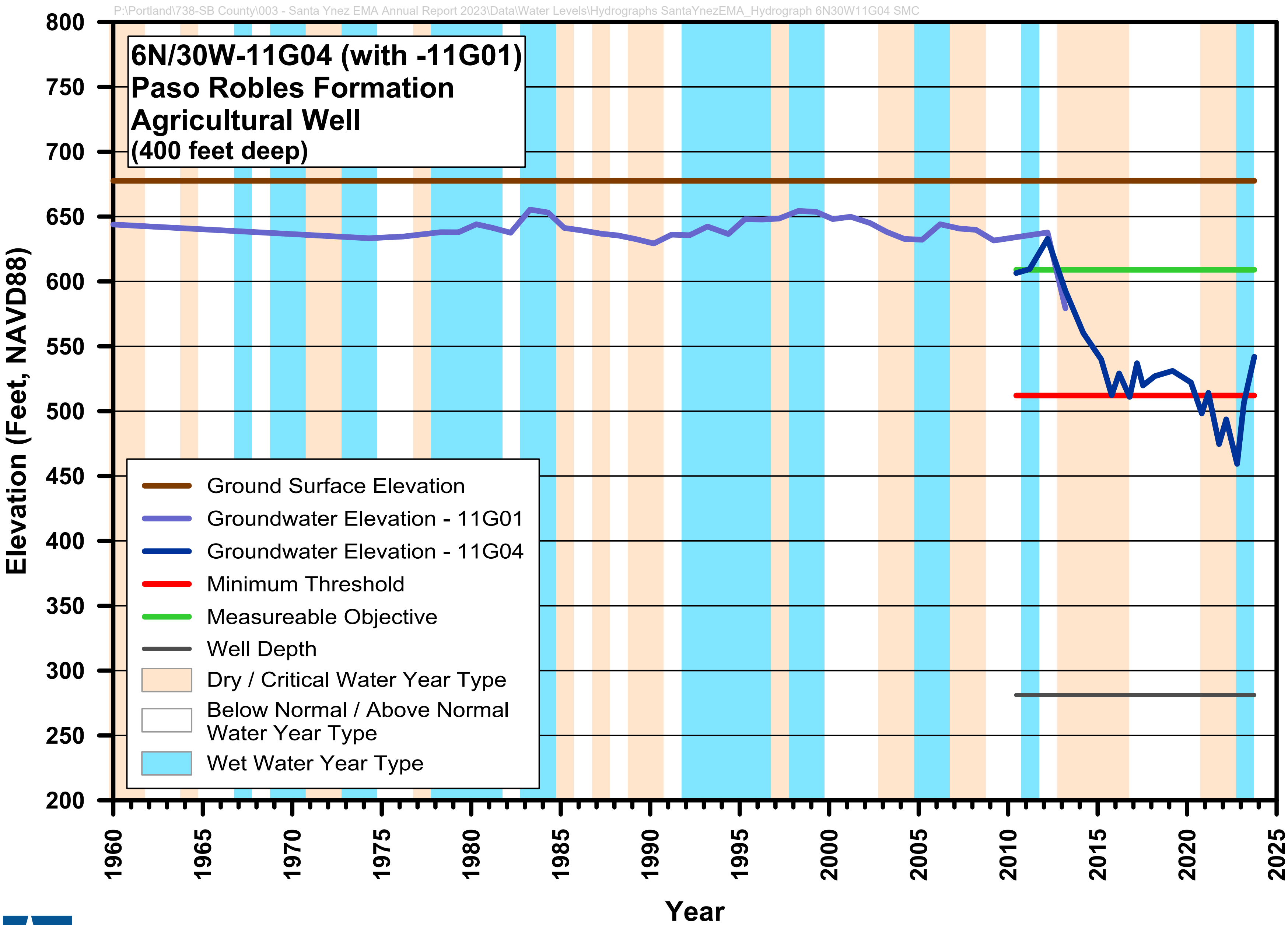
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



