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Paso Basin Cooperative Committee
and the Groundwater Sustainability Agencies

# Paso Robles Subbasin Water Year 2021 Annual Report

February 4, 2022

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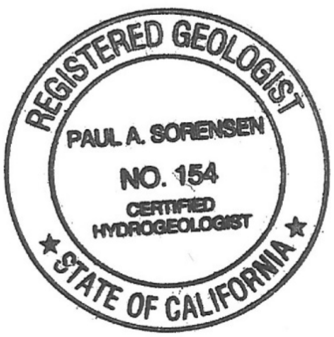
# Paso Robles Subbasin
# Water Year 2021 Annual Report

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

| | |
|---|---|
| AEM | airborne electromagnetic method |
| AF | acre-feet |
| AFY | acre-feet per year |
| AMSL | above mean sea level |
| BMP | Best Management Practice |
| CASGEM | California State Groundwater Elevation Monitoring Program |
| CCR | California Code of Regulations |
| CDEC | California Data Exchange Center |
| CDFFP | California Department of Forestry and Fire Protection |
| CIMIS | California Irrigation Management Information System |
| COC | constituent of concern |
| CSA | Community Service Area |
| CSD | Community Services District |
| CWWCP | Countywide Water Conservation Program |
| DSOD | Division of Safety of Dams |
| DWR | California State Department of Water Resources |
| EPCWD | Estrella-El Pomar-Creston Water District |
| ETo | reference evapotranspiration |
| GDE | groundwater dependent ecosystem |
| GMP | Groundwater Management Plan |
| gpd/ft | gallons per day per foot |
| gpm | gallons per minute |
| GSA | Groundwater Sustainability Agency |
| GSP | Groundwater Sustainability Plan |
| GSSI | Geoscience Support Services, Inc. |
| IDC | IWFM Independent Demand Calculator |
| ILRP | Irrigated Lands Regulatory Program |
| InSAR | interferometric synthetic-aperture radar |
| IWFM | Integrated Water Flow Model |
| LID | low-impact development |
| M&A | Montgomery & Associates, Inc. |
| MOA | memorandum of agreement |
| NPDES | National Pollutant Discharge Elimination System |
| NWP | Nacimiento Water Project |
| PBCC | Paso Basin Cooperative Committee |
| PRWSP | Paso Robles Watershed Plan |
| PWS | public water system |
| RDI | regulated deficit irrigation |

| | |
|---|---|
| RMS | representative monitoring site |
| RU | rural domestic unit |
| S | storage coefficient |
| SEP | Supplemental Environmental Project |
| SGMA | Sustainable Groundwater Management Act |
| SLO | San Luis Obispo |
| SLOFCWCD | San Luis Obispo County Flood Control and Water Conservation District |
| SPI | Standardized Precipitation Index |
| SSJGSA | Shandon-San Juan Groundwater Sustainability Agency |
| SSJWD | Shandon-San Juan Water District |
| Subbasin | Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin |
| SWMP | Stormwater Management Plan |
| SWRCB | State Water Resources Control Board |
| SWRP | San Luis Obispo County Stormwater Resource Plan |
| SWP | State Water Project |
| TDS | total dissolved solids |
| USACE | United States Army Corps of Engineers |
| USGS | U.S. Geological Survey |
| WNND | Water Neutral New Development |
| WY | water year |

# Annual Report Elements Guide and Checklist

| California Code of Regulations – GSP Regulation Sections | Annual Report Elements | Location in Annual Report |
|---|---|---|
| Article 7 | Annual Reports and Periodic Evaluations by the Agency | |
| § 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. | Executive Summary (§356.2[a]) |
| | (b) A detailed description and graphical representation of the following conditions of the basin managed in the Plan: | Section 2.4 Monitoring Networks (§356.2[b]) |
| | (1) Groundwater elevation data from monitoring wells identified in the monitoring network shall be analyzed and displayed as follows: | Section 3 Groundwater Elevations (§356.2[b][1]) |
| | (A) Groundwater elevation contour maps for each principal aquifer in the basin illustrating, at a minimum, the seasonal high and seasonal low groundwater conditions. | Section 3.2 Seasonal High and Low (Spring and Fall) (§356.2[b][1][A]) |
| | (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. | Section 3.3 Hydrographs (§356.2[b][1][B], and Appendix E) |
| | (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. | Section 4 Groundwater Extractions (§356.2[b][2]) |
| | (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. | Section 5 Surface Water Use (§356.2[b][3]) |

| California Code of Regulations – GSP Regulation Sections | Annual Report Elements | Location in Annual Report |
|---|---|---|
| Article 7 | Annual Reports and Periodic Evaluations by the Agency | |
| § 356.2 | Annual Reports | |
| | (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. | Section 6 Total Water Use (§356.2[b][4]) |
| | (5) Change in groundwater in storage shall include the following: | Section 7 Change in Groundwater in Storage (§356.2[b][5]) |
| | (A) Change in groundwater in storage maps for each principal aquifer in the basin. | Section 7.1 Annual Changes in Groundwater Elevation (§356.2[b][5][A]) |
| | (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. | Section 7.2 Annual and Cumulative Change in Groundwater in Storage Calculations (§356.2[b][5][B]) |
| | (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. | Section 8 Progress towards Basin Sustainability (§356.2[c]) |

# Executive Summary (§ 356.2[a])

## Introduction

This Water Year 2021 Annual Report for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin (Paso Robles Subbasin or Subbasin; see Figure 1) has been prepared in accordance with the Sustainable Groundwater Management Act (SGMA) and Groundwater Sustainability Plan (GSP) Regulations. Pursuant to the California Department of Water Resources (DWR) regulations, a GSP Annual Report must be submitted to DWR by April 1 of each year following the adoption of the GSP.

With the submittal of the adopted Paso Robles Subbasin GSP on January 31, 2020, the Groundwater Sustainability Agencies (GSAs) are required to submit an annual report for the preceding Water Year (October 1 through September 30) to DWR by April 1 of each subsequent year. These annual reports will convey monitoring and water use data to the DWR and to Subbasin stakeholders on an annual basis to gauge performance of the Subbasin relative to the sustainability goals set forth in the GSP.

Sections of the Water Year 2021 Annual Report include the following:

**Section 1. Introduction – Paso Robles Subbasin Water Year 2021 Annual Report**: a brief background of the formation and activities of the Paso Robles Subbasin GSAs and development and submittal of the GSP.

**Section 2. Paso Robles Subbasin Setting and Monitoring Networks**: a summary of the Subbasin setting, Subbasin monitoring networks, and 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 contour maps for spring and fall monitoring events and representative hydrographs.

**Section 4. Groundwater Extractions (§356.2[b][2])**: compilation of metered and estimated groundwater extractions by land use sector and location of extractions.

**Section 5. Surface Water Use (§356.2[b][3])**: a summary of reported surface water use.

**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 fall to fall groundwater elevation differences.

**Section 8. Progress towards Basin Sustainability (§356.2[c])**: a summary of management actions taken throughout the Subbasin by GSAs and individual entities towards sustainability of the Subbasin.

## Groundwater Elevations

In general, the groundwater elevations observed in the Subbasin during water year (WY) 2021 show a decline across portions of the Subbasin, likely due predominantly to below-average rainfall conditions in WY 2021. Positive and negative changes in groundwater elevations from year to year are observed in various parts of the Subbasin, as has been observed historically. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels are observed annually.

## Groundwater Extractions

Total groundwater extractions in the Subbasin for WY 2021 are estimated to be 82,100 acre-feet (AF). Table ES-1 summarizes the groundwater extractions by water use sector for each water year. The values for WYs 2017 – 2020 (grayed out) are included for reference purposes. This convention is carried throughout the report.

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

| Water Year | Groundwater Extractions by Water Use Sector | | | Total (AF) |
|---|---|---|---|---|
| | Municipal[1] (AF) | PWS and Rural Domestic (AF) | Agriculture (AF) | |
| 2017 | 1,626 | 5,060 | 64,100 | 70,800 |
| 2018 | 1,677 | 5,060 | 75,500 | 82,200 |
| 2019 | 1,729 | 5,060 | 55,800 | 62,600 |
| 2020 | 1,509 | 5,060 | 60,700 | 67,300 |
| 2021 | 1,553 | 5,060 | 75,500 | 82,100 |
| Method of Measure: | Metered | 2016 Groundwater Model | Soil-Water Balance Model | |
| Level of Accuracy: | high | low-medium | medium | |

Notes:
[1] These volumes include any water produced as Salinas River underflow within the Paso Robles Subbasin.
AF = acre-feet
PWS = public water systems

## Surface Water Use

The Subbasin currently benefits from surface water entitlements from the Nacimiento Water Project (NWP) and the State Water Project (SWP) to supplement municipal groundwater demands in the City of Paso Robles and the community of Shandon, respectively. In WY 2021 the City of Paso Robles actually utilized 1,996 AF of their NWP entitlement, but 746 AF of their NWP deliveries were recharged and extracted in the Atascadero Subbasin, so those volumes do not show up in this accounting. Locations of communities dependent on groundwater and with access to surface water are shown on Figure 8. There is currently no surface water available for agricultural or recharge project use within the Subbasin. A summary of total actual surface water use by source is provided in Table ES-2.

**Table ES- 2. Total Surface Water Use by Source**

| Water Year | Nacimiento Water Project (AF) | Imported Salinas River Underflow[1] (AF) | State Water Project (AF) | Total Surface Water Use (AF) |
|---|---|---|---|---|
| 2017 | 1,650 | 2,609 | 42 | 4,301 |
| 2018 | 1,423 | 3,352 | 55 | 4,829 |
| 2019 | 1,142 | 3,075 | 43 | 4,259 |
| 2020 | 737 | 3,852 | 0 | 4,589 |
| 2021 | 1,250 | 3,612 | 0 | 4,861 |

Notes:
[1] The City of Paso Robles produces Salinas River underflow, regulated as surface water by the State Water Resources Control Board, from its Thunderbird Wells located in the adjacent Atascadero Subbasin.
AF = acre-feet
AFY = acre-feet per year

## Total Water Use

For WY 2021, quantification of total water use was completed through reporting of metered water production data from municipal wells (including imported Salinas River underflow[1], see Section 5), metered surface water use, and from models used to estimate agricultural crop water supply requirements. In addition, rural water use and small commercial public water system use was estimated. Table ES-3 summarizes the total annual water use in the Subbasin by source and water use sector.

**Table ES- 3. Total Water Use in the Subbasin by Source and Water Use Sector**

| Water Year | Municipal (AF) | | PWS and Rural Domestic (AF) | Agriculture (AF) | Total (AF) |
|---|---|---|---|---|---|
| Source: | Groundwater | Surface Water[1] | Groundwater | Groundwater | |
| **2017** | 1,626 | 4,301 | 5,060 | 64,100 | **75,100** |
| **2018** | 1,677 | 4,829 | 5,060 | 75,500 | **87,100** |
| **2019** | 1,729 | 4,259 | 5,060 | 55,800 | **66,800** |
| **2020** | 1,509 | 4,589 | 5,060 | 60,700 | **71,900** |
| **2021** | 1,553 | 4,861 | 5,060 | 75,500 | **87,000** |
| Method of Measure: | Metered | Metered | 2016 Groundwater Model | Soil-Water Balance Model | |
| Level of Accuracy: | high | high | low-medium | medium | |

Notes:

[1] Includes imported Salinas River underflow, which is regulated as surface water by the State Water Resources Control Board

AF = acre-feet

PWS = public water systems

## Change in Groundwater in Storage

The calculation of change in groundwater in storage in the Subbasin was derived from comparison of fall groundwater elevation contour maps from one year to the next as well as taking the difference between groundwater elevations throughout the Subbasin as the aquifer becomes saturated (storage gain) or dewatered (storage loss). For this analysis, fall 2020 groundwater elevations were subtracted from the fall 2021 groundwater elevations resulting in a map depicting the changes in groundwater elevations in the Paso Robles Formation Aquifer that occurred during WY 2021.

The groundwater elevation change map for WY 2021 (Figure 10) shows that water levels declined primarily in areas east and southeast of Shandon and within and to the west of Creston. The 2021 map also shows that groundwater elevations generally increased within a north-south strip through the Shandon area, and also notably in the northeastern portion of the City of Paso Robles.

The annual change of groundwater in storage calculated for WY 2021 is presented in Table ES-4. Increases of groundwater in storage are presented as positive numbers and decreases of groundwater in storage are presented as negative numbers.

[1] Salinas River underflow is regulated as surface water by the State Water Resources Control Board.

**Table ES- 4. Annual Change of Groundwater in Storage**

| Water Year | Annual Change (AF) |
|---|---|
| 2017 | 60,100 |
| 2018 | 6,400 |
| 2019 | 59,700 |
| 2020 | -80,800 |
| 2021 | -62,300 |

**Note:** AF = acre-feet

## Summary of Response to DWR Review of GSP

On June 3, 2021, the Paso Robles Subbasin GSP manager received a consultation letter from DWR. The letter was intended to initiate consultation between DWR and the Paso Robles Subbasin GSAs in advance of issuance of a plan adequacy determination. The letter indicates that DWR had identified deficiencies which may result in an incomplete determination. The letter also presents two potential corrective actions that, if addressed sufficiently, may result in GSP approval. Since receipt of the consultation letter, the GSAs have retained the services of a consultant to address these potential corrective actions and rewrite related sections of the GSP. This work is ongoing as of the date of this report. On January 21, 2022, DWR released an official 'incomplete' determination for the Paso Robles Subbasin GSP. Basins with GSPs that are determined incomplete have 180 days to address deficiencies and resubmit their corrected GSPs to DWR for review. The corrected Paso Robles Subbasin GSP must be resubmitted to DWR by July 20, 2022.

## Progress towards Meeting Basin Sustainability

Several projects and management actions are in process or have been recently implemented in the Subbasin to attain sustainability. These projects and actions include capital projects as well as non-structural basin-wide policies intended to reduce or optimize local groundwater use. Some of these projects were described in concept in the GSP; some of the actions described herein are new initiatives designed to make new water supplies available to the Subbasin that may be implemented by project participants to reduce pumping and partially mitigate the degree to which the management actions would be needed. Some of the ongoing efforts include:

- Development of New San Luis Obispo County Position of Director of Groundwater Sustainability
- Paso Basin Aerial Groundwater Mapping Pilot Study
- Paso Basin Land Use Management Area Planting Ordinance
- Airborne Electromagnetic (AEM) Geophysical Survey
- Assessment of Economic Impacts of Irrigated Agriculture
- Three-Dimensional Geologic Model of Basin using SkyTEM Survey Data
- Installation of Monitoring Wells and Stream Gages (SEP)
- City of Paso Robles Recycled Water Program
- San Miguel Community Services District Recycled Water Project
- Blended Water Project
- Expansion of Monitoring Well Network
- Expansion of Salinas Dam and Ownership Transfer

Relative to the basin conditions at the end of the study period as reported in the GSP, the First Annual Report (WYs 2017–2019) (GSI, 2020) and the Water Year 2020 Annual Report indicated an improvement in groundwater conditions throughout the Subbasin and a modest increase of total groundwater in storage. However, the groundwater conditions documented in this Water Year 2021 Annual Report indicate a return to worsening conditions following two consecutive years with below average rainfall. It is clear that historical groundwater pumping in excess of the sustainable yield has created challenging conditions for sustainable management. However, actions are underway to collect data, improve the monitoring and data collection networks, and coordinate with affected agencies and entities throughout the Subbasin to develop and implement solutions that address the shared mutual interest in the Subbasin's overall sustainability goal.

The above-average rainfall water years of 2017 and 2019 improved groundwater conditions in the Subbasin. However, two consecutive below average rainfall years in 2020 and 2021 have resulted in a reversal of this trend. One of the 22 Paso Robles Formation Aquifer representative monitoring site (RMS) wells in the Subbasin groundwater monitoring network exhibit groundwater elevations below the minimum threshold established in the GSP for the second consecutive year (this is discussed in more detail in Section 3.3). Although groundwater elevations in three of the Paso Robles Formation Aquifer RMS wells are recovering in the past few years, groundwater elevations in several of the RMS wells are continuing to trend downward. Three of the 22 Paso Robles Formation Aquifer RMS wells have current groundwater elevations greater than the measurable objective for that RMS well.

As of the date of this report, updated Interferometric Synthetic Aperture Radar (InSAR) data has been provided by DWR through October 2020. As discussed in the GSP, there is a potential error of 0.1 feet (or 1.2 inches) associated with the InSAR measurement and reporting methods. A land surface change of less than 0.1 feet is therefore within the noise of the data and is equivalent to no evidence of subsidence. Considering this range of potential error, examination of the October 2019 through October 2020 InSAR data show that zero land subsidence has occurred since October 2019 . These data indicate that there is no indication of an undesirable result. The GSAs will continue to monitor and report annual subsidence as more data become available.

At this time, there are insufficient data available to adequately assess the interconnectivity of surface water and groundwater and the potential depletion of interconnected surface water. There is at present only a single Alluvial Aquifer RMS well in the Subbasin. Additional Alluvial Aquifer wells will need to be established in the monitoring network before groundwater/surface water interaction can be more robustly analyzed. The GSAs have retained the services of a consultant to address potential corrective actions to the GSP, including improvements to the groundwater/surface water interactions analysis. This work is ongoing as of the date of this report.

Additional time will be necessary to judge the effectiveness and quantitative impacts of the projects and management actions either now underway or in the planning and implementation stage. However, it is clear that the actions in place and as described in this Water Year 2021 Annual Report are a good start towards reaching the sustainability goals laid out in the GSP. It is too soon to judge the observed changes in basin conditions against the interim goals outlined in the GSP, but the anticipated effects of the projects and management actions now underway are expected to positively affect the ability of the Subbasin to reach the necessary sustainability goals.

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# SECTION 1: **Introduction – Paso Robles Subbasin Water Year 2021 Annual Report**

The Water Year 2021 Annual Report for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin (Paso Robles Subbasin or Subbasin) has been prepared for the Paso Basin Cooperative Committee (PBCC) and the Groundwater Sustainability Agencies (GSAs) in accordance with the Sustainable Groundwater Management Act (SGMA) and Groundwater Sustainability Plan (GSP) Regulations (§ 356.2. Annual Reports) (see Appendix A, GSP Regulations for Annual Reports). Pursuant to the California Department of Water Resources (DWR) regulations, a GSP Annual Report must be submitted to DWR by April 1 of each year following the adoption of the GSP. Submittal of the adopted Paso Robles Subbasin GSP occurred on January 31, 2020. The GSAs are required to submit an annual report for the preceding water year (October 1 through September 30) to DWR by April 1 of each subsequent year. This Water Year 2021 Annual Report for the Paso Robles Subbasin documents groundwater production, water use data and water level data from October 1, 2020 through October 31, 2021 [2].

## 1.1 Setting and Background

The Paso Robles Subbasin GSP was prepared by Montgomery & Associates, Inc. (M&A, 2020), on behalf of and in cooperation with the Paso Basin Cooperative Committee and the Subbasin GSAs. The GSP, and subsequent annual reports including this Water Year 2021 Annual Report, covers the entire Paso Robles Subbasin (Figure 1). The Subbasin lies in the northern portion of San Luis Obispo County. The majority of the Subbasin comprises gentle flatlands near the Salinas River Valley, ranging in elevation from approximately 450 to 2,400 feet above mean sea level (AMSL). The Subbasin is drained by the Salinas River and its tributaries, including the Estrella River, Huer Huero Creek, and San Juan Creek. Communities in the Subbasin are the City of Paso Robles and the communities of San Miguel, Creston, and Shandon. Highway 101 is the most significant north-south highway in the Subbasin, with Highways 41 and 46 running east-west across the Subbasin.

The GSP was jointly developed by four GSAs:

- City of Paso Robles GSA
- Paso Basin - County of San Luis Obispo GSA
- San Miguel Community Services District (CSD) GSA
- Shandon - San Juan GSA

The Paso Basin GSAs overlying the Subbasin entered into a Memorandum of Agreement (MOA) in September 2017. The purpose of the MOA was to establish a Paso Basin Cooperative Committee (PBCC) to develop a single GSP for the entire Subbasin to be considered for adoption by each GSA and subsequently submitted to DWR for approval. Under the framework of the original MOA, the GSAs engaged the public and coordinated to jointly develop the Paso Robles Subbasin GSP. At its November 20, 2019 meeting, in accordance with the MOA, the PBCC voted unanimously to recommend that the GSAs adopt the GSP and submit it to DWR by the SGMA deadline. Subsequent actions by each GSA resulted in unanimous approval of the GSP and a joint submittal of the GSP to DWR.

[2] The required timeframe of the annual reports, pursuant to the SGMA regulations, is by water year, which is October 1 through September 30 of any year. However, because the County of San Luis Obispo Groundwater Level Monitoring Program measures water levels in October, the October 2021 measurements, for instance, are utilized to reflect conditions at the end of water year 2021.

The original MOA included provision for automatic termination upon approval of the GSP by DWR. Resolutions adopted by each GSA during the GSP approval process included an amendment to the MOA that removed automatic termination language because the GSAs will continue cooperating on the GSP and its implementation until such time as the long-term governance structure for implementation of the GSP is developed.

Each of the GSAs appointed a representative Member and Alternate to the PBCC to coordinate activities among the GSAs during the development of the GSP and the development and submittal of this Water Year 2021 Annual Report. The GSAs also agreed to designate the County of San Luis Obispo Director of Public Works as the Plan Manager with the authority to submit the GSP and annual reports and serve as the point of contact with DWR.

## 1.2 Organization of This Report

The required contents of an annual report are provided in the GSP Regulations (§ 356.2), included as Appendix A. Organization of the report is meant to follow the regulations where possible to assist in the review of the document. The sections are briefly described as follows:

**Section 1. Introduction – Paso Robles Subbasin Water Year 2021 Annual Report**: a brief background of the formation and activities of the Paso Robles Subbasin GSAs and development and submittal of the GSP.

**Section 2. Paso Robles Subbasin Setting and Monitoring Networks**: a summary of the Subbasin setting, Subbasin 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 spring and fall monitoring events and representative hydrographs.

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**Section 5. Surface Water Use (§356.2[b][3])**: a summary of reported surface water use.

**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 fall to fall groundwater elevation differences.

**Section 8. Progress towards Basin Sustainability (§356.2[c])**: a summary of management actions taken throughout the Subbasin by the GSAs and individual entities towards sustainability of the Subbasin.

# SECTION 2: Paso Robles Subbasin Setting and Monitoring Networks

## 2.1 Introduction

This section provides a brief description of the basin setting and the groundwater management monitoring programs described in the GSP, as well as any notable events affecting monitoring activities or the quality of monitoring results in the reported WY 2021. Much of the background information reported on in this Water Year 2021 Annual Report was taken from the GSP prepared by Montgomery & Associates, Inc. (M&A, 2020).

## 2.2 Subbasin Setting

The Subbasin is a structural trough trending to the northwest filled with terrestrially derived sediments sourced from the surrounding mountains. The Subbasin is surrounded by relatively impermeable geologic formations, sediments with poor water quality, and structural faults. Land surface elevation ranges from approximately 2,000 feet AMSL in the southeast extent of the Subbasin to about 600 feet AMSL in the northwest extent, where the Salinas River exits the Subbasin. Agriculture is the dominant land use. The Subbasin includes the incorporated City of Paso Robles and unincorporated communities of San Miguel, Creston, and Shandon.

The Subbasin is the southernmost portion of the Salinas Valley Groundwater Basin. As originally defined by DWR (2003), the Subbasin was in both San Luis Obispo and Monterey counties. The 2019 DWR basin boundary modification process resulted in a revision of the northern boundary of the Paso Robles Subbasin to be coincident with the San Luis Obispo/Monterey county line, thereby placing the Subbasin entirely within San Luis Obispo County.

The top of the Subbasin is defined by land surface. The bottom of the Subbasin is defined by the base of the Paso Robles Formation. Sediments below the base of the Paso Robles Formation are typically much less permeable than the overlying sediments. Although the bedrock sediments often produce usable quantities of groundwater, the water is generally of poor quality, so they are not considered part of the Subbasin. As described in the GSP, the lateral boundaries of the Subbasin include the following:

- The western boundary is defined by the contact between the sediments in the Subbasin and the sediments of the Santa Lucia Range. A portion of the western boundary is defined by the Rinconada fault system which separates the Paso Robles Subbasin from the Atascadero Subbasin.
- The eastern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the Temblor Range. The San Andreas Fault generally forms the eastern Subbasin boundary.
- The southern boundary of the Subbasin is defined by the contact between the sediments in the Subbasin and the sediments of the La Panza Range. To the southeast, a watershed and groundwater divide separates the Subbasin from the adjacent Carrizo Plain Basin; sedimentary layers are likely continuous across this divide.
- The northern boundary of the Subbasin is defined by the San Luis Obispo/Monterey county line.

Two principal aquifers exist in the Subbasin, including the Alluvial Aquifer and the Paso Robles Formation Aquifer. The Alluvial Aquifer is the youngest aquifer. It is unconfined and consists of predominantly coarse-grained sediments (sand and gravel) deposited along the Salinas River, Estrella River, Huer Huero Creek, and San Juan Creek. The Alluvial Aquifer varies in thickness but may be up to 100 feet thick along the channels. Much of the Alluvial Aquifer is characterized by relatively high transmissivity that may exceed

100,000 gallons per day per foot (gpd/ft). Wells screened in the Alluvial Aquifer can be very productive and may yield over 1,000 gallons per minute (gpm).

The Paso Robles Formation Aquifer underlies the Alluvial Aquifer and outcrops in the Subbasin everywhere outside of the Holocene stream channels. The Paso Robles Formation represents the largest volume of sediments in the Subbasin, with a total thickness up to 3,000 feet in the northern Estrella area and up to 2,000 feet in the Shandon area. The Paso Robles Formation has a thickness of 700 to 1,200 feet throughout most of the Subbasin. It is generally characterized by interbedded, discontinuous lenses of sand and gravel that comprise the most productive strata within the aquifer, separated vertically by comparatively thick zones of fine-grained sediments (silts and clays). Well depths generally range from approximately 200 feet to 1,000 feet or more. As described in the GSP, reported aquifer transmissivity estimates in the Paso Robles Formation range from approximately 1,000 to 9,000 gpd/ft, and well yields range from approximately 150 gpm to 850 gpm.

The primary components of recharge to the Subbasin aquifers are percolation of precipitation and infiltration of surface water from rivers and streams. Natural discharge from the Subbasin aquifers occurs through springs and seeps, evapotranspiration, and discharge to surface water bodies. The most significant component of discharge is pumping of groundwater from wells. The regional direction of groundwater flow is from the southeast to the northwest. As there is no hydrogeologic barrier to flow along the northern boundary of the Subbasin, groundwater exits the Subbasin along that boundary to the adjacent Salinas Valley Basin to the north.

## 2.3 Precipitation and Climatic Periods

Annual precipitation recorded at the Paso Robles weather station (National Oceanic and Atmospheric Administration [NOAA] station 46730) is presented by water year in Figure 2. The total annual precipitation recorded at the Paso Robles weather station for WY 2021 is 8.2 inches. The long-term average annual precipitation for the period 1925 through 2021 is 14.5 inches per water year, as recorded at the Paso Robles weather station. Climatic periods in the Subbasin have been determined based on analysis of data from the Paso Robles weather station using the Standardized Precipitation Index (SPI), which quantifies deviations from normal precipitation patterns. The WY 2021 SPI analysis uses a 24-month period instead of the 60-month period used in previous analyses in the GSP and prior Annual Reports[3]. Climatic periods are categorized according to the following designations: wet, dry, and average/alternating wet and dry (Figure 2). It is generally recognized that the eastern portion of the Subbasin receives less annual rainfall than the rest of the Subbasin. Recently, the University of California Cooperative Extension (UCCE) installed a series of sophisticated weather stations across San Luis Obispo County and nine of these are now located in the Subbasin. Station locations and rainfall totals for WY 2021 are presented in Figure 3, along with the spatial distribution of long-term average annual precipitation in the Paso Robles Subbasin[4]. Historical precipitation records for the Paso Robles weather station and monthly UCCE station records for WY 2021 are provided in Appendix B.

[3] The 24-month period SPI analysis is considered an improvement over the 60-month period analysis due to its improved sensitivity to short-term climatic variations. The 24-month period SPI analysis provides insight into the relationship between water year type and groundwater elevation response (WMO, 2012).

[4] Average distribution of annual precipitation based on 30-year normal PRISM data calibrated to the Paso Robles Station (NOAA 46730).

## 2.4 Monitoring Networks

This section provides a brief description of the monitoring programs currently in place and any notable events affecting monitoring activities or the quality of monitoring results. Monitoring networks are developed for each of the five sustainability indicators relevant to the Paso Robles Subbasin:

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

Monitoring for the first two sustainability indicators (chronic lowering of water levels and reduction of groundwater in storage) is implemented using the representative monitoring sites (RMS), discussed in Section 2.4.1. Monitoring for the remaining three sustainability indicators (degraded water quality, land subsidence, and depletion of interconnected surface water) is discussed in Section 2.4.2.

### 2.4.1 Groundwater Elevation Monitoring Network (§ 356.2[b])

The GSP provided a summary of existing groundwater monitoring efforts currently promulgated under various existing local, state, and federal programs. SGMA requires that monitoring networks be developed in the Subbasin to provide sufficient data quality, frequency, and spatial distribution to evaluate changing aquifer conditions in response to GSP implementation.

The GSP identifies an existing network of 23 RMS wells for water level monitoring. Of these 23 wells, 22 are wells that screen the Paso Robles Formation[5], and one is an Alluvial Aquifer well. These RMS have been monitored biannually, in April and October, for various periods of record. The RMS groundwater monitoring network developed in the GSP is intended to support efforts to do the following:

- Monitor changes in groundwater conditions and demonstrate progress toward achieving measurable objectives and minimum thresholds documented in the GSP
- Quantify annual changes in water use
- Monitor impacts to the beneficial uses and users of groundwater

The RMS are displayed in Figure 4, and a summary of information for each of the wells is included in Appendix C.

#### 2.4.1.1 Monitoring Data Gaps

The GSP noted numerous data gaps in the current RMS network. It should be noted that efforts are continuing during the implementation phase of the GSP to identify existing wells that can be added to the network, or to construct new wells for the network. As a start to this effort, the GSP identified nine additional wells that may be incorporated into the RMS network once the depth and screened aquifer are established. These wells are displayed in Figure 4, and a summary of available well information is included in Appendix D.

[5] Since initial establishment of the monitoring well network, two of the 22 Paso Robles Formation Aquifer RMS wells (27S/13E-30N01 and 26S/12E-2607) have become either inactive or inaccessible.

### 2.4.2 Additional Monitoring Networks

Evaluation of the water quality sustainability indicator is achieved through monitoring of an existing network of supply wells in the Subbasin. Constituents of concern (COCs) identified in the GSP that have the potential to impact suitability of water for public supply or agricultural use include salinity (as indicated by electrical conductivity), total dissolved solids (TDS), sodium, chloride, nitrate, sulfate, boron, and gross alpha.

COCs for drinking water are monitored at public water supply wells (PWS). There are 41 PWSs in the Subbasin. PWSs constitute part of the monitoring network for water quality in the Subbasin. In addition, the GSP identified 28 agricultural supply wells that are monitored for COCs under the Irrigated Lands Regulatory Program (ILRP) (see GSP Figure 7-4 [M&A, 2020]).

Land subsidence in the Subbasin is monitored using interferometric synthetic-aperture radar (InSAR) data collected using microwave satellite imagery provided by DWR. Available data to date indicate no significant subsidence in the Subbasin that impacts infrastructure. The GSAs will annually assess subsidence using the InSAR data provided by DWR.

A monitoring network to assess the sustainability indicator of groundwater/surface water interconnection is a current data gap that will be addressed during GSP implementation. There is at present only a single Alluvial Aquifer RMS well in the Subbasin. However, the City of Paso Robles installed two new Alluvial Aquifer wells using Supplemental Environmental Project (SEP) funding during WY 2021[6]. The GSAs should incorporate these two new Alluvial Aquifer wells into the RMS network during WY 2022. Additional Alluvial Aquifer wells will need to be established in the monitoring network before groundwater/surface water interaction can be more robustly analyzed. The GSAs have retained the services of a consultant to address potential corrective actions to the GSP, including improvements to the groundwater/surface water interactions analysis. This work is ongoing as of the date of this report.

[6] The City of Paso Robles GSA and the SWRCB agreed to the use of SEP funds that are available as a result of a settlement agreement between the SWRCB and the City of Paso Robles for violations of the City's National Pollutant Discharge Elimination System (NPDES) permit related to wastewater treatment releases.

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

## 3.1 Introduction

This section provides a detailed report on groundwater elevations in the Subbasin measured during spring and fall of 2021. These maps present the most up-to-date seasonal conditions in the Basin. Most of the data presented characterizes conditions in the Paso Robles Formation Aquifer. Data for the Alluvial Aquifer are too sparse for regional analysis. Monitoring data is reviewed for quality and an appropriate time frame is chosen to provide the highest consistency in the wells used for each reporting period. Data quality is often difficult to ascertain when measurements are taken by other agencies or private well owners, and well construction information may be incomplete or unavailable. This means that a careful review of the data is required prior to uploading to DWR's Monitoring Network Module[7] to verify whether measurements are trending consistent with trends of previous years and with the current year's hydrology and level of extractions.

### 3.1.1 Principal Aquifers

As discussed in Section 2, there are two principal aquifers in the Subbasin. The Paso Robles Formation Aquifer is several hundreds of feet thick, represents the greatest volume of saturated sediments in the Subbasin, and is the aquifer that is most utilized for supply. The Alluvial Aquifer is limited in extent to the active channels of the streams in the Subbasin and is generally less than 100 feet thick.

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

The assessment of groundwater elevation conditions in the Subbasin as described in the GSP is largely based on data from the San Luis Obispo County Flood Control and Water Conservation District (SLOFCWCD) groundwater monitoring program. Groundwater levels are measured by the SLOFCWCD through a network of public and private wells in the Subbasin. Data from many of the wells in the monitoring program are collected subject to confidentiality agreements between the SLOFCWCD and well owners. Consistent with the terms of such agreements, the well owner information and specific locations for these wells are not published in the GSP and that convention is continued in this Water Year 2021 Annual Report. To maintain consistency with the GSP and represent conditions that can be easily compared from year to year, this Water Year 2021 Annual Report used the same set of wells as was used in the GSP. Groundwater level data from 42 wells were used to create the spring 2021 groundwater elevation contour map and data from 44 wells were used for the fall 2021 contour map. The well locations and data points are not shown on the maps to preserve confidentiality of the data between the well owner and the SLOFCWD. Of these wells, owners of 23 of the wells have agreed to allow public use of the well data and are therefore used as RMS wells for the purpose of monitoring sustainability indicators. As implementation of the GSP progresses, it is anticipated that additional wells will be added to the data set and that many of the wells with current confidentiality agreements will be modified to allow for public use of the data.

[7] The Paso Robles Subbasin is no longer in the CASGEM program since implementation of the GSP. The GSAs are now responsible for monitoring and reporting of groundwater elevation data.

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

- Groundwater elevation contour maps for the seasonal high and seasonal low groundwater conditions for the previous water year. Groundwater elevation contour maps are presented for spring 2021 and fall 2021.
- A map depicting the change in groundwater elevation for the preceding water year. A change in groundwater elevation map is shown here for the period fall 2020 to fall 2021 (Section 7.1).
- Hydrographs for wells with publicly available data (Appendix E).

### 3.2.1 Alluvial Aquifer Groundwater Elevation Contours

Groundwater elevation data for the Alluvial Aquifer are too limited to prepare representative contour maps of the seasonal high and seasonal low groundwater elevations. Figure 5 shows the current (as of 2017) groundwater elevation contours for the Alluvial Aquifer, as shown in the GSP. This map, however, was developed using 2017 data (when available) as well as the most recent data prior to 2017. A reasonable data set of Alluvial Aquifer groundwater elevations specific to 2021 is not available, so the map as presented in the GSP is the most recent map available. This same map was also presented in the First Annual Report (GSI, 2020) and Water Year 2020 Annual Report (GSI, 2021). Work is currently underway to identify existing alluvial wells that along with the two newly constructed SEP funded wells (see Section 2.4.2) can be added to the RMS network.

Groundwater elevations range from approximately 1,400 feet AMSL in the southeastern portion of the Subbasin to approximately 600 feet AMSL near San Miguel. Groundwater flow direction in the Alluvial Aquifer generally follows the alignment of the creeks and rivers. Overall, groundwater in the Alluvial Aquifer flows from southeast to northwest across the Subbasin. On a basin-wide scale, the average horizontal hydraulic gradient in the alluvium is about 0.004 feet per foot (ft/ft) from the southeastern portion of the Subbasin to San Miguel.

### 3.2.2 Paso Robles Formation Aquifer Groundwater Elevation Contours

Spring and fall 2021 (high and low) groundwater elevation data for the Paso Robles Formation Aquifer in the Subbasin were contoured to assess spatial variations, yearly fluctuations, trends in groundwater conditions, groundwater flow directions, and horizontal groundwater gradients. Contour maps were prepared for the seasonal high groundwater levels, which typically occur in the spring, and the seasonal low groundwater levels, which typically occur in the fall. In general, the spring groundwater data are for April and the fall groundwater data are for October. Information identifying the owner or detailed location of private wells is not shown on the maps to preserve confidentiality.

Figures 6 and 7 show contours of groundwater elevations in the Paso Robles Formation Aquifer for spring 2021 and fall 2021, respectively. Overall, groundwater conditions in the Subbasin in the spring and fall of 2021 were similar, with groundwater elevations in the fall generally lower than in the spring, a typical seasonal trend for the Subbasin. Groundwater flow direction is generally to the northwest and west over most of the Subbasin. In general, groundwater flow in the western portion of the Subbasin tends to converge toward areas of low groundwater elevations. These areas of low groundwater elevation are in the area between the City of Paso Robles and the communities of San Miguel and Whitley Gardens. Horizontal groundwater gradients range from approximately 0.002 ft/ft in the southeast portion of the Subbasin to approximately 0.02 ft/ft in the area southeast of Paso Robles.

In general, the groundwater elevations observed in the Subbasin during WY 2021 show a decline across portions of the Subbasin, likely due predominantly to below-average rainfall conditions in WY 2021. Positive and negative changes in groundwater elevations from year to year are observed in various parts of the

Subbasin, as has been observed historically. Seasonal trends of slightly higher spring groundwater elevations compared with fall levels are observed annually.

## 3.3 Hydrographs (§ 356.2[b][1][B])

Groundwater elevation hydrographs are used to evaluate aquifer behavior over time. Changes in groundwater elevation at a given point in the Subbasin can result from many influencing factors, with all or some occurring at any given time. Factors can include changing climatic trends, seasonal variations in precipitation, varying Subbasin extractions, changing inflows and outflows along boundaries, availability of recharge from surface water sources, and influence from localized pumping conditions. Climatic variation can be one of the most significant factors affecting groundwater elevations over time. For this reason, the hydrographs also display periods of climatic variation categorized as wet, dry, or average/alternating wet and dry (see Figure 2).

### 3.3.1 Hydrographs

Groundwater elevation hydrographs and associated location maps for the 22 RMS wells that are constructed in and extract groundwater from the Paso Robles Formation Aquifer and the single Alluvial Aquifer RMS well are presented in Appendix E. These hydrographs also include information on well screen interval (if available), reference point elevation, as well as measurable objectives and minimum thresholds for each well that were developed during the preparation of the GSP. Many of the hydrographs illustrate a condition of declining water levels since the late 1990s, although some indicate relative water level stability over the same period.

As described in the GSP for the Paso Robles Formation Aquifer RMS wells[8], an average of the 2017 non-pumping groundwater levels was selected as the measurable objectives and minimum thresholds are set below those levels. Going forward from 2017, the average of the spring and fall measurements in any one water year will be the benchmark against which trends will be assessed.

Three of the 22 Paso Robles Formation Aquifer RMS wells have current groundwater elevations greater than the measurable objective for that RMS well. Although groundwater elevations in three of the Paso Robles Formation Aquifer RMS wells are recovering in the past few years, groundwater elevations in several of the RMS wells are continuing to trend downward. One of the 22 Paso Robles Formation Aquifer RMS wells exhibit groundwater elevations below the minimum threshold for the second consecutive year (27S/13E-28F01). This condition constitutes a chronic lowering of groundwater elevation undesirable result as defined in the GSP. Based on initial observation this appears to be an isolated local issue. However, according to Section 8.4.5.1 of the GSP[9], the GSAs must initiate an investigation to determine if local or Subbasin-wide actions are required to address this undesirable result.

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[8] A measurable objective and minimum threshold were not set for the single Alluvial Aquifer monitoring network well due to lack of available historical groundwater elevation data at the time of GSP submittal (M&A, 2020).

[9] Section 8.4.5.1 of the GSP – Criteria for Defining Undesirable Results includes the text: "*A single monitoring well in exceedance for two consecutive years also represents an undesirable result for the area of the Basin represented by the monitoring well. Geographically isolated exceedances will require investigation to determine if local or Basin wide actions are required in response*."

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

## 4.1 Introduction

This section presents the metered and estimated groundwater extractions from the Subbasin for WY 2021. The types of groundwater extraction described in this section include municipal (Table 1), agricultural (Table 2), rural domestic (Table 3), and small public water systems (Table 4). Each following subsection 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 5.

## 4.2 Municipal Metered Well Production Data

The municipal groundwater extractions documented in this report are metered data. Metered groundwater pumping extraction data are from the City of Paso Robles, San Miguel CSD, and the County of San Luis Obispo for Community Service Area 16 (CSA 16), providing service to the community of Shandon. The data shown in Table 1 reflect metered data reported by the respective agencies. The accuracy level rating of these metered data is high.

**Table 1. Municipal Groundwater Extractions**

| Water Year | Metered Groundwater Extractions | | | Total (AF) |
|---|---|---|---|---|
| | City of Paso Robles[1] (AF) | San Miguel CSD (AF) | CSA 16 (AF) | |
| 2017 | 1,261 | 295 | 70 | 1,626 |
| 2018 | 1,302 | 325 | 50 | 1,677 |
| 2019 | 1,392 | 289 | 48 | 1,729 |
| 2020 | 1,121 | 297 | 91 | 1,509 |
| 2021 | 1,157 | 300 | 96 | 1,553 |

Notes:
1 – The City of Paso Robles produces water from wells located in both the Paso Robles Subbasin and the Atascadero Subbasin. Only the portion produced from within the Paso Robles Subbasin is included here. These volumes include any water produced as Salinas River underflow within the Paso Robles Subbasin.
AF = acre-feet
CSA = community service area (County of San Luis Obispo)
CSD = community services district

## 4.3 Estimate of Agricultural Extraction

Agricultural water use constituted 92 percent of the total anthropogenic groundwater use in the Subbasin in WY 2021. To estimate agricultural water demand, land use data along with climate and soil data were analyzed and processed using the soil-water balance model that was developed for the Paso Robles Groundwater Basin Model Update (GSSI, 2014). Annual land use spatial data sets from San Luis Obispo County were used to determine the appropriate crop categories, distribution, and acreages. Land use types were grouped within seven crop categories, including alfalfa, citrus, deciduous, nursery, pasture, vegetable, and vineyard, each with a respective set of crop water demand coefficients from the San Luis Obispo County Master Water Report[10] (Carollo, 2012). Climate data inputs include precipitation from the Paso Robles

10 Vineyard crop coefficients were modified based on discussions with Mark Battany, University of California Extension (GSSI, 2014).

Station (NOAA station 46730) and reference evapotranspiration (ETo) data from several private stations in the Subbasin operated by Western Weather Group. Soil water holding capacity data from National Resources Conservation Service soil surveys of San Luis Obispo County were used. The soil-water balance model includes consideration for regulated deficit irrigation (RDI), cover crop, and frost protection water demands for vineyards as well as irrigation system efficiencies (GSSI, 2014).

The soil-water balance model was utilized to estimate agricultural water demands through WY 2016 during completion of the GSP (M&A, 2020) and for WYs 2017, 2018, and 2019 in the First Annual Report (GSI, 2020), and for WY 2020 in the Water Year 2020 Annual Report (GSI, 2021). Agricultural water demand for this Water Year 2021 Annual Report was estimated for WY 2021 also using the soil-water balance model. The resulting estimated groundwater extractions for agricultural demands are summarized in Table 2. The accuracy level rating of this estimated volume is medium.

**Table 2. Estimated Agricultural Irrigation Groundwater Extractions**

| Water Year | Agricultural Demand (AF) |
|---|---|
| 2017 | 64,100 |
| 2018 | 75,500 |
| 2019 | 55,800 |
| 2020 | 60,700 |
| 2021 | 75,500 |

**Note:** AF = acre-feet

## 4.4 Rural Domestic and Small Public Water System Extraction

Rural domestic and small PWS groundwater extractions in the Subbasin were estimated using the methods described here.

### 4.4.1 Rural Domestic Demand

As documented in the Paso Robles Groundwater Basin Model Update (GSSI, 2014), the rural domestic water demand was originally estimated as the product of County estimates of rural domestic units (DUs) and a water demand factor of 1.7 AFY per DU, which included small PWS water demand (Fugro, 2002). This factor was subsequently modified to 1.0 AFY/DU in the San Luis Obispo County Master Water Report, not including small PWS demand (Carollo, 2012). Based on further investigation completed for the 2014 groundwater model update, the rural domestic water use factor was refined to 0.75 AFY/DU (GSSI, 2014). To simulate rural water demand over time in the groundwater model, an annual growth rate of 2.25 percent for the rural population was assumed, based on recommendation from the San Luis Obispo County Planning Department (GSSI, 2014). The groundwater model update completed for the GSP (M&A, 2020) used a linear regression projection based on the 2014 model update to estimate rural domestic demand through WY 2016. The projected future water budget presented in the GSP (M&A, 2020) assumes water neutral growth in rural domestic water demand from WY 2016 going forward. Therefore, the rural domestic demand has been held constant at the estimated WY 2016 volume for this Water Year 2021 Annual Report. The resulting groundwater extractions for rural domestic demands are summarized in Table 3. The accuracy level rating of these estimated volumes is low-medium.

**Table 3. Estimated Rural Domestic Groundwater Extractions**

| Water Year | Rural Domestic (AF) |
|---|---|
| 2017 | 3,530 |
| 2018 | 3,530 |
| 2019 | 3,530 |
| 2020 | 3,530 |
| 2021 | 3,530 |

Note: AF = acre-feet

### 4.4.2 Small Public Water System Extractions

The category of small PWSs includes a wide variety of establishments and facilities including small mutual water companies, golf courses, wineries, rural schools, and rural businesses. Various studies over the years used a mix of pumping data and estimates for type-specific water demand rates to estimate small PWS groundwater demand (Fugro, 2002; Todd Engineers, 2009). The 2012 San Luis Obispo County Master Water Report used the County of San Luis Obispo geographic information services mapping to define the distribution and number of commercial systems at the time and applied a single annual factor of 1.5 AFY per system (Carollo, 2012).

For the 2014 model update, actual pumping data were used as available to provide a monthly record over the study period (GSSI, 2014). Groundwater demand for four major golf courses (at the time) in the Subbasin (The Links, Hunter Ranch, Paso Robles, and River Oaks) was estimated using the following factors: ETo data measured in Paso Robles, the crop coefficient for turf grass, monthly rainfall data, and golf course acreage (GSSI, 2014). Water use for wineries was estimated by identifying each winery and its permitted capacity and applying a water use rate of 5 gallons of water per gallon of wine produced. Minor landscaping, wine tasting/restaurant functions, and return flows were also accounted for (GSSI, 2014). Water use for several small commercial/institutional water systems was estimated using water duty factors specific to the water system type (i.e., camp, school, restaurant, and other uses) (GSSI, 2014).

The groundwater model update completed for the GSP (M&A, 2020) used a linear regression projection for the 2014 model update to estimate small PWS demand through WY 2016. The projected future water budget presented in the GSP (M&A, 2020) assumes water neutral growth in small PWS water demand from WY 2016 going forward. Therefore, the small PWS demand has been held constant at the estimated WY 2016 volume for this Water Year 2021 Annual Report. The resulting groundwater extractions for small PWS demands are summarized in Table 4. The accuracy level rating of these estimated volumes is low-medium.

**Table 4. Estimated Small Public Water System Groundwater Extractions**

| Water Year | Small PWS (AF) |
|---|---|
| 2017 | 1,530 |
| 2018 | 1,530 |
| 2019 | 1,530 |
| 2020 | 1,530 |
| 2021 | 1,530 |

Note: AF = acre-feet

## 4.5 Total Groundwater Extraction Summary

Total groundwater extractions in the Subbasin for WY 2021 are estimated to be 82,100 AF. Table 5 summarizes the total groundwater use by sector and indicates the method of measure and associated level of accuracy. Approximate points of extraction were spatially distributed and colored according to a grid system to represent the relative pumping across the basin in terms of AF per acre (see Figure 8).

**Table 5. Total Groundwater Extractions**

| Water Year | Groundwater Extractions by Water Use Sector | | | Total (AF) |
|---|---|---|---|---|
| | Municipal (AF) | PWS and Rural Domestic (AF) | Agriculture (AF) | |
| 2017 | 1,626 | 5,060 | 64,100 | 70,800 |
| 2018 | 1,677 | 5,060 | 75,500 | 82,200 |
| 2019 | 1,729 | 5,060 | 55,800 | 62,600 |
| 2020 | 1,509 | 5,060 | 60,700 | 67,300 |
| 2021 | 1,553 | 5,060 | 75,500 | 82,100 |
| Method of Measure: | Metered | 2016 Groundwater Model | Soil-Water Balance Model | |
| Level of Accuracy: | high | low-medium | medium | |

Notes:
AF = acre-feet
PWS = public water systems

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

## 5.1 Introduction

This section addresses the reporting requirement of providing surface water supplies used, or available for use, and describes the annual volume and sources for WY 2021. This section also reports quantities of Salinas River underflow, regulated as surface water by the State Water Resources Control Board (SWRCB), produced and imported into the Subbasin by the City of Paso Robles from the adjacent Atascadero Subbasin. The method of measurement and level of accuracy is rated on a qualitative scale. The Subbasin currently benefits from surface water entitlements from the Nacimiento Water Project (NWP) and the State Water Project (SWP) to supplement municipal groundwater demands in the City of Paso Robles and the community of Shandon, respectively. Locations of communities dependent on groundwater and with access to surface water are shown on Figure 9.

## 5.2 Surface Water Available for Use

Table 6 provides a breakdown of surface water available for municipal use in the Subbasin. There is currently no surface water available for agricultural or recharge project use within the Subbasin.

**Table 6. Surface Water Available for Use**

| Water Year | Nacimiento Water Project[1] (AF) | State Water Project[2] (AF) | Total Available Surface Water (AF) |
|---|---|---|---|
| 2017 | 6,488 | 100 | 6,588 |
| 2018 | 6,488 | 100 | 6,588 |
| 2019 | 6,488 | 100 | 6,588 |
| 2020 | 6,488 | 100 | 6,588 |
| 2021 | 6,488 | 100 | 6,588 |

Notes:
[1] Contract annual entitlement to the City of Paso Robles
AF = acre-feet
[2] Contract annual entitlement to CSA 16

## 5.3 Imported Salinas River Underflow

Salinas River underflow, which is regulated as surface water by the SWRCB, is produced by the City of Paso Robles from the adjacent Atascadero Subbasin and imported into the Subbasin. These imported underflow volumes are integrated into the City of Paso Robles water distribution system and served to municipal customers located predominantly within the Subbasin[11]. The annual volumes of imported Salinas River underflow production are presented in Table 7. The accuracy level rating of these metered data is high.

[11] A minor portion of the City of Paso Robles municipal water supply is used by customers located outside of the Subbasin.

**Table 7. Imported Salinas River Underflow**

| Water Year | Imported Salinas River Underflow[1] (AF) |
|---|---|
| 2017 | 2,609 |
| 2018 | 3,352 |
| 2019 | 3,075 |
| 2020 | 3,852 |
| 2021 | 3,612 |

Notes: AF = acre-feet

[1] – The City of Paso Robles produces Salinas River underflow, regulated as surface water by the State Water Resources Control Board, from wells located in both the Paso Robles Subbasin and the Atascadero Subbasin. Only the portion produced from within the Atascadero Subbasin is included here.

## 5.4 Total Surface Water Use

A summary of total actual surface water use by source is provided in Table 8. The accuracy level rating of these metered data is high.

Environmental uses of surface water are also recognized but not estimated due to insufficient data to make an estimate of surface water use. It is expected that environmental uses will be quantified in future annual reports as more data become available.

**Table 8. Surface Water Use**

| Water Year | Nacimiento Water Project (AF) | Imported Salinas River Underflow[1] (AF) | State Water Project (AF) | Total Surface Water Use (AF) |
|---|---|---|---|---|
| 2017 | 1,650 | 2,609 | 42 | 4,301 |
| 2018 | 1,423 | 3,352 | 55 | 4,829 |
| 2019 | 1,142 | 3,075 | 43 | 4,259 |
| 2020 | 737 | 3,852 | 0 | 4,589 |
| 2021 | 1,250 | 3,612 | 0 | 4,861 |

Notes:
[1] The City of Paso Robles produces Salinas River underflow, regulated as surface water by the State Water Resources Control Board, from its Thunderbird Wells located in the adjacent Atascadero Subbasin
AF = acre-feet
AFY = acre-feet per year

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

This section summarizes the total annual groundwater and imported surface water used to meet municipal, agricultural, and rural demands within the Subbasin. For WY 2021, the quantification of total water use was completed from reported metered municipal water production and metered surface water delivery, and from models used to estimate agricultural and rural water demand. Table 9 summarizes the total water use in the Subbasin by source and water use sector for WY 2021. The method of measurement and a qualitative level of accuracy for each estimate is rated on a qualitative scale of low, medium, and high.

**Table 9. Total Water Use by Source and Water Use Sector, Water Year 2021**

| Water Year | Municipal (AF) | | PWS and Rural Domestic (AF) | Agriculture (AF) | Total (AF) |
|---|---|---|---|---|---|
| Source: | Groundwater | Surface Water[1] | Groundwater | Groundwater | |
| 2017 | 1,626 | 4,301 | 5,060 | 64,100 | 75,100 |
| 2018 | 1,677 | 4,829 | 5,060 | 75,500 | 87,100 |
| 2019 | 1,729 | 4,259 | 5,060 | 55,800 | 66,800 |
| 2020 | 1,509 | 4,589 | 5,060 | 60,700 | 71,900 |
| 2021 | 1,553 | 4,861 | 5,060 | 75,500 | 87,000 |
| Method of Measure: | Metered | Metered | 2016 Groundwater Model | Soil-Water Balance Model | |
| Level of Accuracy: | high | high | low-medium | medium | |

Notes:
[1] Includes imported Salinas River underflow, which is regulated as surface water by the State Water Resources Control Board
AF = acre-feet
PWS = public water systems

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

## 7.1 Annual Changes in Groundwater Elevation (§ 356.2[b][5][A])

Annual changes in groundwater elevation in the Paso Robles Formation Aquifer for WY 2021 are derived from comparison of fall groundwater elevation contour maps from one year to the next. For this analysis, fall 2020 groundwater elevations were subtracted from the fall 2021 groundwater elevations resulting in a map depicting the changes in groundwater elevations in the Paso Robles Formation Aquifer that occurred during WY 2021 (see Figure 10). This groundwater elevation change map is based on a reasonable and thorough analysis of the currently available data. As stated in Section 3, groundwater elevation data for the Alluvial Aquifer are too limited to prepare annual groundwater elevation contour maps. Therefore, the change in groundwater in storage analysis is limited to the Paso Robles Formation Aquifer for this Water Year 2021 Annual Report.

The groundwater elevation change map for WY 2021 (Figure 10) shows that compared to the previous fall, water levels are lower primarily in areas east and southeast of Shandon and within and to the west of Creston. The 2021 map also shows that groundwater elevations generally higher within a north-south strip through the Shandon area, and also notably in the northeastern portion of the City of Paso Robles. The groundwater elevation change map represents the difference in groundwater elevations between two snapshots in time, made approximately one year apart. Considering that groundwater elevations may fluctuate dynamically throughout each year in response to changing climatic conditions and groundwater pumping patterns, the specific patterns of 'higher' versus 'lower' water level areas shown on Figure 10 may not necessarily be representative of conditions occurring throughout the entire water year.

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

The groundwater elevation change map presented above represents a volume change within the Paso Robles Formation Aquifer for WY 2021. The volume change inferred from the groundwater elevation change map (Figure 10) represents a total volume, including the volume displaced by the aquifer material and the volume of groundwater stored within the void space of the aquifer. The portion of void space in the aquifer that can be utilized for groundwater storage is represented by the aquifer storage coefficient (S), a unitless factor, which is multiplied by the total volume change to derive the change in groundwater in storage. Based on work completed for the GSP, S is estimated to be 7 percent.[12] The annual change of groundwater in storage calculated for WY 2021 is presented in Table 10 and the annual and cumulative change in groundwater in storage since 1981 are presented on Figure 11.

[12] Appendix F includes derivation of the storage coefficient from the GSP groundwater model files and a sensitivity analysis.

**Table 10. Annual Change in Groundwater in Storage - Paso Robles Formation Aquifer**

| Water Year | Annual Change (AF) |
|---|---|
| 2017 | 60,100 |
| 2018 | 6,400 |
| 2019 | 59,700 |
| 2020 | -80,800 |
| 2021 | -62,300 |

**Note:** AF = acre-feet

The 62,300 AF decrease of groundwater in storage in WY 2021 shown in Table 10 is coincident with below average precipitation in 2021 (8.2 inches). Historical comparison of annually tabulated precipitation, total groundwater extractions, and annual change in groundwater in storage reveals a close correlation between annual total precipitation and change in groundwater in storage (see Figure 12). Specifically, years with well above average precipitation (i.e. 1983, 1993, 1995, 1998, 2005, and 2017) are all associated with years of large increases in groundwater in storage. Conversely, nearly all[13] below average precipitation years are associated with years of decline in groundwater in storage. The influence of total annual groundwater extractions on annual change in groundwater in storage is also apparent, although to a lesser degree. The influence of groundwater extractions on annual changes in groundwater in storage is most apparent during the drought of the mid-1980's through the early 1990's, when below average precipitation prevailed, but a trend of decreasing groundwater extractions resulted in a slight upward trend in annual changes of groundwater in storage.

Annual Change in Groundwater in Storage was calculated using the groundwater model for water years 1981 through 2016 and by groundwater elevation change maps for water years 2017 through present. The groundwater elevation method has been calibrated to groundwater model results (see Appendix F), however, some noteworthy differences between the methods remain; While the estimated value of S, used in the groundwater elevation change method, is based on sound science and using the best readily available information, it is necessary to acknowledge that the true value of S in the Paso Robles Formation Aquifer is spatially variable (as indicated in the GSP groundwater model) and ranges in value both above and below the estimated value of seven percent. This, coupled with the necessity to rely on interpolated water levels through data gap areas in the groundwater level monitoring network (see Section 2.4.1), contributes to a moderate amount of method uncertainty. In addition, the groundwater elevation change method is susceptible to potential over or under-estimation due to the method's inability to account for groundwater in transit[14]. Regardless, the groundwater elevation change method is considered the best available tool for estimating annual change in groundwater in storage until the GSP groundwater model can be updated.

[13] The exception to this is water year 2018, which was a below average precipitation year associated with a minor increase in groundwater in storage. It should be noted that this change in groundwater in storage was calculated independently from the groundwater model using the groundwater elevation change map method described above.
[14] Groundwater in transit refers to recharged groundwater that is in the process of percolating downward through the unsaturated zone and is not yet contributing to a measurable change in groundwater elevation. The amount of groundwater in transit is assumed to be highly spatially and temporally variable in the Subbasin.

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

## 8.1 Introduction

This section describes several projects and management actions that are in process, have been initiated, or have been recently implemented in the Subbasin as a means to improve groundwater conditions, avoid potential undesirable results, attain subbasin sustainability, and improve understanding of the Subbasin groundwater dynamics as well as implications of GSP implementation. These projects and actions include capital projects and non-structural policies intended to reduce or optimize local groundwater use. Some of these projects were described in concept in the GSP; some of the actions described herein are new initiatives designed to make new water supplies available to the Subbasin that may be implemented by the GSAs to reduce pumping and partially mitigate the degree to which the management actions would be needed.

As described in the GSP, the need for projects and management actions is based on emerging Subbasin conditions, including the following:

- Groundwater levels are declining in some parts of the Subbasin, indicating that the amount of groundwater pumping is more than the natural recharge.
- The calculated water budget of the Paso Robles Formation aquifer indicates that the amount of groundwater in storage is in decline and will continue to decline if there is no net decrease in groundwater extractions.

To mitigate declines in groundwater levels in some parts of the Subbasin, achieve the Subbasin sustainability goal by 2040, and avoid undesirable results as required by SMGA regulations, new water supplies must be imported into the Subbasin [i.e., project(s)] and/or groundwater pumping must be reduced through management action(s).

In addition to project and management actions that address chronic declines in groundwater levels and depletion of groundwater in storage, this section also provides a brief discussion of land subsidence, potential depletion of interconnected surface waters, and groundwater quality trends that occurred during WY 2021.

The projects and management actions described in this section are all intended to help achieve groundwater sustainability in the Subbasin and avoid undesirable results.

## 8.2 Implementation Approach

As described in the GSP, the volume of groundwater pumping in the Subbasin is more than the estimated sustainable yield and, as a result, groundwater levels are persistently declining in some parts of the Subbasin. In response, the GSAs have initiated several projects and management actions designed to address the impacts of the decline in groundwater levels and reductions of groundwater in storage. It is anticipated that additional new projects and management actions, some of which are described herein, will be implemented in the future to continue progress towards avoiding or mitigating undesirable results.

Some of the projects and management actions described in this section are Subbasin-wide initiatives and some are area-specific. Generally, the basin-wide management actions apply to all areas of the Subbasin. Area-specific projects have been designed to aid in mitigating persistent water level declines in certain parts of the Subbasin.

## 8.3 Basin-Wide Management Actions and Projects

### 8.3.1 Development of New San Luis Obispo County Position of Director of Groundwater Sustainability

On December 17, 2019 the County Board of Supervisors directed County staff to conduct a staffing analysis and recommendations for GSP implementation. County staff evaluated options ranging from no SGMA participation as County GSA to full SGMA participation utilizing 100% County staff. The staffing analysis report was presented to the County Board of Supervisors on March 16, 2021. After deliberation, the board directed staff to assess a configuration of a single new County staff position (1.0 FTE) with consultant support for GSP implementation. On April 20, 2021 County staff presented this requested staffing configuration, detailing the single new County staff position as Director of Groundwater Sustainability (1.0 FTE), reporting directly to the County Administrative Officer, independent of the Public Works Department. The timeline laid out in the County staff presentation indicated that consultant support would be assessed through a request for proposal process following hire of the new Director of Groundwater Sustainability. The County Board of Supervisors directed staff to proceed with creation of and hiring for the new Director of Groundwater Sustainability County staff position during the April 20, 2021 board meeting. The Director of Groundwater Sustainability position organization chart is presented in Appendix G.

After the conclusion of Water Year 2021, the County of San Luis Obispo filled the position of Director of Groundwater Sustainability on November 2, 2021.

### 8.3.2 Paso Basin Aerial Groundwater Mapping Study

In November 2019, the County of San Luis Obispo joined in a pilot study through DWR and Stanford University to conduct aerial groundwater mapping of a large portion of the Subbasin utilizing Airborne Electromagnetic method (AEM). The goal of the study was to acquire survey data to characterize and map subsurface geologic structures as well as the presence and extent of clay, silt, sand, and gravel layers to a depth of approximately 1,000 to 1,400 feet below the ground surface.

The SkyTEM aerial survey was flown from November 5th to November 7th, 2019, encompassing a large portion of the center of the Subbasin plus a few transects extending to the eastern edge of the Subbasin. Throughout 2020, the acquired data were compiled and analyzed. An initial data report was finalized and made public in October 2020 (SkyTEM, 2020) and a hydrogeologic conceptual model report summarizing the results and interpretations of the data was completed in December 2020 (Ramboll, 2020)[15]. The results of the study have enhanced understanding of groundwater flow within the Subbasin, the interconnectedness of different parts of the Subbasin, and the geologic framework that controls groundwater flow. The dataset generated by this study has been input into a 3D geologic model using Leapfrog Works®, which is described in greater detail below.

### 8.3.3 Paso Basin Land Use Management Area Planting Ordinance

On April 6, 2021 the County Board of Supervisors provided authorization to develop a new planting ordinance for the Paso Basin Land Use Management Area (PBLUMA) to be in effect through 2045. Funding was subsequently approved by the board in June 2021 for the new ordinance development and Environmental Impact Report (EIR). On August 24, 2021, the board adopted Ordinance No. 3456, amending Title 22 of the San Luis Obispo County code by amending section 22.30.204 agricultural offset requirements

[15] The Ramboll (2020) report can be downloaded here: https://www.slocounty.ca.gov/Departments/Public-Works/Forms-Documents/Projects/Paso-Basin-Aerial-Groundwater-Mapping-Pilot-Study/Hydrogeologic-Conceptual-Model-in-Paso-Robles,-Tra.pdf.

to extend the termination date to August 31, 2022, and to add a table grapes specific water duty factor. This action effectively extends the existing Water Neutral New Development amendments to Title 22 [16]. The termination date was extended to allow time to develop the new PBLUMA Planting Ordinance. A copy of Ordinance No. 3456 is included in Appendix H.

After the conclusion of Water Year 2021 the draft PBLUMA Planting Ordinance was released for public comment on October 22 and the public review period concluded on November 24, 2021. The 45-day Draft EIR public review period is scheduled to begin in January of 2022 and the Final EIR is expected in April 2022. As of this writing, the tentative effective date for the new PBLUMA Planting Ordinance is August 31, 2022. Further details shall be provided in next year's annual report.

### 8.3.4 Airborne Electromagnetic (AEM) Geophysical Survey

The DWR is conducting airborne electromagnetic (AEM) surveys in California's high- and medium-priority groundwater basins, where data collection is feasible, to assist local water managers as they implement SGMA to manage groundwater for long term sustainability. The surveys are funded by voter-approved Proposition 68, Senate Bill 5, and from the State general fund.

In August 2021 DWR, together with Ramboll and SkyTEM, conducted additional airborne electromagnetic (AEM) geophysical surveying in San Luis Obispo County, including portions of the Paso Robles Subbasin that had not been previously surveyed during the Paso Basin Aerial Groundwater Mapping Study survey in November 2019 (see above). Results from this 2021 survey are expected to become available sometime in March 2022. It is anticipated that the results from this 2021 survey will infill data gaps in the existing SkyTEM dataset that resulted from the initial Paso Basin Aerial Groundwater Mapping Study. The results of the study will improve understanding of the geologic framework that controls groundwater flow in the Subbasin and specifically within the data gap areas of the existing SkyTEM dataset. Once available, the dataset generated from this 2021 survey will be input into the 3D geologic model, which is described in greater detail below.

### 8.3.5 Assessment of Economic Impacts of Irrigated Agriculture

The statutory and regulatory requirements of SGMA compel the GSP and member GSA agencies to evaluate the potential impacts of GSP implementation on land uses and property interests (SGMA emergency regulations sections §354.10(a), §354.26(b)(3), §354.28(b)(4), and §355.4(b)(4)). To that end, an economic impacts of irrigated agriculture study commissioned by Shandon-San Juan Water District (SSJWD), Estrella-El Pomar-Creston Water District (EPCWD), and several other interested parties was conducted in 2020 by Cal Poly San Luis Obispo (Hamilton and McCullough, 2020). A copy of the report is provided in Appendix I.

The purpose of the study was to analyze the economic impact of the agricultural industry within the Paso Robles Subbasin and to assess the impact of potential changes in the industry as a result of possible

[16] In October 2015, the County Board of Supervisors adopted the Water Neutral New Development (WNND) amendments to the County Land Use Ordinance (Title 22) and Building and Construction Ordinance (Title 19). The amendments require a 1:1 water offset for new non-agricultural development and new or expanded irrigated commercial crop production while providing a 5 AFY exemption for irrigated properties outside of an "area of severe decline" defined based on changes in groundwater elevation measurements from Spring 1997 to Spring 2013. The action to amend the ordinances was taken in response to declining groundwater levels to minimize further depletion of the groundwater resource. The 1:1 water offset requirement was originally intended to be a stopgap measure to avoid further depletion of the groundwater basin until SGMA implementation and included a termination clause to expire upon the effective date of a final and adopted GSP. On November 5, 2019, the County Board of Supervisors extended the termination date of the WNND ordinances to January 1, 2022 and removed "off-site" agricultural water offsets.

implementation policies of the GSP. This study was intended to provide an overview of potential economic impacts that may result from reductions to groundwater use for irrigated agriculture.

The results of the study conclude that implementation of the GSP has the potential to cause significant impacts to the local economy that is dependent on groundwater from the Subbasin. The study concludes that the loss to the economy from reduced irrigated agriculture ranges from $49.5 million to $146.3 million in lost economic value and in terms of employment, losing between 459 and 1,289 jobs, depending on the volume of water reduction. The economic impact of lost wine value is estimated to be a $183.4 million to $458 million loss to the overall economy in the Subbasin. Job losses across the economy in industries in the Subbasin are estimated at 1,358 to 3,351.

### 8.3.6 Three-Dimensional Geologic Model of Basin using SkyTEM Survey Data

SSJWD retained the services of a consultant to conduct a basin-wide groundwater recharge desktop study utilizing all available science, including the results of the Paso Basin Aerial Groundwater Mapping Study (Ramboll, 2020). This ongoing study has resulted in the creation of a digital 3D geologic model of the Paso Robles Subbasin incorporating the SkyTEM geophysical survey results (Ramboll, 2020) developed in Leapfrog Works®[17]. The 3D model is being used to enhance data visualization and communication with stakeholders and to help identify favorable groundwater recharge areas in the Subbasin. The initial concept of the ongoing desktop study is to focus on the physical characteristics of the basin materials, including aquifers and aquitards, and to identify areas with favorable conditions to recharge the major aquifers of the basin (primarily the Paso Robles Formation Aquifer) regardless of location within the basin or proximity to potential recharge water sources. As further data are developed, such as the 2021 AEM geophysical survey (see above), these data can be incorporated into the 3D geologic model to produce an ever-improving understanding of the geologic framework and groundwater flow within the Subbasin. It is anticipated that this 3D geologic model will ultimately be used to select key target areas where high resolution, site specific subsurface investigations may be performed for the purpose of developing groundwater recharge project(s) that would benefit areas of the Subbasin that are experiencing the greatest groundwater elevation declines.

## 8.4 Area-Specific Projects

### 8.4.1 Installation of Monitoring Wells and Stream Gages (SEP)

The existing network of monitoring wells in the Alluvial Aquifer in areas where surface water and groundwater interaction may occur is insufficient for adequate assessment, and surface water flows in the Subbasin are ephemeral. Together, these two factors make it difficult to evaluate the interconnectivity of surface water and groundwater and to quantify whether any surface water depletion has occurred. The lack of publicly available groundwater level data for the Alluvial Aquifer is a significant data gap.

The inadequacy of publicly available data to assess the interconnectivity of the surface water with the underlying aquifers also affects the understanding of the potential impacts of pumping on groundwater dependent ecosystems (GDEs), which are plant and animal communities that require groundwater to meet some or all of their water needs. GDEs can be associated with areas where there is a direct connection between shallow alluvial water-bearing formations and deeper aquifers. The existing groundwater monitoring program in the Subbasin does not include any nested monitoring wells that can be used to assess the interaction between the surface stream flows, associated Alluvial Aquifer, and the underlying Paso Robles Formation Aquifer.

[17] A video demonstrating the current status of the 3D geologic model can be found at this link: https://youtu.be/C4F08rJc8ak.

Per the recommendations set forth in the GSP, *"Definitive data delineating any interconnections between surface water and groundwater or a lack of interconnected surface waters is a data gap that will be addressed during implementation of this GSP."* The GSAs recognize that installing the proposed network of monitoring wells and stream gages throughout the Subbasin will require a significant initial capital investment as well as a commitment of resources and funding for annual operation and maintenance of the sites. Thus, the GSAs intend to implement the proposed monitoring network over time.

As an initial step to address this significant data gap and assess the potential for interconnectivity of the surface water with the principal aquifers of the Subbasin, the City of Paso Robles GSA proposed to the SWRCB to use the Supplemental Environmental Project (SEP) funds that were available as a result of a settlement agreement between the SWRCB and the City of Paso Robles for violations of the City's National Pollutant Discharge Elimination System (NPDES) permit related to wastewater treatment releases.

Through the assistance of the SEP funds, the potential for interconnected surface water within the Alluvial Aquifer will be assessed after data from this expanded network of monitoring wells and stream gages are collected and analyzed. Prior to this work, two stream gages existed within the Subbasin. The initial phase of work utilizing the SEP funds has expanded that network by coupling stream gages with monitoring wells.

The SEP project resulted in installations of four new monitoring wells and three new stream gages that record stream stage. The monitoring wells were installed in pairs at two locations, each with existing stream gages: Site 1 – near the 13th Street Bridge over the Salinas River in Paso Robles, and Site 9 – near the intersection of Airport Road and Estrella Road next to the Estrella River (Cleath-Harris Geologists, 2021a; a copy of the report is provided in Appendix J). A shallow well, completed in the Alluvial Aquifer, and an intermediate well, completed in the upper Paso Robles Formation were installed at each site. A third deeper well was originally planned at each site, however, due to shallow bedrock and potential geothermal activity encountered at Site 1 a deep well is no longer recommended at Site 1. Installation of a deep well remains as a recommendation at Site 9, although its completion has been deferred to another project phase. Initial groundwater levels measured in each of these four new wells are being used to improve understanding of interconnection between the two principal aquifers and the potential surface water/groundwater interaction at these two sites. The GSAs have retained the services of a consultant to analyze these and other available data to evaluate the potential interconnectivity of surface water and groundwater. This work is ongoing as of the date of this report.

The SEP project funds were sufficient for performing the feasibility analysis of stream gage installation, identifying potential sites, developing a work plan, and installing three gages (Cleath-Harris Geologists, 2021b; a copy of the report is provided in Appendix J). Rating curve development is not part of the project. Stage data without a rating curve is useful for identifying flow/no flow conditions and the timing of stormwater runoff when analyzed with rain gages and other stream gages in the watershed. The stage data may also be used to evaluate the interconnectivity of surface water and groundwater. The three new stream gage sites, installed in April 2021 are:

- Salinas River at the River Road Bridge in San Miguel
- Estrella River at the River Grove Drive Bridge in Whitley Gardens
- Huer Huero Creek at the Geneseo Road Bridge near Eagle Oak Ranch Way

### 8.4.2 City of Paso Robles Recycled Water Program

In 2016, the City completed a major upgrade of its Wastewater Treatment Plant to remove all harmful pollutants efficiently and effectively from the wastewater. The City's master plan is to produce tertiary-quality recycled water and distribute it to various locations within the City as well as east Paso Robles, where it may be used for irrigation of city parks, golf courses, and vineyards. This will reduce the need to pump groundwater from the Subbasin and will further improve the sustainability of the City's water supply. In 2019, the City began operating the recycled water system. Some sections of the distribution system are currently in construction in anticipation of eventually building the full system, pending development of funding mechanisms.

The project will have the capacity to use up to 2,200 AFY of disinfected tertiary effluent for in-lieu recharge inside the City of Paso Robles and in the central portion of the Subbasin (see Section 8.4.4) Water that is not used for recycled water purposes can potentially be discharged to surface infiltration facilities, such as Huer Huero Creek, with the possibility for additional recharge benefits.

The primary benefit from the City's Recycled Water Program is higher groundwater elevations in the central portion of the Subbasin due to in-lieu recharge from the direct use of the recycled water and potential surface recharge opportunities.

### 8.4.3 San Miguel CSD Recycled Water Project

The San Miguel CSD Recycled Water project is currently in the final design phase. This planned project will upgrade the CSD wastewater treatment plant to meet California Code of Regulations (CCR) Title 22 criteria for disinfected secondary recycled water for irrigation use by vineyards. Potential customers include a group of agricultural irrigators on the east side of the Salinas River, and a group of agricultural customers northwest of the wastewater treatment plant. The project could provide between 200 AFY and 450 AFY of additional water supplies. The primary benefit from the CSD's Recycled Water project is higher groundwater elevations in the vicinity of the community of San Miguel due to in-lieu recharge from the direct use of the recycled water.

### 8.4.4 Blended Water Project

Private entities and individuals are working actively with the City of Paso Robles and numerous agricultural irrigators to develop a project that can bring recycled water to the central portion of the Subbasin. As described above, the City estimates that as much as 2,200 AFY of recycled water will be available, and the volume will likely increase in the future as the City grows. The wastewater treatment plant is designed to process and deliver up to 4,000 AFY.

The goal of the Blended Water Project is to design and construct a pipeline system to connect to the City's Recycled Water Program and convey recycled water into the agricultural areas east of the City. Although there are many ways to utilize the Recycled Water Program water directly, certain challenges exist to make the water quality of the recycled water attractive to some agricultural users. Blending the recycled water with surplus Nacimiento Water Project water, when available, may mitigate these challenges. Additional challenges with the use of NWP water include acreage limitations on the place of use for irrigated agricultural lands within SLO County – a constraint in the existing water right held by the Monterey County Water Resources Agency.

Numerous challenges exist to develop the project, but considerable time and effort has been expended by several private entities as well as City and County staff to develop this conceptual project. Key developments in 2021 include ongoing negotiations with Monterey County regarding modification to the point of use requirements for Nacimiento Water Project water. The primary benefit from the Blended Water Project is higher groundwater elevations in the central portion of the Subbasin east of the City of Paso Robles due to reductions in groundwater pumping for irrigation and in-lieu recharge from the direct use of the blended water. Associated benefits may include improved groundwater quality from the use and recharge of high-quality irrigation water.

### 8.4.5 Expansion of Monitoring Well Network

As described in the GSP, SGMA regulations require a sufficient density of monitoring wells to characterize the groundwater elevation in each principal aquifer. The GSP concluded that a significant data gap existed in the number of monitoring wells in both the Alluvial Aquifer and Paso Robles Formation Aquifer within the Subbasin. The City of Paso Robles GSA project (using SEP funds) has partially addressed this data gap by drilling new monitoring wells, as described in Section 8.4.1.

The 22 wells in the Paso Robles Formation Aquifer monitoring network are insufficient to develop representative and sufficiently detailed groundwater contour maps. The lack of publicly available data for the aquifer is identified as a data gap that must be addressed in GSP implementation. This section describes new projects and initiatives undertaken by SLOFCWCD, Shandon-San Juan GSA (SSJGSA), and EPCWD to expand the collection of water level data in the Paso Robles Formation Aquifer and develop potential new monitoring wells in their respective districts.

#### 8.4.5.1 SLOFCWCD Initiative to Expand the Monitoring Well Network on Public Properties

On July 7, 2020, the County Board of Supervisors directed staff to evaluate groundwater wells that are located on public properties and include them into the SLOFCWCD's existing monitoring network. County staff is evaluating approximately 6 groundwater wells in the Paso Robles Subbasin and has identified 2-3 wells on public properties that are suitable to be added to the semiannual groundwater level measuring program.

#### 8.4.5.2 SSJGSA Program to Expand the Monitoring Well Network

The SSJGSA initiated a program in WY 2020 to enlist many well owners that are members of the SSJWD to join a pilot study to measure water levels in wells throughout the District. Beginning in March 2021 and continuing through the end of WY 2021 water levels were measured during 7 monitoring events in 66 wells. This initial effort is being undertaken to gain a better understanding of the time of year of the seasonal high and low water levels and to identify key representative wells in each area throughout the District. Data collection is continuing into WY 2022.

After about a year of this extensive monitoring and recording program, the data will be analyzed with the intent to reduce the number of measuring points as well as frequency of measurements. The eventual goal of the program is to develop a network of 20 to 30 new wells to incorporate into the GSP RMS monitoring network. It is expected that water level data from this expanded monitoring network will be incorporated into the groundwater elevation and change in groundwater in storage analyses for WY 2022.

#### 8.4.5.3 EPCWD Program to Expand the Monitoring Well Network

The EPCWD initiated a program in WY 2020 similar to the SSJGSA program. Beginning in April 2021 and continuing through the end of WY 2021 water levels were measured during 2 monitoring events in approximately 30 wells throughout the EPCWD membership area. Data collection is continuing into WY 2022. Like the SSJGSA program, the eventual goal of the EPCWD initiative is to develop a network of 20 to 30 new wells to incorporate into the GSP RMS monitoring network. It is expected that water level data from this expanded monitoring network will be incorporated into the groundwater elevation and change in groundwater in storage analyses for WY 2022.

### 8.4.6 Expansion of Salinas Dam and Ownership Transfer

One of the conceptual projects discussed in the GSP (Section 9.5.2.7 of the GSP) is expansion of the Salinas Dam. The dam is owned by the United States Army Corps of Engineers (USACE), which jointly holds Santa Margarita Reservoir water rights permits with the City of San Luis Obispo (City of SLO). The USACE leases the dam to the SLOFCWCD, who oversees its operation and maintenance, including water delivery to the City of SLO.

The original dam design included the installation of spillway gates that would raise the reservoir elevation, however they were not installed due to seismic safety concerns. The storage capacity of Santa Margarita Reservoir could be expanded by installing the spillway gates, potentially increasing the maximum volume in the reservoir from 23,843 AF to 41,792 AF.

As described in the GSP, expanded reservoir storage might benefit the Subbasin by scheduling summer releases from reservoir storage to the Salinas River, which would benefit the Subbasin by increasing streamflow recharge through augmented flows in the Salinas River. Another way the project might indirectly benefit the Subbasin is if the City of SLO could increase their Santa Margarita Reservoir deliveries, thereby freeing up a portion of their NWP water allocation for purchase by the GSAs.

In 2018, the USACE initiated a Disposition Study to evaluate options to dispose of the Salinas Dam, including transferring ownership to a local agency. An option under investigation is to transfer the dam to a local agency such as the SLOFCWCD, thus the USACE has requested that the County Board of Supervisors, acting in their role as the SLOFCWCD, submit a letter expressing interest in potentially moving forward with the ownership transfer process. Such an ownership transfer would help facilitate the dam expansion, should it prove to be a cost-effective and worthwhile project.

Some of the known issues with transferring ownership of the dam include:

- The USACE has indicated that the Salinas Dam has some deficiencies but is considered low risk. As such, the USACE has indicated that the dam would need to be transferred "as-is", with the USACE only willing to consider providing minimal funding to support retrofit.
- The State, as the California DWR Division of Safety of Dams (DSOD), has indicated that seismic rehabilitation of Salinas Dam would be required. Any retrofit or structural improvements, including expanding the dam's capacity, will require coordination with and approval by the DSOD following acquisition of the dam by the SLOFCWCD.
- Since the USACE has indicated they are unlikely to install the gates, ownership of the dam would need to be transferred from the federal government to a local agency to pursue the opportunity. This transfer would result in the Salinas Dam oversight responsibilities transferring from federal to state jurisdiction and require the dam retrofit and expansion to meet any additional requirements from the State.

On September 22, 2020, the County Board of Supervisors approved sending a letter to the USACE expressing interest in moving forward with the ownership transfer process. Key developments in WY 2021 include continued coordination between the agencies and advocacy for the ownership transfer by United States Congressman Salud Carbajal. It will require considerable time and expense to eventually bring this potential project to fruition and increase the local water supply resiliency, including potential benefits to the Subbasin and other public or private entities downstream of the dam along or near the Salinas River.

## 8.5 Summary of Progress toward Meeting Subbasin Sustainability

Relative to the basin conditions at the end of the study period as reported in the GSP, the First Annual Report (WYs 2017–2019) (GSI, 2020) and the Water Year 2020 Annual Report (GSI, 2021) indicated an improvement in groundwater conditions throughout the Subbasin and a modest increase of total groundwater in storage. However, the groundwater conditions documented in this Water Year 2021 Annual Report indicate a return to worsening conditions following two consecutive years with below average rainfall. Historical groundwater pumping in excess of the sustainable yield has created challenging conditions for sustainable management. However, actions are underway to collect data, improve the monitoring and data collection networks, and coordinate with affected agencies and entities throughout the Subbasin to develop solutions that address the shared mutual interest in the Subbasin's overall sustainability goal.

### 8.5.1 Summary of Response to DWR Review of GSP

On June 3, 2021, the Paso Robles Subbasin GSP manager received a consultation letter from DWR. The letter was intended to initiate consultation between DWR and the Paso Robles Subbasin GSAs in advance of issuance of a plan adequacy determination. The letter indicates that DWR had identified deficiencies which may result in an incomplete determination. The letter also presents two potential corrective actions that, if addressed sufficiently, may result in GSP approval. The two potential corrective actions are:

- Potential Corrective Action 1. Provide justification for, and effects associated with, the sustainable management criteria for groundwater levels
- Potential Corrective Action 2. Develop Sustainable Management Criteria for the Depletions of Interconnected Surface Water Based on Best Available Information and Science

Since receipt of the consultation letter, the GSAs have retained the services of a consultant to address these potential corrective actions and rewrite related sections of the GSP. This work is ongoing as of the date of this report. On January 21, 2022, DWR released an official 'incomplete' determination for the Paso Robles Subbasin GSP. Basins with GSPs that are determined incomplete have 180 days to address deficiencies and resubmit their corrected GSPs to DWR for review. The corrected Paso Robles Subbasin GSP must be resubmitted to DWR by July 20, 2022.

### 8.5.2 Subsidence

Land subsidence is the lowering of the land surface. As described in the GSP, several human-induced and natural causes of subsidence exist, but the only process applicable to SGMA are those due to permanently lowered ground surface elevations caused by groundwater pumping (M&A, 2020). Historical subsidence can be estimated using Interferometric Synthetic Aperture Radar (InSAR) data provided by DWR. InSAR measures ground elevation using microwave satellite imagery data. The GSP documents minor subsidence in the Subbasin using data provided by DWR depicting the difference in InSAR measured ground surface elevations between June 2015 and June 2018. These data show that subsidence of up to 0.025 feet may have occurred over this three-year period in a few small, isolated areas of the Subbasin (M&A, 2020). As of the date of this report, updated InSAR data has been provided by DWR through October 2020. As discussed in the GSP, there is a potential error of 0.1 feet (or 1.2 inches) associated with the InSAR measurement and reporting methods. A land surface change of less than 0.1 feet is therefore within the noise of the data and is equivalent to no subsidence. Considering this range of potential error, examination of the October 2019 through October 2020 InSAR data show that zero land subsidence has occurred since October 2019 (Figure 13). Therefore, subsidence of up to 0.025 feet may have occurred in a few small, isolated areas over the five-year period between June 2015 and October 2020. The GSA's will continue to monitor and report annual subsidence as more data become available.

### 8.5.3 Interconnected Surface Water

Ephemeral surface water flows in the Subbasin make it difficult to assess the interconnectivity of surface water and groundwater and to quantify the degree to which surface water depletion has occurred. As stated in the GSP, water elevation contour maps of the Paso Robles Formation wells may suggest that a continuous saturated zone between the surface water and the Paso Robles Formation aquifer does not exist (M&A, 2020). As of the date of this report, there are insufficient publicly available data to adequately assess the interconnectivity of surface water and groundwater or to quantify potential surface water depletion. However, the GSAs have retained the services of a consultant to address potential corrective actions to the GSP, including improvements to the groundwater/surface water interactions analysis. This work is ongoing as of the date of this report.

### 8.5.4 Groundwater Quality

Although groundwater quality is not a primary focus of SGMA, actions or projects undertaken by GSAs to achieve sustainability cannot degrade water quality to the extent that they would cause undesirable results. As stated in the GSP, groundwater quality in the Subbasin is generally suitable for both drinking water and agricultural purposes (M&A, 2020). Eight constituents of concern (COC's) were identified and discussed in the GSP that have the potential to be impacted by groundwater management activities. These COC's identified in the GSP are salinity (as indicated by electrical conductivity), total dissolved solids (TDS), sodium, chloride, nitrate, sulfate, boron, and gross alpha. For this Water Year 2021 Annual Report, trends of concentrations of these eight COC's were analyzed through WY 2021 using data from the GeoTracker GAMA database (GAMA, 2021). All COC's reviewed show a steady concentration trend since 2016.

Overall, there are no significant changes to groundwater quality since 2016, as documented in the GSP, the First Annual Report, WY 2020 Annual Report, and this WY 2021 Annual Report. Implementation of sustainability projects and/or management actions, as presented in the GSP, in this WY 2021 Annual Report, or in future reports or GSP updates, are not anticipated to result in degraded groundwater quality in the Subbasin. Any potential changes in groundwater quality will be documented in future annual reports and GSP updates.

### 8.5.5 Summary of Changes in Basin Conditions

The above-average rainfall water years of 2017 and 2019 improved groundwater conditions in the Subbasin. However, two consecutive below average rainfall years in 2020 and 2021 have resulted in a reversal of this trend. Although groundwater elevations in three of the Paso Robles Formation Aquifer RMS wells are recovering in the past few years, groundwater elevations in several of the RMS wells are continuing to trend downward. Groundwater pumping continues to exceed the estimated future sustainable yield and the projects and management actions described in the GSP and in this Water Year 2021 Annual Report will be necessary in order to bring the Subbasin into sustainability.

### 8.5.6 Summary of Impacts of Projects and Management Actions

Additional time will be necessary to judge the effectiveness and quantitative impacts of the projects and management actions either now underway or in the planning and implementation stage. However, it is clear that the actions in place and as described in this Water Year 2021 Annual Report are a good start towards reaching the sustainability goals laid out in the GSP. It is too soon to judge the observed changes in basin conditions against the interim goals outlined in the GSP, but the anticipated effects of the projects and management actions now underway are expected to significantly affect the ability of the Subbasin to reach the necessary sustainability goals.