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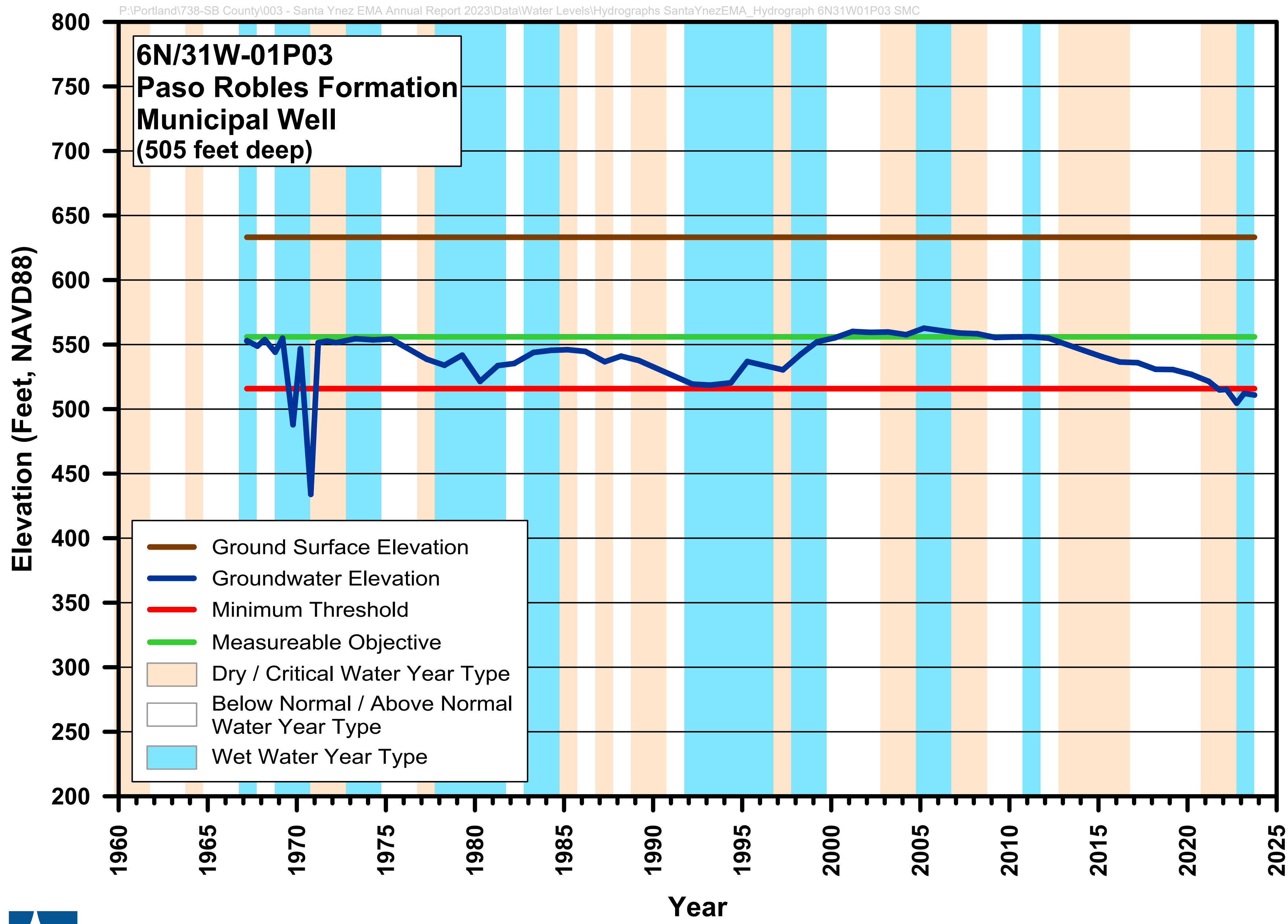
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



Groundwater Elevation Hydrograph

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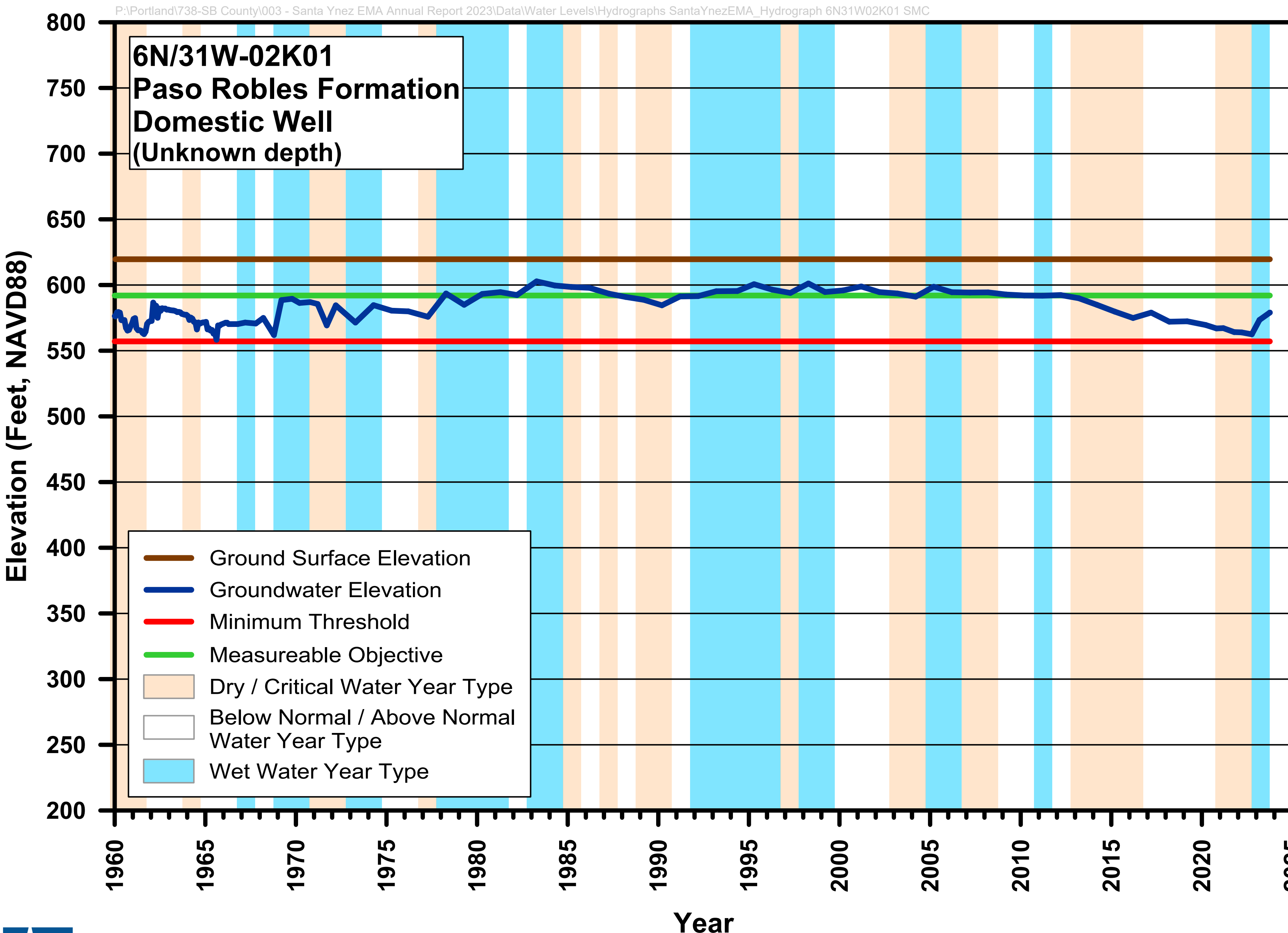

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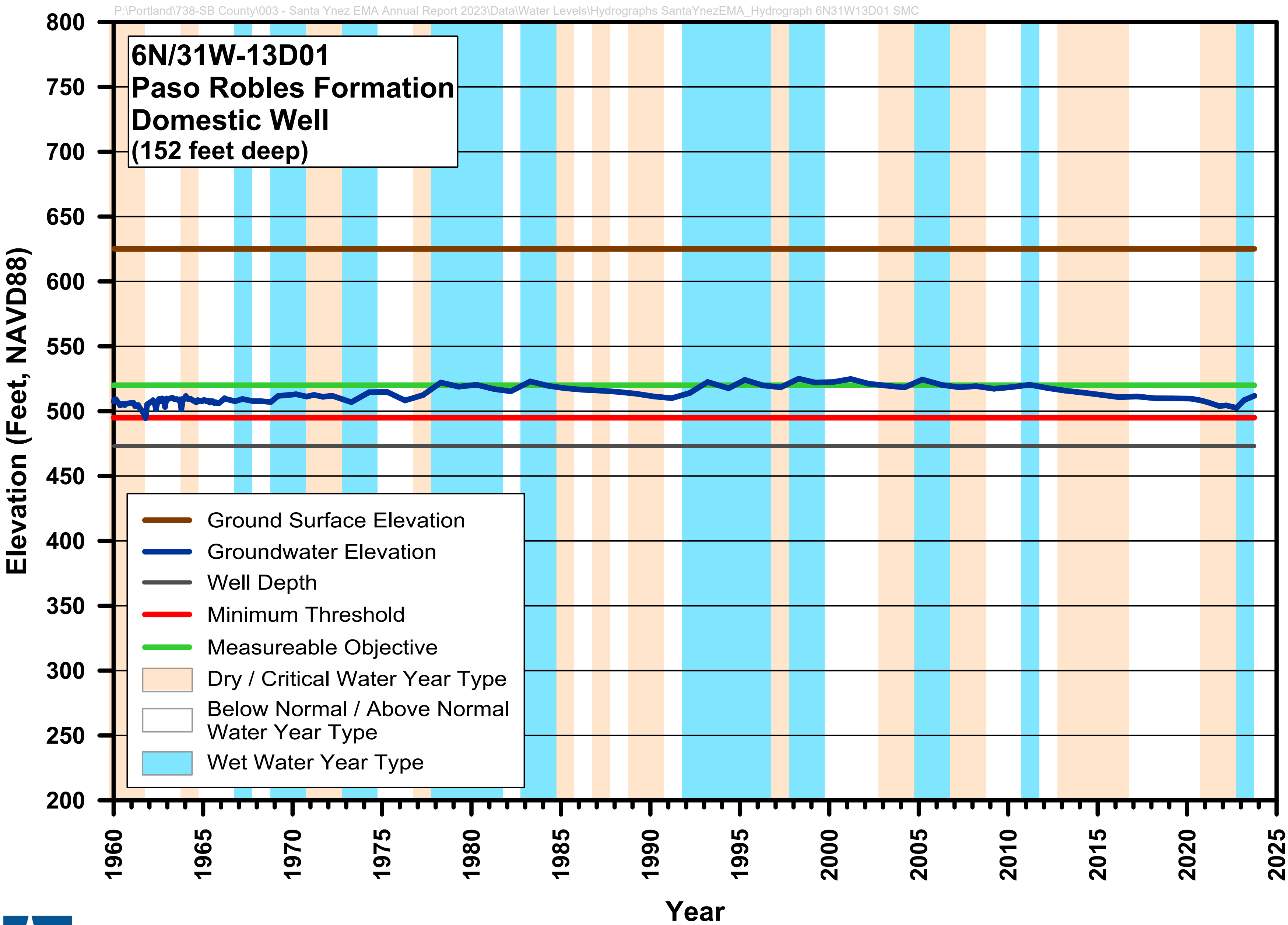