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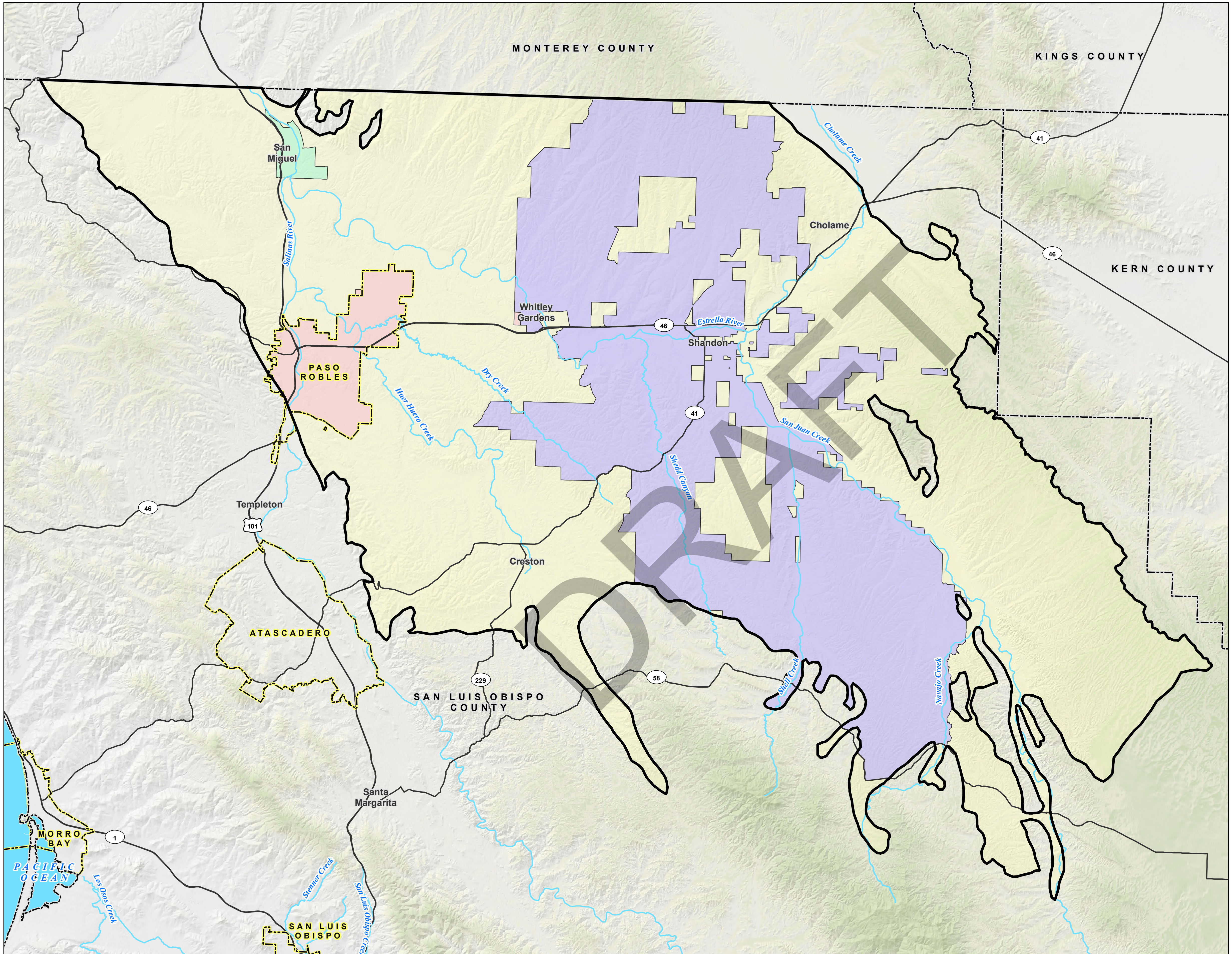
# FIGURES




# FIGURE 1

**Extent of the Paso Robles Subbasin and Exclusive Groundwater Sustainability Agencies**

Paso Robles Subbasin
Water Year 2021 Annual Report

**LEGEND**

- Paso Robles Subbasin

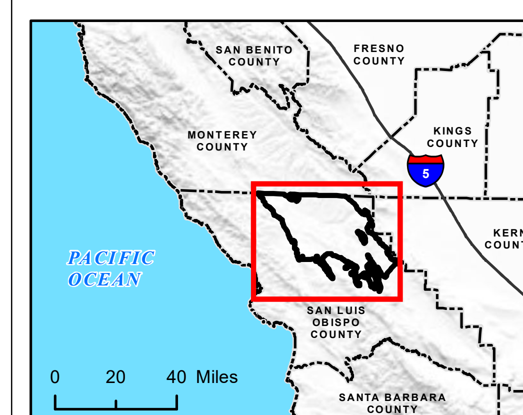
**Exclusive Groundwater Sustainability Agencies**

- San Miguel Community Services District
- City of Paso Robles
- Shandon- San Juan Water District
- Paso Basin - County of San Luis Obispo

**All Other Features**

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

**LOCATOR MAP:**



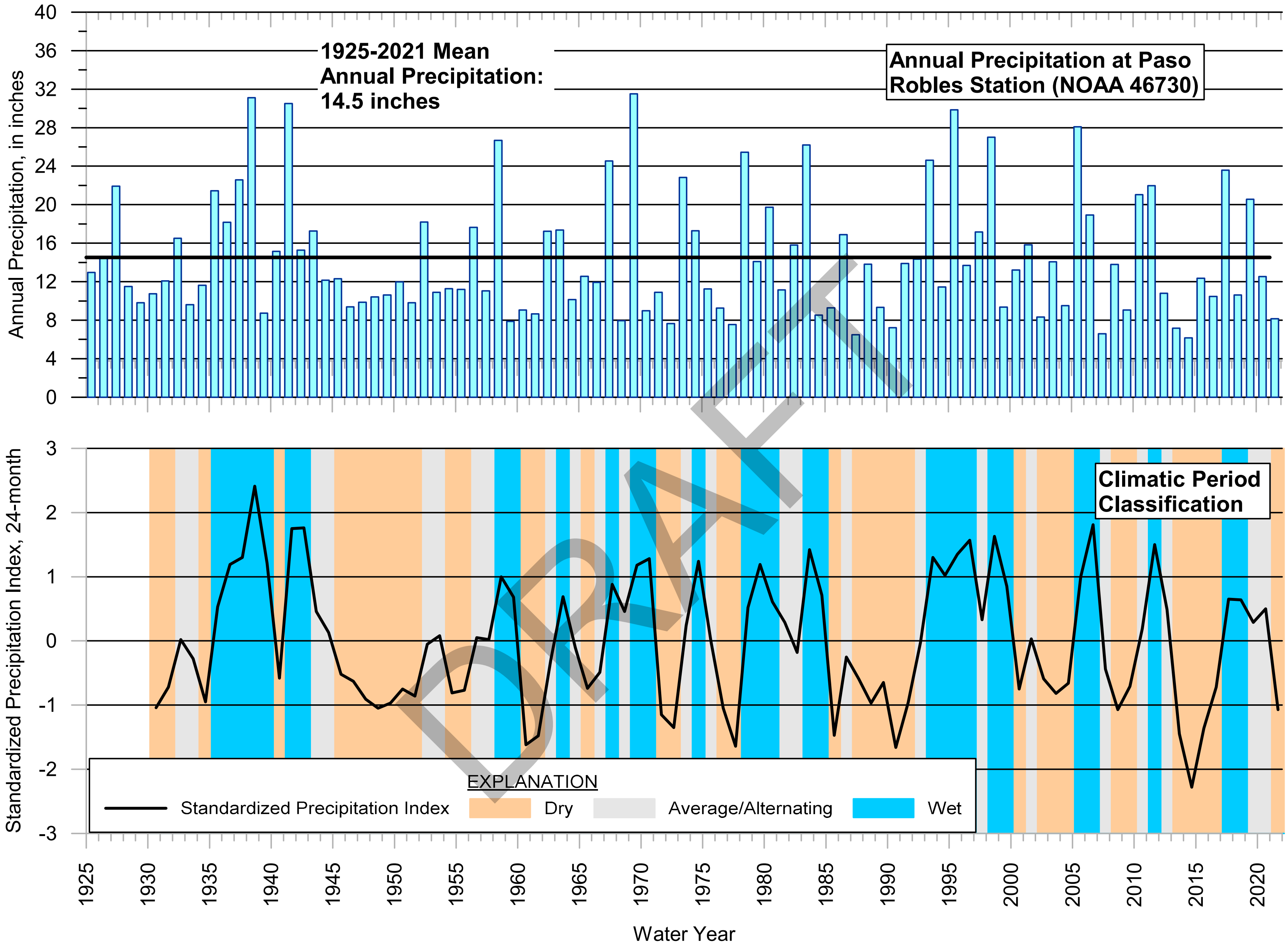

N

0 10,000 20,000 30,000
Feet

Date: December 9, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure1_Paso_Robles_Subbasin_and_Exclusive_GW_Sust_Agencies.mxd





## FIGURE 2

**Annual Precipitation and Climatic Periods in the Paso Robles Subbasin**

Paso Robles Subbasin Water Year 2021 Annual Report

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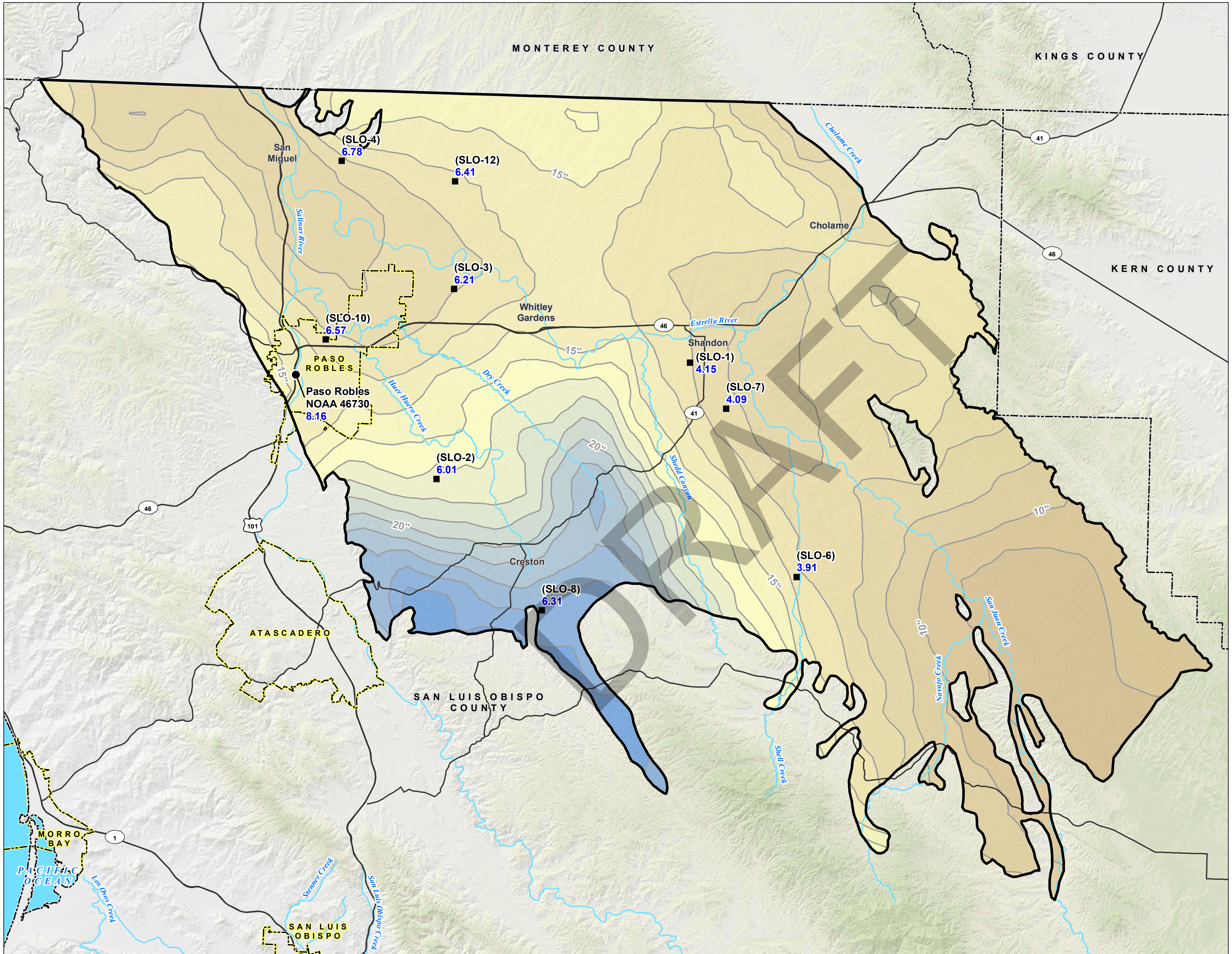



# FIGURE 3

## Water Year 2021 Precipitation Totals and Average Distribution of Annual Precipitation in the Paso Robles Subbasin

Paso Robles Subbasin
Water Year 2021 Annual Report

### LEGEND

- ● Paso Robles NOAA Precipitation Station
  WY 2021 Precipitation Total (inches)
- ■ UCCE Precipitation Station
  WY 2021 Precipitation Total (inches)
- Paso Robles Subbasin
- 1 in. Precipitation Contour

**Annual Precipitation (in.)**

- 8 - 9
- 9 - 10
- 10 - 11
- 11 - 12
- 12 - 13
- 13 - 14
- 14 - 15
- 15 - 16
- 16 - 17
- 17 - 18
- 18 - 19
- 19 - 20
- 20 - 21
- 21 - 22
- 22 - 23
- 23 - 24
- 24 - 25

**All Other Features**

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

### NOTES

Average distribution of annual precipitation based on 30-year normal PRISM data calibrated to the Paso Robles Station (NOAA 46730).

UCCE: University of California Cooperative Extension

N

0 10,000 20,000 30,000
Feet

Date: February 4, 2022
Data Sources: CA DWR, SLO Co., USGS, PRISM (OregonState), NOAA, UCCE

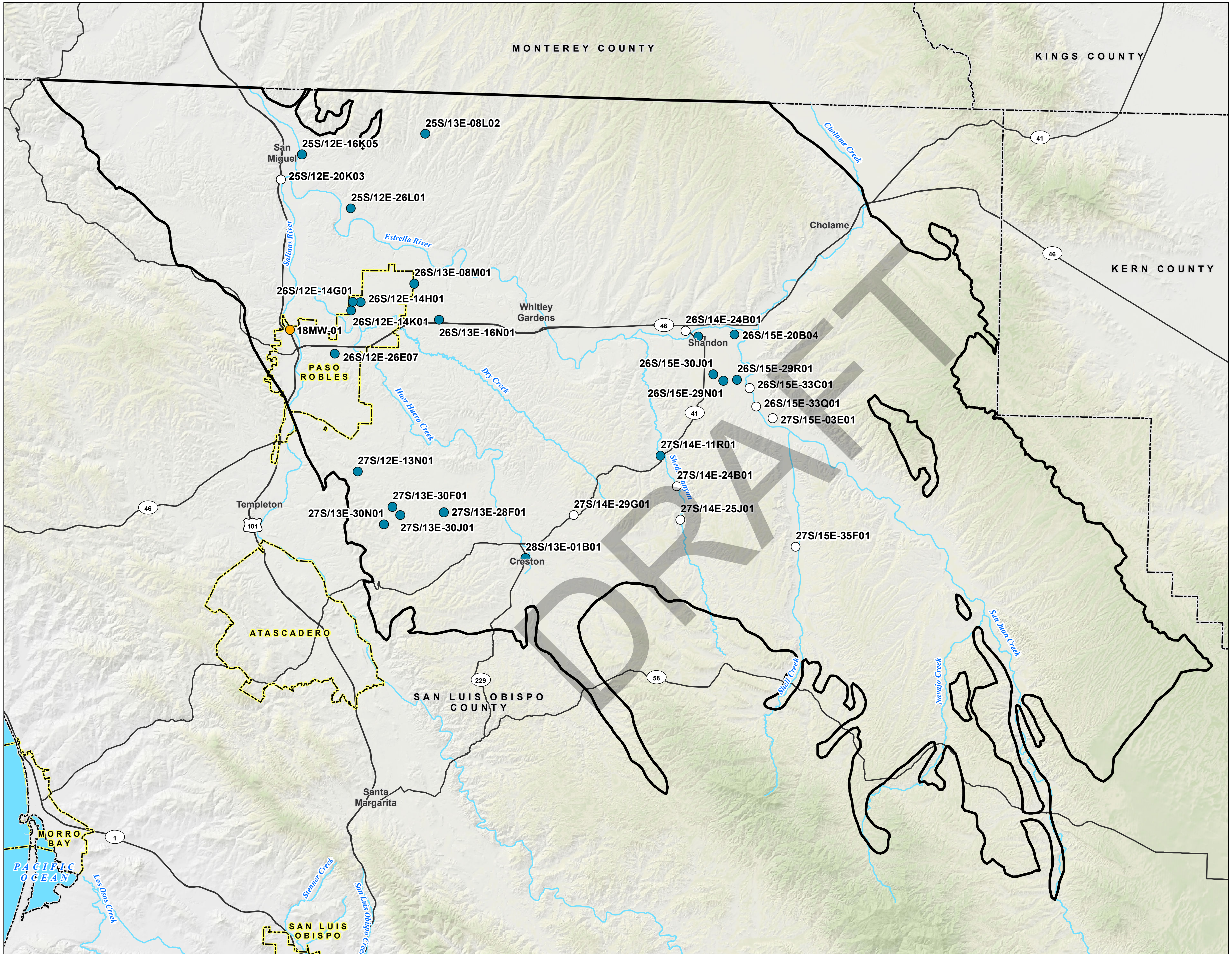
GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure3_Avg_Dist_Annual_Precip.mxd

# FIGURE 4

## Groundwater Elevation Monitoring Well Network in the Paso Robles Subbasin

Paso Robles Subbasin
Water Year 2021 Annual Report




## LEGEND

**Wells**

- Paso Robles Formation
- Alluvial Aquifer
- Potential Future Monitoring Well

**All Other Features**

- Paso Robles Subbasin
- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

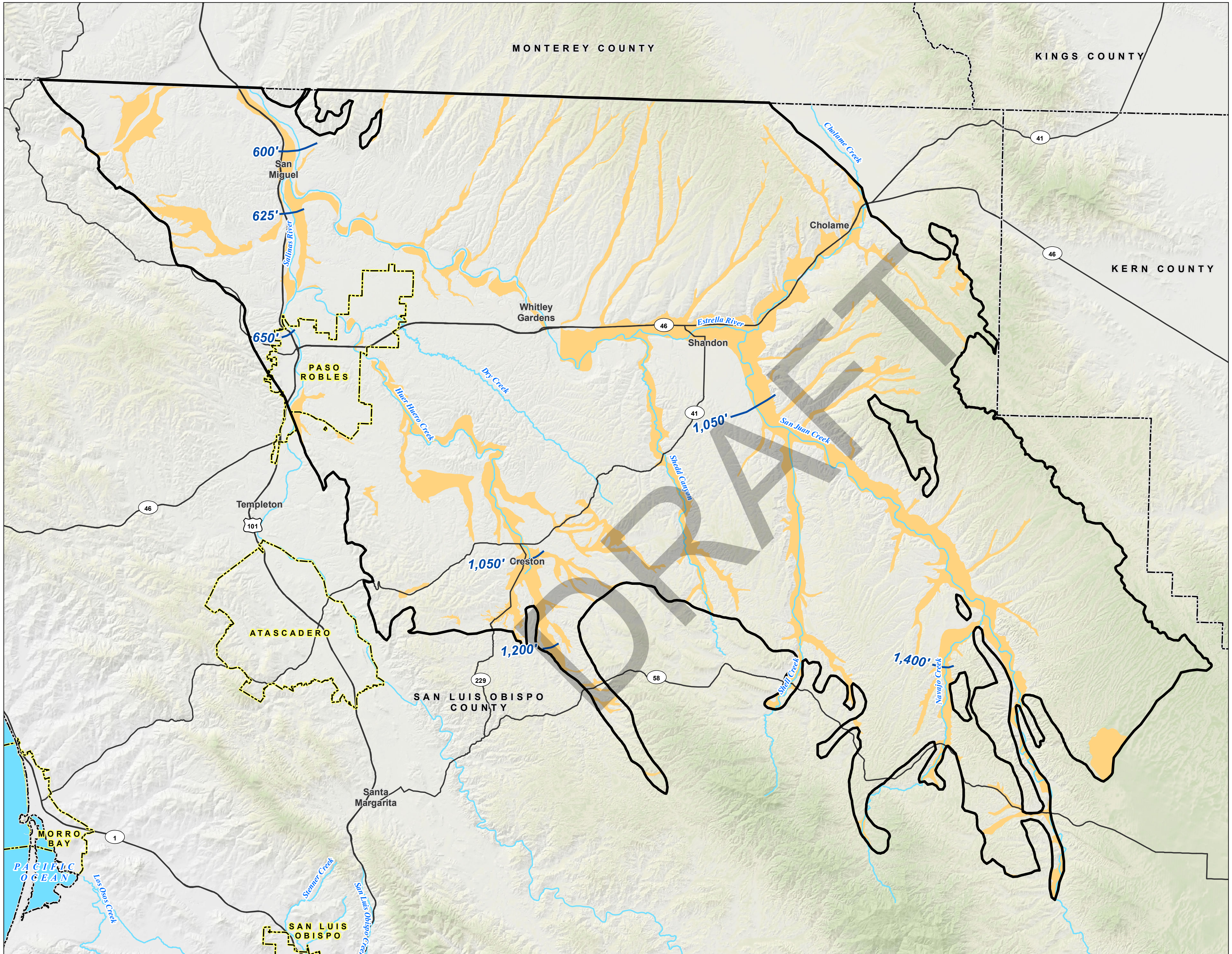
N

0 10,000 20,000 30,000
Feet

Date: December 9, 2021
Data Sources: CA DWR, SLO Co., City of Paso Robles, USGS

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure4_GW_Elev_Monitoring_Well_Network.mxd




# FIGURE 5

## Alluvial Aquifer Groundwater Elevation Contours

Paso Robles Subbasin
Water Year 2021 Annual Report

### LEGEND

- Alluvial Groundwater Elevation Contour, in feet above mean sea level
- Paso Robles Subbasin

**Geologic Alluvial Units**

- Qal: Alluvial Deposits

**All Other Features**

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

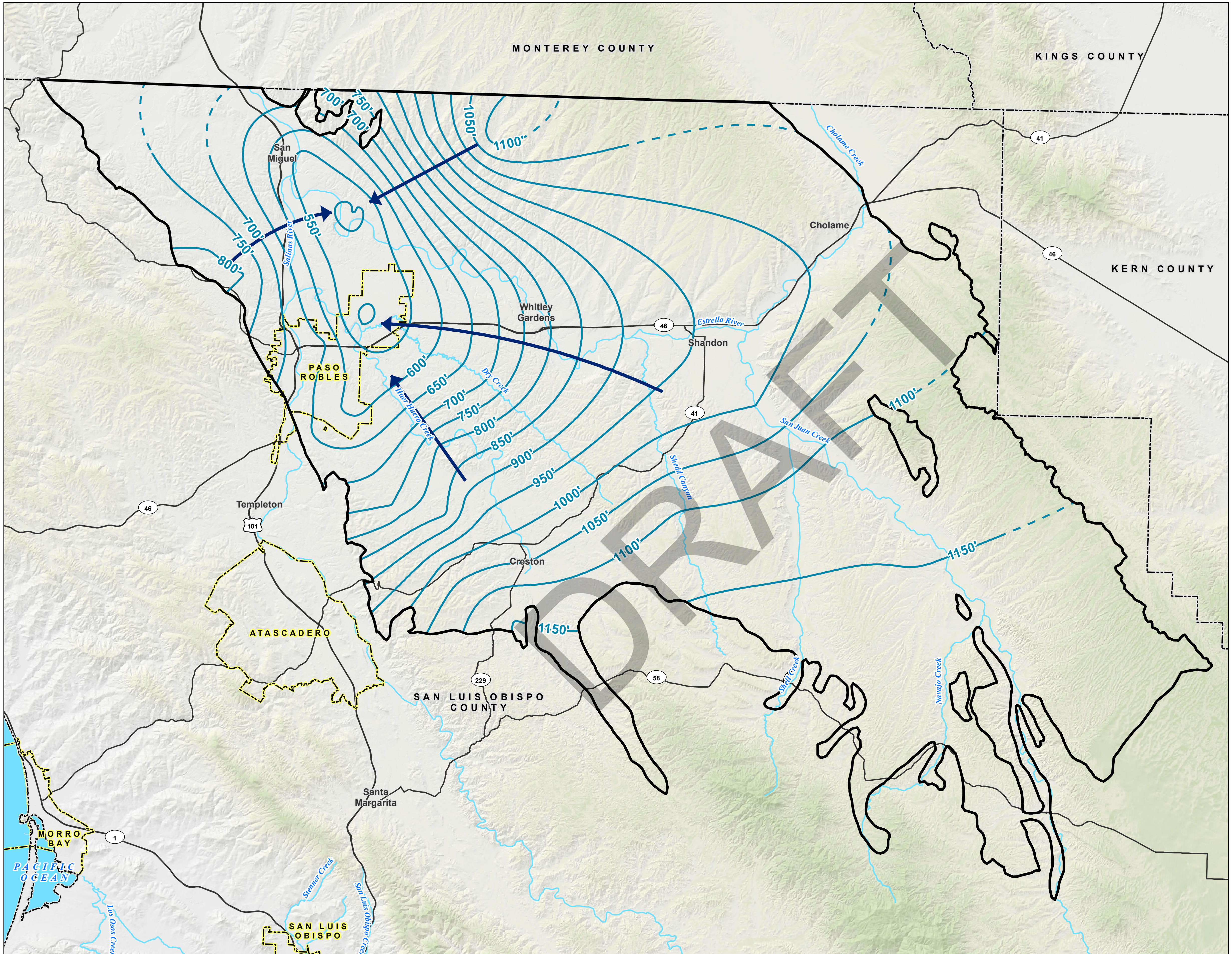
N

0 10,000 20,000 30,000
Feet

Date: December 9, 2021
Data Sources: CA DWR, SLO Co., Montgomery, USGS

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure5_Alluvial_Aquifer_GW_Elev_Contours.mxd




# FIGURE 6

**Paso Robles Formation Aquifer Spring 2021 Groundwater Elevation Contours**

Paso Robles Subbasin
Water Year 2021 Annual Report

**LEGEND**

- Spring 2021 Groundwater Elevation Contour in feet above mean sea level; dashed where inferred
- Inferred Groundwater Flow Direction
- Paso Robles Subbasin

**All Other Features**

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

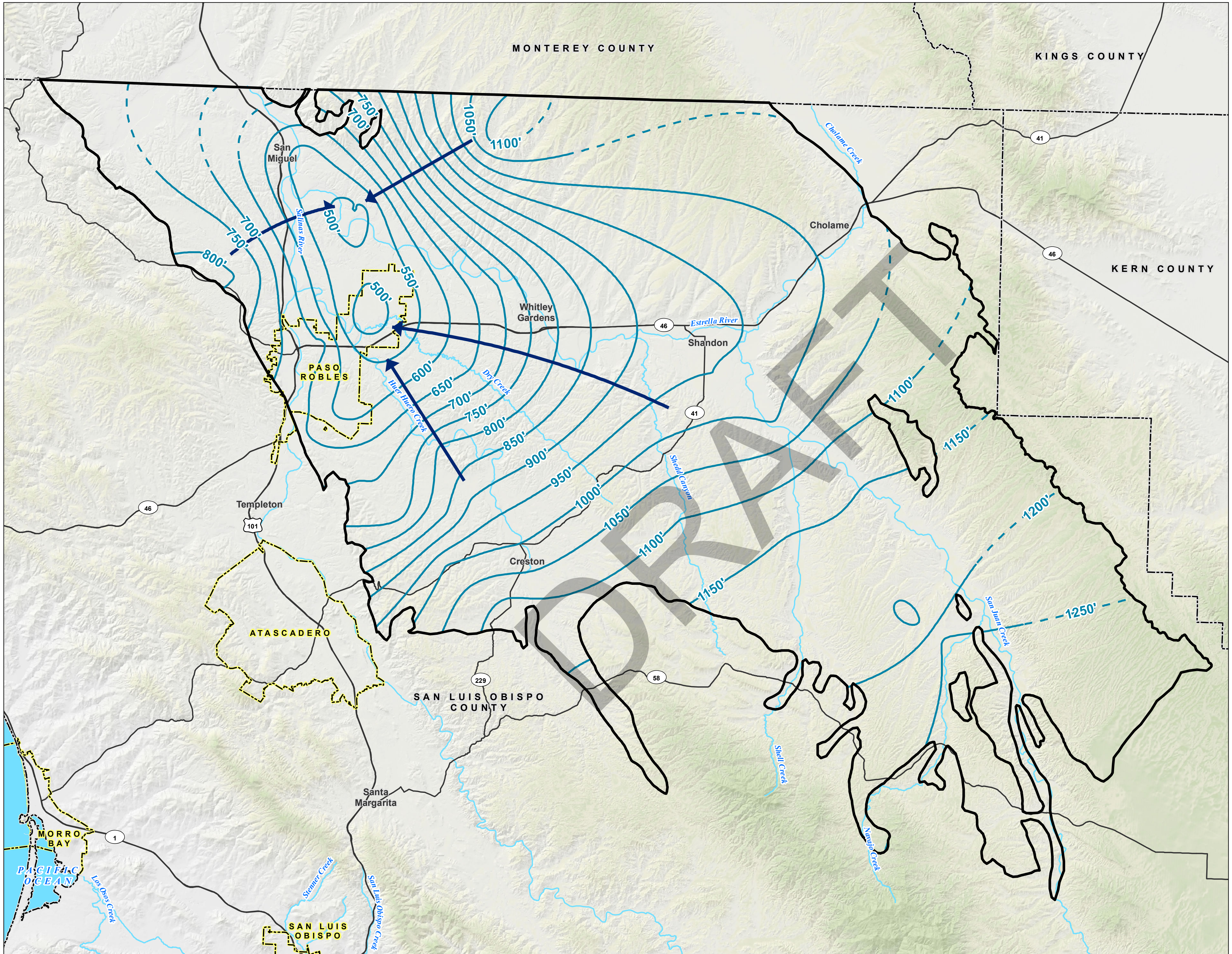
N

0 10,000 20,000 30,000
Feet

Date: December 15, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure6_Spring_2021_GW_Contours.mxd




Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure7_Fall_2021_GW_Contours.mxd

# FIGURE 7

**Paso Robles Formation Aquifer Fall 2021 Groundwater Elevation Contours**

Paso Robles Subbasin
Water Year 2021 Annual Report

**LEGEND**

- Fall 2021 Groundwater Elevation Contour in feet above mean sea level; dashed where inferred
- Inferred Groundwater Flow Direction
- Paso Robles Subbasin

**All Other Features**

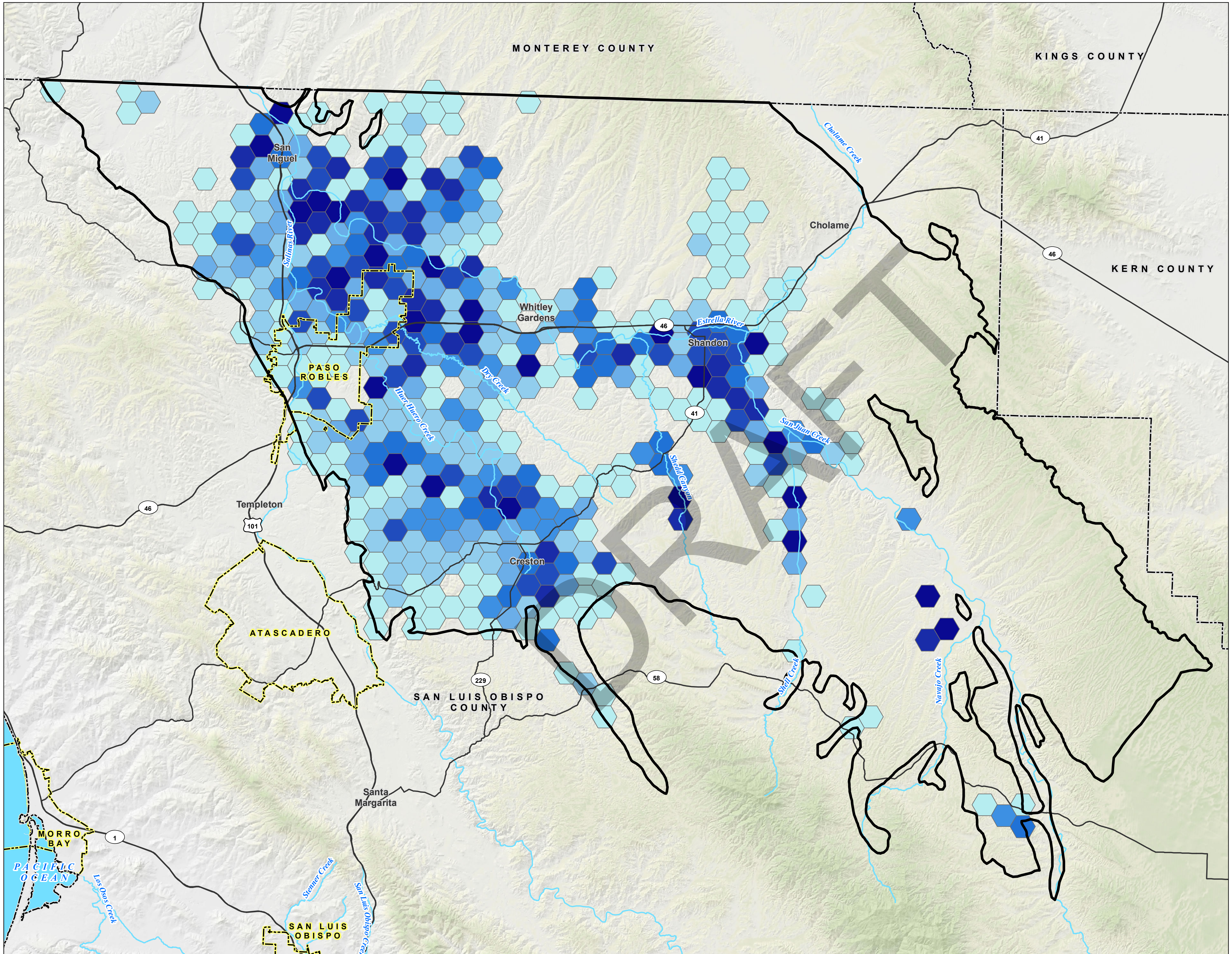
- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

N

0 10,000 20,000 30,000
Feet

Date: December 15, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.




# FIGURE 8

## General Locations and Volumes of Groundwater Extraction

Paso Robles Subbasin
Water Year 2021 Annual Report

### LEGEND

Paso Robles Subbasin

**Water Year 2021 Groundwater Extraction (AFY)**

- 1 - 28
- 29 - 84
- 85 - 149
- 150 - 219
- 220 - 311
- 312 - 464
- 465 - 770
- 771 - 1696

**All Other Features**

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

### NOTE

AFY: Acre-Feet per Year

N

0 10,000 20,000 30,000
Feet

Date: December 13, 2021
Data Sources: CA DWR, SLO Co., Soil Water Balance Model, USGS

GSI Water Solutions, Inc.

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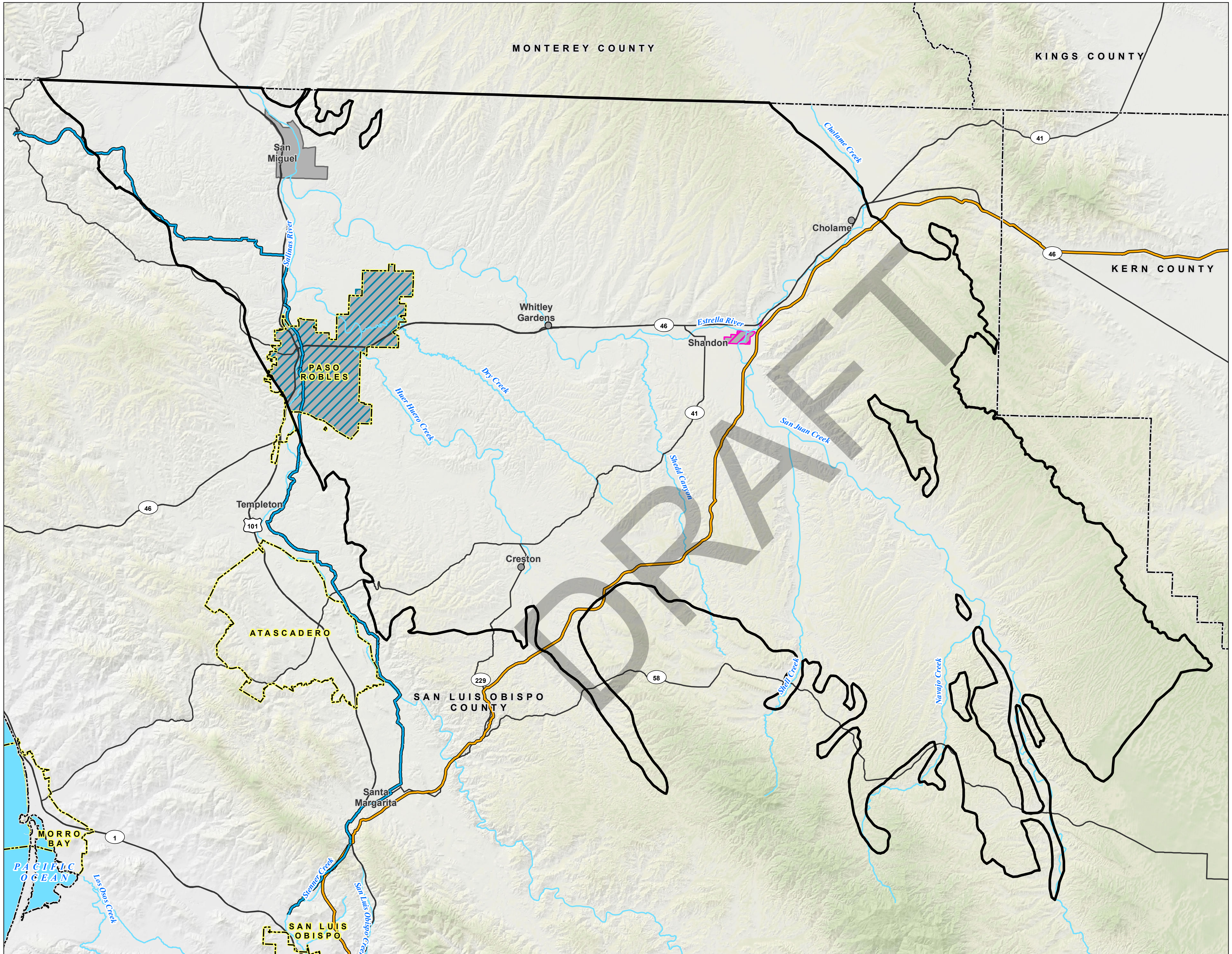



# FIGURE 9

## Communities Dependent on Groundwater and with Access to Surface Water

Paso Robles Subbasin
Water Year 2021 Annual Report

**LEGEND**

- Nacimiento Water Project Pipeline
- State Water Project Pipeline
- Community Dependent Solely on Groundwater
- Community Served by Groundwater and Nacimiento Water Project
- Community Served by Groundwater and State Water Project
- Paso Robles Subbasin

**All Other Features**

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

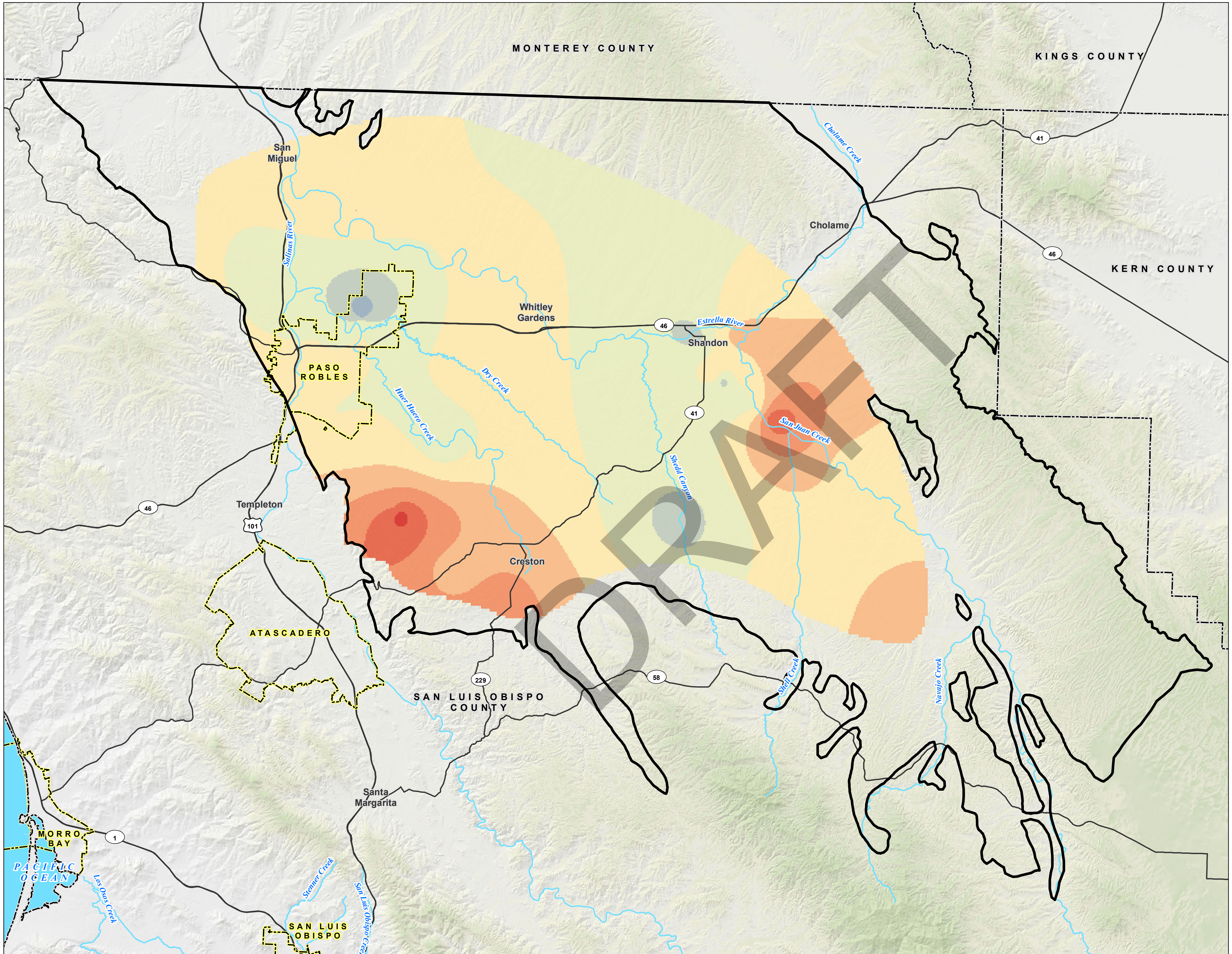
N

0 10,000 20,000 30,000
Feet

Date: December 9, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure9_Comms_Dependent_on_GW.mxd




# FIGURE 10

## Paso Robles Formation Aquifer Change in Groundwater Elevation Fall 2020 to Fall 2021

Paso Robles Subbasin
Water Year 2021 Annual Report

**LEGEND**

Paso Robles Subbasin

**Water Level Change, in feet**

**Fall 2020 to Fall 2021**

- < -40 feet
- -40 to -30 feet
- -30 to -20 feet
- -20 to -10 feet
- -10 to 0 feet
- 0 to 10 feet
- 10 to 20 feet
- 20 to 30 feet
- 30 to 40 feet
- > 40 feet

**All Other Features**

- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

N

0 10,000 20,000 30,000
Feet

Date: December 15, 2021
Data Sources: CA DWR, SLO Co., USGS

GSI Water Solutions, Inc.

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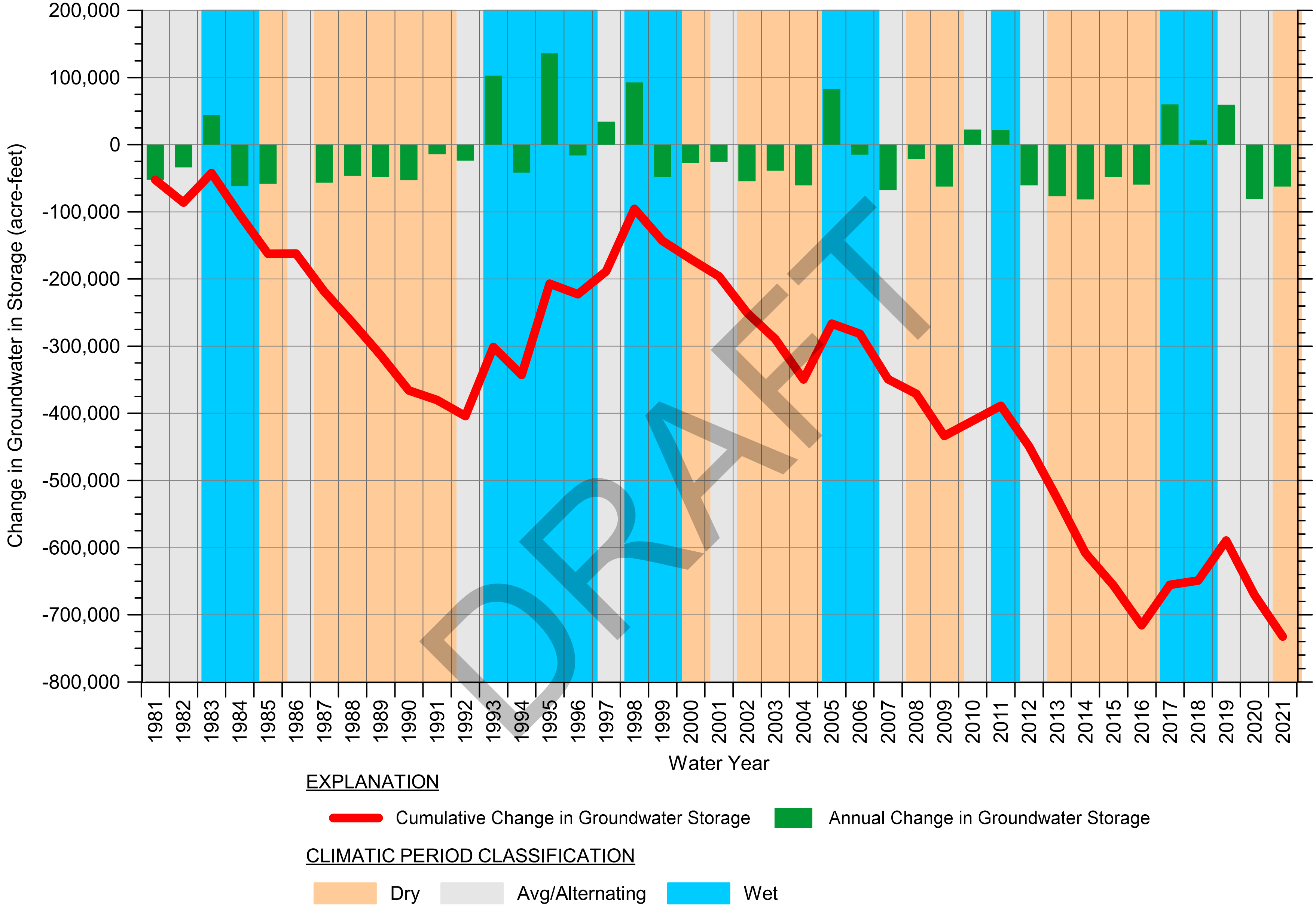


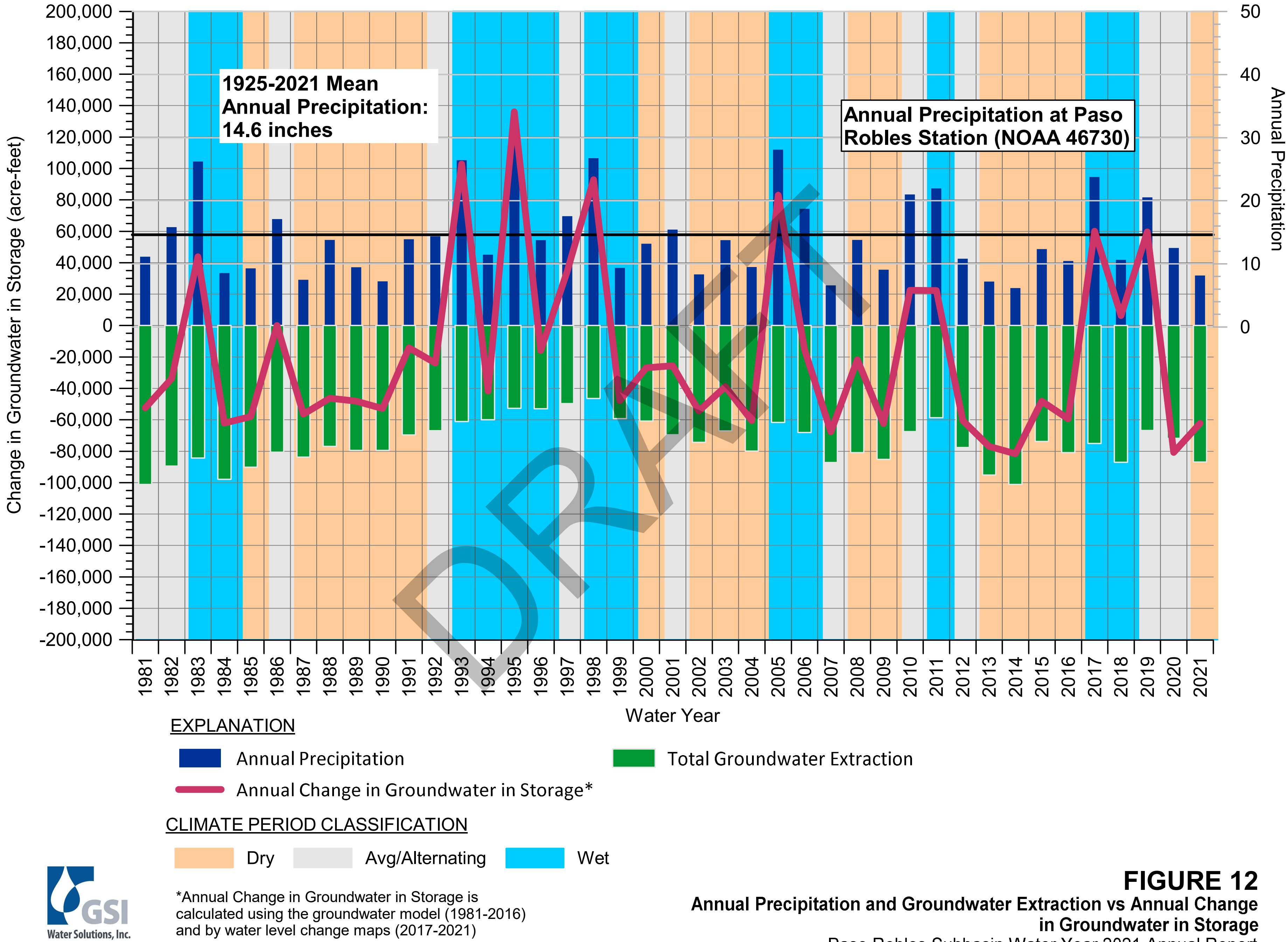

GSI Water Solutions, Inc.

**FIGURE 11**

**Estimated Annual and Cumulative Change in Groundwater in Storage in the Paso Robles Subbasin**

Paso Robles Subbasin Water Year 2021 Annual Report

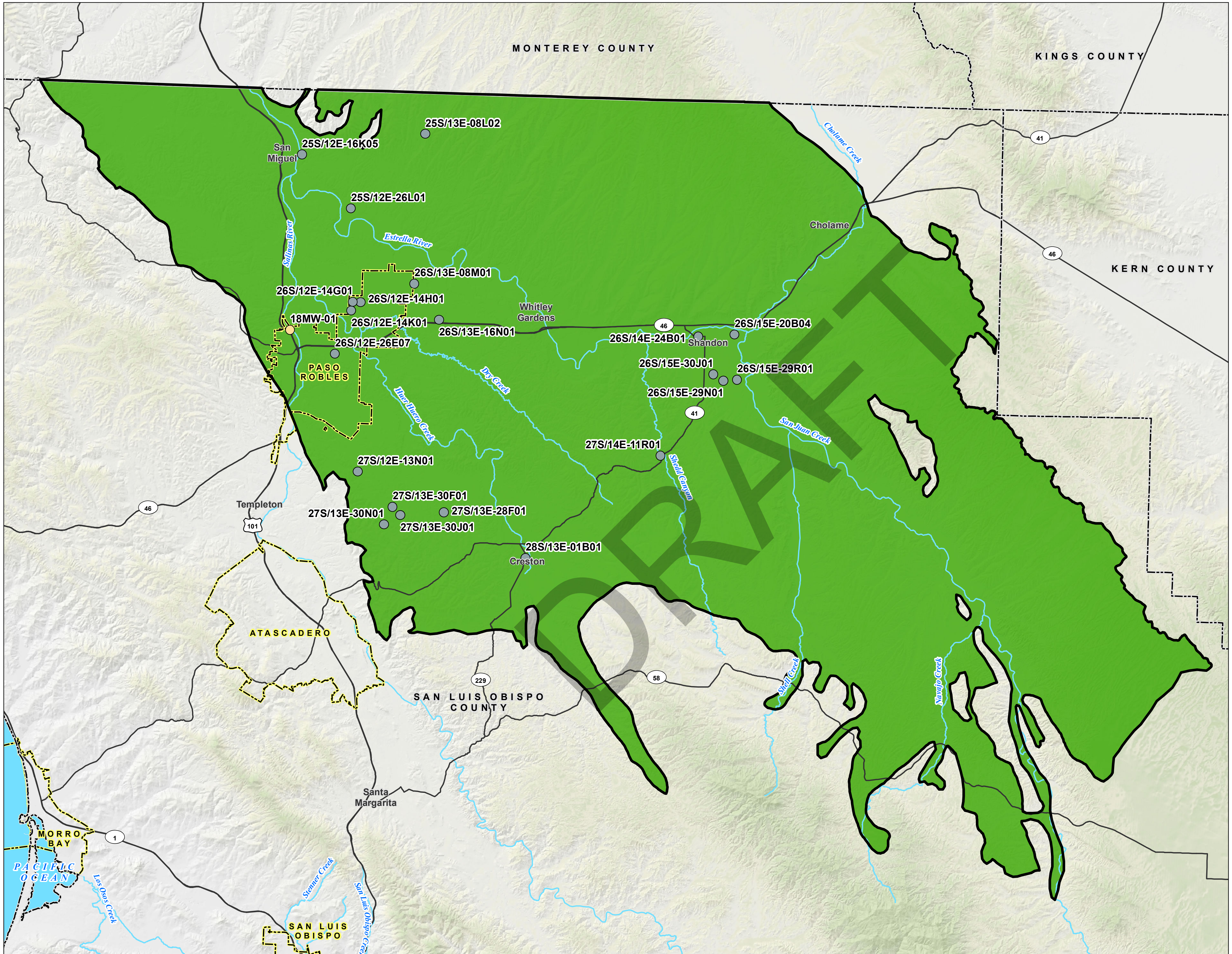
P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\ChangeInStorage\GW_CumulativeChangeGWStoragePRannual_wTitle.grf




GSI Water Solutions, Inc.

**FIGURE 12**
**Annual Precipitation and Groundwater Extraction vs Annual Change in Groundwater in Storage**
Paso Robles Subbasin Water Year 2021 Annual Report

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\ChangeInStorage\Annual Precipitation and Groundwater Extraction vs Annual Change in Groundwater in Storage.gpj




# FIGURE 13

**Land Subsidence Measured by InSAR (October 2019 – October 2020)**

Paso Robles Subbasin
Water Year 2021 Annual Report

**LEGEND**

**Wells**

- Paso Robles Formation
- Alluvial Aquifer

**Estimated Subsidence (decimal ft)**

**October 2019 - October 2020**

- -0.1 - 0.1

**All Other Features**

- Paso Robles Subbasin
- County Boundary
- City Boundary
- Major Road
- Watercourse
- Waterbody

**NOTE**

InSAR: Interferometric Synthetic Aperture Radar

N

0 10,000 20,000 30,000
Feet

Date: December 15, 2021
Data Sources: CA DWR, SLO Co., City of Paso Robles, USGS, TRE Altamira InSAR dataset

GSI Water Solutions, Inc.

Document Path: Y:\0824_PasoRobles\Source_Figures\003_Annual_Report_2021\Figure13_Land_Subsidence_InSAR.mxd

APPENDIX A

# GSP Regulations for Annual Reports

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§ 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

# Precipitation Data

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## Monthly Precipitation at the Paso Robles Station (NOAA 46730)

(inches)

Source: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6730

Source: https://www.prcity.com/462/Rainfall-Totals

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | WY Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1925** | 0.34 | 2.44 | 2.57 | 2.01 | 2.41 | 0.08 | 0.09 | 0.12 | 0.02 | 0.17 | 0.21 | 1.98 | **12.95** |
| **1926** | 2.13 | 6.26 | 0.27 | 3.52 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.25 | 7.14 | 0.90 | **14.56** |
| **1927** | 1.84 | 9.04 | 1.45 | 1.27 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 1.33 | 2.02 | 1.63 | **21.91** |
| **1928** | 0.23 | 2.87 | 2.76 | 0.37 | 0.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 1.82 | 2.87 | **11.50** |
| **1929** | 1.27 | 1.65 | 1.22 | 0.49 | 0.00 | 0.49 | 0.00 | 0.00 | ----- | 0.00 | 0.00 | 0.24 | **9.82** |
| **1930** | 4.32 | 1.80 | 3.00 | 0.54 | 1.01 | 0.04 | 0.00 | 0.00 | 0.04 | 0.00 | 1.64 | 0.16 | **10.99** |
| **1931** | 4.58 | 1.87 | 0.39 | 0.56 | 2.01 | 0.93 | 0.00 | 0.09 | 0.00 | 0.01 | 1.89 | 7.04 | **12.23** |
| **1932** | 2.74 | 3.89 | 0.50 | 0.30 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.11 | 1.28 | **16.50** |
| **1933** | 6.05 | 0.08 | 0.84 | 0.22 | 0.32 | 0.68 | 0.00 | 0.00 | 0.00 | 0.64 | 0.00 | 4.26 | **9.62** |
| **1934** | 2.06 | 3.75 | 0.04 | 0.00 | 0.12 | 0.75 | 0.00 | 0.00 | 0.00 | 1.56 | 2.61 | 2.66 | **11.62** |
| **1935** | 6.23 | 0.65 | 4.08 | 3.41 | 0.02 | 0.00 | 0.00 | 0.16 | 0.07 | 0.18 | 1.58 | 1.66 | **21.45** |
| **1936** | 0.61 | 11.07 | 1.24 | 1.52 | 0.01 | 0.04 | 0.25 | 0.00 | 0.00 | 1.93 | 0.00 | 6.10 | **18.16** |
| **1937** | 4.59 | 4.54 | 5.25 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.66 | 7.40 | **22.57** |
| **1938** | 1.73 | 12.74 | 6.77 | 0.93 | 0.30 | 0.00 | 0.00 | 0.00 | 0.41 | 0.23 | 0.33 | 1.45 | **31.10** |
| **1939** | 3.11 | 1.45 | 1.58 | 0.05 | 0.09 | 0.00 | 0.00 | 0.00 | 0.43 | 0.55 | 0.78 | 1.29 | **8.72** |
| **1940** | 5.28 | 5.57 | 1.13 | 0.54 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 | 0.13 | 8.18 | **15.14** |
| **1941** | 4.73 | 8.16 | 6.14 | 2.76 | 0.19 | 0.00 | 0.00 | 0.02 | 0.00 | 1.34 | 0.70 | 5.15 | **30.50** |
| **1942** | 2.40 | 0.76 | 1.77 | 3.01 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.58 | 1.01 | 1.64 | **15.28** |
| **1943** | 8.00 | 1.68 | 3.63 | 0.72 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.34 | 0.12 | 3.38 | **17.26** |
| **1944** | 0.94 | 5.96 | 0.64 | 0.65 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 | 2.64 | 1.38 | **12.16** |
| **1945** | 0.80 | 4.17 | 2.76 | 0.26 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 1.09 | 0.49 | 1.72 | **12.31** |
| **1946** | 0.31 | 1.64 | 3.01 | 0.05 | 0.72 | 0.00 | 0.26 | 0.00 | 0.10 | 0.00 | 4.57 | 2.17 | **9.39** |
| **1947** | 0.56 | 0.97 | 1.14 | 0.13 | 0.28 | 0.00 | 0.00 | 0.00 | 0.04 | 0.32 | 0.18 | 0.62 | **9.86** |
| **1948** | 0.00 | 1.85 | 3.51 | 3.50 | 0.45 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 3.04 | **10.43** |
| **1949** | 1.09 | 1.95 | 3.73 | 0.36 | 0.38 | 0.00 | 0.00 | 0.00 | 0.00 | 0.78 | 0.78 | 2.33 | **10.61** |
| **1950** | 2.39 | 2.43 | 1.65 | 0.89 | 0.05 | 0.00 | 0.68 | 0.00 | 0.00 | 1.24 | 1.18 | 2.50 | **11.98** |
| **1951** | 2.50 | 0.68 | 0.58 | 1.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.33 | 1.94 | 4.64 | **9.82** |
| **1952** | 5.54 | 0.20 | 3.92 | 1.50 | 0.03 | 0.00 | 0.07 | 0.00 | 0.02 | 0.02 | 1.76 | 4.78 | **18.19** |
| **1953** | 1.71 | 0.00 | 0.66 | 1.90 | 0.06 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 2.46 | 0.00 | **10.90** |
| **1954** | 3.06 | 1.89 | 3.12 | 0.64 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.29 | 1.51 | **11.27** |
| **1955** | 3.57 | 1.85 | 0.37 | 1.16 | 1.31 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 1.36 | 8.14 | **11.19** |
| **1956** | 3.82 | 1.00 | 0.01 | 1.87 | 1.45 | 0.00 | 0.00 | 0.00 | 0.00 | 1.07 | 0.00 | 0.17 | **17.65** |
| **1957** | 4.77 | 1.90 | 0.31 | 1.63 | 0.71 | 0.47 | 0.00 | 0.00 | 0.02 | 0.62 | 0.30 | 3.30 | **11.05** |
| **1958** | 2.93 | 6.02 | 6.35 | 5.22 | 0.37 | 0.00 | 0.00 | 0.38 | 1.20 | 0.00 | 0.13 | 0.48 | **26.69** |
| **1959** | 1.69 | 4.53 | 0.03 | 0.44 | 0.05 | 0.00 | 0.00 | 0.00 | 0.52 | 0.00 | 0.00 | 0.31 | **7.87** |
| **1960** | 2.42 | 4.20 | 0.70 | 1.40 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 3.63 | 1.17 | **9.07** |
| **1961** | 1.72 | 0.20 | 0.88 | 0.22 | 0.74 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 1.99 | 2.59 | **8.66** |
| **1962** | 2.05 | 8.49 | 1.98 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.79 | 0.01 | 2.52 | **17.23** |
| **1963** | 4.41 | 3.79 | 2.10 | 3.32 | 0.17 | 0.01 | 0.00 | 0.00 | 0.24 | 1.00 | 4.25 | 0.01 | **17.36** |
| **1964** | 1.87 | 0.15 | 1.46 | 0.68 | 0.55 | 0.06 | 0.00 | 0.08 | 0.03 | 1.05 | 2.27 | 2.37 | **10.14** |
| **1965** | 2.50 | 0.51 | 1.16 | 2.48 | 0.00 | 0.00 | 0.04 | 0.03 | 0.15 | 0.00 | 6.43 | 3.24 | **12.56** |
| **1966** | 1.17 | 0.68 | 0.08 | 0.00 | 0.01 | 0.14 | 0.08 | 0.00 | 0.11 | 0.00 | 2.43 | 8.60 | **11.94** |
| **1967** | 3.93 | 0.35 | 3.99 | 4.41 | 0.03 | 0.02 | 0.00 | 0.00 | 0.79 | 0.14 | 1.74 | 1.70 | **24.55** |
| **1968** | 1.19 | 0.68 | 1.76 | 0.70 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 1.83 | 1.14 | 3.13 | **7.95** |
| **1969** | 13.93 | 9.12 | 0.35 | 1.68 | 0.06 | 0.01 | 0.25 | 0.00 | 0.00 | 0.24 | 0.44 | 0.68 | **31.50** |
| **1970** | 3.71 | 1.66 | 1.83 | 0.37 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.08 | 3.14 | 4.56 | **8.97** |
| **1971** | 1.08 | 0.24 | 0.85 | 0.69 | 0.21 | 0.00 | 0.00 | 0.00 | 0.05 | 0.29 | 0.88 | 4.27 | **10.90** |
| **1972** | 1.35 | 0.30 | 0.00 | 0.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 1.68 | 4.14 | 0.85 | **7.65** |
| **1973** | 6.54 | 6.95 | 2.60 | 0.01 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.68 | 3.09 | 1.61 | **22.83** |

## Monthly Precipitation at the Paso Robles Station (NOAA 46730)

(inches)

Source: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6730

Source: https://www.prcity.com/462/Rainfall-Totals

| YEAR | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | WY Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1974 | 6.39 | 0.05 | 4.56 | 0.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.43 | 2.33 | 17.29 |
| 1975 | 0.01 | 4.12 | 2.81 | 0.89 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.76 | 0.03 | 0.10 | 11.24 |
| 1976 | 0.00 | 2.61 | 1.09 | 0.66 | 0.00 | 0.08 | 0.00 | 1.02 | 2.90 | 0.58 | 0.55 | 1.80 | 9.25 |
| 1977 | 1.47 | 0.03 | 1.41 | 0.00 | 1.71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.25 | 5.25 | 7.55 |
| 1978 | 5.77 | 7.31 | 3.10 | 2.77 | 0.00 | 0.00 | 0.00 | 0.00 | 0.92 | 0.00 | 2.47 | 1.04 | 25.45 |
| 1979 | 4.70 | 3.52 | 2.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.93 | 0.85 | 2.31 | 14.09 |
| 1980 | 4.47 | 8.05 | 1.88 | 0.65 | 0.24 | 0.00 | 0.35 | 0.00 | 0.00 | 0.00 | 0.02 | 0.44 | 19.73 |
| 1981 | 4.00 | 1.60 | 4.52 | 0.56 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.01 | 1.44 | 0.62 | 11.14 |
| 1982 | 2.65 | 0.88 | 5.10 | 3.05 | 0.00 | 0.02 | 0.00 | 0.00 | 1.04 | 0.90 | 3.98 | 1.96 | 15.81 |
| 1983 | 5.86 | 4.53 | 4.69 | 3.35 | 0.05 | 0.00 | 0.00 | 0.52 | 0.37 | 1.34 | 2.07 | 3.68 | 26.21 |
| 1984 | 0.20 | 0.24 | 0.66 | 0.35 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 | 2.10 | 3.01 | 8.54 |
| 1985 | 0.52 | 0.92 | 2.11 | 0.19 | 0.00 | 0.00 | 0.02 | 0.00 | 0.04 | 0.40 | 1.07 | 0.97 | 9.29 |
| 1986 | 2.11 | 6.73 | 4.64 | 0.32 | 0.00 | 0.00 | 0.03 | 0.00 | 0.62 | 0.02 | 0.15 | 0.64 | 16.89 |
| 1987 | 0.88 | 2.01 | 3.40 | 0.14 | 0.06 | 0.07 | 0.00 | 0.00 | 0.00 | 1.50 | 2.63 | 2.73 | 7.37 |
| 1988 | 1.94 | 2.54 | 0.10 | 2.02 | 0.21 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 1.16 | 2.87 | 13.81 |
| 1989 | 0.98 | 1.59 | 0.71 | 0.37 | 0.07 | 0.00 | 0.00 | 0.00 | 1.59 | 0.97 | 0.22 | 0.00 | 9.34 |
| 1990 | 3.02 | 1.48 | 0.24 | 0.12 | 0.66 | 0.00 | 0.00 | 0.00 | 0.51 | 0.00 | 0.14 | 0.20 | 7.22 |
| 1991 | 0.63 | 2.17 | 10.25 | 0.08 | 0.03 | 0.20 | 0.00 | 0.10 | 0.10 | 0.50 | 0.16 | 3.00 | 13.90 |
| 1992 | 1.44 | 6.09 | 2.99 | 0.10 | 0.00 | 0.03 | 0.03 | 0.00 | 0.01 | 0.79 | 0.00 | 3.59 | 14.35 |
| 1993 | 9.63 | 6.96 | 3.43 | 0.06 | 0.01 | 0.14 | 0.00 | 0.00 | 0.00 | 0.17 | 0.86 | 1.28 | 24.61 |
| 1994 | 1.90 | 3.37 | 1.16 | 0.49 | 1.05 | 0.00 | 0.00 | 0.00 | 1.17 | 0.70 | 2.32 | 0.93 | 11.45 |
| 1995 | 11.51 | 1.42 | 12.31 | 0.09 | 0.44 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 1.92 | 29.86 |
| 1996 | 1.84 | 6.52 | 2.03 | 0.72 | 0.55 | 0.00 | 0.00 | 0.00 | 0.00 | 1.78 | 1.52 | 5.78 | 13.70 |
| 1997 | 7.93 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.05 | 0.10 | 0.07 | 4.05 | 3.93 | 17.17 |
| 1998 | 2.99 | 9.06 | 2.71 | 1.96 | 2.05 | 0.11 | 0.00 | 0.00 | 0.08 | 0.21 | 0.99 | 0.73 | 27.01 |
| 1999 | 1.84 | 1.26 | 2.68 | 1.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.71 | 0.22 | 9.37 |
| 2000 | 3.16 | 5.89 | 1.55 | 1.56 | 0.05 | 0.04 | 0.00 | 0.00 | 0.03 | 1.34 | 0.05 | 0.16 | 13.21 |
| 2001 | 4.43 | 5.14 | 3.59 | 1.08 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.24 | 2.81 | 2.19 | 15.83 |
| 2002 | 0.87 | 0.33 | 1.40 | 0.23 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.54 | 4.52 | 8.32 |
| 2003 | 0.13 | 2.10 | 1.86 | 1.70 | 1.18 | 0.00 | 0.16 | 0.03 | 0.00 | 0.00 | 1.36 | 2.31 | 14.22 |
| 2004 | 0.91 | 4.31 | 0.30 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.11 | 1.39 | 6.75 | 9.51 |
| 2005 | 4.81 | 5.02 | 3.07 | 0.76 | 1.10 | 0.01 | 0.00 | 0.08 | 0.00 | 0.02 | 0.46 | 2.54 | 28.10 |
| 2006 | 5.78 | 1.23 | 4.50 | 2.92 | 1.48 | 0.00 | 0.00 | 0.00 | 0.00 | 0.61 | 0.28 | 1.13 | 18.93 |
| 2007 | 0.74 | 2.98 | 0.13 | 0.37 | 0.00 | 0.00 | 0.00 | 0.31 | 0.04 | 0.96 | 0.00 | 2.23 | 6.59 |
| 2008 | 8.44 | 1.83 | 0.00 | 0.33 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 1.26 | 1.13 | 13.80 |
| 2009 | 0.91 | 3.89 | 1.37 | 0.17 | 0.12 | 0.02 | 0.00 | 0.00 | 0.05 | 4.04 | 0.02 | 3.96 | 9.06 |
| 2010 | 6.09 | 3.38 | 0.64 | 2.75 | 0.12 | 0.00 | 0.03 | 0.00 | 0.00 | 1.06 | 1.57 | 7.14 | 21.03 |
| 2011 | 2.07 | 3.05 | 5.29 | 0.28 | 0.95 | 0.53 | 0.00 | 0.00 | 0.03 | 0.90 | 1.93 | 0.12 | 21.97 |
| 2012 | 2.38 | 0.25 | 2.44 | 2.60 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.28 | 0.75 | 3.94 | 10.80 |
| 2013 | 1.02 | 0.28 | 0.69 | 0.07 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.26 | 0.30 | 7.18 |
| 2014 | 0.00 | 2.75 | 1.96 | 0.85 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 1.00 | 5.48 | 6.16 |
| 2015 | 0.32 | 2.16 | 0.10 | 0.37 | 0.05 | 0.00 | 2.82 | 0.00 | 0.05 | 0.07 | 1.45 | 0.89 | 12.35 |
| 2016 | 4.13 | 0.85 | 2.92 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.61 | 1.46 | 1.80 | 10.46 |
| 2017 | 9.50 | 6.44 | 0.92 | 1.45 | 0.24 | 0.00 | 0.00 | 0.00 | 0.16 | 0.08 | 0.22 | 0.04 | 23.58 |
| 2018 | 2.08 | 0.25 | 7.74 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.28 | 3.23 | 1.12 | 10.62 |
| 2019 | 5.30 | 6.72 | 3.01 | 0.08 | 0.82 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.40 | 5.22 | 20.56 |
| 2020 | 0.65 | 0.00 | 3.53 | 1.59 | 0.03 | 0.00 | 0.00 | 0.11 | 0.00 | 0.00 | 0.29 | 0.89 | 12.53 |
| 2021 | 6.07 | 0.01 | 0.90 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.02 | 0.05 | 7.70 | 8.16 |
| | | | | | | | | | | | | Water Year Average (1925 - 2021): | 14.53 |

**University of California Cooperative Extension Weather Stations in Paso Robles Subbasin**
**Total Monthly Precipitation for Water Year 2021**
(inches)

Source: https://ucce-slo.westernweathergroup.com/

| WY 2021 | Shandon (SLO-1) | Creston Rd (SLO-2) | NE Paso Robles (SLO-3) | Cross Canyon Rd (SLO-4) | Shell Creek Rd (SLO-6) | South Shandon (SLO-7) | South Creston (SLO-8) | Experimental Station (SLO-10) | Von Dollen Road (SLO-12) |
|---|---|---|---|---|---|---|---|---|---|
| OCT | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| NOV | 0.29 | 0.32 | 0.20 | 0.12 | 0.25 | 0.23 | 0.48 | 0.25 | 0.13 |
| DEC | 0.52 | 0.86 | 0.52 | 0.47 | 0.50 | 0.49 | 0.91 | 0.70 | 0.50 |
| JAN | 2.67 | 4.13 | 4.57 | 5.56 | 2.34 | 2.55 | 4.04 | 4.91 | 4.83 |
| FEB | 0.07 | 0.02 | 0.05 | 0.07 | 0.09 | 0.06 | 0.01 | 0.00 | 0.09 |
| MAR | 0.60 | 0.68 | 0.86 | 0.52 | 0.68 | 0.76 | 0.86 | 0.62 | 0.68 |
| APR | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.01 | 0.06 | 0.18 |
| MAY | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| JUN | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| JUL | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| AUG | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| SEP | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **WY Total** | **4.15** | **6.01** | **6.21** | **6.78** | **3.91** | **4.09** | **6.31** | **6.57** | **6.41** |

APPENDIX C

# Groundwater Level and Groundwater Storage Monitoring Well Network

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**Table C-1 – Groundwater Level and Groundwater Storage Monitoring Well Network**

| Well ID (alt ID) | Well Depth (feet) | Screen Interval(s) (feet bls) | Reference Point Elevation (feet AMSL) | First Year of Data | Last Year of Data | Years Measured | Number of Measurement | Aquifer |
|---|---|---|---|---|---|---|---|---|
| 18MW-0191[1] | 50 | 10-50 | 672 (LSE) | 2018 | 2018 | <1 | 1 | Qa |
| 25S/12E-16K05 (PASO-0345) | 350 | 300-310, 330-340 | 669.8 | 1992 | 2019 | 27 | 56 | PR |
| 25S/12E-26L01 (PASO-0205) | 400 | 200-400 | 719.72 | 1970 | 2019 | 49 | 107 | PR |
| 25S/13E-08L02 (PASO-0195) | 270 | 110-270 | 1,033.81 | 2012 | 2019 | 7 | 15 | PR |
| 26S/12E-14G01 (PASO-0048) | 740 | --- | 789.3 | 1969 | 2019 | 50 | 121 | PR |
| 26S/12E-14G02 (PASO-0017) | 840 | 640-840 | 787 | 1993 | 2019 | 26 | 28 | PR |
| 26S/12E-14H01 (PASO-0184) | 1230 | 180-? | 790 | 1969 | 2019 | 50 | 48 | PR |
| 26S/12E-14K01 (PASO-0238) | 1100 | --- | 786 | 1979 | 2019 | 40 | 84 | PR |
| 26S/12E-26E07 (PASO-0124) | 400 | --- | 835 | 1958 | 2018 | 60 | 131 | PR |
| 26S/13E-08M01 (PASO-0164) | 400 | 260-400 | 827.92 | 2013 | 2019 | 6 | 16 | PR |
| 26S/13E-16N01 (PASO-0282) | 400 | 200-400 | 890.17 | 2012 | 2019 | 7 | 16 | PR |
| 26S/15E-19E01 (PASO-0073) | 512 | 223-512 | 1,020 | 1987 | 2019 | 32 | 56 | PR |
| 26S/15E-20B04 (PASO-0401) | 461 | 297-461 | 1,036.36 | 1984 | 2019 | 35 | 71 | PR |
| 26S/15E-29N01 (PASO-0226) | 350 | --- | 1,135 | 1958 | 2019 | 61 | 127 | PR |
| 26S/15E-29R01 (PASO-0406) | 600 | 180-600 | 1,109.5 | 2012 | 2019 | 7 | 12 | PR |
| 26S/15E-30J01 (PASO-0393) | 605 | 195-605 | 1,123.3 | 1970 | 2019 | 49 | 83 | PR |
| 27S/12E-13N01 (PASO-0223) | 295 | 195-295 | 972.42 | 2012 | 2019 | 7 | 15 | PR |
| 27S/13E-28F01 (PASO-0243) | 230 | 118-212 | 1,072 | 1969 | 2019 | 50 | 108 | PR |
| 27S/13E-30F01 (PASO-0355) | 310 | 200-310 | 1,043.2 | 2012 | 2019 | 7 | 14 | PR |
| 27S/13E-30J01 (PASO-0423) | 685 | 225-685 | 1,095 | 2012 | 2019 | 7 | 10 | PR |
| 27S/13E-30N01 (PASO-0086) | 355 | 215-235, 275-355 | 1,086.73 | 2012 | 2016 | 4 | 6 | PR |
| 27S/14E-11R01 (PASO-0392) | 630 | 180-630 | 1,160.5 | 1974 | 2019 | 45 | 75 | PR |
| 28S/13E-01B01 (PASO-0066) | 254 | 154-254 | 1,099.93 | 2012 | 2019 | 7 | 17 | PR |

NOTES: New alluvial monitoring well information provided by City of Paso Robles; well not included in County database.
"—" = unknown; AMSL – above mean sea level; PR Paso Robles Formation Aquifer; Qa Alluvial Aquifer

# APPENDIX D

# Potential Future Groundwater Monitoring Wells

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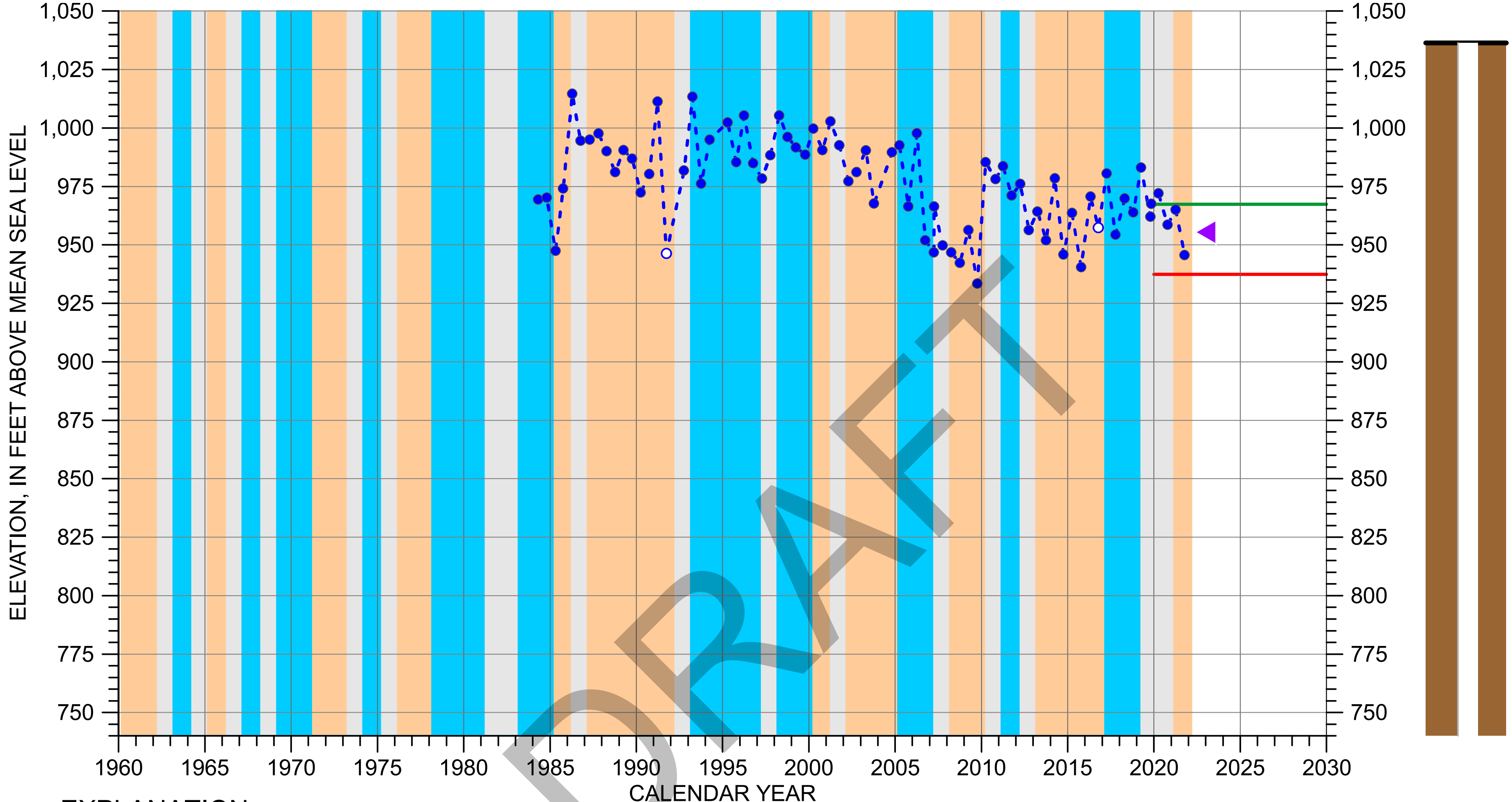
**Table D-1 – Potential Future Groundwater Monitoring Wells**

| Well ID (alt ID) | Well Depth (feet) | Screen Interval(s) (feet bls) | Reference Point Elevation (feet AMSL) | First Year of Data | Last Year of Data | Years Measured (years) | Number of Measurements | Aquifer |
|---|---|---|---|---|---|---|---|---|
| 25S/12E-20K03 (PASO-0304) | --- | --- | 625 | 1974 | 2019 | 45 | 86 | --- |
| 26S/14E-24B01 (PASO-0302) | --- | --- | 1001 | 1962 | 2019 | 57 | 99 | --- |
| 26S/15E-33C01 (PASO-0314) | --- | --- | 1095 | 1973 | 2019 | 46 | 80 | --- |
| 26S/15E-33Q01 (PASO-0381) | --- | --- | 1102 | 1973 | 2019 | 46 | 82 | --- |
| 27S/15E-03E01 (PASO-0277) | --- | --- | 1120.8 | 1968 | 2019 | 51 | 109 | --- |
| 27S/14E-24B01 (PASO-0391) | --- | --- | 1180.5 | 1973 | 2019 | 46 | 74 | --- |
| 27S/14E-25J01 (PASO-0074) | --- | --- | 1,225.5 | 1972 | 2019 | 47 | 72 | -- |
| 27S/14E-29G01 (PASO-0041) | --- | --- | 1201.5 | 1974 | 2019 | 45 | 78 | --- |
| 27S/15E-35F01 (PASO-0053) | --- | --- | 1230 | 1965 | 2019 | 54 | 82 | --- |

NOTES: "—" = unknown

# APPENDIX E
# Hydrographs

## Paso Robles Formation Aquifer Hydrographs






## EXPLANATION

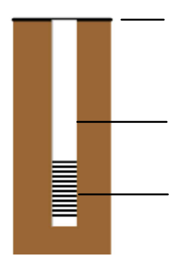
Groundwater Elevation

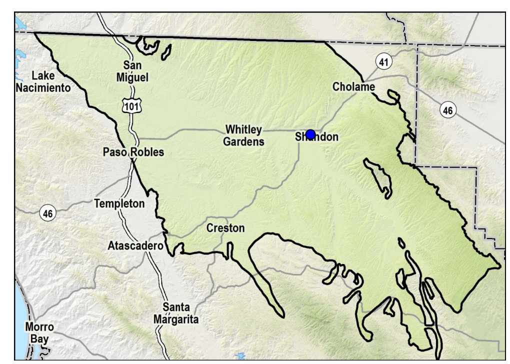
Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold




## CLIMATE PERIOD CLASSIFICATION

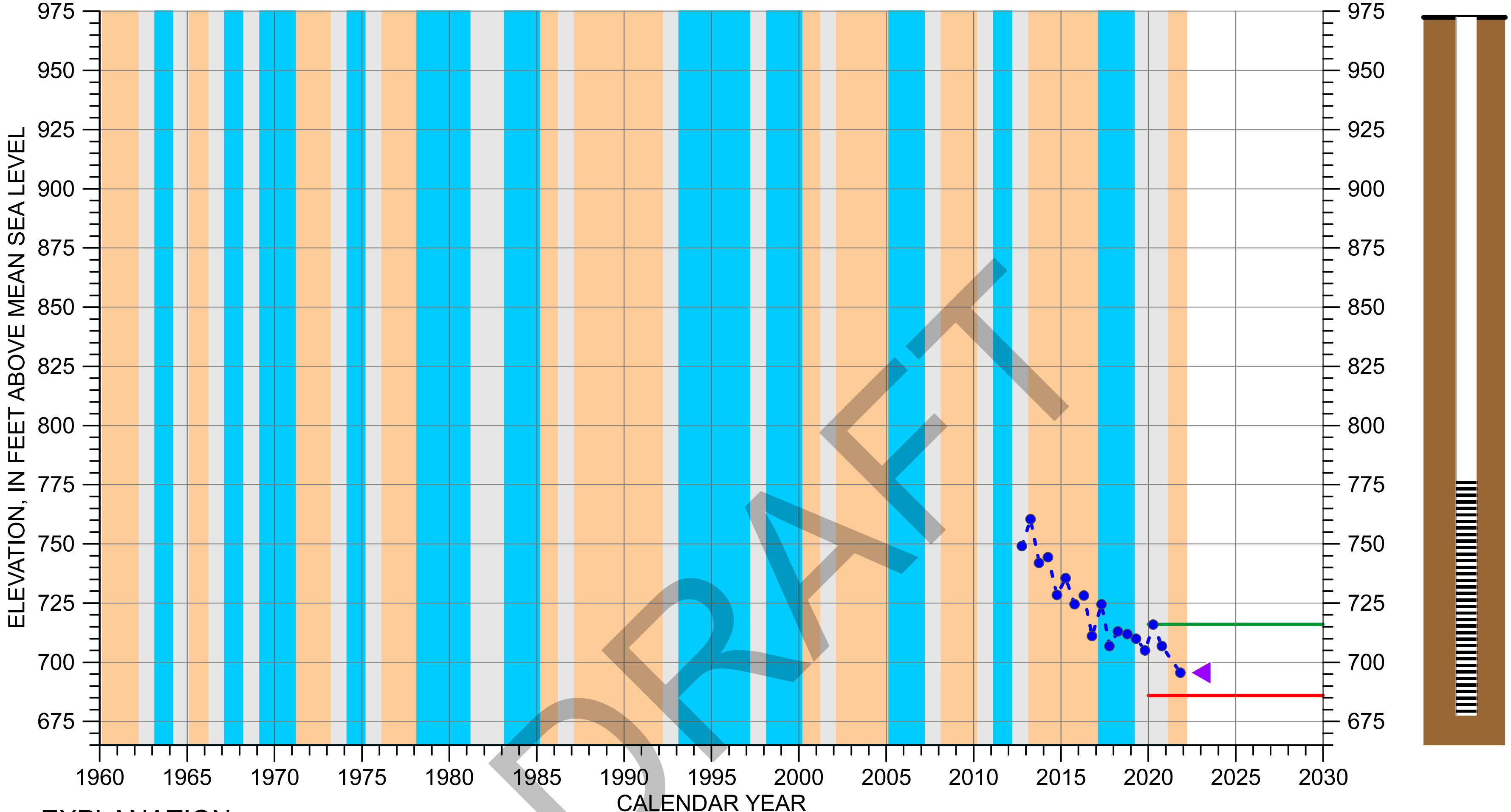
Dry Avg/Alternating Wet

Well Depth: 461 feet
Screened Interval: 297-461 feet below ground surface
Reference Point Elevation: 1036.36 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-20B04**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-20B04.grf




## EXPLANATION

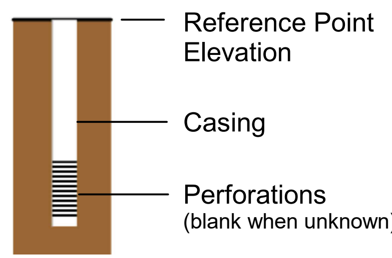
Groundwater Elevation

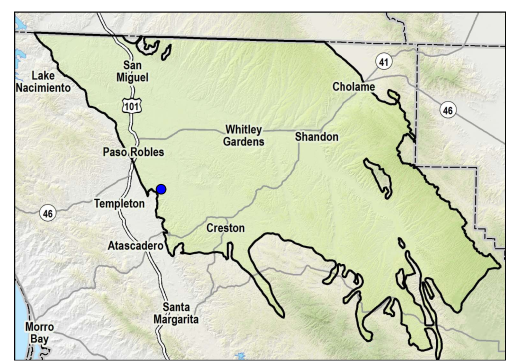
Measurement Not Verified*

Measurable Objective

Minimum Threshold

Average of spring and fall 2021 water elevations




## CLIMATE PERIOD CLASSIFICATION

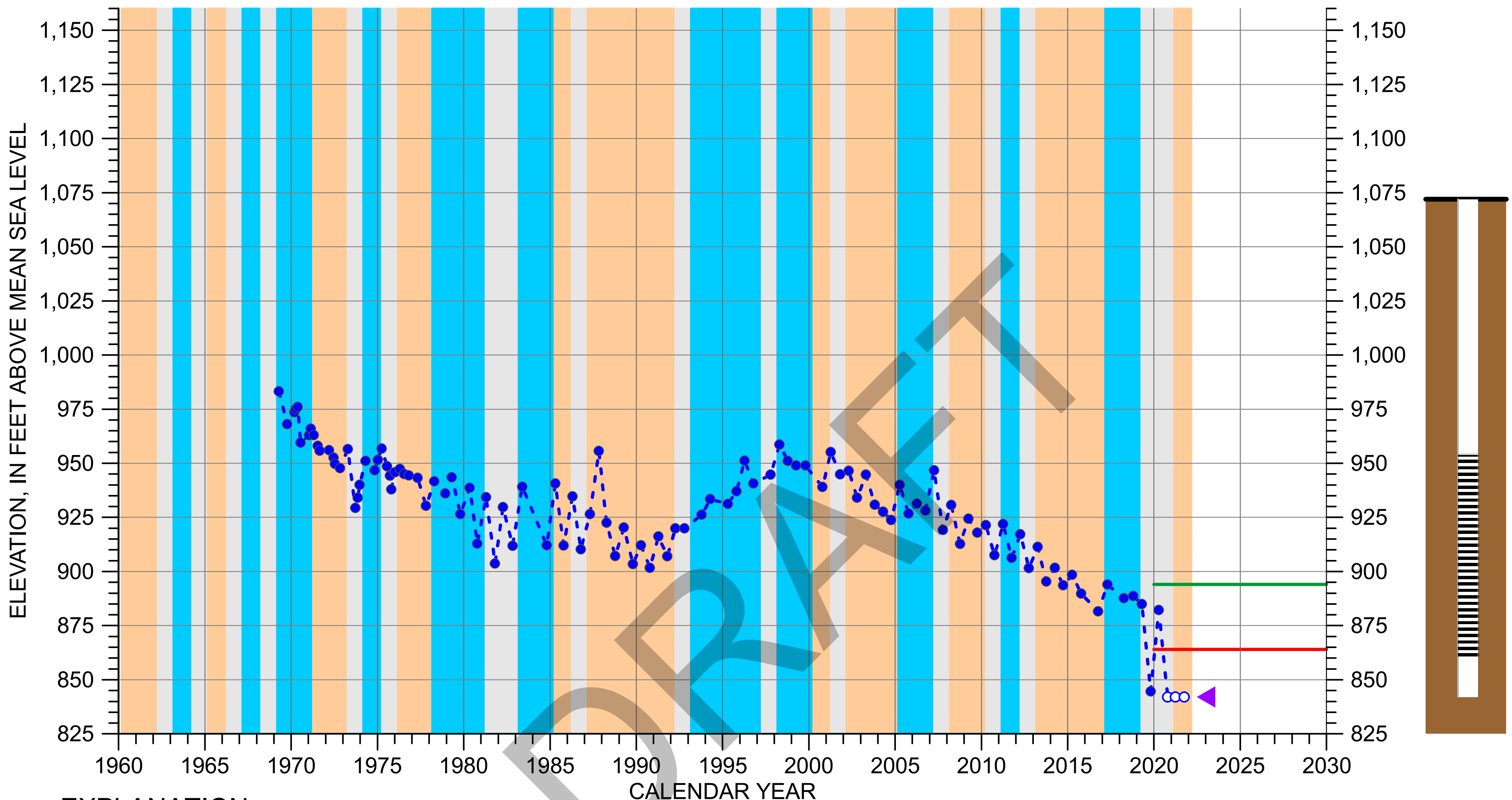
Dry — Avg/Alternating — Wet

Well Depth: 295 feet
Screened Interval: 195-295 feet below ground surface
Reference Point Elevation: 972.4 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/12E-13N01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_12E-13N01.grf



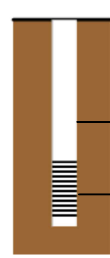



EXPLANATION

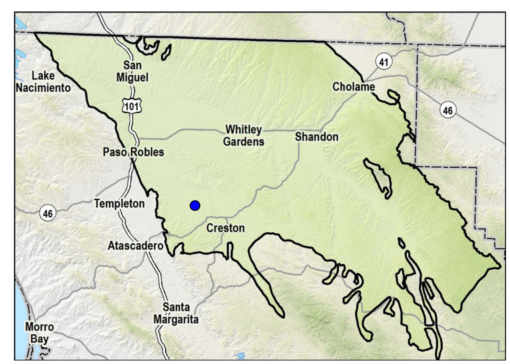
- Groundwater Elevation
- Measurement Not Verified*
- Measurable Objective
- Minimum Threshold
- Average of spring and fall 2021 water elevations

CLIMATE PERIOD CLASSIFICATION

- Dry
- Avg/Alternating
- Wet



- Reference Point Elevation
- Casing
- Perforations (blank when unknown)

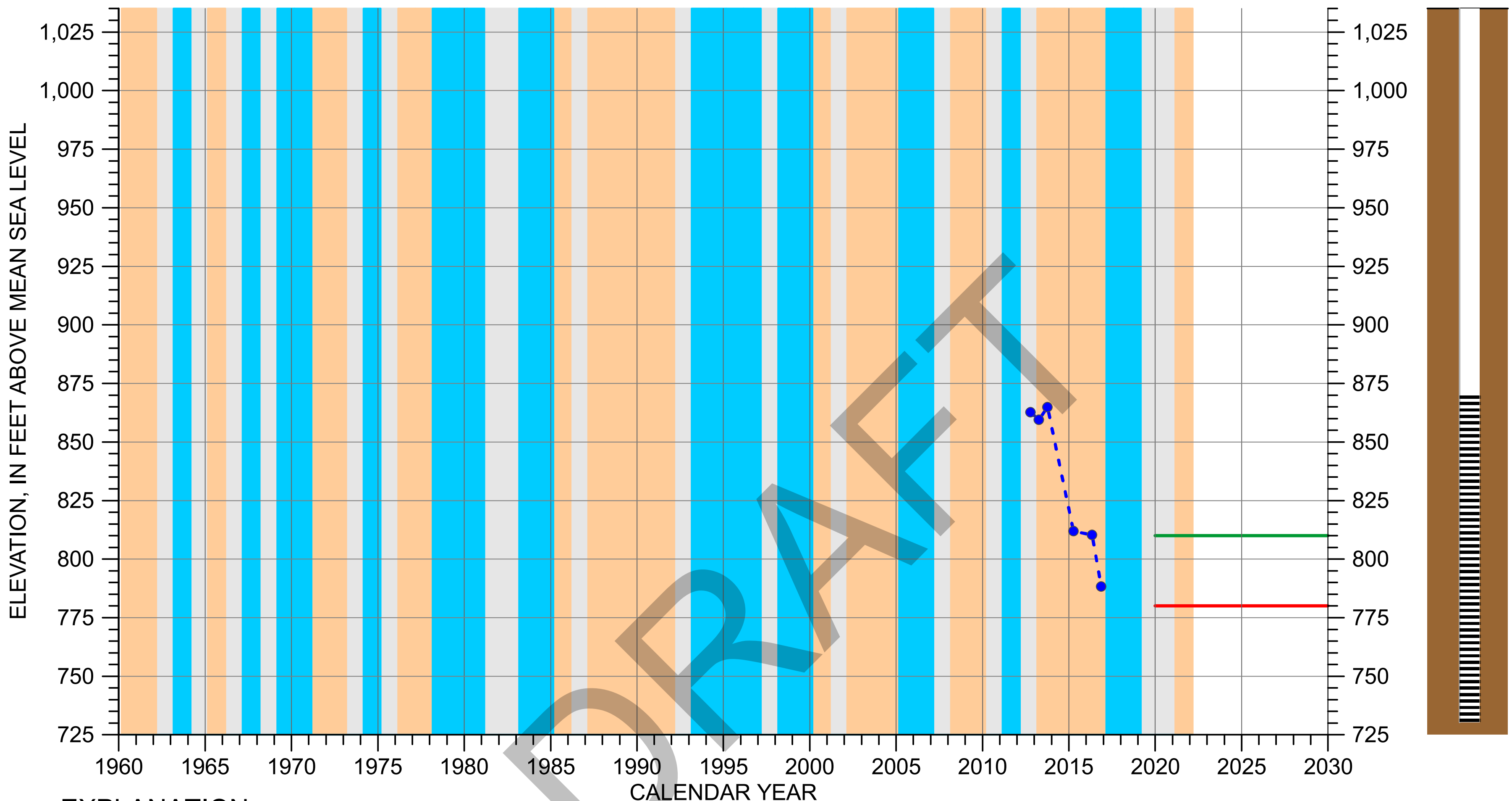



Well Depth: 212 feet
Screened Interval: 118-212 feet below ground surface
Reference Point Elevation: 1072 feet above mean sea level

* Measurement recorded at bottom of well (dry well). Actual elevation may be lower.