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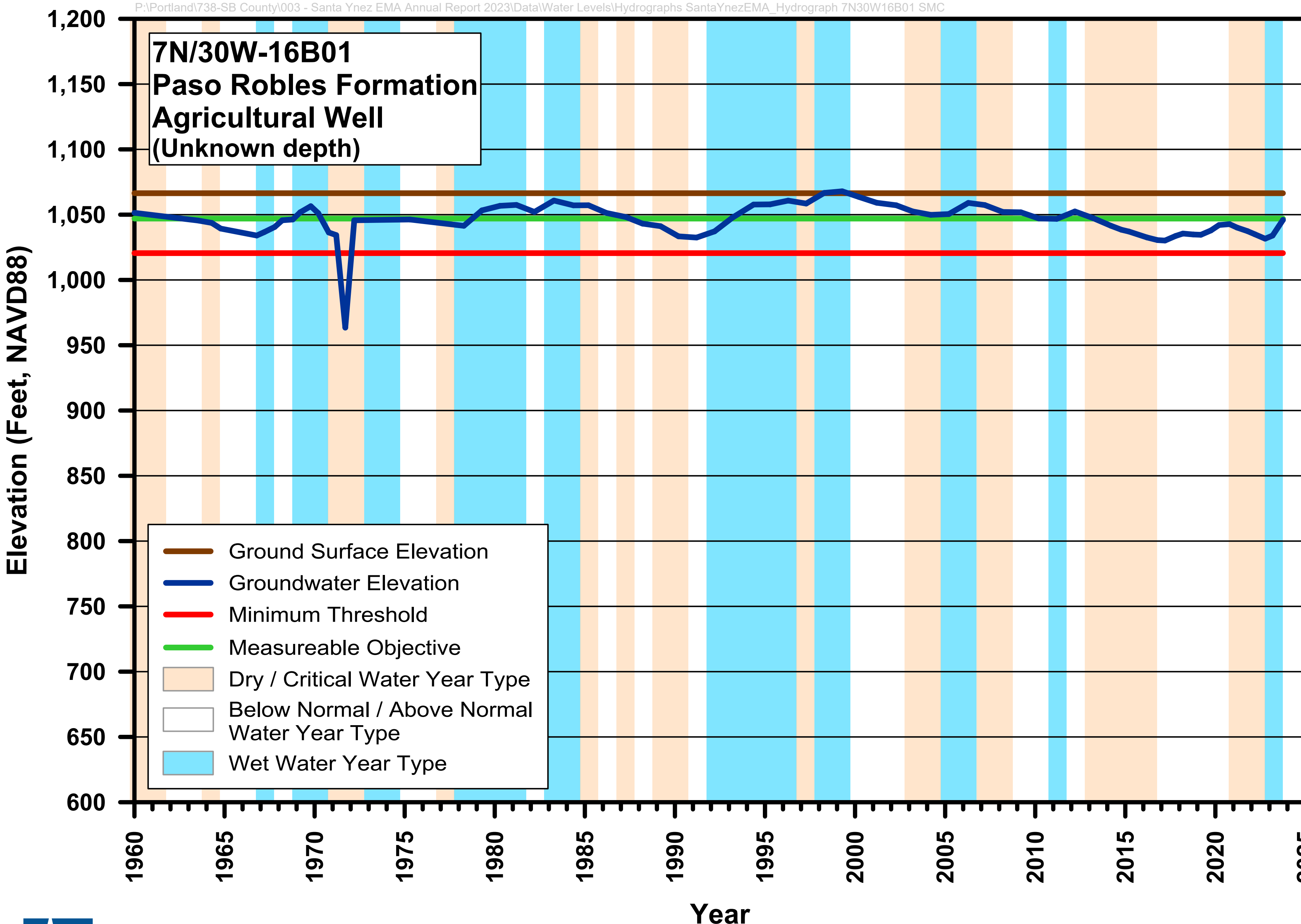
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



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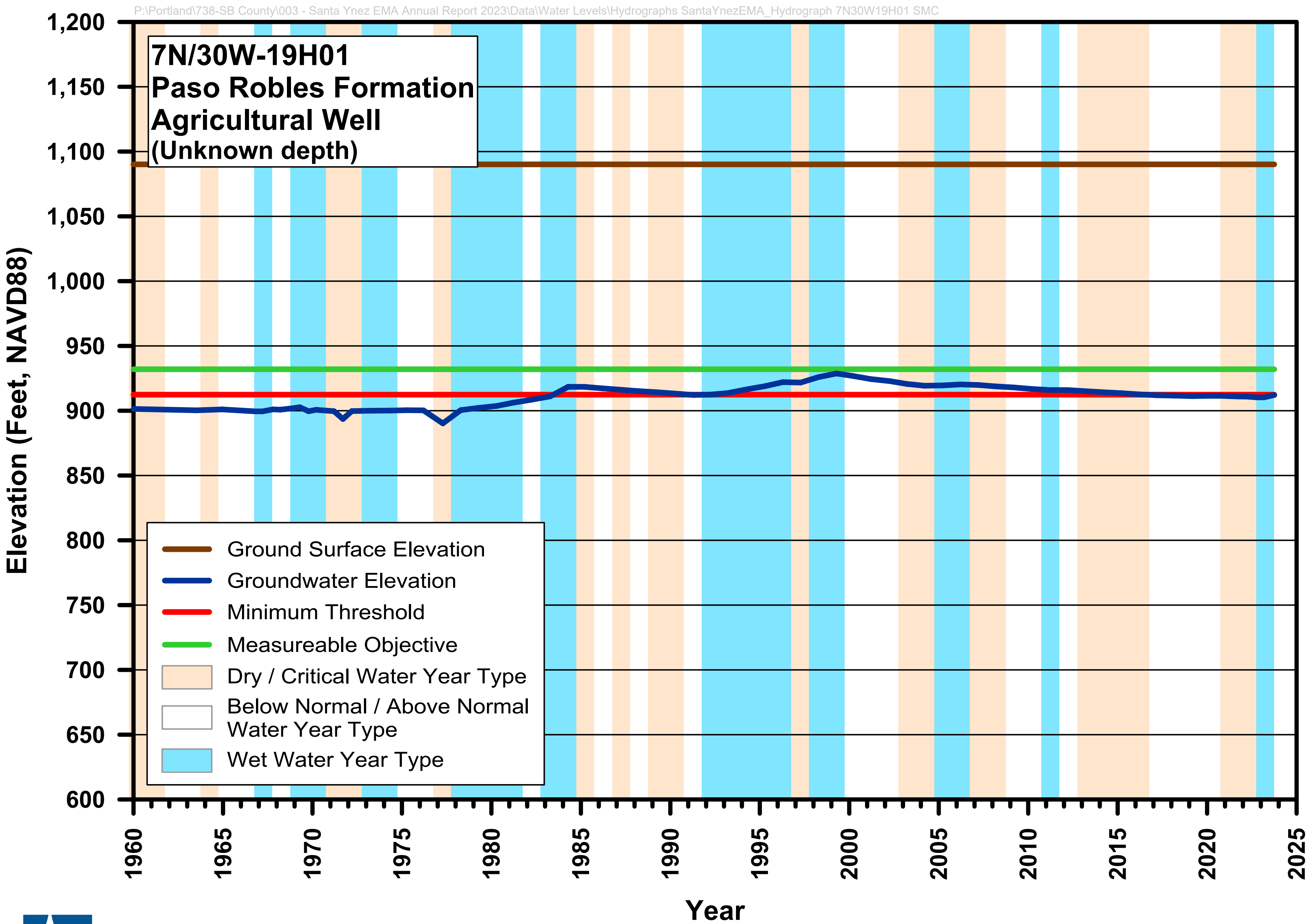

GSI Water Solutions, Inc.

Groundwater Elevation Hydrograph
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area

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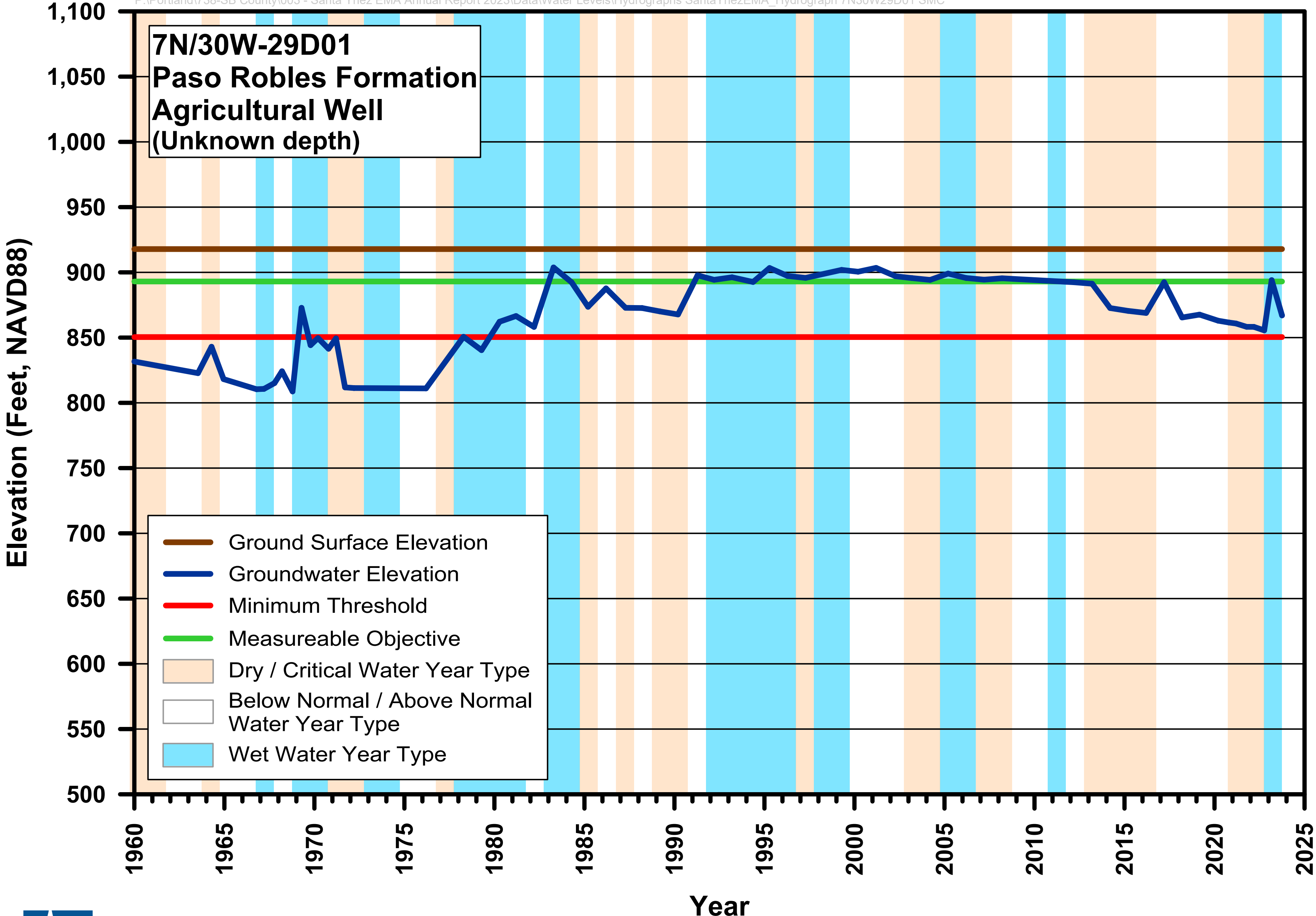