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-28F01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-28F01.grf



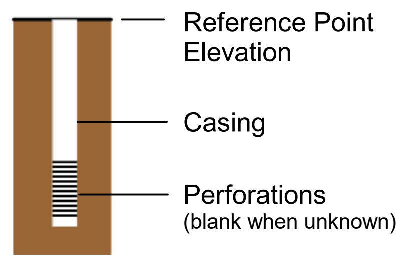

## EXPLANATION

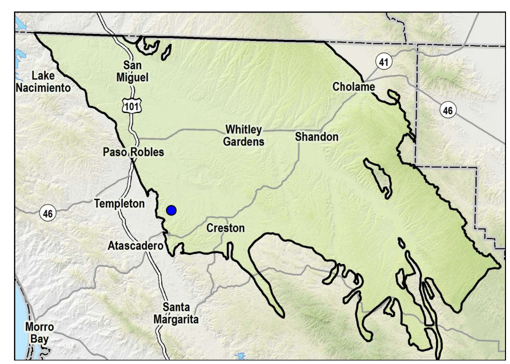
Groundwater Elevation

Measurement Not Verified*

Measurable Objective

Minimum Threshold




## CLIMATE PERIOD CLASSIFICATION

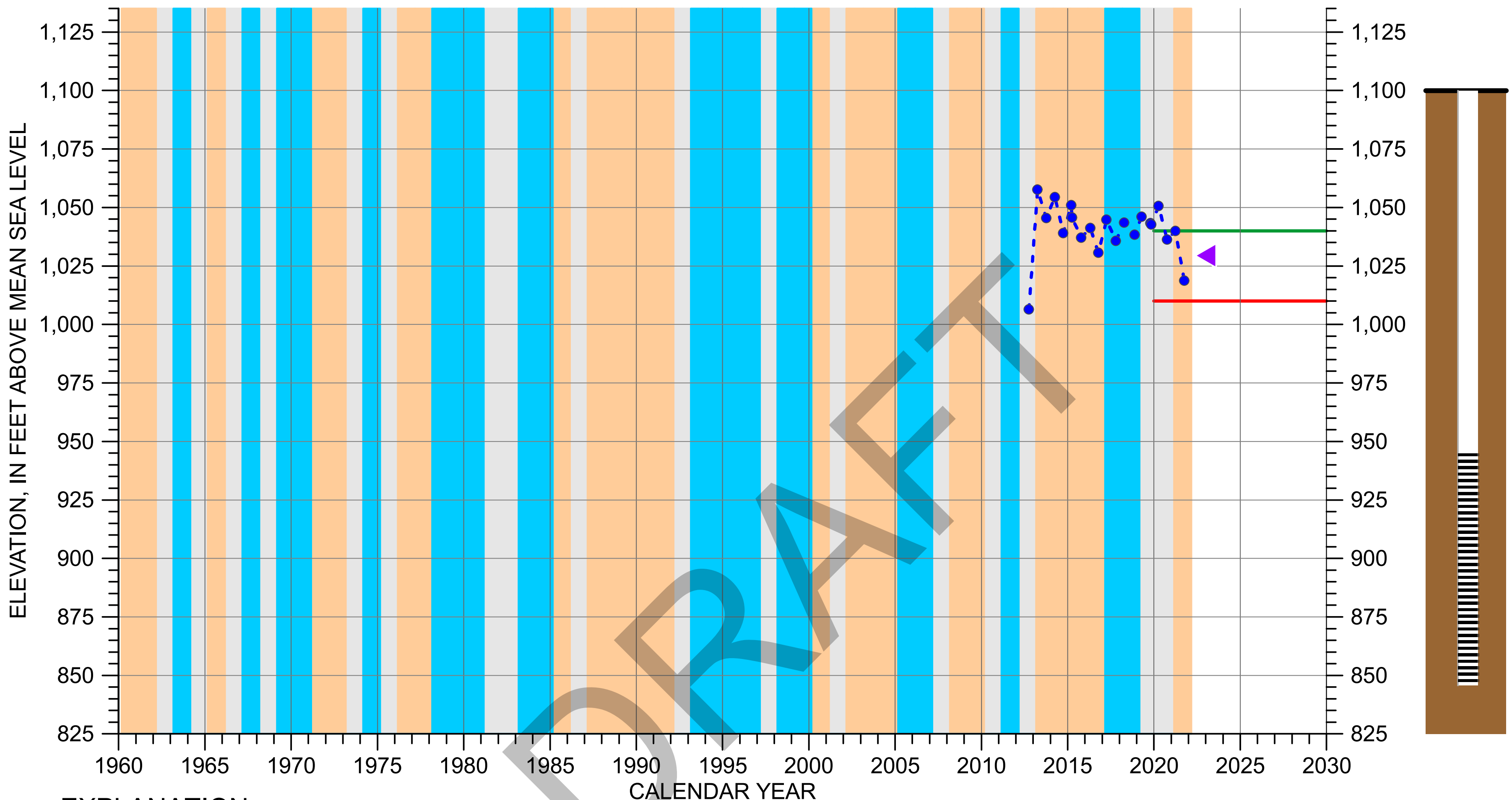
Dry | Avg/Alternating | Wet

Well Depth: 355 feet
Screened Interval: 215-235, 275-355 feet below ground surface
Reference Point Elevation: 1086.7 feet above mean sea level

* Measurement reported as not static

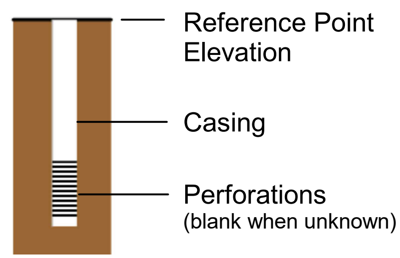
**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-30N01**

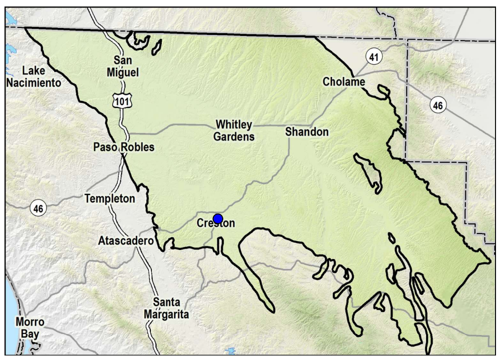
P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-30N01.grf




## EXPLANATION

- Groundwater Elevation
- Measurement Not Verified*
- Measurable Objective
- Minimum Threshold
- Average of spring and fall 2021 water elevations




## CLIMATE PERIOD CLASSIFICATION

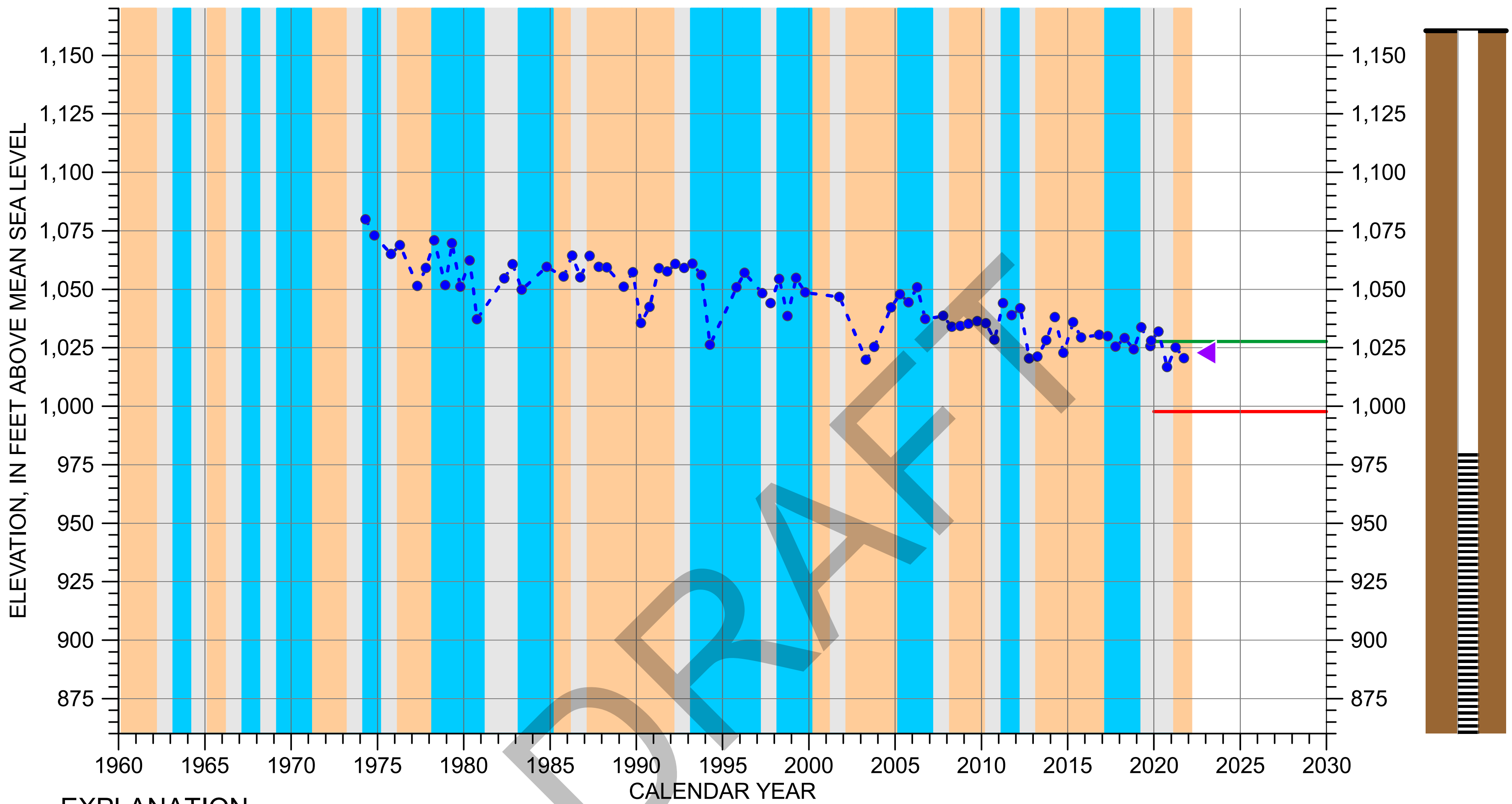
Dry | Avg/Alternating | Wet

Well Depth: 254 feet
Screened Interval: 154-254 feet below ground surface
Reference Point Elevation: 1099.9 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 28S/13E-01B01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_28S_13E-01B01.grf




## EXPLANATION

Groundwater Elevation

Measurable Objective

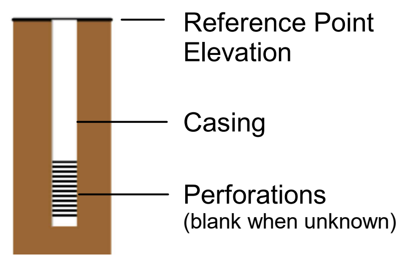
Average of spring and fall 2021 water elevations

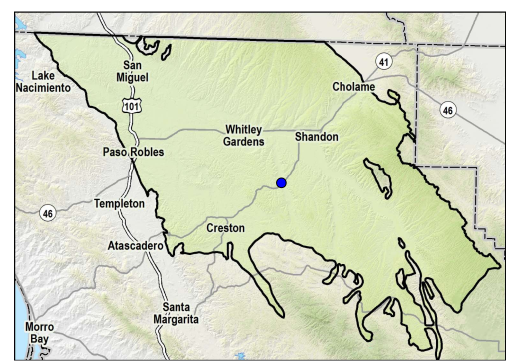
Measurement Not Verified*

Minimum Threshold

## CLIMATE PERIOD CLASSIFICATION

Dry | Avg/Alternating | Wet



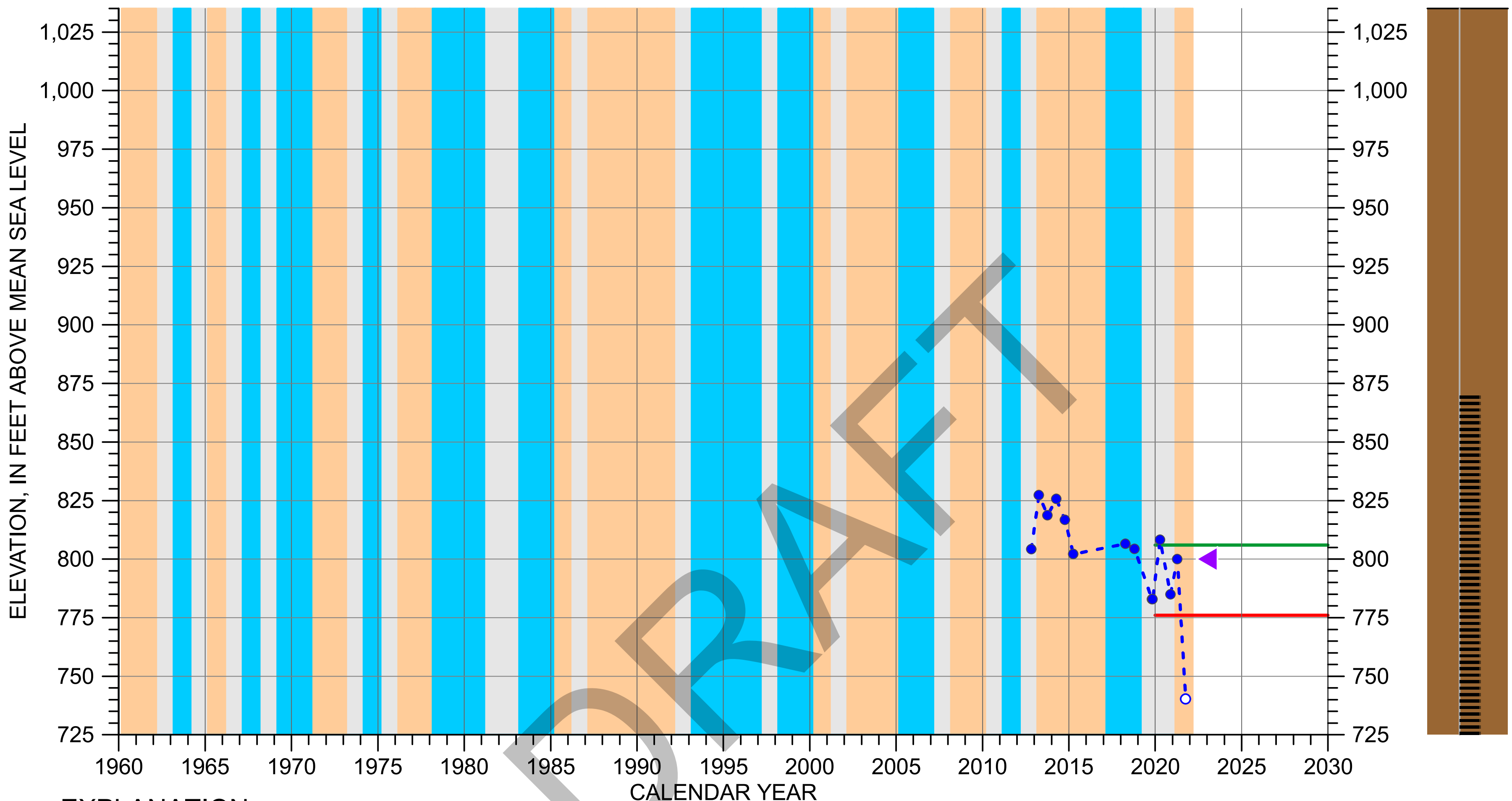




Well Depth: 630 feet
Screened Interval: 180-630 feet below ground surface
Reference Point Elevation: 1160.5 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/14E-11R01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_14E-11R01.grf




## EXPLANATION

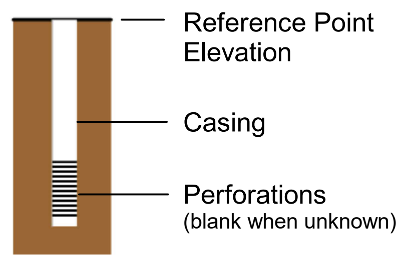
Groundwater Elevation

Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold

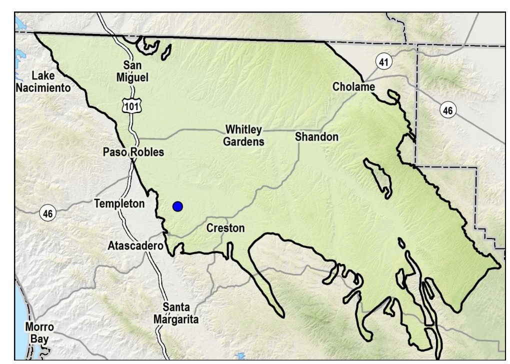



## CLIMATE PERIOD CLASSIFICATION

Dry | Avg/Alternating | Wet

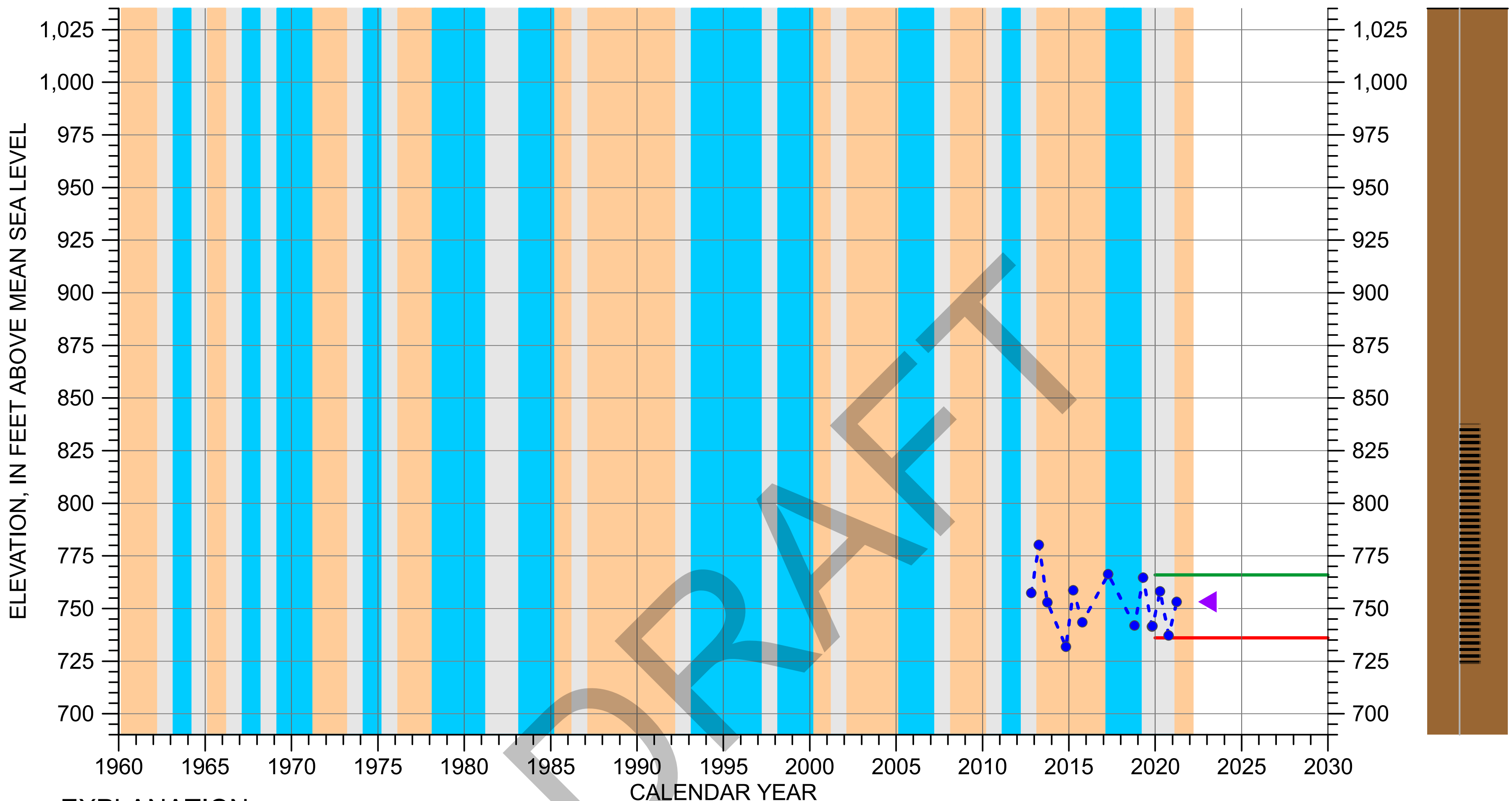
Well Depth: 685 feet
Screened Interval: 225-685 feet below ground surface
Reference Point Elevation: 1095 feet above mean sea level

* Measurement reported as not static



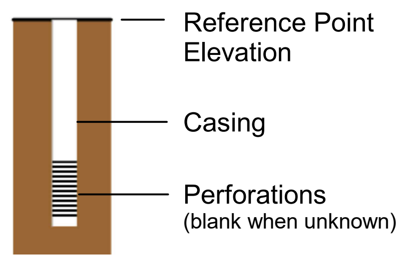

## HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-30J01

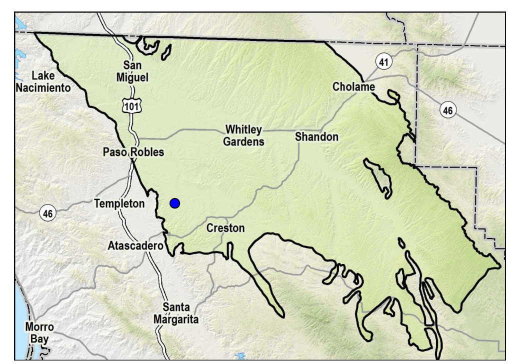
P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-30J01.grf




## EXPLANATION

- Groundwater Elevation
- Measurement Not Verified*
- Measurable Objective
- Minimum Threshold
- Average of spring and fall 2021 water elevations




## CLIMATE PERIOD CLASSIFICATION

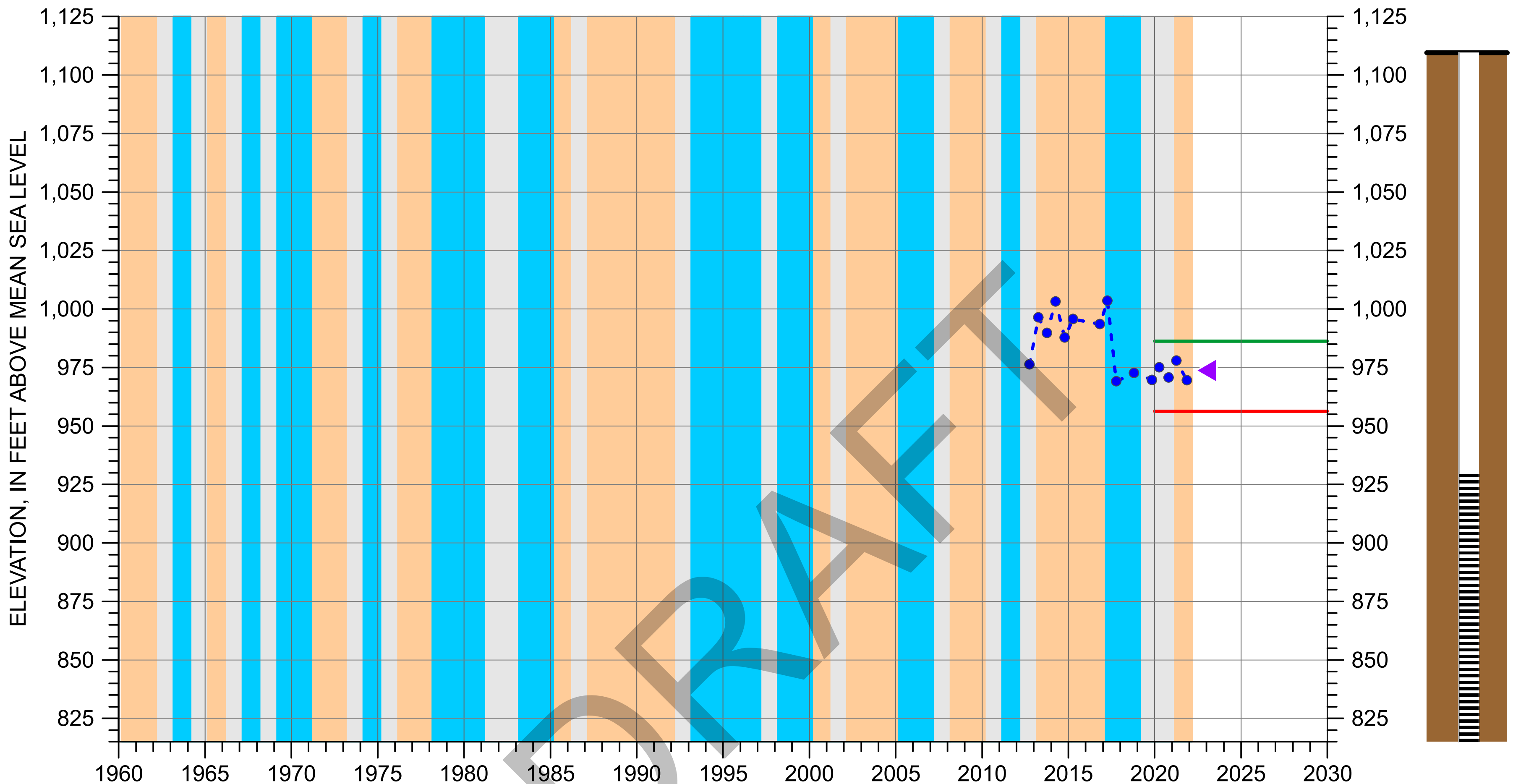
Dry | Avg/Alternating | Wet

Well Depth: 310 feet
Screened Interval: 200-310 feet below ground surface
Reference Point Elevation: 1043.2 feet above mean sea level

* Measurement recorded at elevation below reported bottom of well.

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 27S/13E-30F01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_27S_13E-30F01.grf






## EXPLANATION

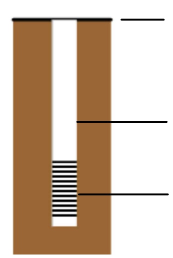
Groundwater Elevation

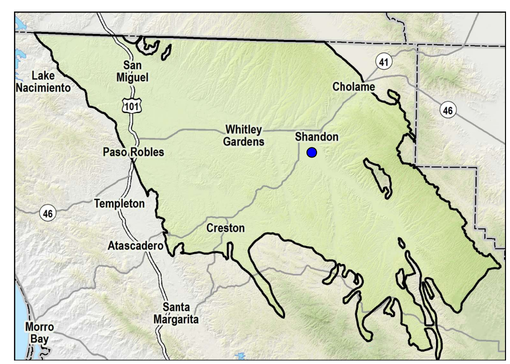
Measurement Not Verified*

Measurable Objective

Minimum Threshold

Average of spring and fall 2021 water elevations




## CLIMATE PERIOD CLASSIFICATION

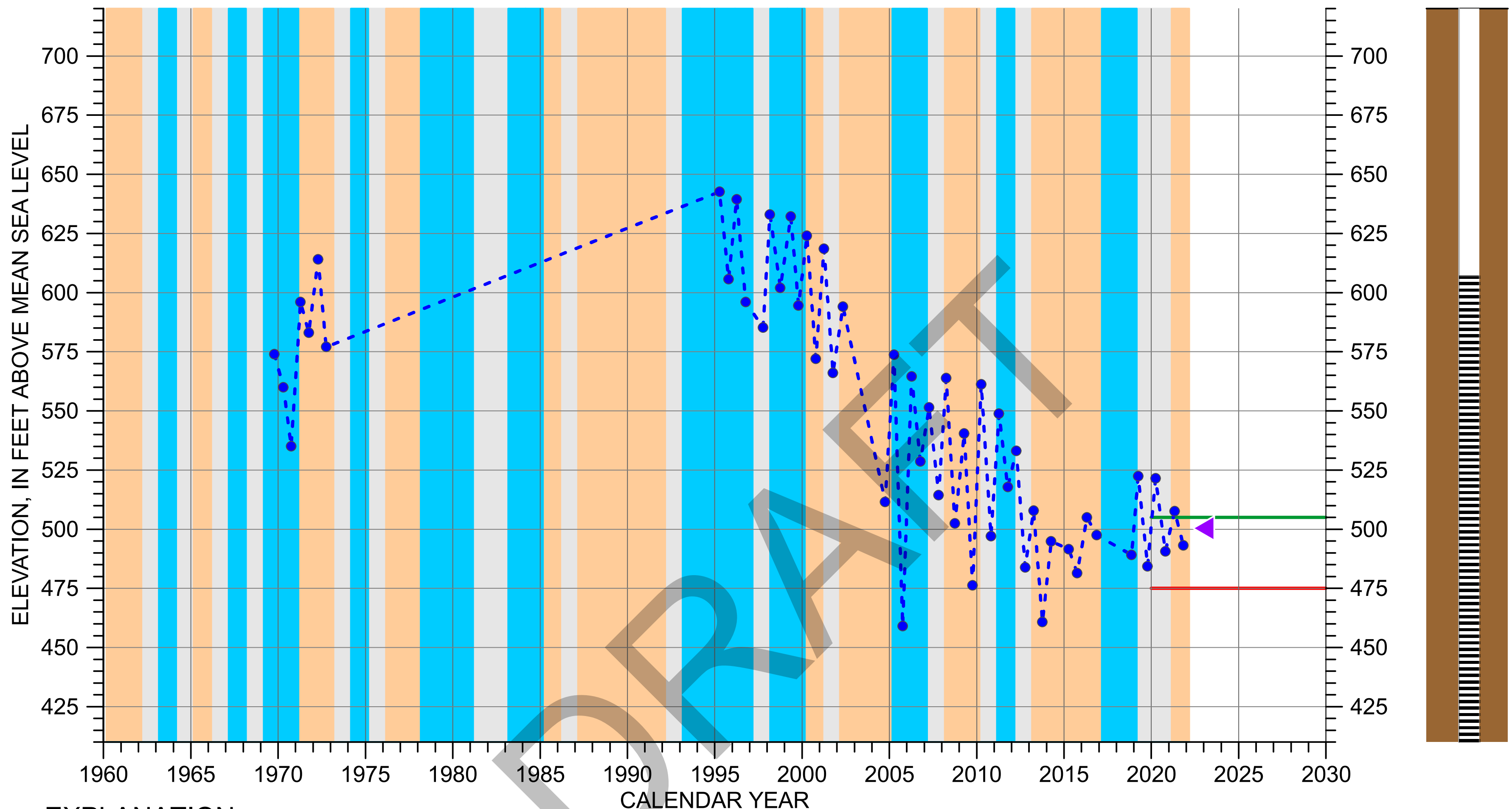
Dry    Avg/Alternating    Wet

Well Depth: 600 feet
Screened Interval: 180-600 feet below ground surface
Reference Point Elevation: 1109.5 feet above mean sea level

* Measurement reported as not static

## HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-29R01

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-29R01.grf




## EXPLANATION

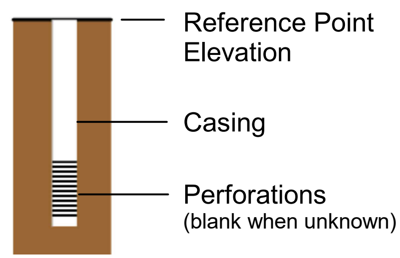
Groundwater Elevation

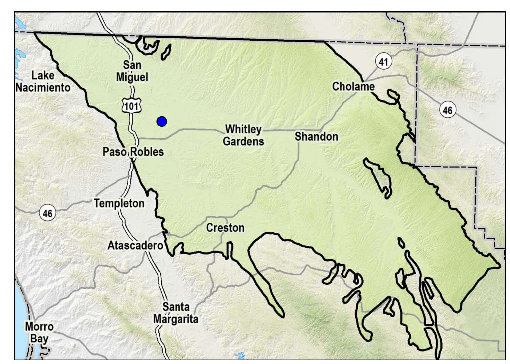
Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold




## CLIMATE PERIOD CLASSIFICATION

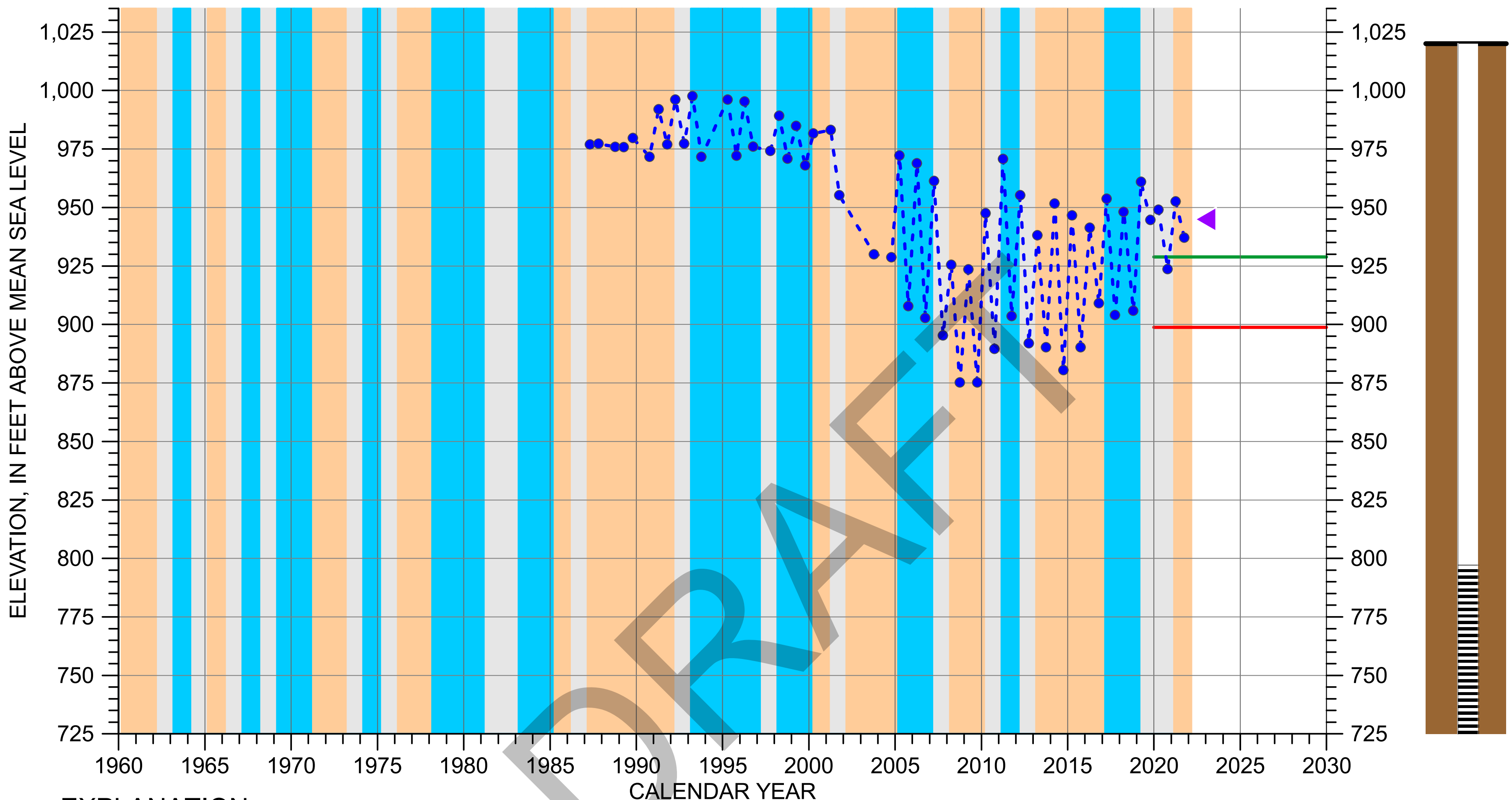
Dry | Avg/Alternating | Wet

Well Depth: 1230 feet
Screened Interval: 180-1230 feet below ground surface
Reference Point Elevation: 790 feet above mean sea level

* Measurement reported as not static

## HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14H01

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14H01.grf






## EXPLANATION

Groundwater Elevation

Measurement Not Verified*

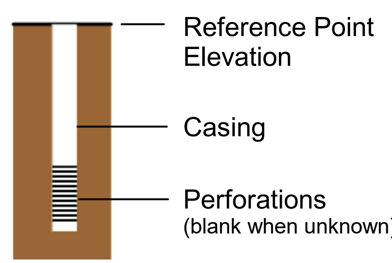
Measurable Objective

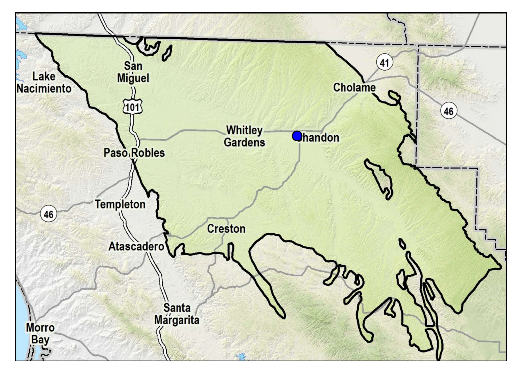
Minimum Threshold

Average of spring and fall 2021 water elevations

## CLIMATE PERIOD CLASSIFICATION

Dry Avg/Alternating Wet



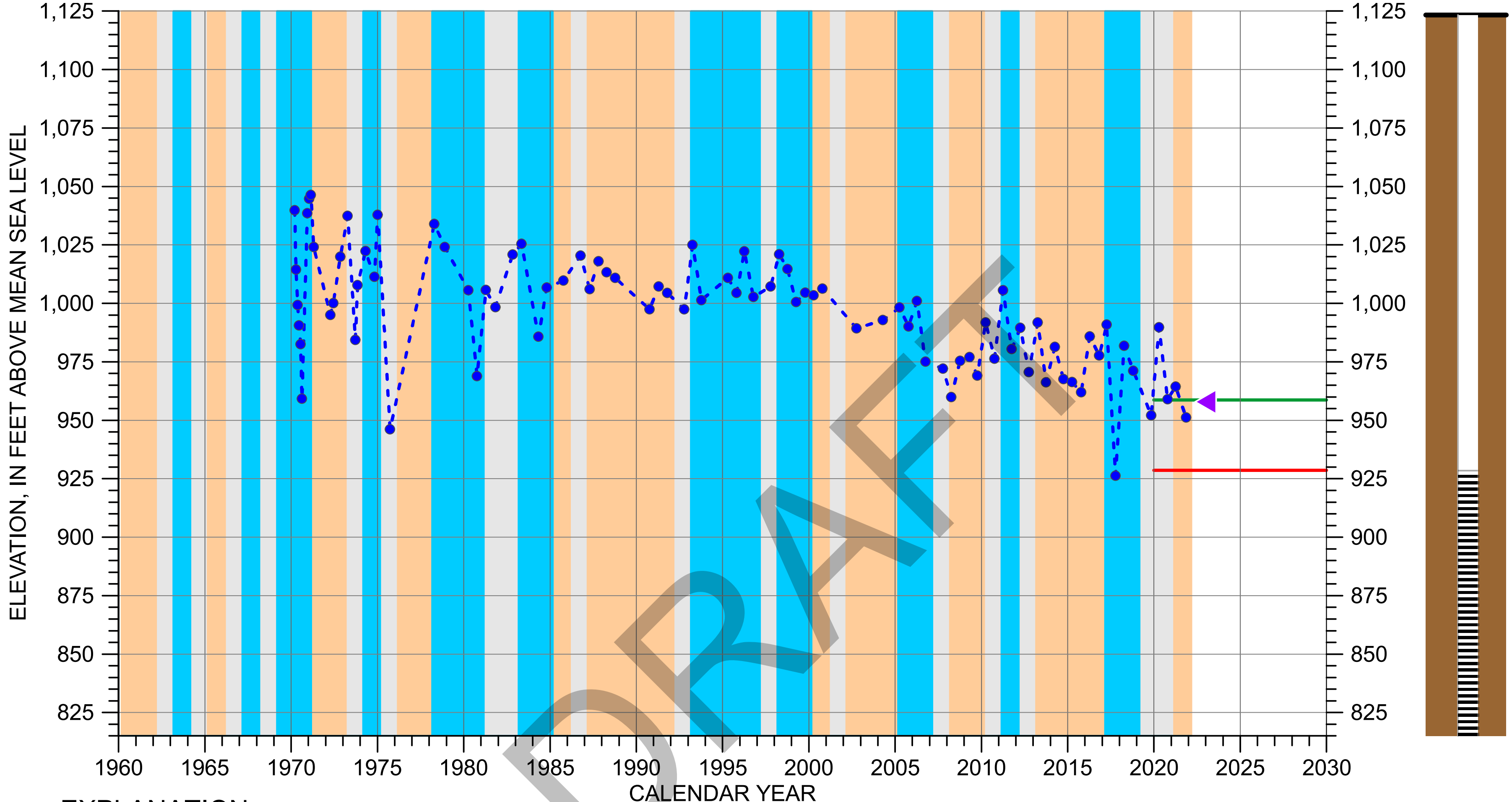




Well Depth: 512 feet
Screened Interval: 223-512 feet below ground surface
Reference Point Elevation: 1020 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-19E01**

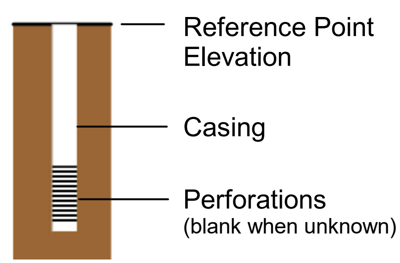
P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-19E01.grf

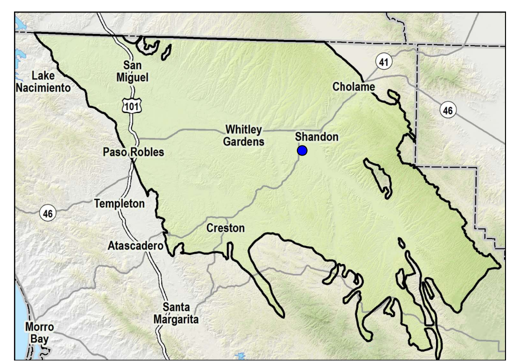





## EXPLANATION

- Groundwater Elevation
- Measurement Not Verified*
- Measurable Objective
- Minimum Threshold
- Average of spring and fall 2021 water elevations




## CLIMATE PERIOD CLASSIFICATION

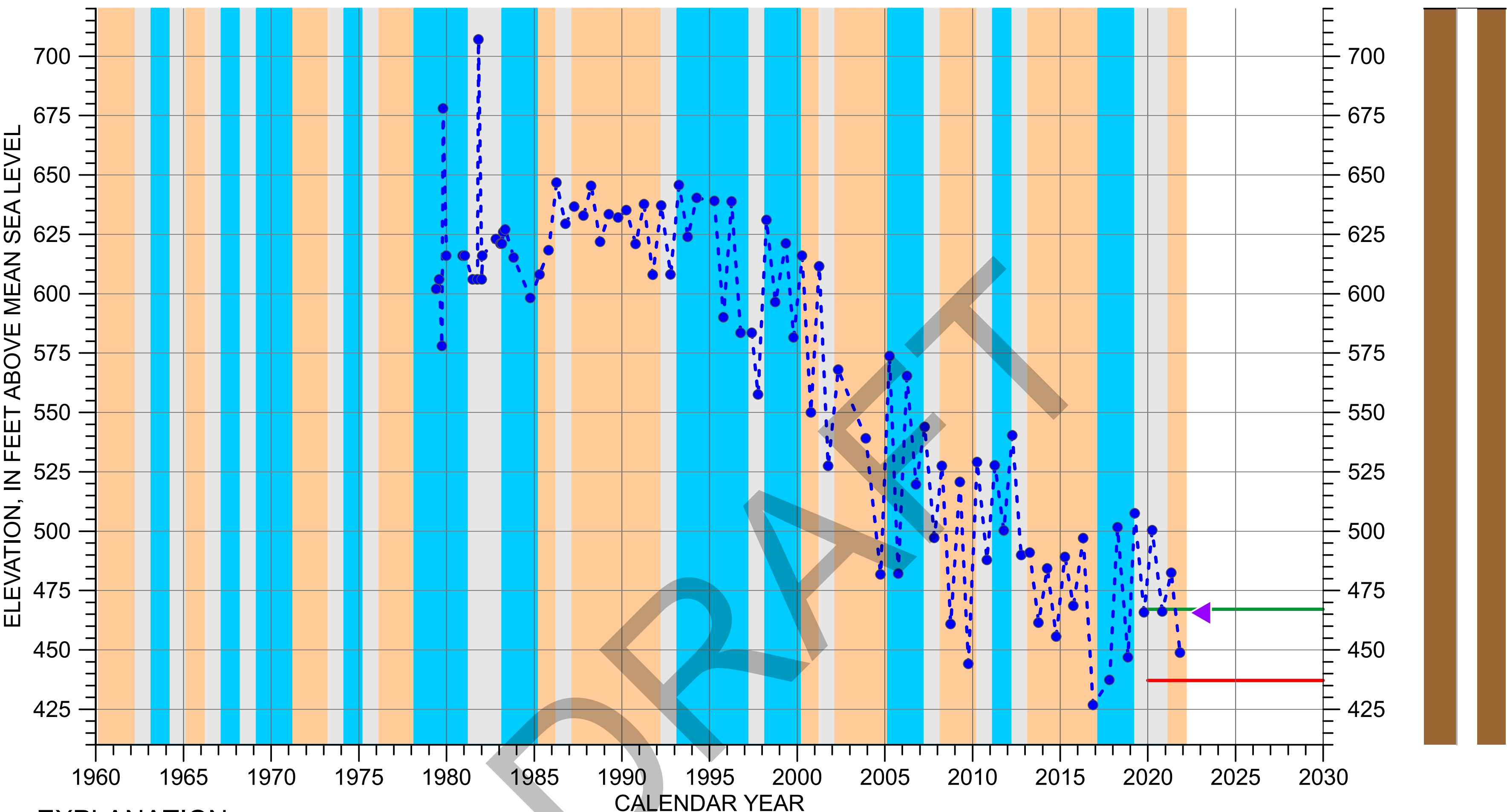
Dry   Avg/Alternating   Wet

Well Depth: 605 feet
Screened Interval: 195-605 feet below ground surface
Reference Point Elevation: 1123.3 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-30J01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-30J01.grf




EXPLANATION

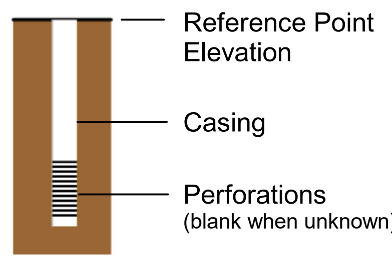
Groundwater Elevation

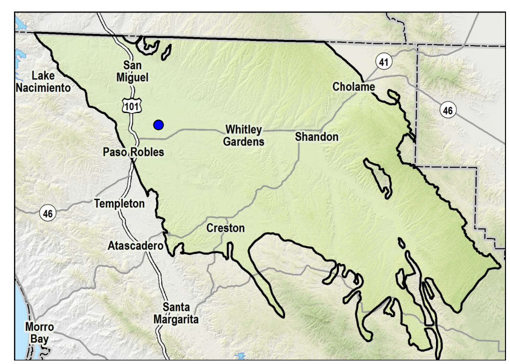
Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold