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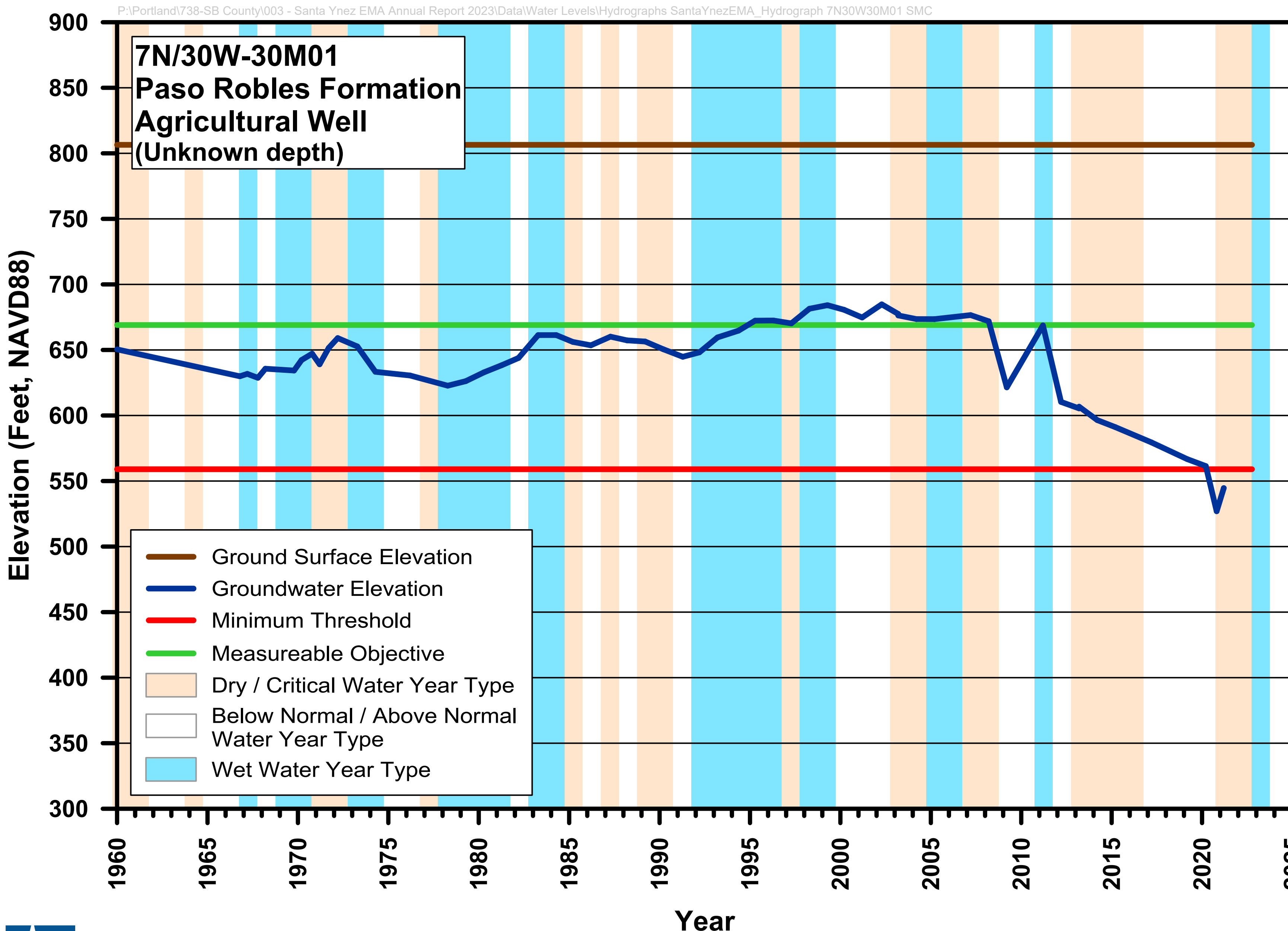
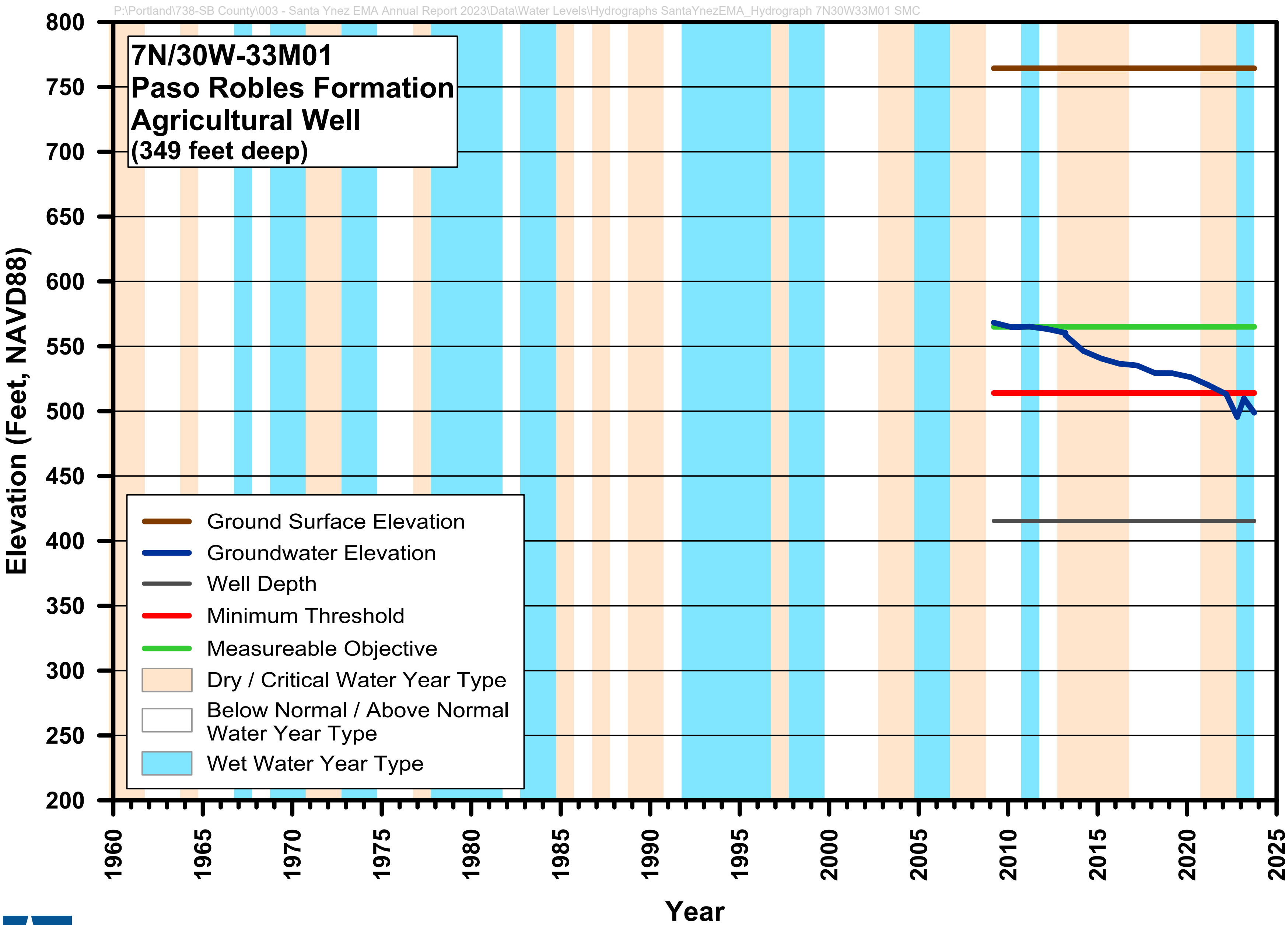
Groundwater Elevation Hydrograph
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



GSI Water Solutions, Inc.

Groundwater Elevation Hydrograph
Annual Report Water Year 2023 for the Santa Ynez River Valley Groundwater Basin, Eastern Management Area



GSI Water Solutions, Inc.

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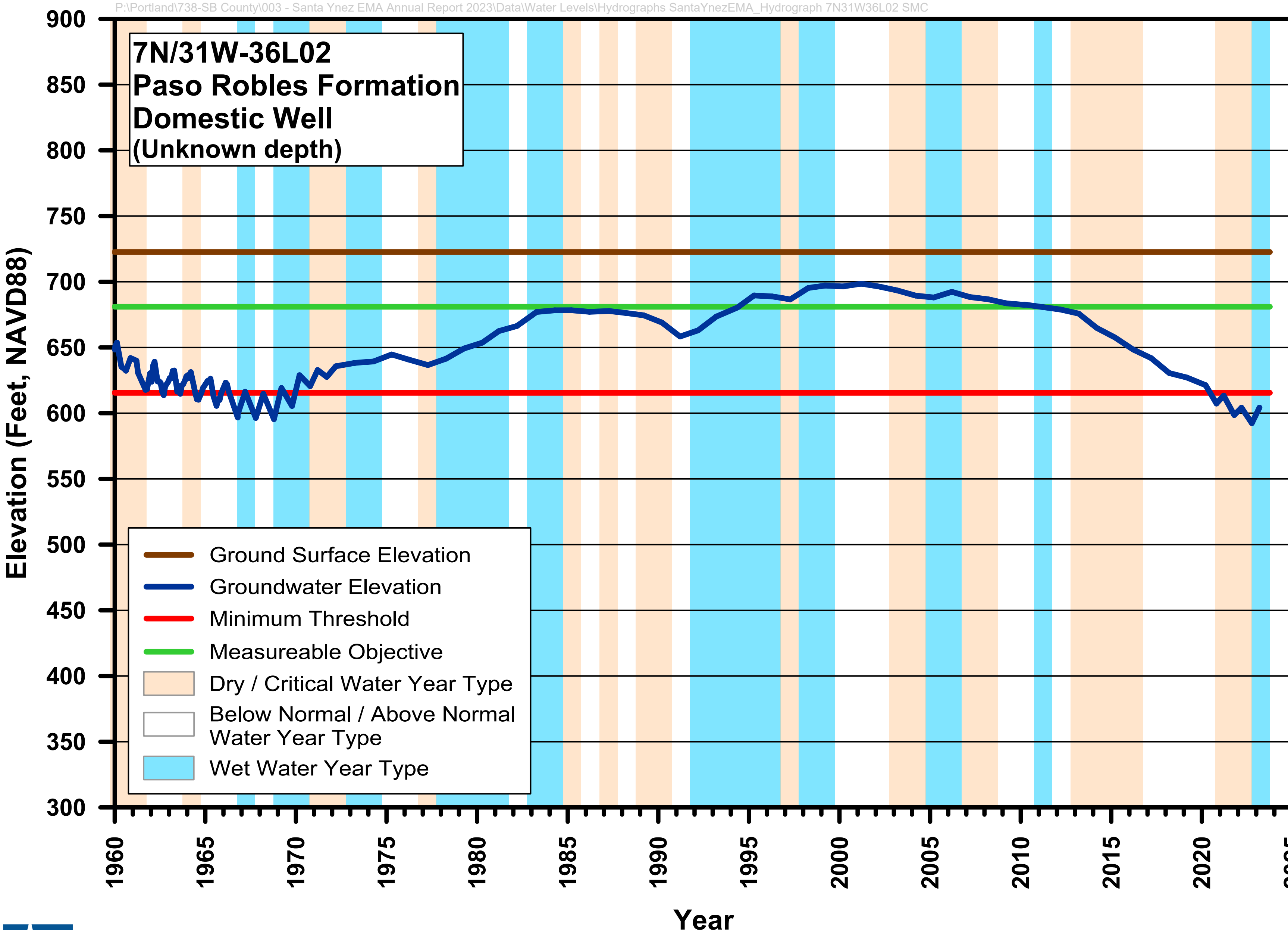