CLIMATE PERIOD CLASSIFICATION

Dry

Avg/Alternating

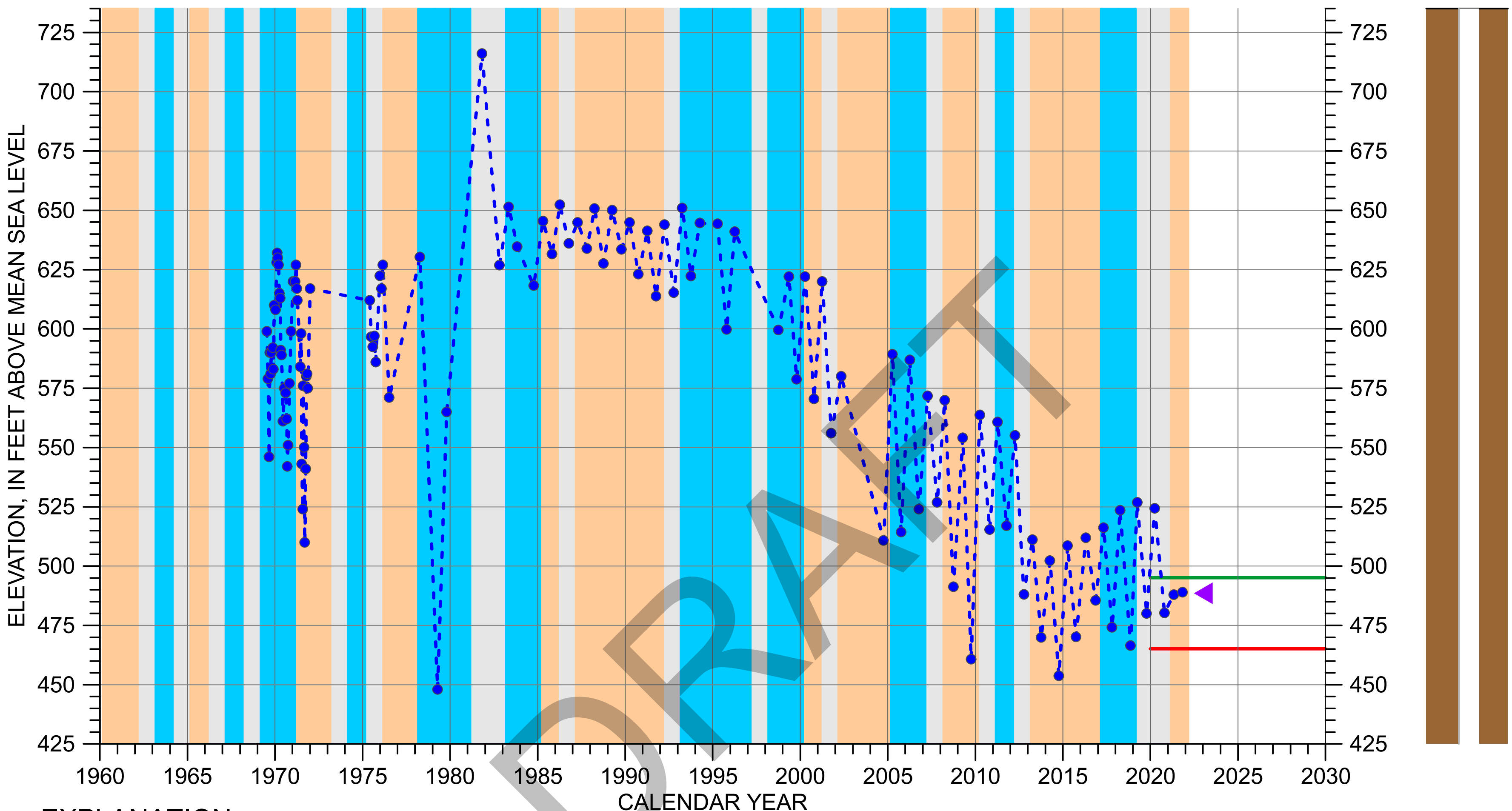
Wet

Well Depth: 1100 feet
Screened Interval: unknown
Reference Point Elevation: 786 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14K01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14K01.grf




EXPLANATION

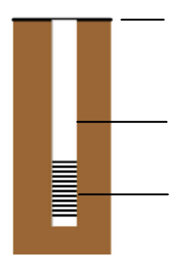
Groundwater Elevation

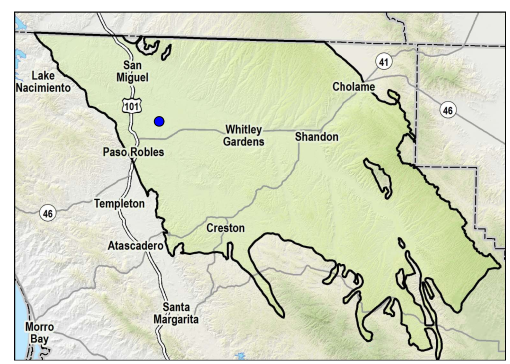
Measurement Not Verified*

Measurable Objective

Minimum Threshold

Average of spring and fall 2021 water elevations




CLIMATE PERIOD CLASSIFICATION

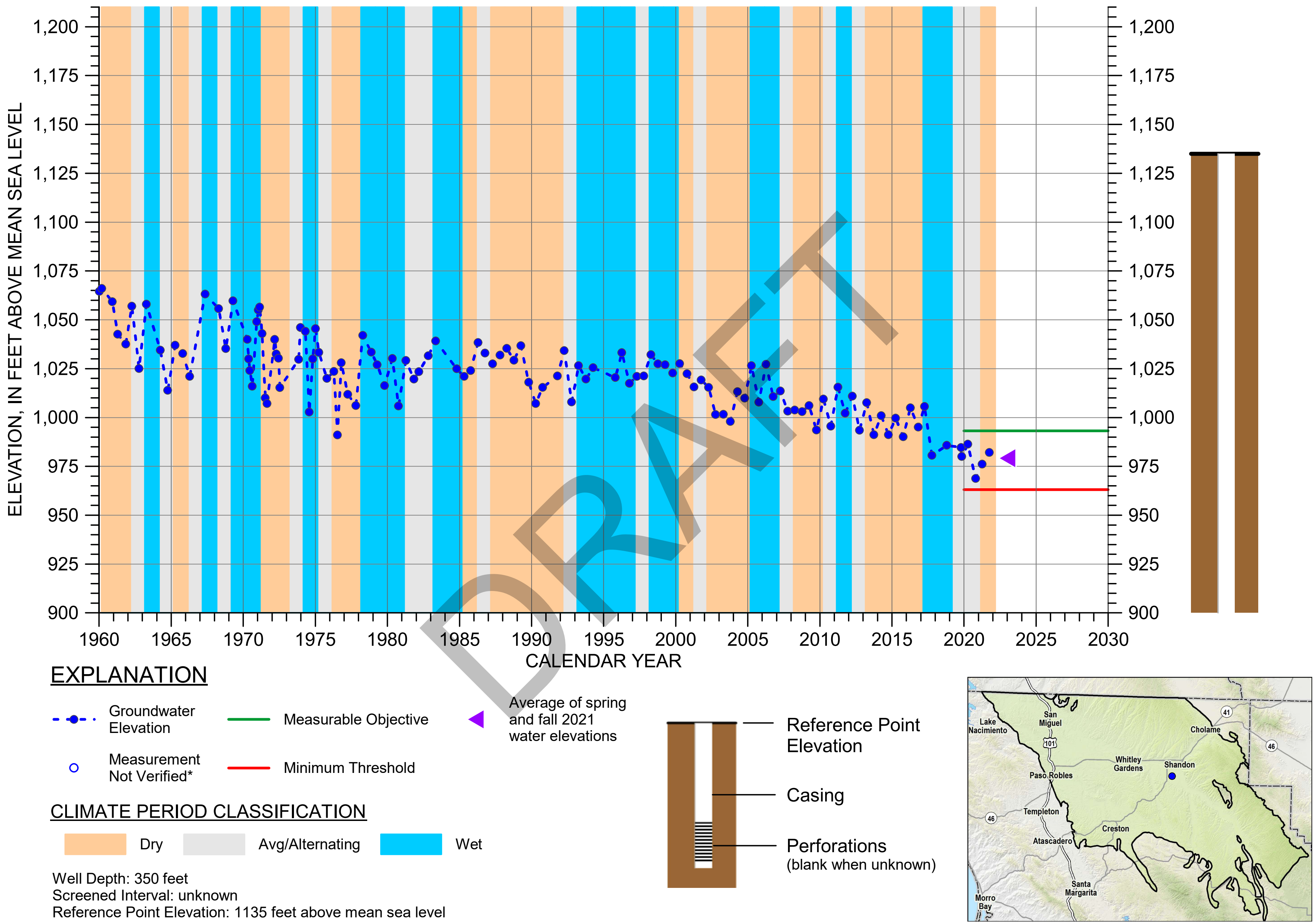
Dry Avg/Alternating Wet

Well Depth: 740 feet
Screened Interval: unknown
Reference Point Elevation: 789.3 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14G01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14G01.grf

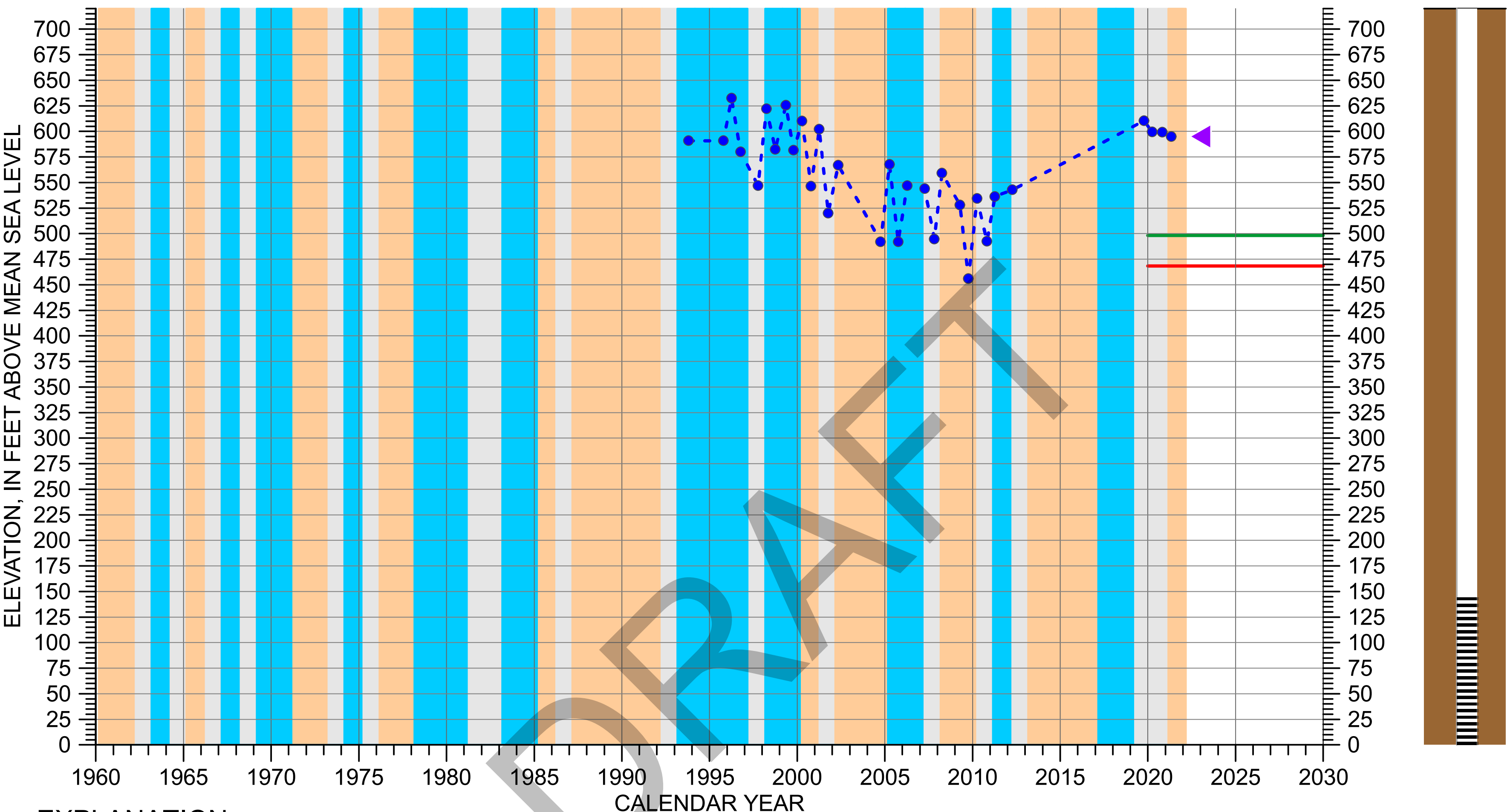



Well Depth: 350 feet
Screened Interval: unknown
Reference Point Elevation: 1135 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/15E-29N01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_15E-29N01.grf






## EXPLANATION

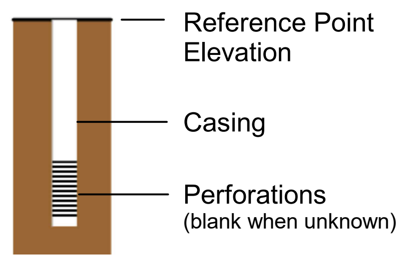
Groundwater Elevation

Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold

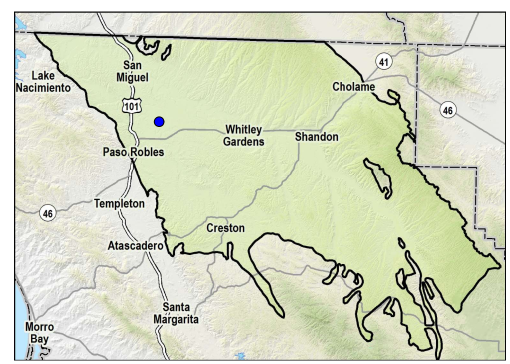



## CLIMATE PERIOD CLASSIFICATION

Dry Avg/Alternating Wet

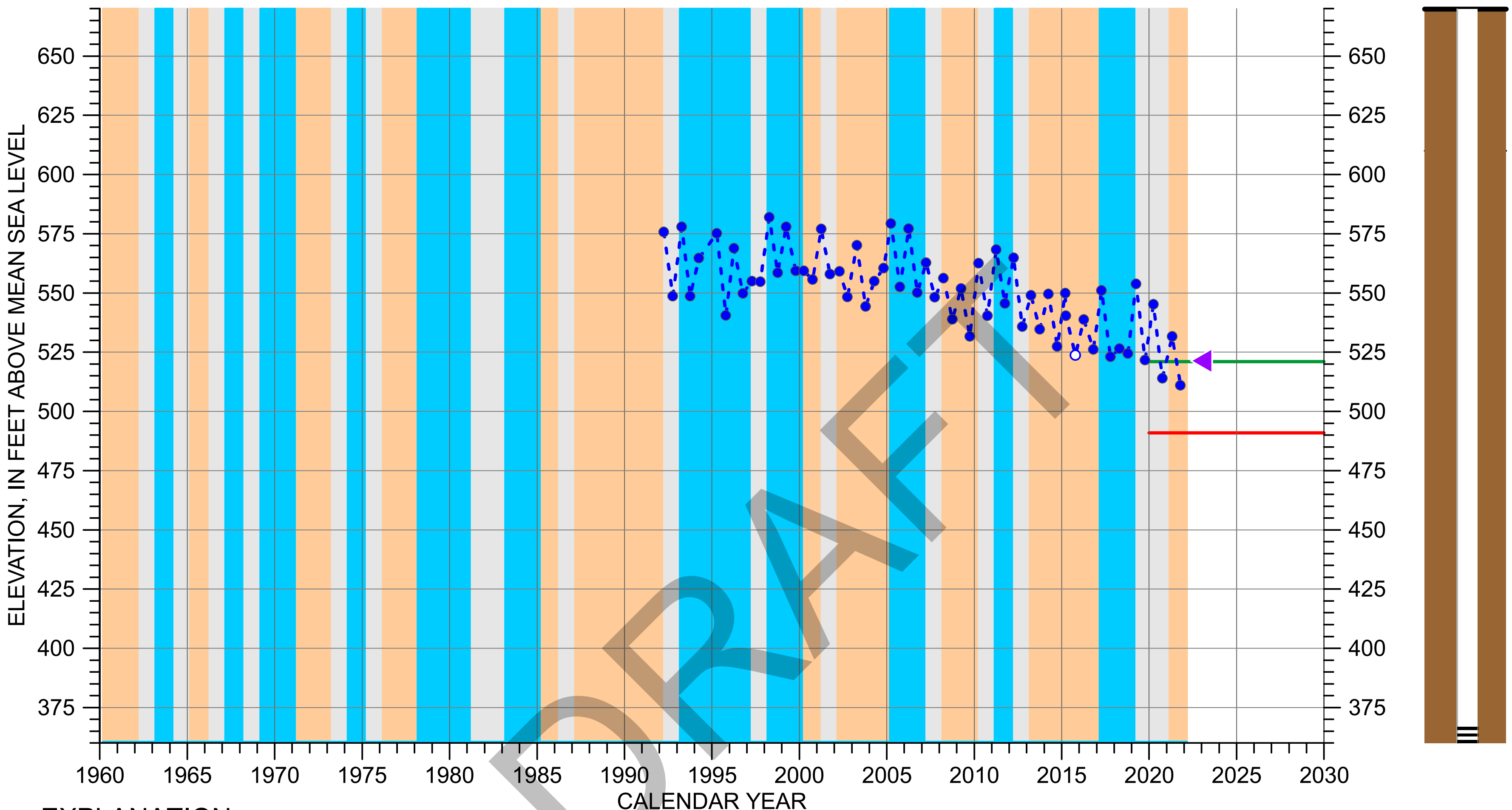
Well Depth: 840 feet
Screened Interval: 640-840 feet below ground surface
Reference Point Elevation: 787 feet above mean sea level

* Measurement reported as not static




**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-14G02**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_12E-14G02.grf




## EXPLANATION

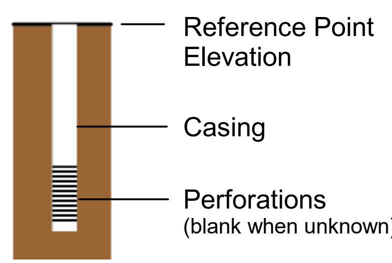
Groundwater Elevation

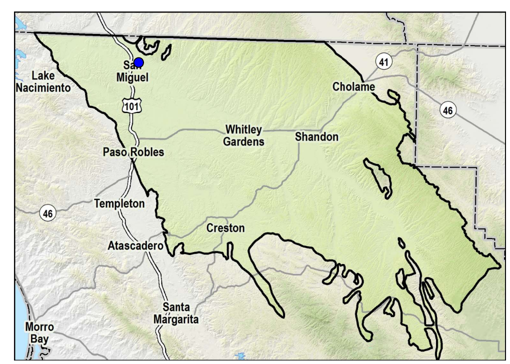
Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold




## CLIMATE PERIOD CLASSIFICATION

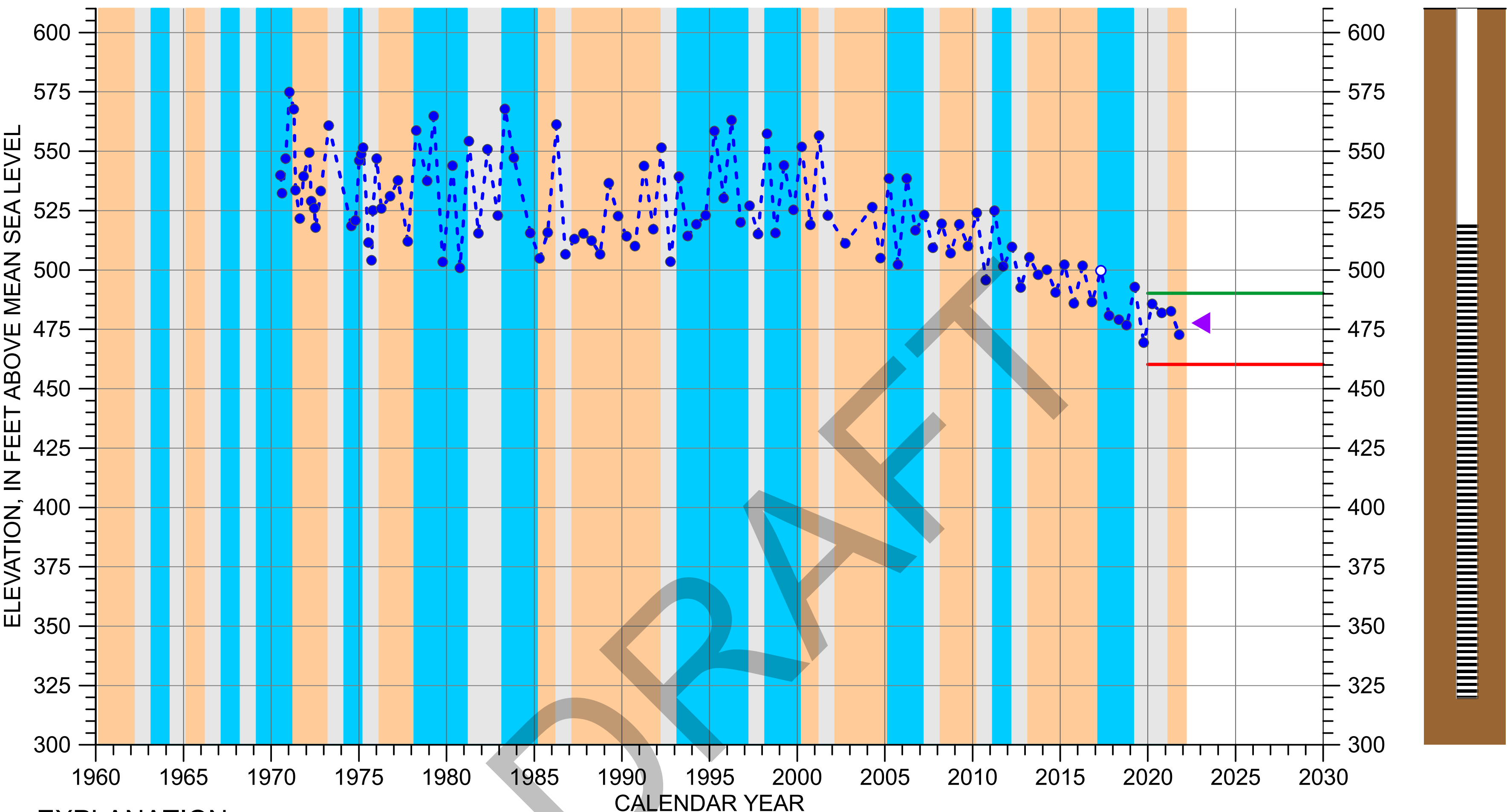
Dry | Avg/Alternating | Wet

Well Depth: 350 feet
Screened Interval: 300-310, 330-340 feet below ground surface
Reference Point Elevation: 669.8 feet above mean sea level

* Measurement reported as not static

## HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 25S/12E-16K05

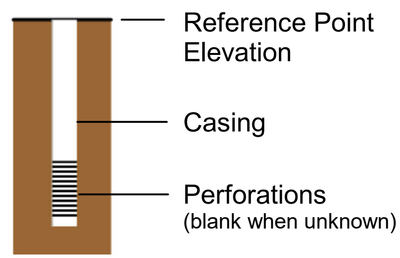
P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_25S_12E-16K05.gpj

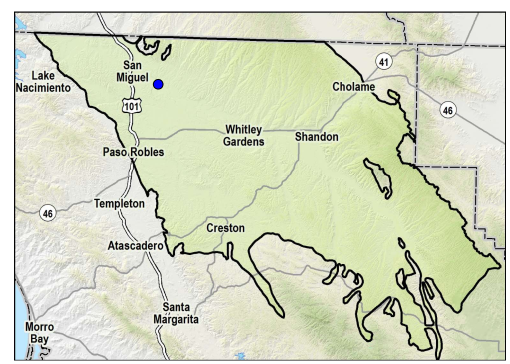





## EXPLANATION

- Groundwater Elevation
- Measurement Not Verified*
- Measurable Objective
- Minimum Threshold
- Average of spring and fall 2021 water elevations




## CLIMATE PERIOD CLASSIFICATION

Dry   Avg/Alternating   Wet

Well Depth: 400 feet
Screened Interval: 200-400 feet below ground surface
Reference Point Elevation: 719.7 feet above mean sea level

* Measurement reported as not static

## HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 25S/12E-26L01

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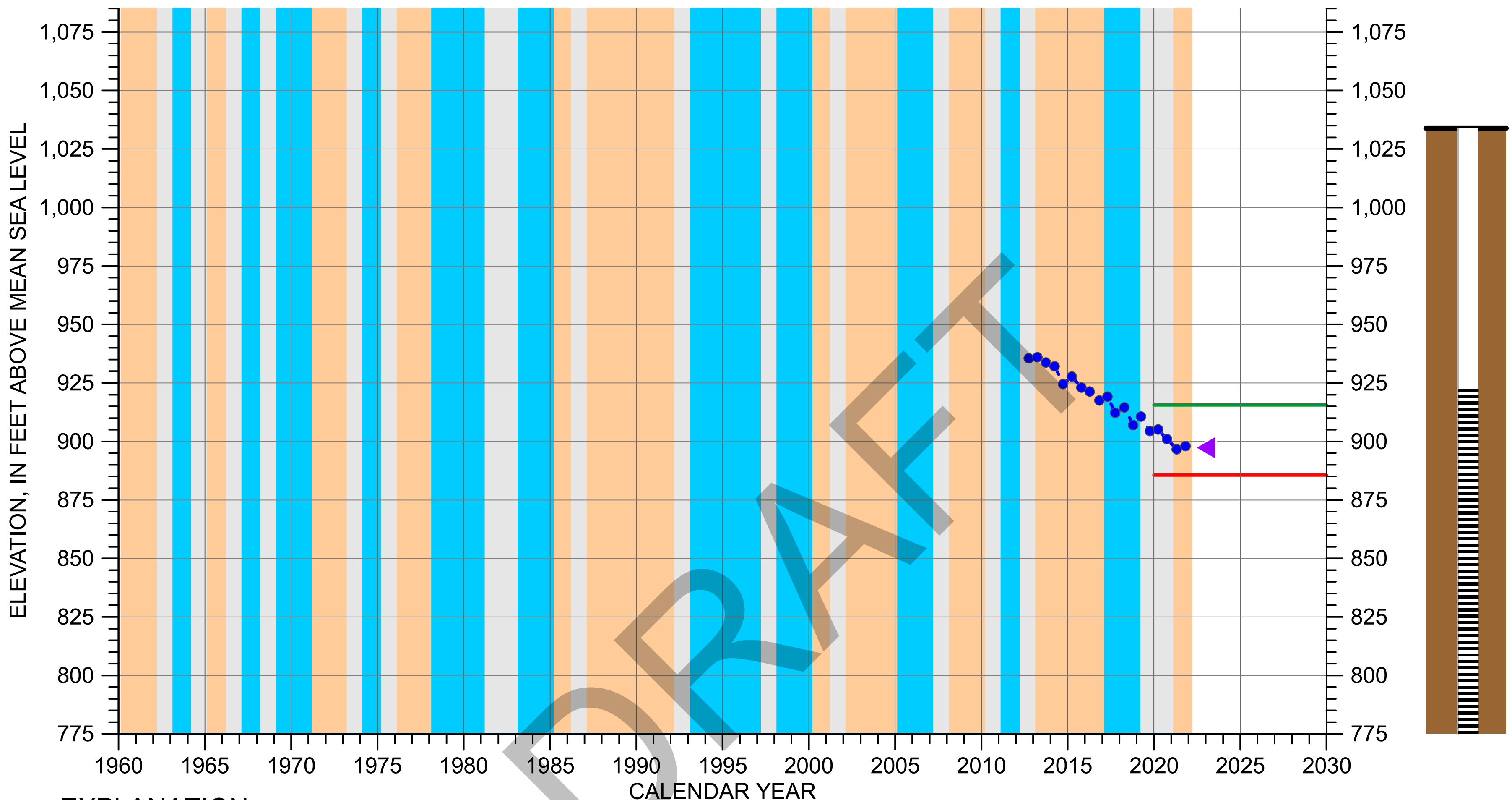



## EXPLANATION

Groundwater Elevation

Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold

## CLIMATE PERIOD CLASSIFICATION

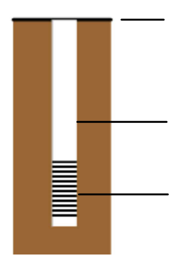
Dry

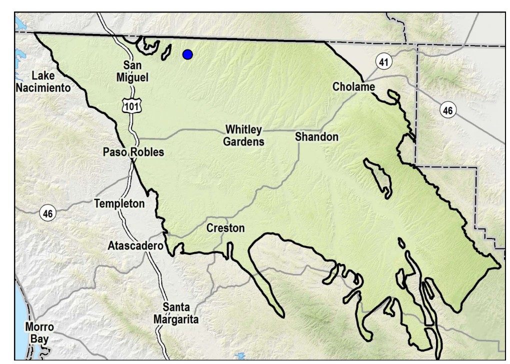
Avg/Alternating

Wet

Well Depth: 270 feet
Screened Interval: 110-270 feet below ground surface
Reference Point Elevation: 1033.8 feet above mean sea level

* Measurement reported as not static




**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 25S/13E-08L02**

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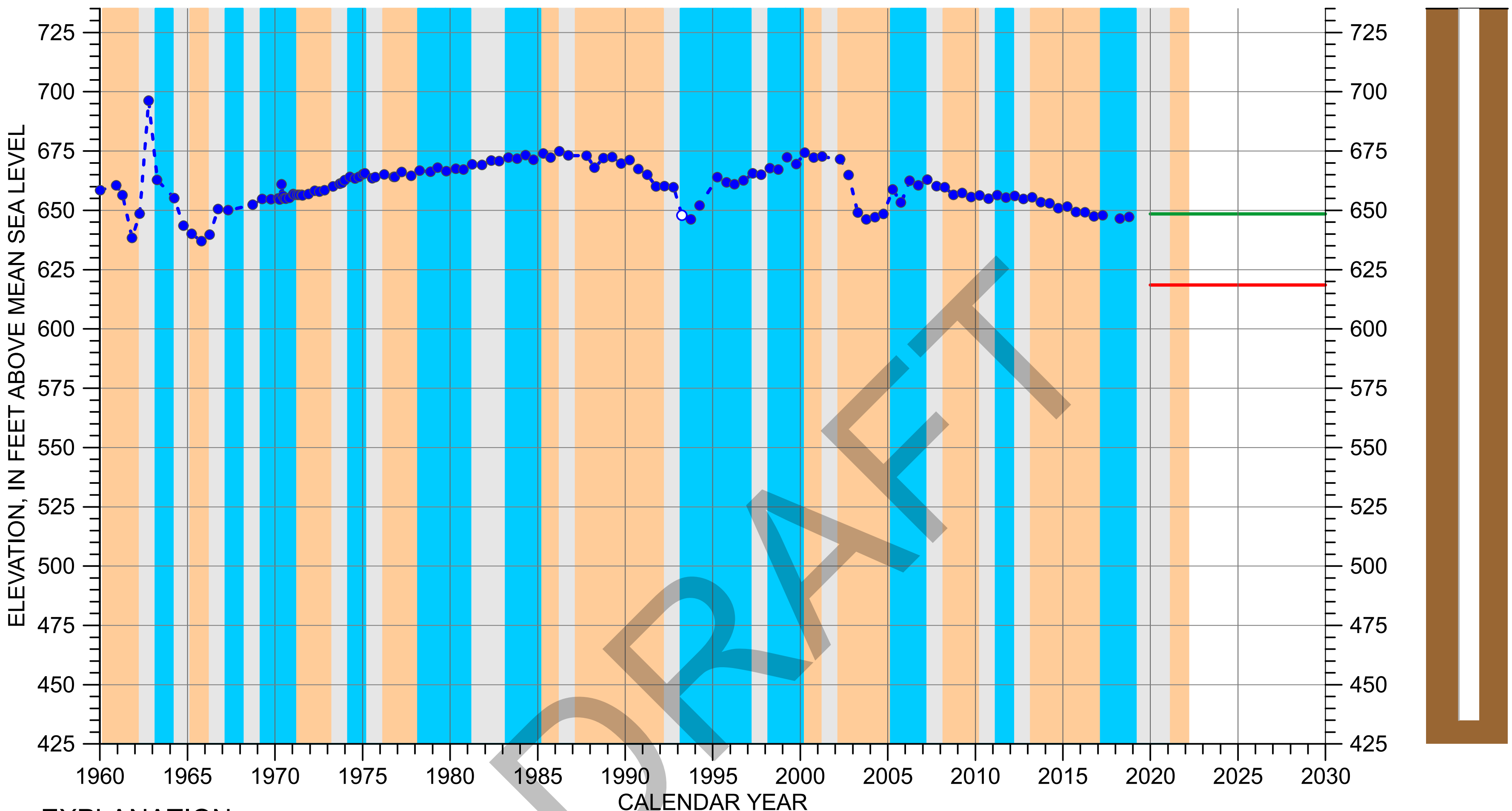


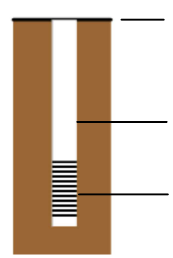

## EXPLANATION

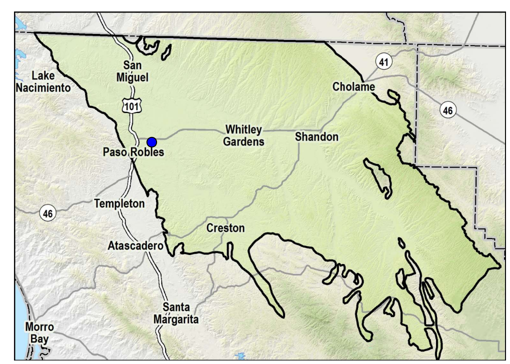
Groundwater Elevation

Measurement Not Verified*

Measurable Objective

Minimum Threshold




## CLIMATE PERIOD CLASSIFICATION

Dry    Avg/Alternating    Wet

Well Depth: 400 feet
Screened Interval: unknown
Reference Point Elevation: 835 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/12E-26E07**

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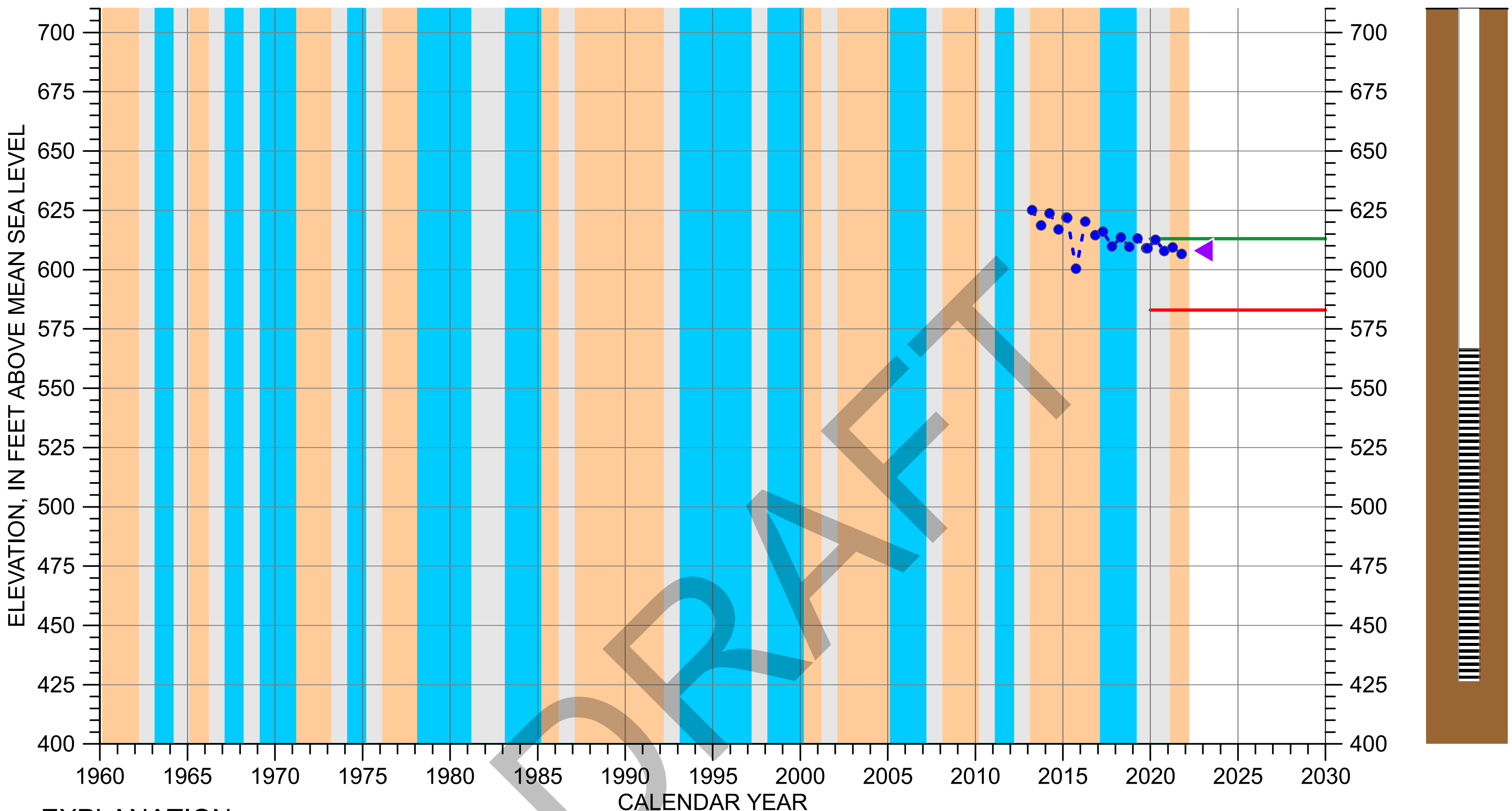



## EXPLANATION

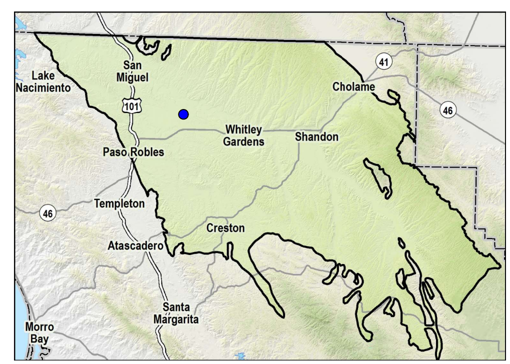
Groundwater Elevation

Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold


## CLIMATE PERIOD CLASSIFICATION

Dry | Avg/Alternating | Wet

Well Depth: 400 feet
Screened Interval: 260-400 feet below ground surface
Reference Point Elevation: 827.9 feet above mean sea level

* Measurement reported as not static

## HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/13E-08M01

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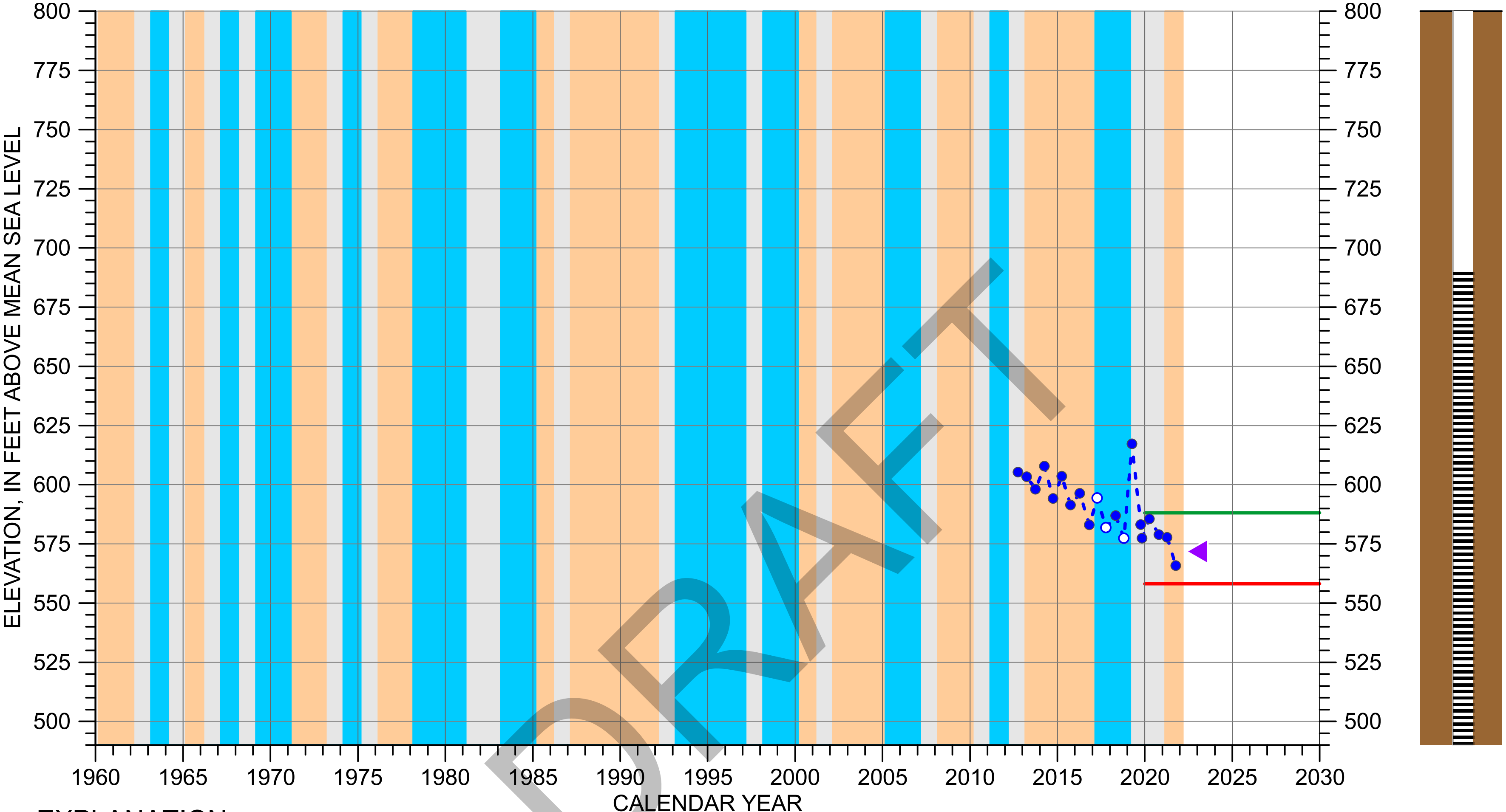





## EXPLANATION

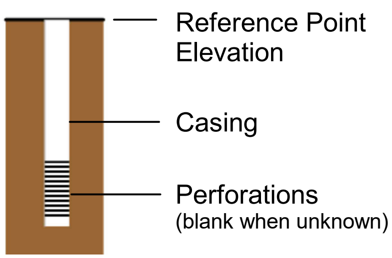
Groundwater Elevation

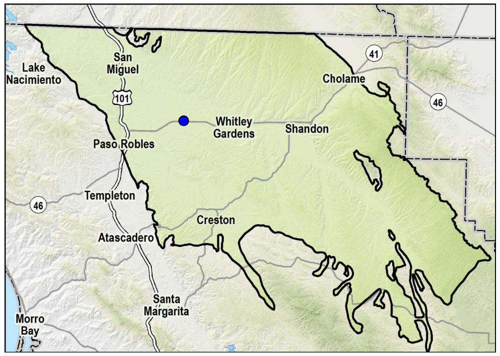
Measurable Objective

Average of spring and fall 2021 water elevations

Measurement Not Verified*

Minimum Threshold




## CLIMATE PERIOD CLASSIFICATION

Dry Avg/Alternating Wet

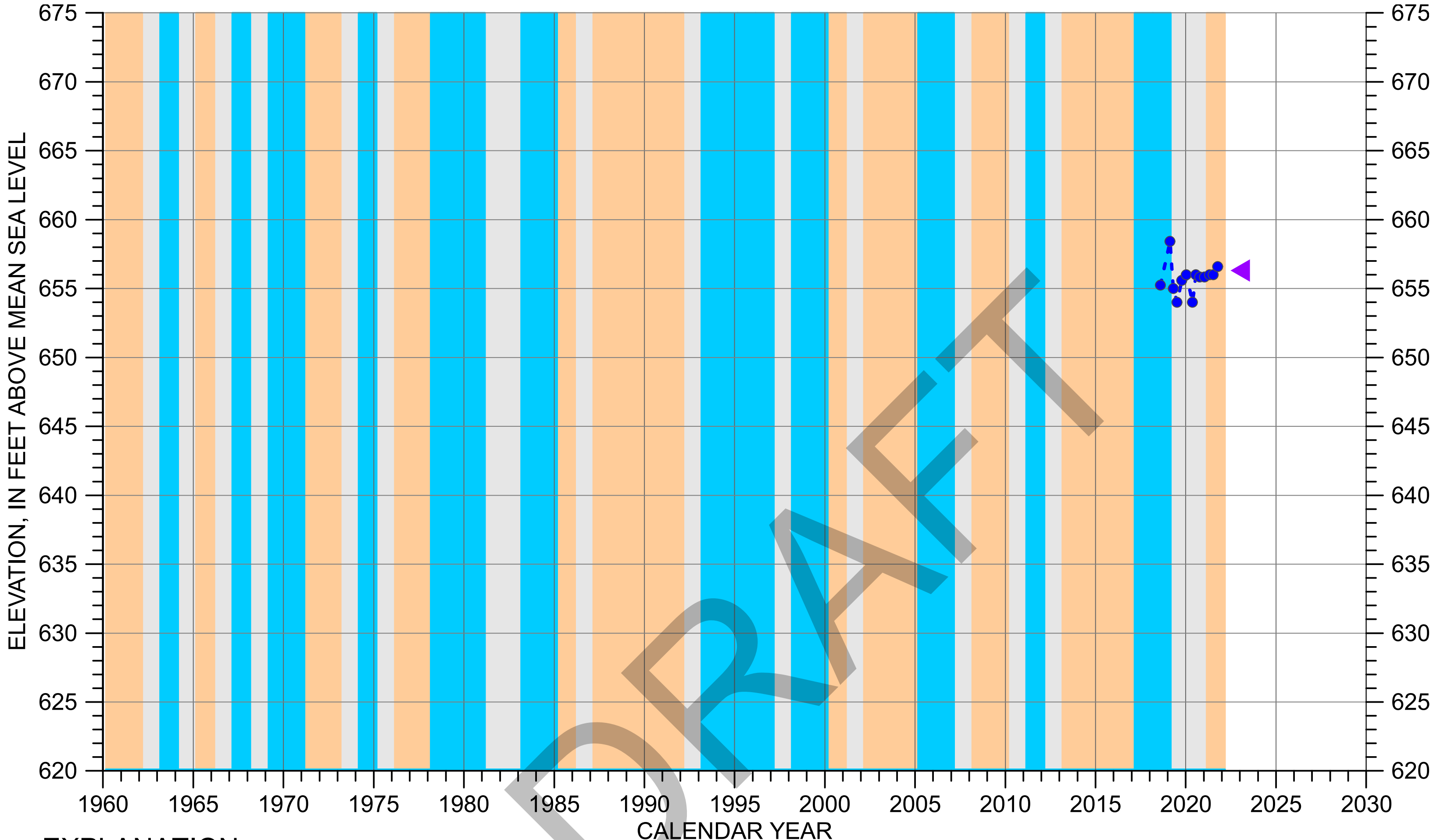
Well Depth: 400 feet
Screened Interval: 200-400 feet below ground surface
Reference Point Elevation: 890.2 feet above mean sea level

* Measurement reported as not static

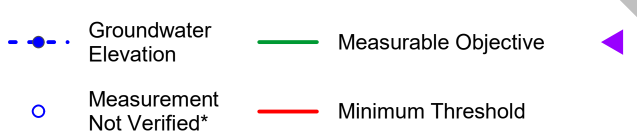
**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 26S/13E-16N01**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\Hydr_26S_13E-16N01.grf

# Alluvial Aquifer Hydrographs

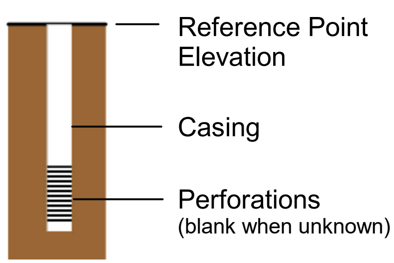


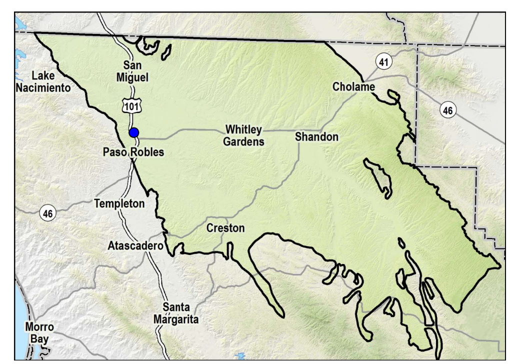

## EXPLANATION




CLIMATE PERIOD CLASSIFICATION

Dry | Avg/Alternating | Wet




Well Depth: 50 feet
Screened Interval: 10-50 feet below ground surface
Reference Point Elevation: 672 feet above mean sea level

* Measurement reported as not static

**HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 18MW-0191**

P:\Portland\824-Paso Robles\003-GSP 2021 AR\Analysis\Hydrographs\Grapher\Annual Rpt\18MW-0191.gpj

APPENDIX F

# Paso Robles Formation Aquifer Storage Coefficient Derivation and Sensitivity Analysis (GSI, 2020)

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# Paso Robles Formation Aquifer Storage Coefficient Derivation and Sensitivity Analysis

The annual changes in groundwater in storage calculated for water years 2017, 2018, and 2019 in the Paso Robles Formation Aquifer presented in this first annual report are based on a fixed storage coefficient (S) value derived from groundwater modeling and groundwater elevation data presented in the Groundwater Sustainability Plan (GSP) for water year 2016. The derivation of S for the Paso Robles Formation Aquifer and a sensitivity analysis are presented below. It should be noted that while the GSP groundwater model utilizes a spatially variable S (both laterally and vertically) the S value derived here and used in this first annual report is a single average value representing the Paso Robles Formation Aquifer within the Subbasin.