Groundwater Elevation Hydrograph

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APPENDIX D

Land Subsidence Data

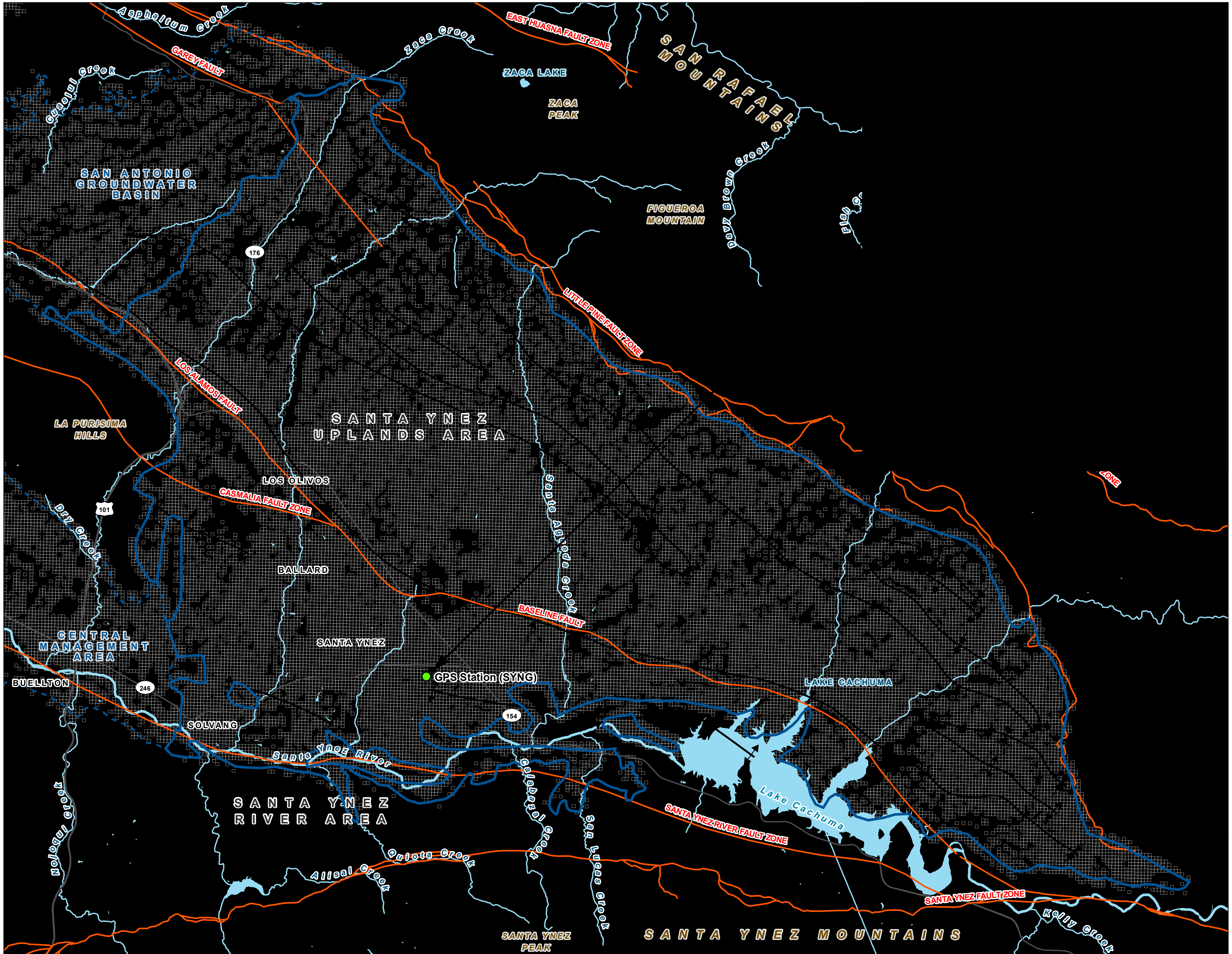

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FIGURE D-1

Land Subsidence

Annual Report Water Year 2023
for the Santa Ynez River Valley
Groundwater Basin,
Eastern Management Area

LEGEND

Vertical Displacement Point Data Location Q4 2023

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.

N

0 5,000 10,000 15,000

Feet

Date: March 4, 2024

Data Sources: ESRI, USGS, Maxar 2019