## 1.1 Derivation of the Storage Coefficient Term

Derivation of S was accomplished through a back calculation using the change in groundwater in storage in the Paso Robles Formation Aquifer determined from the GSP groundwater model for water year 2016 and the total volume change represented by a Paso Robles Formation Aquifer groundwater elevation change map prepared for water year 2016. The change in groundwater in storage for water year 2016 in the Paso Robles Formation Aquifer is -59,459 acre-feet (AF) based on the GSP groundwater model.

The Paso Robles Formation Aquifer groundwater elevation change map for water year 2016 was prepared for this annual report by comparing the fall 2015 groundwater elevation contour map to the fall 2016 groundwater elevation contour map. The fall 2015 groundwater elevations were subtracted from the fall 2016 groundwater elevations resulting in a map depicting the changes in groundwater elevations in the Paso Robles Formation Aquifer that occurred during the 2016 water year (not pictured, but similar to Figures 12, 13, and 14 in this first annual report).

The groundwater elevation change map for water year 2016 represents a total volume change within the Paso Robles Formation Aquifer of -807,490 AF. As described in Section 7.2 of this annual report, this total volume change includes the volume displaced by the aquifer material and the volume of groundwater stored within the void space of the aquifer. The portion of void space in the aquifer that can be utilized for groundwater storage is represented by S. The change in groundwater in storage is equivalent to the product of S and the total volume change, as shown here:

$$Change\ of\ Groundwater\ in\ Storage = S \times Total\ Volume\ Change$$

This equation can be re-arranged and solved for S:

$$S = \frac{Change\ of\ Groundwater\ in\ Storage}{Total\ Volume\ Change} = \frac{-59{,}459\ AF}{-807{,}490\ AF} = 0.07$$

Therefore, based on analysis of data for water year 2016, an average S value for the Paso Robles Formation Aquifer in the Paso Robles Subbasin is 0.07.

## 1.2 Sensitivity Analysis

The annual changes in groundwater in storage in the Paso Robles Formation Aquifer calculated for water years 2017, 2018, and 2019 presented in this first annual report are 60,106, 6,398, and 59,682 AF, respectively. These values, calculated using an S value of 0.07, appear reasonable when compared to historical changes in groundwater in storage (see Figure 15 in this first annual report). While the calculated value of S, presented above, is based on sound science and using the best readily available information, it is necessary to acknowledge that the true value of S in the Paso Robles Formation Aquifer is spatially variable (as indicated in the GSP groundwater model) and ranges in value both above and below the calculated value of 0.07. A sensitivity analysis was performed to demonstrate the range of annual changes in groundwater in storage that result from using a range of S values. Table F1 shows that the annual change in groundwater in storage volumes can range from 27 percent less to 27 percent more than presented in this first annual report based on S values ranging from 0.05 to 0.09. This shows the sensitivity of the S value to determination of annual change in groundwater in storage. However, neither the 27 percent lower nor the 27 percent higher annual change in groundwater in storage volumes seem reasonable when compared to historical changes in groundwater in storage (as shown in Figure 15 in this first annual report). Based on this sensitivity analysis, GSI believes that the calculated value of S (0.07) is reasonable and defensible for the purposes of this first annual report.

**Table F 1. Change in Groundwater in Storage Sensitivity Analysis**

| Water Year | Total Volume of Change (AF) | Change in Groundwater in Storage (AF), based on: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | S = 0.05 | | S = 0.06 | | Calculated S [0.07] | S = 0.08 | | S = 0.09 | |
| | | (AF) | % Diff | (AF) | % Diff | (AF) | (AF) | % Diff | (AF) | % Diff |
| 2017 | 816,274 | 43,781 | | 51,943 | | 60,106 | 68,269 | | 76,432 | |
| 2018 | 86,885 | 4,660 | -27% | 5,529 | -14% | 6,398 | 7,267 | 14% | 8,135 | 27% |
| 2019 | 810,508 | 43,471 | | 51,577 | | 59,682 | 67,787 | | 75,892 | |

notes:

AF = acre-feet, S = storage coefficient, % Diff = percent difference from calculated S

APPENDIX G

# Development of New San Luis Obispo County Staff Position

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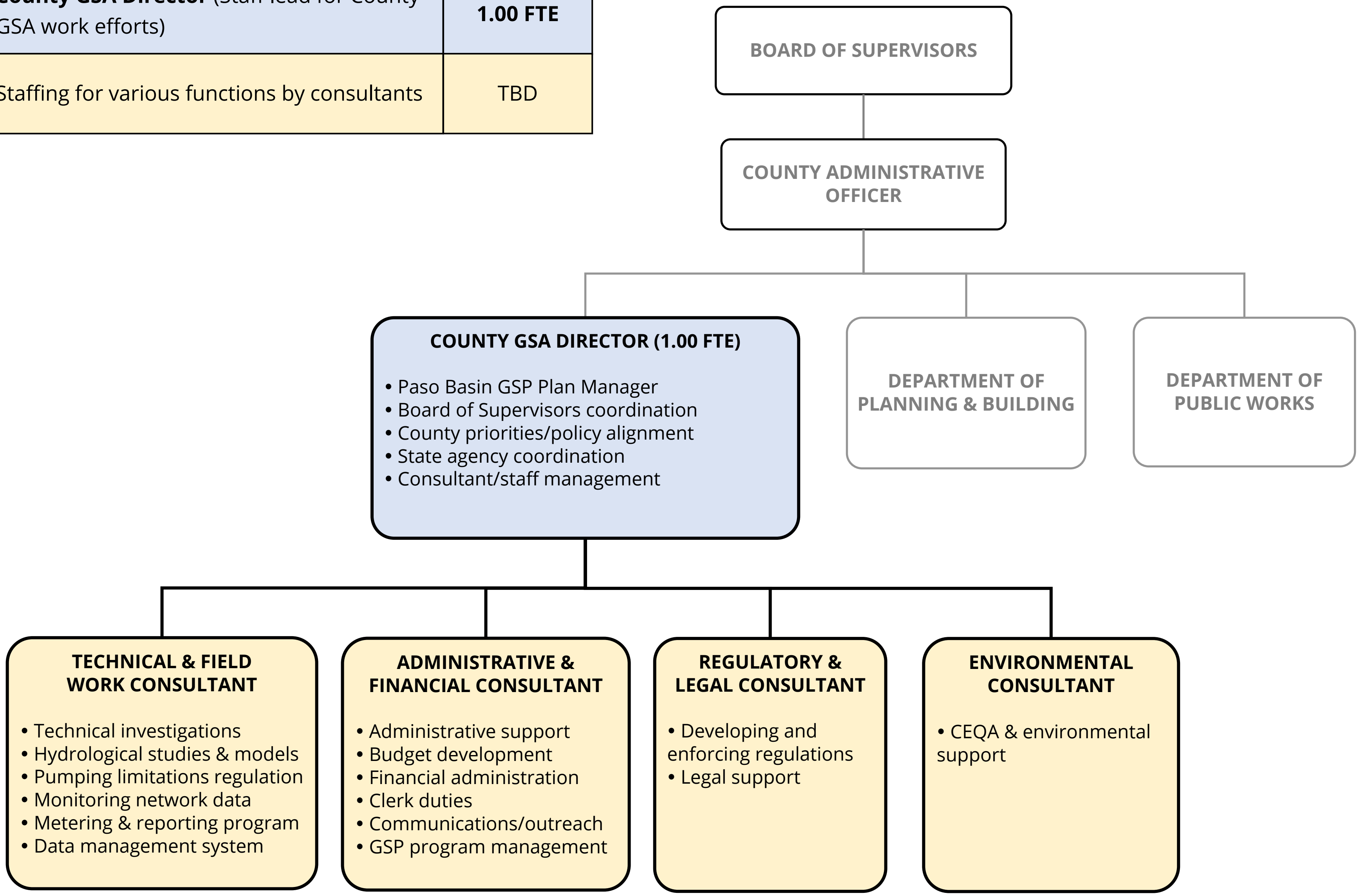
# Attachment 1 - County GSA Director Organization Chart

| Position | Workload |
|---|---|
| **County GSA Director** (Staff lead for County GSA work efforts) | **1.00 FTE** |
| Staffing for various functions by consultants | TBD |



APPENDIX H

# San Luis Obispo County Ordinance 3456

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ORDINANCE NO. 3456

AN ORDINANCE AMENDING TITLE 22 OF THE SAN LUIS OBISPO COUNTY CODE, THE LAND USE ORDINANCE, BY AMENDING SECTION 22.30.204 AGRICULTURAL OFFSET REQUIREMENTS TO EXTEND THE TERMINATION DATE AND CHANGE TABLE GRAPES WATER DUTY FACTOR

The Board of Supervisors of the County of San Luis Obispo, State of California, does ordain as follows:

SECTION I: That Section 22.30.204 of Title 22 of the San Luis Obispo County Code be amended as follows:

**Chapter 22.30.204 – New or Expanded Irrigated Crop Production Using Water from the Paso Robles Groundwater Basin, Excluding the Atascadero Sub-basin.**

**Table 2 – Crop Group and Commodities Used for the Agricultural Demand Analysis**

| **Crop Group** | **Primary Commodities** |
|---|---|
| Alfalfa | Alfalfa |
| Nursery | Christmas trees, miscellaneous nursery plants, flowers |
| Pasture | Miscellaneous grasses, mixed pastures |
| Citrus | Avocados, grapefruits, lemons, oranges, olives, kiwis, pomegranates (non-deciduous) |
| Deciduous | Apples, apricots, berries, peaches, nectarines, plums, figs, pistachios, persimmons, pears, quinces |
| Strawberries | Strawberries |
| Vegetables | Artichokes, beans, miscellaneous vegetables, mushrooms, onions, peas, peppers, tomatoes |
| CBD Hemp | Field Grown CBD Hemp |
| ~~Vineyard~~ | ~~Wine grapes, table grapes~~ |
| Wine grapes | Wine grapes |
| Table grapes | Table grapes |

| | |
|---|---|
| Supplementally Irrigated Dry Cropland* | Barley, wheat, oat, grain/forage hay, safflower |

*Source: Table 3 of the Agricultural Water Offset Program, Paso Robles Groundwater Basin, October 2014.*

**San Luis Obispo County General Plan Agriculture Element*

**Table 3 – Existing Crop-Specific Applied Water by Crop Type**

| Crop Group | Applied Water (AF/Ac/Yr) |
|---|---|
| Alfalfa | 4.5 |
| Citrus | 2.3 |
| Deciduous | 3.5 |
| Strawberries | 2.3[1] |
| Nursery | 2.5 |
| Pasture | 4.8 |
| Vegetables | 1.9 |
| CBD Hemp | 1.5[2] |
| ~~Vineyard~~ Wine Grapes | 1.25**[1]** |
| Table Grapes | 3.0 [4] |
| Supplementally Irrigated Dry Cropland | 0.1[3] |

1. Information obtained from RCD Program, UCCE, UC Davis (Strawberries 2011 data)

2. Information obtained from UCCE, San Luis Obispo County Cooperative Extension, April 2019

3. Supplementally irrigated Dry Cropland application requirements outlined per Section G.3.C above.

4. Information obtained from UCCE, San Luis Obispo County Cooperative Extension, April 2021

Source: *Table 9 of the Agricultural Water Offset Program, Paso Robles Groundwater Basin, October 2014.*

**H. Termination.** The provisions of this section for the Paso Robles Groundwater Basin (excluding the Atascadero Sub-basin) shall expire on ~~January 1, 2022~~ August 31, 2022.

SECTION II: If any section, subsection, clause, phrase or portion of this ordinance is for any reason held to be invalid or unconstitutional by the decision of a court of competent jurisdiction, such decision shall not affect the validity or constitutionality of the remaining portion of this ordinance. The Board of Supervisors hereby declares that it would have passed this ordinance and each section, subsection, clause, phrase or portion thereof irrespective of the fact that any one or more sections, subsections, sentences, clauses, phrases or portions be declared invalid or unconstitutional.

SECTION III: This ordinance shall take effect and be in full force and effect thirty (30) days after its passage and before the expiration of fifteen (15) days after passage of this ordinance, it shall be published once with the names of the members of the Board of Supervisors voting for and against the ordinance in a newspaper of general circulation published in the County of San Luis Obispo, State of California.

SECTION IV: An addendum to the Supplemental Environmental Impact Report (SEIR) (SCH 2014081056) certified for the Countywide Water Conservation Program in 2015 was prepared in accordance with the applicable provisions of the California Environmental Quality Act, Public Resources Code Section 21000 et. seq. for the proposed changes to the County Code Section 22.30.204.

SECTION V: In accordance with Government Code Section 25131, after reading the title of this Ordinance, further reading of the Ordinance in full is waived.

Partially recommended at a regular meeting of the San Luis Obispo County Planning Commission held on the 19th day of September, 2019, introduced at a regular meeting of the Board of Supervisors held on the 10th day of August, 2021, and passed and adopted by the Board of Supervisors of the County of San Luis Obispo, State of California, on the 24th day of August, 2021, by the following roll call to vote, to wit:

AYES: Supervisors John Peschong, Dawn Ortiz-Legg, Bruce S. Gibson, and Chairperson Lynn Compton

NOES: Supervisor Debbie Arnold

ABSENT: None

ABSTAINING: None

Lynn Compton
Chairperson of the Board of Supervisors,
County of San Luis Obispo, State of California

ATTEST:

WADE HORTON
Ex-Officio Clerk of the Board of Supervisors,
County of San Luis Obispo State of California

By: ____________________________________________
Deputy Clerk

# APPENDIX I

# Economic Impact of Irrigated Agriculture
# Hamilton and McCullough (2020)

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# The Economic Impact on the Local Economy of Irrigated Agriculture in the Paso Robles Area

# and

# Potential Impacts of the Sustainable Groundwater Management Act


Lynn Hamilton[1]

and

Michael McCullough[2]

Cal Poly, San Luis Obispo


August 28, 2020




1 Lynn Hamilton, Ph.D., is a Professor of Agribusiness at Cal Poly, San Luis Obispo

2 Michael McCullough, Ph.D., is a Professor of Agribusiness at Cal Poly, San Luis Obispo

*Acknowledgements*

*We appreciate the support and input from the following organizations who sponsored the work presented in this report (listed alphabetically): Estrella- El Pomar Creston (EPC) Water District, Farm Credit West, Paso Robles Wine Country Alliance, San Luis Obispo County Farm Bureau, Shandon-San Juan (SSJ) Water District and Travel Paso. We also acknowledge the cooperation and support of the County Agricultural Commissioner Martin Settevendemie*

# Table of Contents

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# Executive Summary

The purpose of this study is to analyze the economic impact of the agricultural and wine industry within the Paso Robles Subbasin and AVA and San Luis Obispo County and to assess the economic impact of potential changes in the agricultural industry as a result of the Paso Robles Subbasin Groundwater Sustainability Plan that will reduce water allocations and/or increase the cost of water in the basin from 2020 – 2040 and beyond.

The Groundwater Sustainability Plan submitted to the state Department of Water Resources notes that if water use and precipitation patterns continue, the basin will be in overdraft by 14,000 acre-feet annually, which is about 17% of the total draw from the basin, based on hydrologists' reports. Groundwater is the only source of irrigation water for agriculture in the subbasin. We analyze scenarios in which 10%, 17% and 23% of current water use is reduced. We show the economic effects for both irrigated agriculture as well as the impacts of lost fruit production for wineries in the region.

The loss to the Paso Subbasin economy from reduced irrigated agriculture ranges from $49.5 million to $146.3 million in lost economic value and in terms of employment, losing between 459 and 1,289 jobs, depending on the water reduction. The economic impact of lost wine value is even more significant, resulting in $183.4 million to $458 million loss to the overall economy in the subbasin, and $83.8 million to $215.6 million in lost output value to Paso Robles wineries. Job losses are estimated at 1,358 to 3,351 across the PR Subbasin economy, because of the lost grower, wine producer and consumer sales and expenditures. The Paso Robles wine industry is estimated to lose 376 to 967 jobs.

The analysis provided here indicates that between 12% to 32% of the total economic value and jobs could be lost in the Paso Subbasin wine industry, and between 10% to 26% of all SLO County winery economic output and jobs. In terms of lost economic value to the overall agricultural economy, both our analysis and an independent study sponsored by the SLO County Agricultural Commissioner's office show that the SLO County wineries contribute almost $860 million to the overall SLO County economy. Our analysis indicates that between 21% and 53% of the total value of output could be lost from SLO County's wine industry should water cutbacks occur. Irrigated agriculture overall will also have significant losses, with an estimated 4% to 11% decline in the total value of SLO County production agriculture.

This study is intended to provide an overview of potential economic impacts that may result from reductions to groundwater use for irrigated agriculture. The economic implications of water reductions are sizable and would cause a restructuring of the local business environment. This analysis may provide impetus for local officials to pursue alternatives for additional water supplies and find creative solutions to pursue groundwater sustainability in the Paso Robles Subbasin.

Summary tables of results are provided on the following page.

**Table 1** 10% Reduction in Water, Economic Impact in Paso Robles Subbasin

| | ***Change in Total Output*** | ***Number of Jobs Lost*** |
|---|---|---|
| ***Low Value Crops*** | -$60,119,684 | -459 |
| ***10% Across All Crops*** | -$63,615,961 | -560 |
| ***High Value Crops*** | -$49,541,448 | -519 |

**Table 2** 17% Reduction in Water, Economic Impact in Paso Robles Subbasin

| | ***Change in Total Output*** | ***Number of Jobs Lost*** |
|---|---|---|
| ***Low Value Crops*** | -$95,394,009 | -646 |
| ***17% Across All Crops*** | -$108,147,134 | -953 |
| ***High Value Crops*** | -$84,220,463 | -883 |

**Table 3** 23% Reduction in Water, Economic Impact in Paso Robles Subbasin

| | ***Change in Total Output*** | ***Number of Jobs Lost*** |
|---|---|---|
| ***Low Value Crops*** | -$125,629,144 | -806 |
| ***23% Across All Crops*** | -$146,316,711 | -1,289 |
| ***High Value Crops*** | -$113,945,332 | -1,194 |

**Table 4** Economic Impact of Lost Wine Grape Production on Wineries and Entire PR Subbasin

| | ***5% Non-local Grapes*** | ***10% Non-local Grapes*** | ***15% Non-local Grapes*** |
|---|---|---|---|
| ***10% Water Reduction*** | -$199,180,593 | -$191,304,849 | -$183,429,105 |
| ***17% Water Reduction*** | -$338,607,009 | -$325,218,243 | -$311,829,478 |
| ***23% Water Reduction*** | -$458,115,365 | -$440,001,153 | -$421,886,941 |

**Table 5** Economic Impact of Lost Wine Grape Production on PR Subbasin Wineries

| | ***5% Non-local Grapes*** | ***10% Non-local Grapes*** | ***15% Non-local Grapes*** |
|---|---|---|---|
| ***10% Water Reduction*** | -$93,740,059 | -$88,806,594 | -$83,873,129 |
| ***17% Water Reduction*** | -$159,358,101 | -$150,971,210 | -$142,584,320 |
| ***23% Water Reduction*** | -$215,602,136 | -$204,255,167 | -$192,908,198 |

# Introduction

Agriculture is an important industry in San Luis Obispo County. A recent study released by the San Luis Obispo Agricultural Commissioner measured agriculture's overall economic contribution at $2.54 billion to the county, when accounting for the multiplier effects (Agricultural Impact Associates 2019). San Luis Obispo is the state's 15th largest agricultural county, with an abundant variety of fruits, vegetables, tree nuts, livestock and horticulture products. The value of agriculture surpassed $1 billion for the first time in 2018.

Even though the county is very diverse with respect to the number of crops grown, over 50% of value originates from two primary crops: wine grapes ($276 million) and strawberries ($268 million). Wine grapes are primarily grown in the North County, though there are several thousand acres in the South County; and strawberries are nearly exclusively grown in the South County (SLO County Agricultural Commissioner 2019).

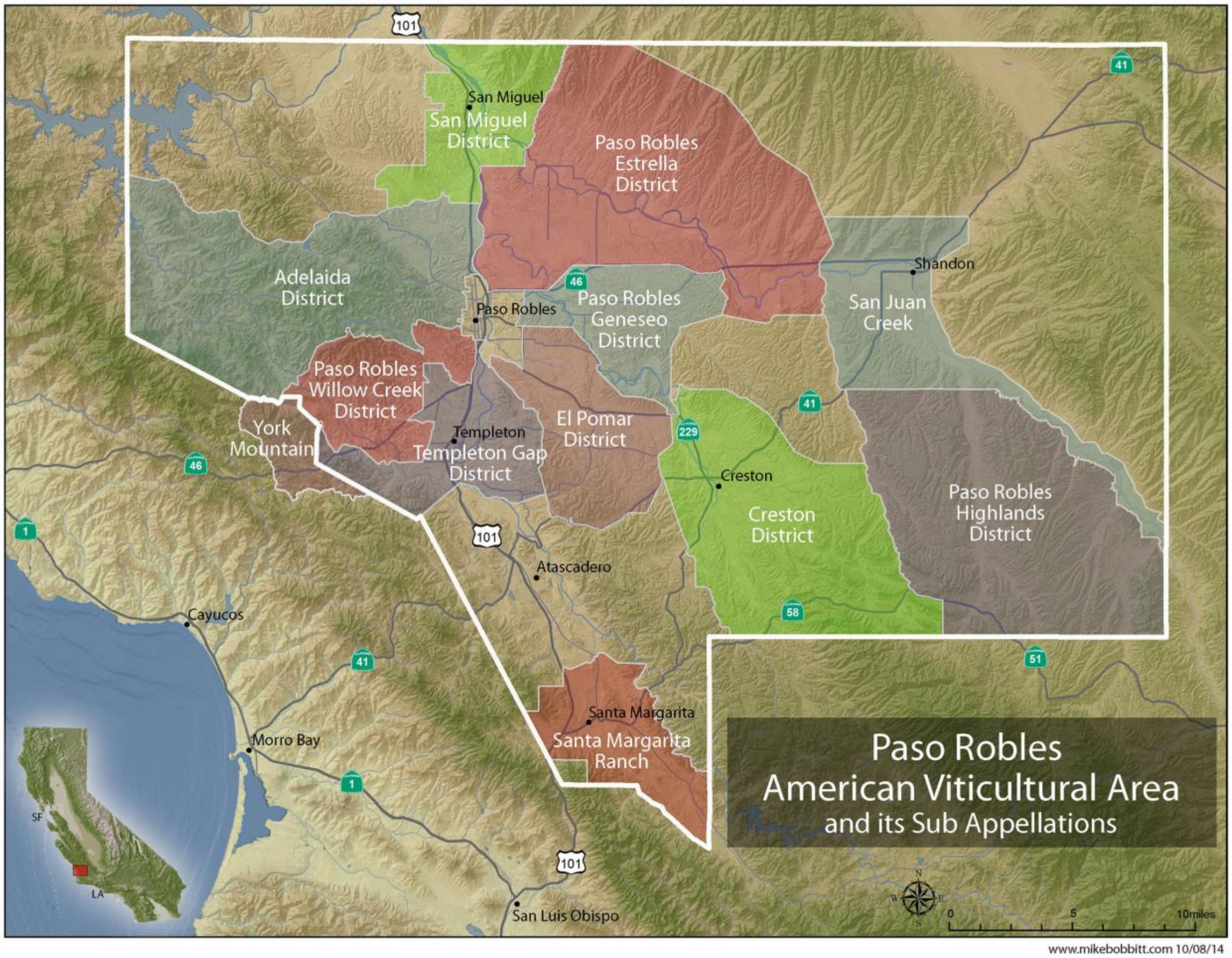
San Luis Obispo County agriculture relies nearly exclusively on precipitation and groundwater supplies. According to the Department of Water Resources, the Central Coast uses the highest proportion of ground water in the state; 84% of the water supply comes from aquifers. The Sustainable Groundwater Management Act of 2014 requires that critically overdrafted groundwater basins reach sustainability by 2040. The Paso Robles Subbasin is classified as critically overdrafted, and local officials must develop plans to either reduce groundwater use, increase groundwater recharge rates, or both, over the next two decades.

Because local irrigated agriculture depends so heavily on groundwater resources, any water reduction is expected to have economic repercussions across the industry. The purpose of this study is to assess the economic impact of potential changes in the agricultural industry as a result of the Paso Robles Subbasin Groundwater Sustainability Plan that may reduce water allocations and/or increase the cost of water in the basin from 2020 – 2040 and beyond.

# Wine and Viticulture Industry in the Paso Robles AVA

A previous economic impact study documented a brief history of the wine and viticulture industry in the Paso Robles American Viticulture Area (PR AVA) (Matthews and Medellin-Azuara, 2015). The PR AVA was first designated in 1983 and is now comprised of about 614,000 acres of land (Figure 1). Over 200 wineries and 37,500 acres of vineyards fall under the PR AVA designation (Paso Robles Wine Country Alliance).

**Figure 1** Map of Paso Robles American Viticulture Area




Source: Paso Robles Wine Country Alliance

The PR AVA is within the California Department of Agriculture's District 8, which is comprised of San Luis Obispo, Santa Barbara and Ventura Counties for the Grape Crush report. Figure 2 shows the change from 2011 to 2018 in the total tons crushed and total value. Figure 3 shows the change in wine grape acreage from 2011 to 2018.

**Figure 2** District 8 Wine Grape Tons Crushed and Total Wine Grape Value

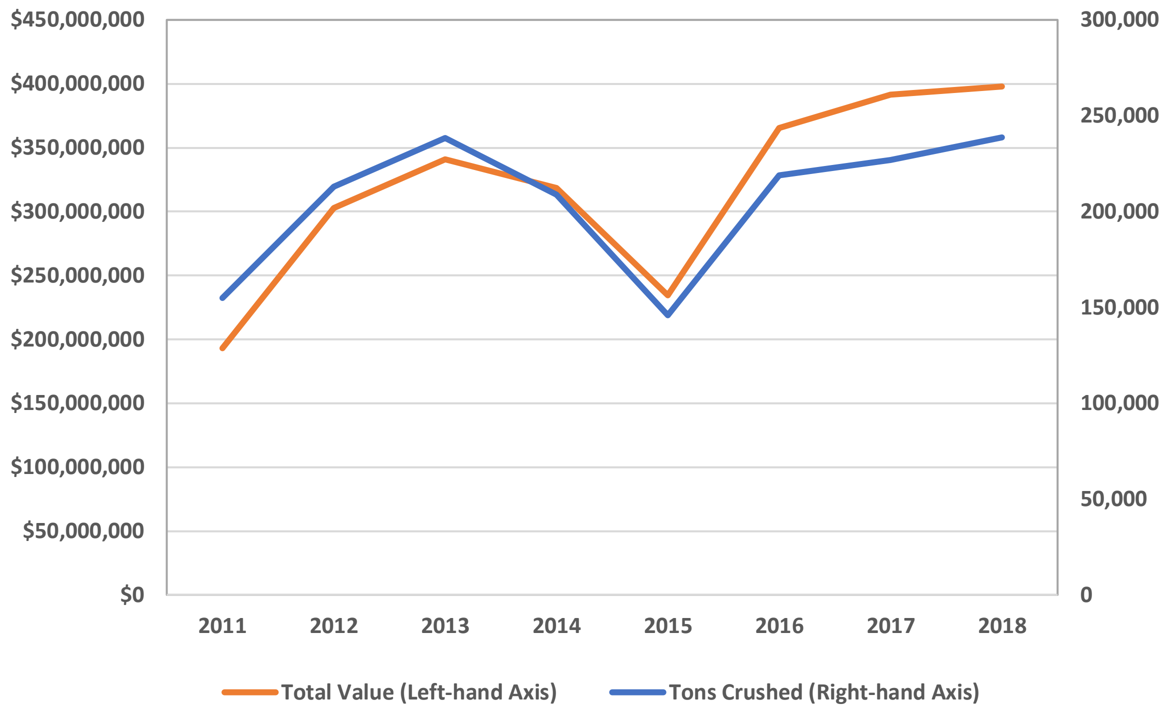
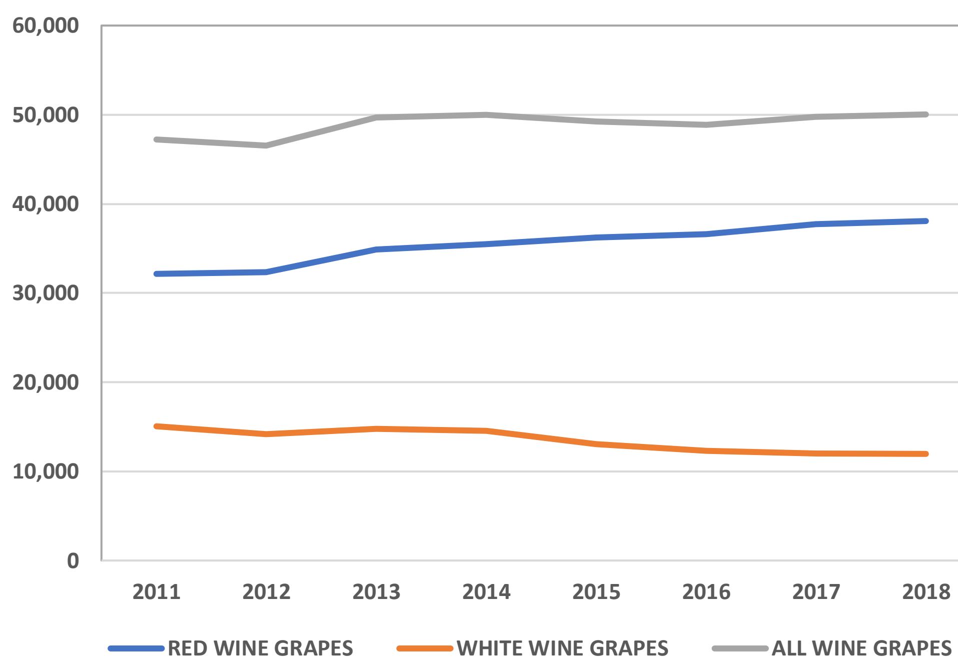



**Figure 3** District 8 Wine Grape Acreage: Red, White and Total, 2011-2018




Source: CDFA Grape Crush Report 2019

Clearly, acreage has grown over the time period, as has the total value of wine grapes produced. As of 2017, San Luis Obispo County had 32,559 acres of bearing grapes, Santa Barbara County had 22,929 acres and Ventura County had 359 acres (CDFA).

It may be helpful to provide context for agriculture's contribution within the greater San Luis Obispo and North County economies. While a detailed description of the economic factors at work in the local economy are beyond the scope of this project, we are able to provide a snapshot of the overall economy as well as the contribution of the wine and viticulture industry to both the PR AVA as well as for San Luis Obispo County using IMPLAN.

IMPLAN is an integrated economic modeling software and data set that provides linkages among economic sectors. We used the 2017 data set for San Luis Obispo County (the most recent available at the start of the project). We created an economic region in the Paso Robles Subbasin by aggregating the nine zip codes therein; IMPLAN data is available at the zip code level. All values have been updated to 2020 values using an inflation factor within IMPLAN.

IMPLAN estimates the multiplier effects of an industry throughout an economy, using direct, indirect and induced impacts which are measured as a dollar value. Direct effects measure the immediate output of an industry and are determined by the inputs that an industry uses. Indirect effects are generated by the primary industries' purchase of goods and services as inputs. Induced effects, also called the wealth effect, measure the impact of consumer incomes that are spent in the economy. These ripple effects are used to quantify the value of outputs, labor income, jobs, and value added before and after changes occur in an industry.

Table 1 shows the total employment across all economic sectors in both the Paso Subbasin as well as the entire economy. Employment is the number of full-time equivalent jobs in all economic sectors; labor income is the value of employee wages, output is the total value of production and value added can be considered the measure of "new" value generated by creating new combinations of purchased inputs into higher value final products. The Paso Subbasin is responsible for about 32% of the total economic value in all of San Luis Obispo County.

**Table 1** Economic Snapshot of Paso Robles Subbasin and San Luis Obispo County, 2020

| **Industry Overview** | **Total** | |
|---|---|---|
| | **PRGWB** | **SLO County** |
| **Employment** | 54,702 | 172,776 |
| **Labor Income** | $2,886,898,652 | $9,067,066,078 |
| **Output** | $8,088,071,216 | $25,833,754,880 |
| **Value Added** | $4,794,184,493 | $15,235,052,085 |

Source: IMPLAN

Table 2 depicts the viticulture and wine industry's economic contribution to the Paso Subbasin and San Luis Obispo County. IMPLAN aggregates grapes into the Fruit and Nut industry, but GIS data files supplied by the SLO County Ag Commissioner showed that in the Paso Subbasin, 99% of the fruit acreage was wine grapes, while countywide wine grapes comprised about 45% of the total fruit acreage. As compared to the entire county, the Paso area vineyards are responsible for almost 50 percent of the county's employment within the fruit sector, and the industry pays 45% of the labor income. These figures do not include supporting industries for agriculture such as chemical and irrigation companies. Vineyards account for 38% of the county's fruit output value, but almost 44% of the value added. The values are much higher when comparing the Paso region as compared to SLO for winery economic impacts. Wineries in Paso are responsible for 81% of the county's winery employment, and 77% of labor income, output and value added attributed to the county wine industry. Wineries in the Paso region contribute over $660 million dollars in total revenue and contribute another $201 million in value-added because of the premium associated with PR AVA wines. In all of SLO County, wineries contribute almost $860 million, and add up to over $1 billion in value when the value-added component is considered. Our county-level findings are consistent those recently released by the 2019 SLO County Ag Commissioner's Crop Report Plus that documents the economic contributions of SLO County agriculture.

**Table 2** Economic Comparison of Paso Region to SLO County Vineyard and Winery Sectors

| Industry Overview | Fruit (Vineyard) | | Winery | |
|---|---|---|---|---|
| | PR Subbasin (99% Grapes) | SLO County (45% Grapes) | PR Subbasin | SLO County |
| **Employment** | 2,565 | 5,148 | 3,035 | 3,756 |
| **Labor Income** | $75,720,709 | $167,175,648 | $114,534,971 | $148,755,301 |
| **Output** | $236,383,300 | $615,051,000 | $662,019,300 | $859,815,000 |
| **Value Added** | $159,178,444 | $364,343,510 | $201,028,921 | $261,091,589 |

Source: Values were estimated by authors by applying input-output multipliers generated in IMPLAN and using input values generated by industry respondents to project questionnaire.

## Data Collection and IMPLAN Modifications

IMPLAN is a very useful tool for economic impact analysis, but the data set and the accompanying economic linkages between industries require modification, particularly when dealing with a high-value and integrated industry such as wine and viticulture. A recent Napa County wine industry economic impact study highlighted several deficiencies with IMPLAN and provided insight on how to correct the problems (Stonebridge 2017). IMPLAN incorporates about a dozen state and federal data sets, including the U.S. Census, the Bureau of Labor Statistics, the Bureau of Economic Analysis and the U.S. Department of Agriculture, among others. However, data regarding agriculture at the federal level is aggregated into categories – for example, wine grapes are classified in the "fruit" category. IMPLAN tends to treat all fruit the same, without recognition of various prices based on AVA classifications, or the value added during processing into wine.

IMPLAN also underestimates the high degree of integration in the wine industry with the local input suppliers that have developed as the wine and viticulture industry have grown in the Paso Robles Region. Mobile bottling units, custom crush facilities and vineyard management companies, among others, have all sprung to life in support of the burgeoning wine industry. IMPLAN also underestimates the linkages between wineries and tourism. It's a unique relationship in the agricultural industry; no other agricultural entity can attract the same level of high-value tourism. Though a thorough analysis of tourism and the region's wine industry is beyond the scope of this project, the impact of tourism will appear in the assessment of various economic factors.

In order to better understand the economic linkages in the wine industry, we updated a questionnaire used in the 2015 study by Matthews and Medellin-Azuara to include water use and tourism questions. Paso Robles Wine Country Alliance sent the survey to its members, both vineyard and wineries. The respondents represented 15% of the grapes grown and wine produced in the PR AVA. We used the findings from the survey to adjust the IMPLAN model to increase the local usage of inputs as appropriate, as well as adjust the values of labor based on higher labor wages in California. We also modified the percentage of local grape usage in the wine industry, which was higher than the IMPLAN model suggested. In addition, we increased the percentage of local demand for PRAVA wines based on survey results.

We also were able to access San Luis Obispo County Agriculture Commissioner data for 2018 at the zip-code level to improve IMPLAN's agricultural database. IMPLAN's data set is generally sufficient for state or county-level analysis, but at the zip code level, it typically misrepresents the distribution of crops and livestock within a county. Since we were interested in the agricultural economy of the Paso Robles Subbasin, we were able to use specific, GIS-level data to appropriately attribute the crop and livestock acreage to the study area zip codes. We also knew whether the crop was produced on cultivated vs. uncultivated land. We assumed that any cultivated cropland was irrigated. Table 3 shows the acreage of crops from the Paso Robles Subbasin area zip codes in 2018. Some of the acreage reported may not be bearing acres, particularly with permanent crops such as trees and vines. The headings in bold are the categories that match IMPLAN, and the items listed underneath the headings are the specific crops from the SLO Ag Commissioner's data that best fit those categories.

**Table 3** Paso Robles Subbasin Agricultural Acreage and Categories

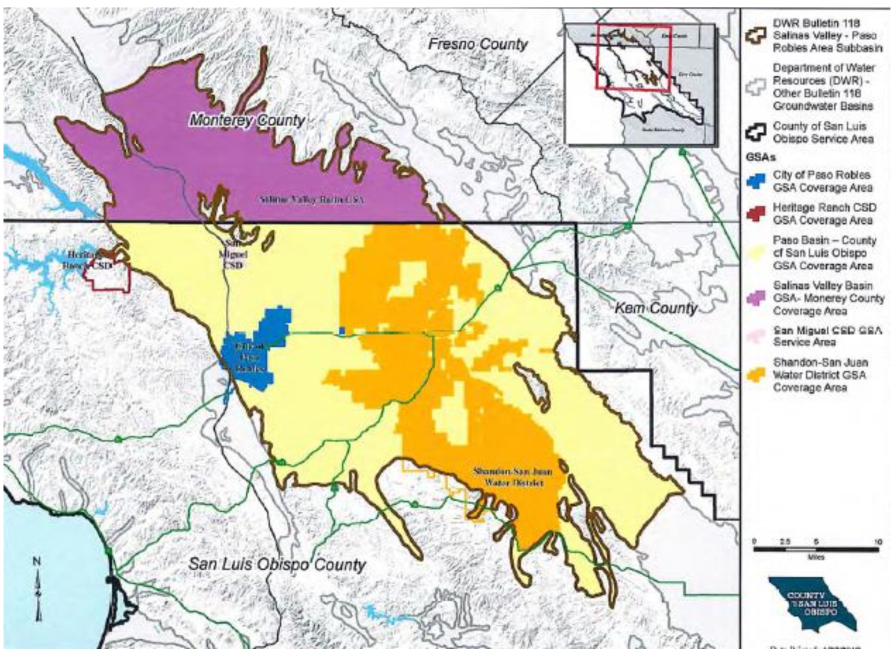
| Agricultural Production Categories | Acres |
|---|---|
| **All other crop farming** | **2,081** |
| Alfalfa | 1,267 |
| Industrial/Unclassified | 814 |
| **Animal production, except cattle and poultry and eggs** | **4** |
| Bees/Livestock | 4 |
| **Beef cattle ranching and farming** | **34,442** |
| Pastureland | 834 |
| Rangeland | 33,608 |
| **Fruit farming** | **37,992** |
| Grape | 37,521 |
| Olive | 383 |
| All other tree fruit | 43 |
| **Grain farming** | **36** |
| Wheat | 36 |
| **Greenhouse, nursery, and floriculture production** | **10** |
| Horticulture | 10 |
| **Landscape and horticultural services** | **716** |
| Landscape | 716 |
| **Tree nut farming** | **698** |
| Almond/Walnut | 62 |
| Pistachio | 637 |
| **Vegetable farming** | **26,253** |
| Field Crops | 26,134 |
| Leafy Greens | 119 |
| **Dairy cattle and milk production** | **23** |
| Forage | 23 |

Source: San Luis Obispo County Agriculture Commissioner 2018

## Overview of SGMA and the GSP in the Paso Basin

The Central Coast (including Monterey, San Luis Obispo, Santa Barbara and Ventura) relies primarily on groundwater for irrigation sources. In the middle of a prolonged drought from 2012 to 2019, the state legislature passed The Sustainable Groundwater Management Act (SGMA) of 2014 which calls for local regulation of groundwater. Of the 515 basins in California, 127 were considered to be medium to high priority, with some high priority basins designated as being in a critical state of overdraft (Bruno 2017). These 127 basins were required to create Groundwater Sustainability Agencies (GSAs) which are tasked with developing Groundwater Sustainability Plans (GSPs). GSAs must develop GSPs by 2022 for high and medium priority subbasins, and by 2020 for high priority subbasins that are in a state of critical groundwater overdraft. Subbasins must be sustainably managed by 2042 for high and medium priority subbasins, and by 2040 for high priority subbasins that are critically overdrafted. Paso Robles Subbasin is considered by the Department of Water Resources to be critically overdrafted. A GSP was submitted to the DWR in January 2020. Figure 4 shows the boundaries of the Paso Robles Subbasin.

**Figure 4** Paso Subbasin Groundwater Sustainability Agency Boundary




Source: San Luis Obispo County Paso Robles Subbasin GSP Appendices

The Paso Robles Subbasin GSP notes that if current pumping rates continue, groundwater storage will decline by nearly 14,000 acre-feet per year. The law requires basin sustainability plans to avoid what are known as the “six sins of SGMA” which are reduced ground water levels, decreased ground water storage, increased sea water intrusion, water quality degradation, land subsidence and depleted surface water supplies.

According to the first annual basin report submitted to DWR by the Paso Robles Subbasin Cooperative Committee, agriculture has drawn an average of 71,900 acre-feet of water out of a total average basin use of 83,533 acre-feet from 2017 – 2019 (GSI Water Solutions, Inc). The GSP calls for reducing groundwater pumping, either via voluntary land fallowing, basin-wide best management practices, or if necessary, mandatory pumping limitations in specific areas. The GSP presents possibilities for a variety of other management actions, including building new infrastructure for surface water projects.

## Impact Scenarios on PR Subbasin Economy from Irrigated Agriculture Reductions

The Paso Robles Subbasin must reach a sustainable level of groundwater use by 2040. Discussions with local agricultural industry, wine and water district representatives led to a decision to analyze scenarios involving 10%, 17% and 23% cutbacks to current water usage in the basin. The acre feet corresponding to those reductions are 7,153 ac/ft, 12,160 ac/ft and 16,452 ac/ft respectively. These percentage reductions are supported by the documentation submitted to the Department of Water Resources. However, because there is no prescription in the GSP for how the water restrictions might occur, we investigated three scenarios in which water reductions are implemented:

a) Low value irrigated crops only (alfalfa and unclassified crops)
b) Percentage reduction evenly spread across all irrigated crops
c) High value crops only (wine grapes and other fruit)

This approach required running the IMPLAN model nine times. The first analysis only deals with the impact based on reductions in agricultural production. We used data from the San Luis Obispo Agricultural Offset Ordinance for guidance on water use for SLO County crops and estimated the water used per crop in the Paso Subbasin. We then reduced the crop acreage and subsequent value of production in each of the three crop categories. Tables 4-6 show these results.

IMPLAN uses multipliers to estimate the economic implications of a change in production in an industry. We present the estimated changes in total output, based on the following three effects measured by IMPLAN, after we customized the dataset and industry linkages.

*Direct effects* measure the impacts on output of the industry in question and is simply measured as price multiplied by quantity of the products produced in an industry. If grape production increases by $5 million, then the direct effect to the region is an additional $5 million.

*Indirect effects* are generated by the primary industries' purchase of goods and services as inputs. For agriculture, this would include purchases of irrigation supplies, management services, chemicals, etc. This is the first ripple, or multiplier effect of an industry

*Induced effects*, also called the wealth effect, measure the impact of consumer incomes that are spent in the economy. For example, when the farm economy is strong and growers are producing more These ripple effects are used to quantify the value of outputs, labor income, jobs, and value added before and after changes occur in an industry.

The values we report here are the sum of the direct, indirect and induced effects on the total value of output for each scenario.[3]

[3] For a more detailed report of the breakdown of these effects for each scenario, please contact the authors.

**Table 4** 10% Reduction in Water, Economic Impact in Paso Robles Subbasin

| | ***Change in Total Output*** | ***Number of Jobs Lost*** |
|---|---|---|
| ***Low Value Crops*** | -$60,119,684 | -459 |
| ***10% Across All Crops*** | -$63,615,961 | -560 |
| ***High Value Crops*** | -$49,541,448 | -519 |

**Table 5** 17% Reduction in Water, Economic Impact in Paso Robles Subbasin

| | ***Change in Total Output*** | ***Number of Jobs Lost*** |
|---|---|---|
| ***Low Value Crops*** | -$95,394,009 | -646 |
| ***17% Across All Crops*** | -$108,147,134 | -953 |
| ***High Value Crops*** | -$84,220,463 | -883 |

**Table 6** 23% Reduction in Water, Economic Impact in Paso Robles Subbasin

| | ***Change in Total Output*** | ***Number of Jobs Lost*** |
|---|---|---|
| ***Low Value Crops*** | -$125,629,144 | -806 |
| ***23% Across All Crops*** | -$146,316,711 | -1,289 |
| ***High Value Crops*** | -$113,945,332 | -1,194 |

The 10% reduction resulted in economic losses of $49.5 to $63.6 million and job losses from 459 to 560, depending on which types of crops lose water resources. The 17% water reduction showed that the PRS would lose $84.2 to $108.1 million in economic output as well as 646 to 953 jobs. The highest water cutbacks, 23%, showed an economic output loss of $113.9 million to $146.3 million and between 806 and 1,289 lost jobs. These are the combined effects not only of the loss of production value, but the lost service and input purchases that growers would use, as well as the lost spending power on consumer goods and services in the economy.

Because low-value crops comprise relatively few acres in the region, all of the alfalfa and unclassified crops were eliminated in each of the low-value crop water scenarios and a portion of the next highest value crops were reduced, which were vegetables and field crops. The scenarios with the highest value loss were those in which all cultivated agriculture was reduced by the respective percentage. Even though some of the types of crops have small acreage (such as tree nuts or landscape/horticulture), they have high value. The wide variety of crops produced in the Paso Subbasin means that growers use many specialized inputs and services to produce their crops; sales would decline for all of those input suppliers. The broad cuts across a wide variety of industries deepens the multiplier effect in the basin. It may also be true that IMPLAN's multipliers for the lower value crops are higher than is warranted for this region. We adjusted fruit and wine-industry related employment and output based on our survey data but did not adapt economic relationships for other commodity areas. When all the water is reduced from the wine grape industry, there is a larger employment impact than when water is reduced from low-value crops. This reflects the higher proportion of labor needed to produce wine grapes and tree fruits.

## Impact Scenarios on Winery and Tourism Economy in the Paso Subbasin

The first round of analysis examined the impact of lost agricultural production on the PR Subbasin's overall economy. In order to estimate the lost value of wine grapes from water reductions on the wine industry and affiliated industries such as tourism, we had to run the models again, this time reducing the value of the wine grapes and measuring the subsequent impact on wineries and related industries. This also required running several different scenarios. Because Paso Robles AVA wines and wine grapes are high quality, they command a price premium (e.g. $1,400/ ton vs $790/ton statewide average (CDFA)). However, to maintain AVA designation, a wine must contain at least 85% of grapes from that AVA. IMPLAN considers local vs. nonlocal inputs to be direct substitutes, which cannot be the case with geographic wine designations. To override IMPLAN's estimation, we only allowed non-local substitution of grapes at three different levels: 5%, 10% and 15%.

We combined the irrigated agriculture reduction scenarios and customized IMPLAN's local input use values so that only 5 to 15% of the lost local grapes could be substituted with grapes from outside the AVA, for a total of 27 model runs. For brevity, we only present the set of scenarios in which all of the water was removed from high value fruit crops, which were primarily wine grapes.[4] The results, shown in Tables 7 and 8 and Figures 5 and 6 show the results in economic impact losses and job losses to the overall PR Subbasin economy as local wine grape losses affect the output of local wineries.

**Table 7** Economic Impact of Lost Wine Grape Production on Wineries and Entire PR Subbasin based on 5, 10 15% non-local grape substitution

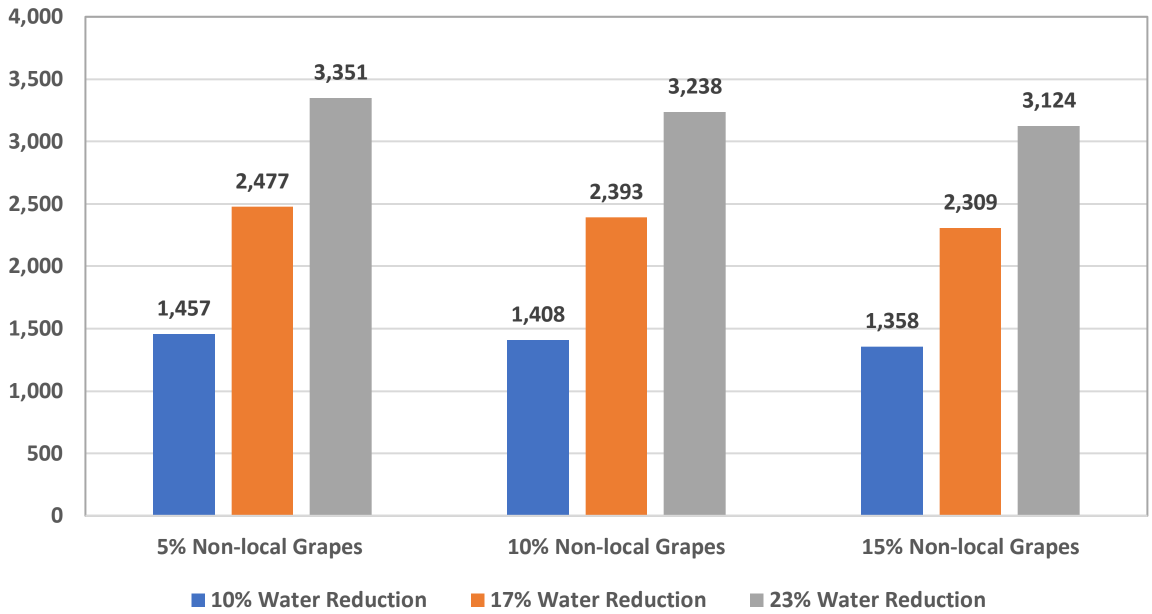
| | ***5% Non-local Grapes*** | ***10% Non-local Grapes*** | ***15% Non-local Grapes*** |
|---|---|---|---|
| ***10% Water Reduction*** | -$199,180,593 | -$191,304,849 | -$183,429,105 |
| ***17% Water Reduction*** | -$338,607,009 | -$325,218,243 | -$311,829,478 |
| ***23% Water Reduction*** | -$458,115,365 | -$440,001,153 | -$421,886,941 |

The results show that the impacts are greatest when only 5% of the local grapes are substituted by non-local grapes. This would result in lower overall production by the wineries, and the higher the water cutbacks, the greater the loss of economic value. If 15% of the lost grape production can be replaced, then the impact isn't as great because wineries can produce closer to their usual output of wine. However, the loss of local grape production means that there are fewer local goods and services being used in vineyards, wineries and related services. In all cases, about 78% of the lost economic value accrues to the wine grape and winery sectors, while the remaining 22% economic losses are borne by agricultural input industries as well as tourism-related industries such as restaurants and hotels. Again, these impacts total the direct, indirect and induced effects across the Paso Subbasin economy.

Measuring the impact on job loss provides another snapshot of the economic impact of water reductions on the greater Paso Subbasin economy. These results are shown in Figure 5.

[4] For a detailed report of the breakdown of each scenario, please contact the authors.

**Figure 5** PR Subbasin Jobs Lost with Water Reduction, PR AVA Grape Substitution



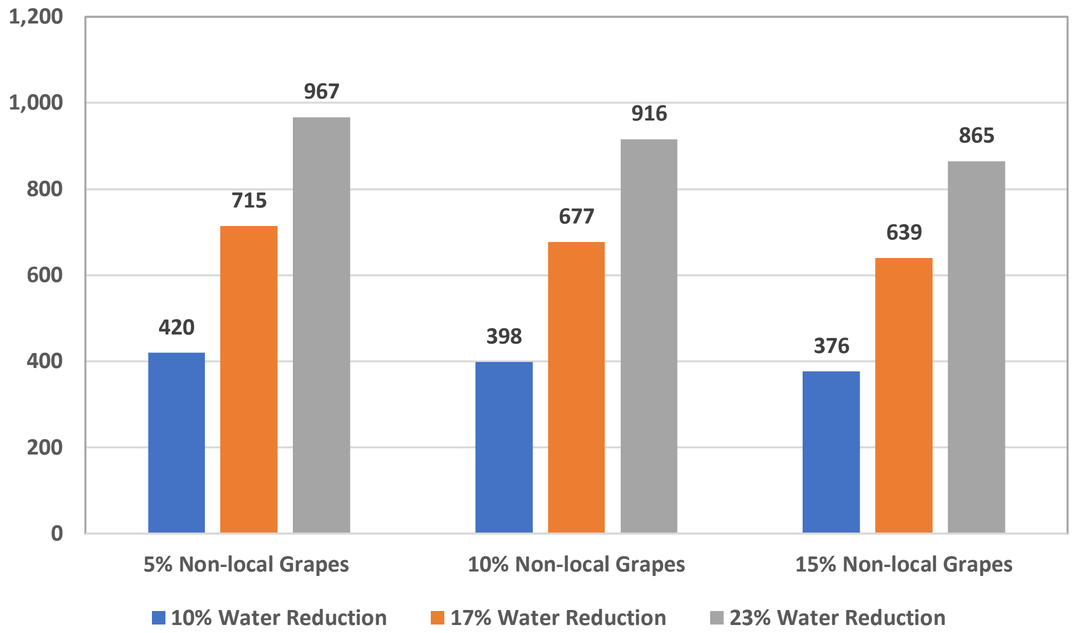

As shown with overall economic impact in Table 7, higher job losses are evident when there is lower substitution of non-local grapes. While wine grape demand is considered elastic, that is, grapes between growing regions are easily substituted based on price, up to the AVA 15% restriction (Fuller and Alston, 2012), if less non-local grapes are available to make up the shortfall in PR AVA wine grape production, winery output will fall.  The jobs are primarily lost in the wineries, wine grape production, agricultural and winery support industries, and tourism-related industries.  Table 8 and Figure 6 show the impacts particular to the wine industry in the Paso Robles Subbasin.

**Table 8** Economic Impact of Lost Wine Grape Production on PR Subbasin Wineries

| | ***5% Non-local Grapes*** | ***10% Non-local Grapes*** | ***15% Non-local Grapes*** |
|---|---|---|---|
| ***10% Water Reduction*** | -$93,740,059 | -$88,806,594 | -$83,873,129 |
| ***17% Water Reduction*** | -$159,358,101 | -$150,971,210 | -$142,584,320 |
| ***23% Water Reduction*** | -$215,602,136 | -$204,255,167 | -$192,908,198 |

The impacts depicted in Table 8 are nearly all direct effects, that is, the lost value of the grape production translates into lost winery output of $93.7 to $215.6 million when only 5% of non-local grapes can be substituted, and $83.8 million to $192.9 million in lost value if more grapes can be used from outside of the area.  Thus, the losses to PR AVA wineries comprise about 47% of the total economic decline in the Paso Robles Subbasin region.

**Figure 6** PR AVA Winery Jobs Lost with Water Reduction, PR AVA Grape Substitution




Job losses from wineries are estimated to range from 376 to 967, depending on the proportion of water reduced and the level of non-local grapes used to make PR AVA wines (Figure 6). The jobs are nearly all lost directly from the wineries.

## Summary/Conclusions

The economy of the Paso Robles Subbasin has become heavily dependent on irrigated agriculture for local livelihoods. High value crops such as wine grapes, fruit and nut trees, as well as vegetables and field crops provide jobs and income not only for the growers and employees who work for the agricultural operations, but for the agricultural support industries such as seed, chemical and equipment suppliers; accounting, legal and management services, as well as the agricultural lending industry, among many others. The wine industry is heavily developed, with over 200 wineries in the study area, up from five when the PR AVA was established in 1983. Over the past 25 years, the Paso area has gained fame as a wine tourism destination, serviced by high-end hotels, restaurants and wine tourism businesses.

The Paso Robles Subbasin, classified as a critically overdrafted groundwater basin, must reach sustainability by 2040. The Groundwater Sustainability Plan submitted to the state Department of Water Resources notes that if water use and precipitation patterns continue, the basin will be in overdraft by 14,000 acre-feet annually, which is about 17% of the total draw from the basin, based on hydrologists' reports. Groundwater is the only source of irrigation water for agriculture in the PRS; surface water availability is minimal and is contracted for municipal use.

The GSP does not call for specific management practices to reduce water use; it relies on best management practices and voluntary fallowing of land before introducing potential managed water reductions. In lieu of specific policy prescriptions, we estimated water reductions of 10%, 17% and 23% on various types of agriculture. Our analysis shows a range of lost economic value from $49.5 million and 459 jobs lost to $146.3 million and 1,289 jobs lost, depending on the water reduction. When considering the loss to economy based on losses to production agriculture, the scenarios in which water is reduced evenly across all agricultural production shows the most significant impact. Because agriculture is so varied in the subbasin, every producer would lose income and all agricultural input suppliers and service providers would lose sales, which would cause reduced spending throughout the economy.

Because the wine grape industry is very integrated with all wineries using a large proportion of local grapes, we also analyzed the impact of lost fruit production on wineries in the Paso Subbasin, which is approximately the same region as the Paso Robles AVA. For each water reduction of 10%, 17% and 23%, we estimated what would happen if the PR AVA had to substitute non-local grapes to continue to produce PR AVA wine. All AVA designated wine must contain at least 85% grapes from that AVA. We estimated the impact if wineries could only substitute 5%, 10% or 15% non-local grapes to make up for the shortage in locally produced fruit.

The economic losses were even more significant, resulting in $83.8 million to $215.6 million in lost output value to PR AVA wineries, and $183.4 million to $458 million loss on the overall economy. The latter economic impact includes service providers to the agricultural and wine industries, as well as the lost value of tourism dollars. Job losses are estimated at 376 to 967 in the wine industry alone, and that expands to 1,358 to 3,351 across the PR Subbasin economy, because of the lost grower, wine producer and consumer sales and expenditures.

To provide perspective for these job losses, in Table 2 we provided a snapshot of the entire economy for both the Paso Subbasin and San Luis Obispo County vineyard and winery employment and total economic output. The analysis provided here indicates that between 12% to 32% of the total economic value and jobs could be lost in the Paso Subbasin wine industry, and between 10% to 26% of all SLO County winery economic output and jobs. In terms of lost economic value to the overall agricultural economy, both our analysis and an independent study commissioned by the SLO County Agricultural Commissioner's office show that the SLO County wineries contribute almost $860 million to the overall SLO County economy. Our analysis shows that between 21% and 53% of the total value of output could be lost from SLO County's wine industry should water cutbacks occur. Irrigated agriculture overall will also have significant losses, with an estimated 4% to 11% decline in the total value of SLO County production agriculture.

This study is intended to provide an overview of potential economic impacts that may result from reductions to groundwater use for irrigated agriculture. The economic implications of water reductions are sizable and would cause a restructuring of the local business environment. This analysis may provide impetus for local officials to pursue alternatives for additional water supplies and find creative solutions to pursue groundwater sustainability in the Paso Robles Subbasin.

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APPENDIX J

# Installation Reports for Monitoring Wells and Stream Gages

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# MONITORING WELL CONSTRUCTION COMPLETION REPORT

# PASO ROBLES SUPPLEMENTAL ENVIRONMENTAL PROJECT

# PASO ROBLES AREA GROUNDWATER SUBBASIN SAN LUIS OBISPO COUNTY CALIFORNIA

June 2021

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San Luis Obispo, California 93401

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## 1.0 INTRODUCTION

In accordance with the approved scope of work for the City's Supplemental Environmental Project to Install Monitoring Wells and Stream Gages on the Salinas River and Major Tributaries within the Paso Robles Groundwater Basin, and consistent with the Groundwater Sustainability Plan (GSP) adopted by the Groundwater Sustainability Agencies (GSAs) for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin[1], four monitoring wells (two wells at each of two sites) have been constructed to help fill a data gap with respect to the interaction between surface water and groundwater in the basin. This report summarizes the drilling and construction activities of these four wells performed under the Paso Robles Supplemental Environmental Project (SEP).

## 2.0 BACKGROUND

The Paso Robles Area Groundwater Subbasin GSP identified a need to expand the network of stream gages and monitoring wells within alluvial deposits associated with the major drainages in the Subbasin. Per the recommendations set forth in the GSP, "*Definitive data delineating any interactions between surface water and groundwater or a lack of interconnected surface waters is a data gap that will be addressed during implementation of this GSP*".

The SEP has expanded the network of both stream gages and adjacent monitoring wells in order to better assess the potential for interconnected surface water and groundwater across the Subbasin. Long-term plans included a minimum of three monitoring wells (paired or nested) at each existing and future stream gage site in the Subbasin[2]. A total of 10 potential sites were identified. One well would be completed within the alluvial aquifer, one completed a short distance below the base of the alluvial aquifer into the Paso Robles Formation, and, where applicable, at least one to be completed deeper into the Paso Robles Formation at elevations similar to production wells in the general vicinity of each individual site.

Prior to implementation of the SEP, there were two existing stream gages, one on the Salinas River at the 13th Street Bridge in the City of Paso Robles (City), and the other on the Estrella River at Airport Road in the unincorporated County area (Figure 1). The monitoring wells installed as part of the SEP were placed in the vicinity of these two stream gage sites to provide the interconnected surface water evaluation capability that would help fill the data gaps.

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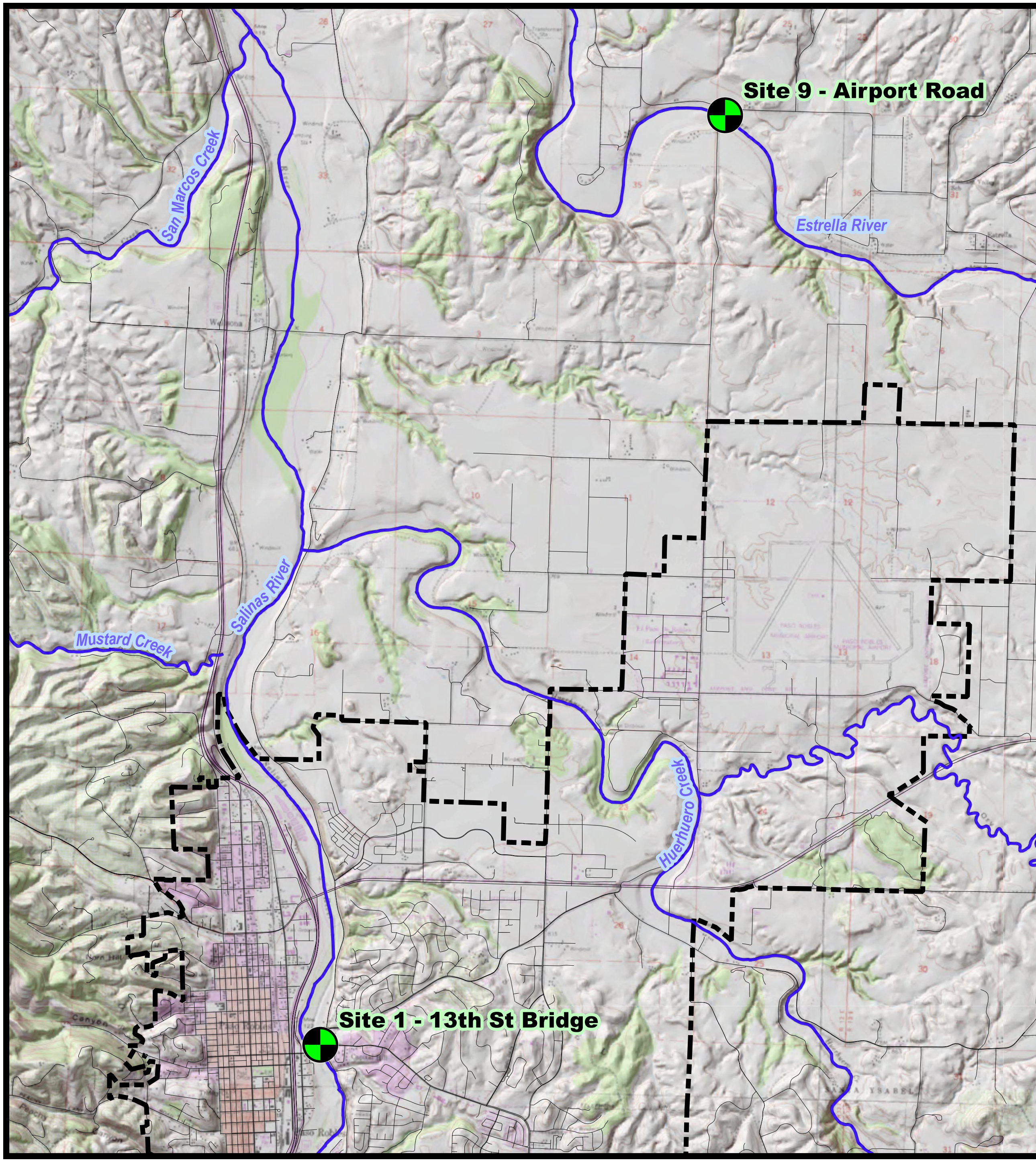
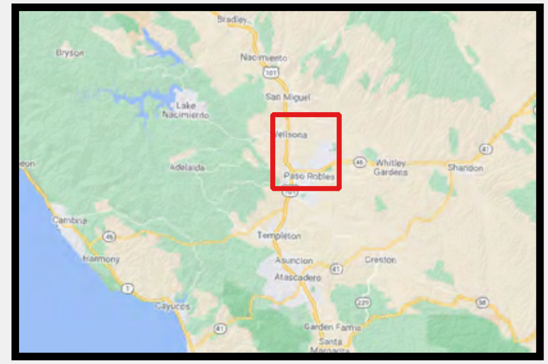
1 Montgomery & Associates, 2020, Paso Robles Subbasin Groundwater Sustainability Plan dated January 31, 2020.
2 SEP Grant Proposal *in* City of Paso Robles Request for Proposal dated April 7, 2020.



**Explanation**

Paso Robles City Limits

Monitoring Well Site

0 1 2 mi

N

**Figure 1**
**Site Overview**

**Monitoring Well Construction Report**

**Paso Robles Groundwater Basin Supplemental Environmental Project**

**City of Paso Robles**

**Cleath-Harris Geologists**

## 3.0 DRILLING METHODS AND DESIGN CONSIDERATIONS

Well siting and preliminary designs were described in a prior Work Plan[3]. For siting and design purposes, SEP monitoring wells were classified as Shallow, Intermediate, or Deep. Shallow wells would be used to monitor water levels and water quality in the alluvial deposits, Intermediate wells are those completed in the Paso Robles Formation aquifers immediately below the alluvial deposits, and Deep wells are those completed at greater depth in the Paso Robles Formation aquifers used locally for water supply. A Shallow and Intermediate well have been constructed at each of the two existing stream gage sites. A Deep well was not recommended at Site 1 (13th Street Bridge) due to the geothermal potential at depths below the Intermediate well. A deeper well at this location would not benefit investigating potentially interconnected surface waters. Construction of a Deep well at the Airport Road site, or identification of an existing Deep well that could be formally monitored by the GSAs, is recommended for a subsequent SEP phase. A Deep well could not be constructed at the Airport Road site due to SEP funding limitations.

The Shallow (alluvial) wells were constructed using hollow stem auger (HSA) drilling, while the Intermediate wells were constructed using sonic drilling. HSA requires less space than other methods, which was important at the 13th Street Bridge Shallow well site. Sonic has greater depth capability than HSA, and was better suited for the Intermediate wells. Both methods avoid the use of drilling mud and provide useful depth to water information during drilling. Deep wells would have been beyond the depth capacity of either method. Wellhead completions consisted of a 12-inch diameter, traffic-rated and water-tight monitoring well box with cement apron.

## 4.0 MONITORING WELL SITES

Monitoring wells are near the existing stream gages on the Salinas River (Site 1) and the Estrella River (Site 9), as shown Figure 1. The site numbers originate from a list of 10 sites that were previously identified as locations where stream gage and monitoring well pairs would help fill the data gap related to surface water and groundwater interaction in the subbasin[4]. Brief descriptions of the hydrogeologic setting are presented below.

### 4.1 Site 1 – City of Paso Robles 13th Street Bridge

The 13th Street Bridge in the City of Paso Robles is near the eastern edge of the Subbasin and within an area of geothermal (hot water) resource potential. Geologic cross-sections from DWR[5],

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[3]CHG, 2020, Monitoring Well Siting Work Plan dated November 10, 2020

[4]Monsoon Consultants, 2019. Figure 1 - Paso Robles Groundwater Basin - Proposed Monitoring Sites, Paso Robles GSP Data Gap Assessment dated September 6, 2019.

[5]DWR, 1981, Water Quality on the Paso Robles Are, Southern District Memorandum Report, June 1981.

along with Subbasin GSP Figure 4-2 (Base of Subbasin as Defined by the Base of the Paso Robles Formation) indicate the Subbasin is several hundred feet thick beneath the 13th Street Bridge, although reference logs of test borings at the bridge site appear to document hard shale immediately beneath the alluvial deposits. A drillers log from a well (26S/12E-33B1) at the old City yard on the east side of the bridge reported mostly shale beginning at 60 feet depth through 400 feet depth, with 1 gallon per minute (gpm) of artesian flow ("sulphurous water"). Several hot water wells are reported within a few thousand feet southwest of the bridge, the closest of which (26S/12E-33F) reported an artesian flow of 347 gpm with a surface temperature of 105 degrees Fahrenheit (well depth was 230 feet)[6]. A geothermal survey also showed higher than normal soil-air temperatures on the west side of the 13th Street Bridge[7]. Historical well records indicate shallow (alluvial) wells along North River Road near the 13th Street Bridge, with Paso Robles Formation logged in wells along Union Road (formerly Paso Robles Boulevard) to the east and Niblick Road to the southeast.

Considering the above indications of shallow bedrock at Site 1 and geothermal activity west and southwest of the bridge, only two monitoring wells were proposed, a Shallow and Intermediate well. Deep well construction is not recommended at this site given the geothermal resource potential.

Two SEP monitoring wells were completed at Site 1, a Shallow well and an Intermediate well. The Shallow well is located on City property alongside the San Juan Bautista bike trail, on the East bank of the Salinas River near the 13th Street Bridge (Figure 2). Ground elevation is approximately 695 feet above sea level. The target aquifer for this well was the alluvium of the Salinas River. Due to the limited access for drilling along the bike path (only HSA drilling was feasible), the Intermediate well was completed on City property northeast of the intersection of Creston and River Roads (Figure 2). Ground elevation is approximately 723 feet above sea level, and the target aquifer was the upper Paso Robles Formation.

## 4.2 Site 9 – Airport Road at Estrella Road

The Airport Road sites are immediately east of a paved crossing of the Estrella River approximately 5 miles north of the intersection of Airport Road and Highway 46, and 3 miles north of the Paso Robles Municipal Airport. Geologic cross-sections from Fugro[8], along with Subbasin GSP Figure 4-2 (Base of Subbasin as Defined by the Base of the Paso Robles Formation) and an oil well log in the vicinity (3,000 feet south of crossing) indicate the Subbasin is 1,800-2,700 feet

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[6]California Division of Mines and Geology, 1983, Resource investigation of Low- and Moderate-Temperature Geothermal Areas in Paso Robles, California, Open File Report 83-11.
[7]GSI/Water, 1983, Geothermal Resource Assessment of the Paso Robles Area, September 1983.
[8]Fugro West and Cleath & Associates, 2002, Paso Robles Groundwater Basin Study, August 2002.



**Explanation**

Well Locations

0 60 120 180 ft

N

**Figure 2**
**Well Site Locations**
**Site 1 - 13th Street Bridge**

**Monitoring Well Construction Report**

**Paso Robles Groundwater Basin**
**Supplemental Environmental Project**

**City of Paso Robles**

**Cleath-Harris Geologists**

thick beneath the site vicinity. Wells in the site vicinity are up to 890 feet deep and tap aquifers in both the Intermediate and Deep zones targeted for monitoring.

Two monitoring wells have been completed at Site 9, a Shallow well and an Intermediate well. The two wells are located within an easement for City use on Hammond Vineyards property on the north side of the Estrella River (Figure 3). As previously mentioned, the Deep well has been deferred for completion under another project phase.

The Shallow and Intermediate wells are located adjacent to the Estrella River (Figure 3). Ground elevation is approximately 681 feet above sea level. The target aquifer for the Shallow well was the alluvium of the Estrella River. The Intermediate well is approximately 80 feet to the northeast of the Shallow well (Figure 3), with the target aquifer being the upper Paso Robles Formation.

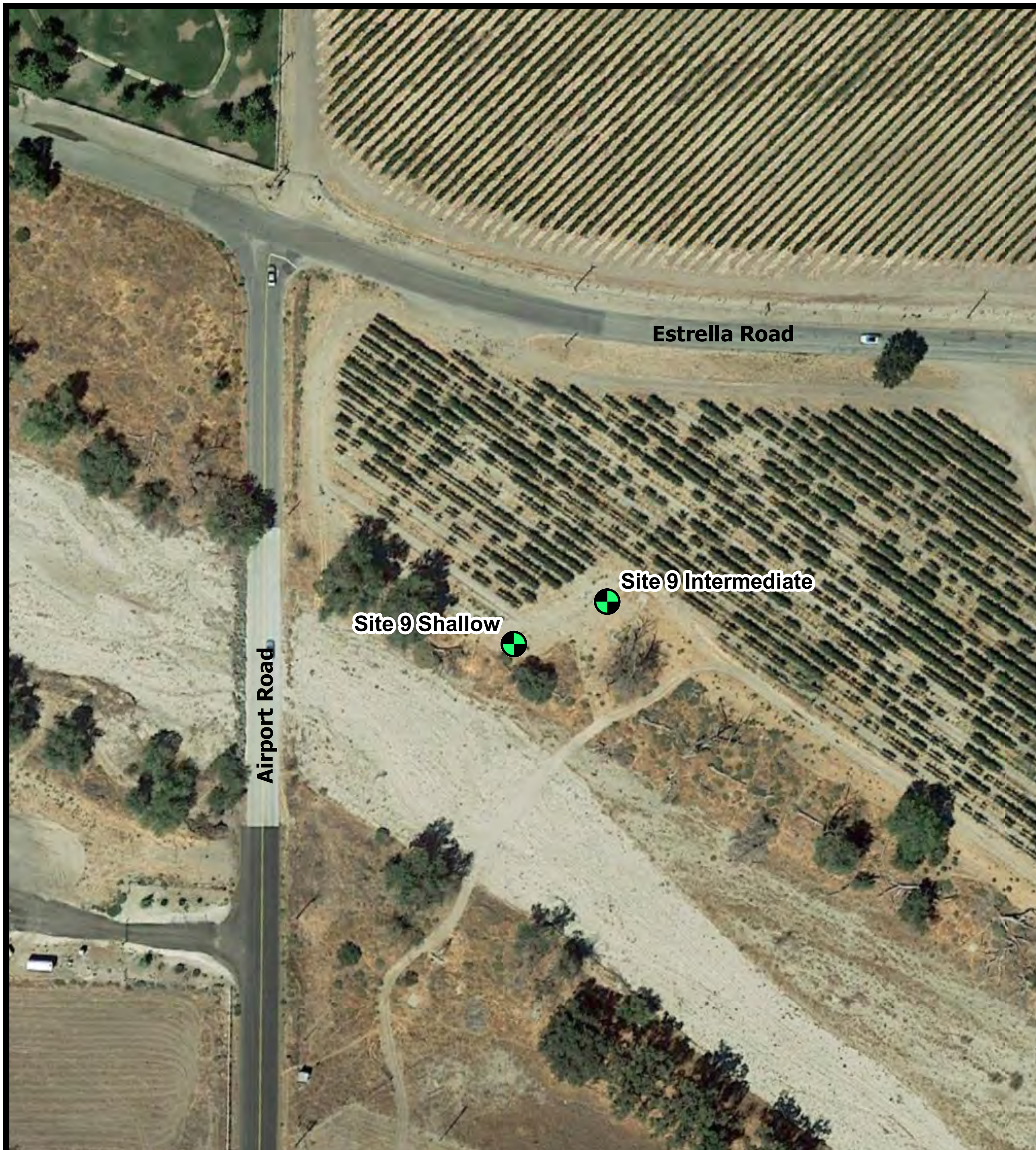
## 5.0 CONSTRUCTION SUMMARIES

The Shallow wells were completed by S/G Drilling on December 7 and 14, 2020, at Site 1 (13th Street Bridge) and on March 23-24 at Site 9 (Airport Road). The Intermediate wells were completed by ABC Liovin Drilling on March 15-18 at Site 1 and March 18-20 at Site 9. All four wells were cased with 4-inch Schedule 40 PVC and set within 12-inch monitoring well vaults at ground surface.

Construction summaries of the wells are provided in Table 1. Well Completion Reports, lithologic logs, and construction diagrams are presented in the Appendix.

Based on the results of SEP drilling, the Salinas River alluvium is interpreted to extend to a depth of 53 feet at the 13th Street Bridge Shallow well site, and is underlain by Paso Robles Formation clay (not hard shale). The Shallow well was completed to a depth of 55 feet. Drilling at the 13th Street Bridge Intermediate well site penetrated Paso Robles Formation sediments, and was completed to a depth of 140 feet. When adjusted for surface elevation, the Intermediate well taps the upper Paso Robles Formation beginning at an elevation of approximately 30 feet below the base of the Salinas River alluvium. The groundwater elevations are similar between the Shallow and Intermediate wells (Table 1).

Based on the results of SEP drilling, the Estrella River alluvium is interpreted to extend to a depth of 30-34 feet at the Airport Road Shallow and Intermediate well sites, and is underlain by Paso Robles Formation sands, clays, and gravels. The Shallow well was completed to a depth of 40 feet, while the Intermediate well was completed to a depth of 240 feet. Groundwater elevations are substantially different between the alluvium and upper Paso Robles Formation aquifers, with the water level in the Paso Robles Formation 158 feet deeper than the alluvial water level (Table 1).





Explanation

Well Locations

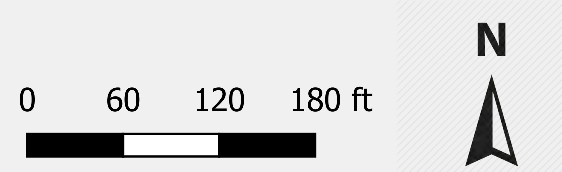



**Figure 3**
**Well Site Locations**
**Site 9 - Airport and Estrella**

**Monitoring Well Construction Report**

**Paso Robles Groundwater Basin**
**Supplemental Environmental Project**

**City of Paso Robles**

**Cleath-Harris Geologists**

**Table 1**
**Monitoring Well Construction Summaries**

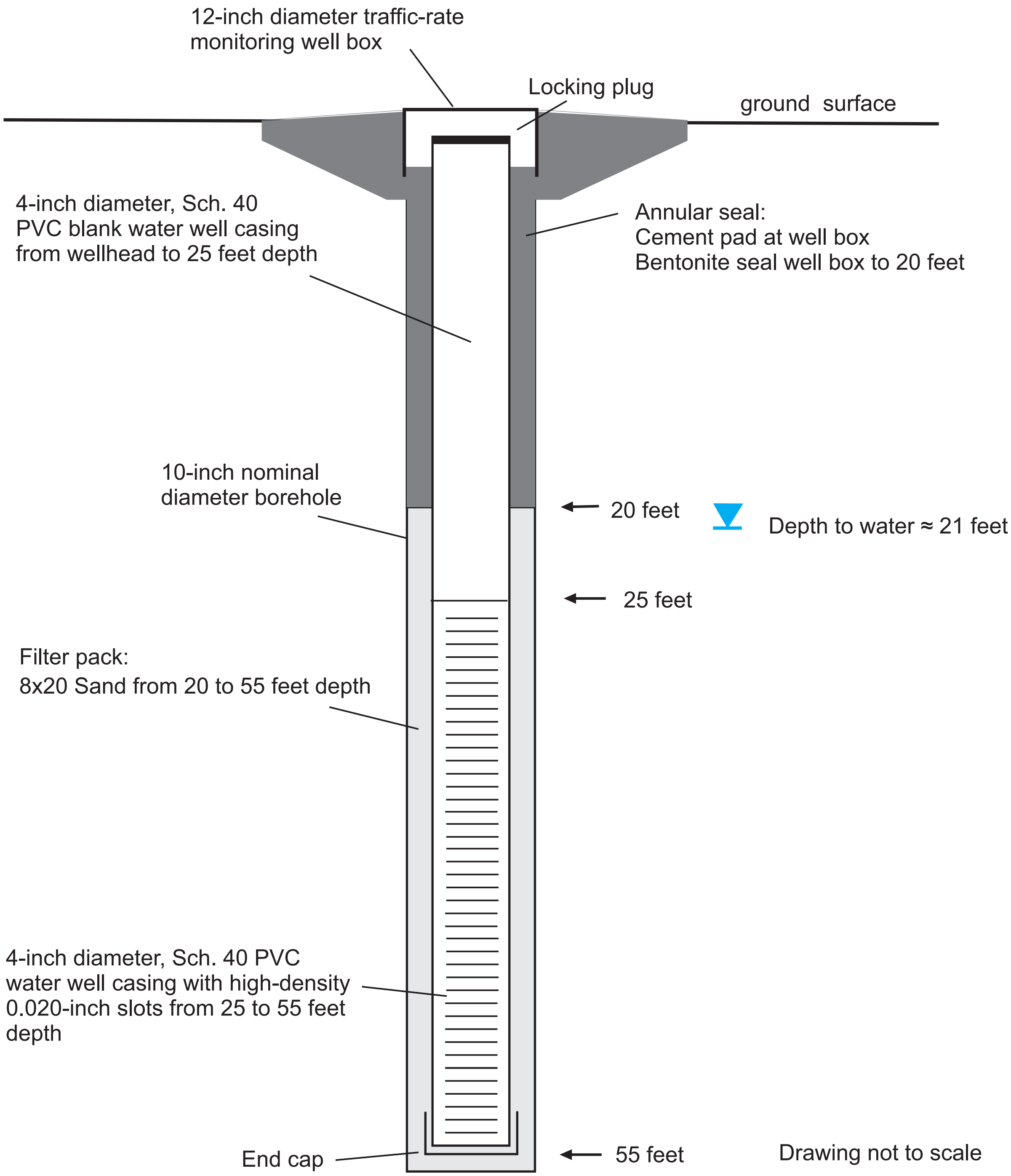
| **Description** | **Site 1 – 13th Street Bridge** | | **Site 9 – Airport Road** | |
|---|---|---|---|---|
| | Shallow | Intermediate | Shallow | Intermediate |
| Approx. Site elevation (ft msl) | 695 | 723 | 681 | 681 |
| Test hole depth (ft) | 65 | 146 | 42.5 | 240 |
| Test hole diameter (in) | 8 | 8.5 | 8 | 8.5 |
| Well depth (ft) | 55 | 140 | 40 | 240 |
| Final borehole diameter (in) | 10 | 8.5 | 10 | 8.5 |
| Casing diameter (in) | 4 | 4 | 4 | 4 |
| Casing material | Sch 40 PVC | Sch 40 PVC | Sch 40 PVC | Sch 40 PVC |
| Filter pack | 8x20 sand | 8x20 sand | 8x20 sand | 8x20 sand |
| Seal depths (ft) | 0-20 | 0-100 | 0-23, 41-42.5 | 0-190 |
| Perforations (ft) | 25-55 | 110-140 | 25-40 | 200-240 |
| Slot size (in) | 0.020 | 0.020 | 0.020 | 0.020 |
| Wellhead completion | 12-inch vault | 12-inch vault | 12-inch vault | 12-inch vault |
| Water level measurement date | 3/23/21 | 3/24/21 | 3/24/21 | 3/23/21 |
| Depth to water (ft) | 17.8 | 43.7 | 29.5 | 187.6 |
| Groundwater elevation (ft msl) | 677 | 679 | 652 | 493 |

Notes: ft msl = feet above mean sea level; ft = feet; in = inches. **All elevations approximate**.

# APPENDIX

**Final Design Diagrams**
**Well Completion Reports**
**Lithologic Logs**

*Site 1 – 13th Street Bridge Shallow*




Shallow Well Final Design
Site 1 - 13th Street Bridge
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

State of California

# Well Completion Report

**Form DWR 188 Submitted 2/11/2021**

**WCR2021-001910**

Owner's Well Number: MW-1 | Date Work Began: 12/07/2020 | Date Work Ended: 12/14/2020

Local Permit Agency: San Luis Obispo County Environmental Health Services

Secondary Permit Agency: | Permit Number: 2020-087 | Permit Date: 11/25/2020

## Well Owner (must remain confidential pursuant to Water Code 13752)

Name: CITY OF PASO ROBLES,

Mailing Address: 1000 Spring Street

City: Paso Robles | State: Ca | Zip: 93446

## Planned Use and Activity

Activity: New Well

Planned Use: Monitoring

## Well Location

Address: 0 13th ST

City: Paso Robles | Zip: 93446 | County: San Luis Obispo

Latitude: 35 Deg. 37 Min. 41.9879 Sec. N | Longitude: -120 Deg. 41 Min. 1.5575 Sec. W

Dec. Lat.: 35.62833 | Dec. Long.: -120.683766

Vertical Datum: | Horizontal Datum: WGS84

Location Accuracy: | Location Determination Method:

APN: 009511001

Township: 26 S

Range: 12 E

Section: 33

Baseline Meridian: Mount Diablo

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

## Borehole Information

Orientation: Vertical | Specify:

Drilling Method: Auger | Drilling Fluid: None

Total Depth of Boring: 65 Feet

Total Depth of Completed Well: 55 Feet

## Water Level and Yield of Completed Well

Depth to first water: (Feet below surface)

Depth to Static Water Level: (Feet) | Date Measured:

Estimated Yield*: (GPM) | Test Type:

Test Length: (Hours) | Total Drawdown: (feet)

*May not be representative of a well's long term yield.

## Geologic Log - Free Form

| Depth from Surface Feet to Feet | | Description |
|---|---|---|
| 0 | 15 | Sand |
| 15 | 35 | Sand With Gravel |
| 35 | 53 | Sand and Gravel |
| 53 | 65 | Clay |

## Casings

| Casing # | Depth from Surface Feet to Feet | | Casing Type | Material | Casings Specificatons | Wall Thickness (inches) | Outside Diameter (inches) | Screen Type | Slot Size if any (inches) | Description |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 25 | Blank | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | | | |
| 1 | 25 | 55 | Screen | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | Milled Slots | 0.02 | |

## Annular Material

| Depth from Surface Feet to Feet | | Fill | Fill Type Details | Filter Pack Size | Description |
|---|---|---|---|---|---|
| 0 | 20 | Bentonite | Other Bentonite | | |
| 20 | 55 | Filter Pack | 8 x 20 | | |

**Other Observations:**

## Borehole Specifications

| Depth from Surface Feet to Feet | | Borehole Diameter (inches) |
|---|---|---|
| 0 | 65 | 8 |

## Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name S/G TESTING LABORATORIES INC
Person, Firm or Corporation

308 NORTH 1ST STREET — Address
LOMPOC — City
CA — State
93436 — Zip

Signed *electronic signature received* — C-57 Licensed Water Well Contractor
02/11/2021 — Date Signed
611394 — C-57 License Number

## Attachments

Well Contruction.pdf - Well Construction Diagram

2020-087.pdf - Permit

Well log.pdf - Geologic Log

## DWR Use Only

| CSG # | State Well Number | Site Code | Local Well Number |
|---|---|---|---|
| | | | |

N — Latitude Deg/Min/Sec

W — Longitude Deg/Min/Sec

TRS:

APN:

# 13th STREET BRIDGE MONITORING WELL
# SUPPLEMENTAL ENVIRONMENTAL PROJECT
# CITY OF PASO ROBLES

Date: December 7, 2020
Location: Southeast side of 13th Street Bridge over the Salinas River in Paso Robles, California
Elevation: Approximately 695 feet above mean sea level (based on topographic map)
Latitude: 35.628344°; Longitude: 120.683822°
Geologist: Andrea Berge
Drilling company: S/G Drilling, Inc.
Drilling method: Hollow stem auger
Pilot Hole diameter: 8.25 inches

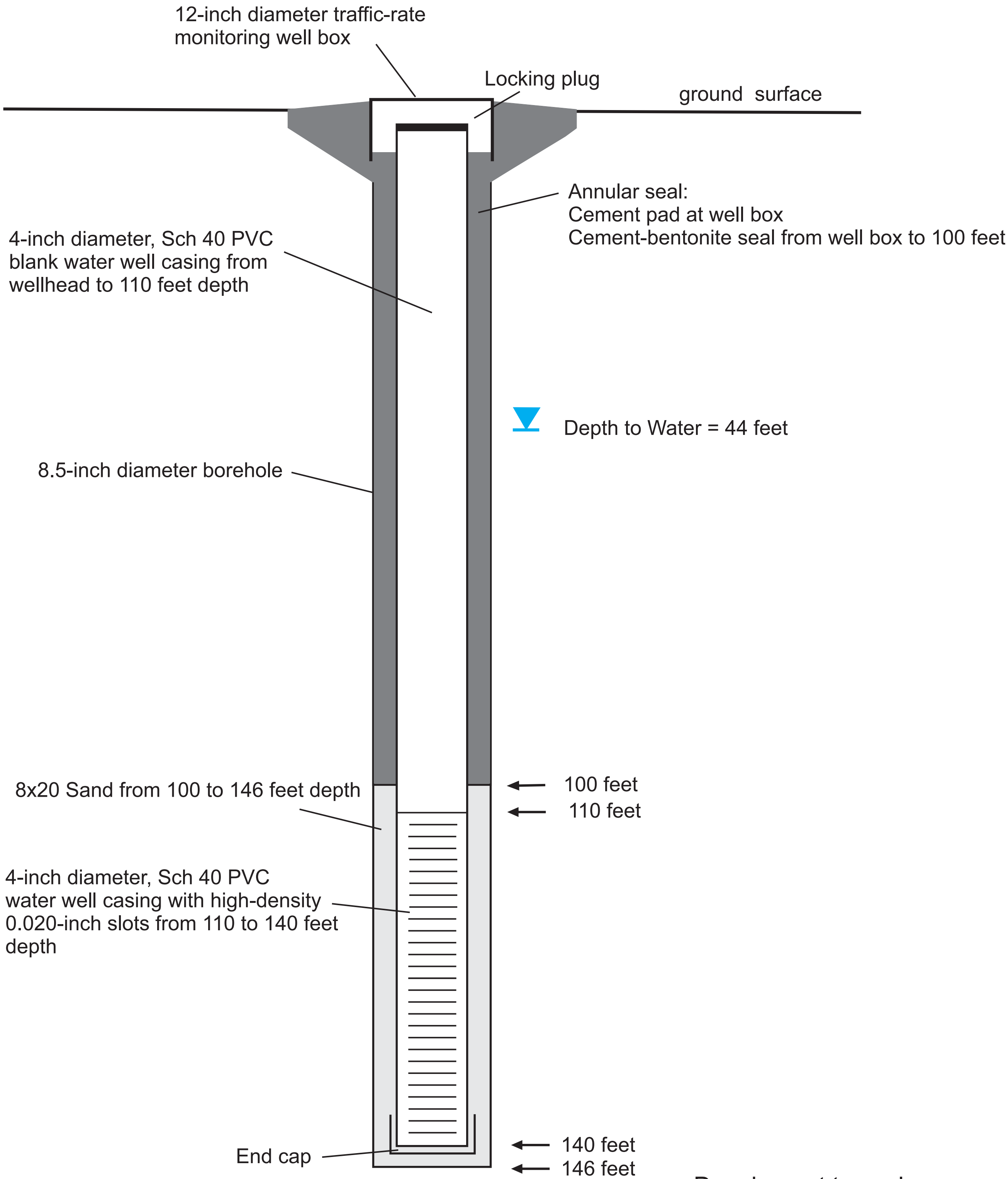
Total depth: 65 feet

**Lithologic Log**
Depth to top and bottom in feet

| Top | Bottom | Thickness | Description |
|---|---|---|---|
| 0 | 15 | 15 | **Sand**, trace clay; light brown to reddish brown; mostly fine. |
| 15 | 35 | 20 | **Sand with Gravel,** trace clay**;** medium brown; fine to coarse subrounded quartz sand; gravel clasts mostly of granitics, trace soft light brown plastic clay. |
| 35 | 53 | 18 | **Sand and Gravel,** trace cobbles, trace clay**;** medium brown transitioning to blue-gray at 40 feet; subrounded and subangular quartzite, granitics, volcanics and siliceous shale gravel clasts, trace cobbles; medium to coarse, subrounded, moderately well sorted quartz sand; trace firm blue clay. |
| 53 | 65 | 12 | **Clay,** trace gravel**;** blue-gray; stiff to hard, non-plastic clay, trace shale gravel as 6 inch stringer at 62-62.5 feet. |

Total Depth: 65 feet

*Site 1- 13^th^ Street Bridge Intermediate*




Drawing not to scale

Intermediate Well Final Design
Site 1 - 13th Street Bridge
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

State of California

# Well Completion Report

**Form DWR 188 Submitted 4/30/2021**
**WCR2021-005179**

Owner's Well Number: 01
Date Work Began: 03/15/2021
Date Work Ended: 03/18/2021
Local Permit Agency: San Luis Obispo County Environmental Health Services
Secondary Permit Agency:
Permit Number: WP 1026984
Permit Date: 02/08/2021

## Well Owner (must remain confidential pursuant to Water Code 13752)

Name: CITY OF PASO ROBLES, Vikki Kuntz
Mailing Address: 1000 Spring Street
City: Paso Robles
State: CA
Zip: 93446

## Planned Use and Activity

Activity: New Well
Planned Use: Monitoring

## Well Location

Address: 101 Creston RD
City: Paso Robles
Zip: 93446
County: San Luis Obispo
Latitude: 35 Deg. 37 Min. 46.5708 Sec. N
Longitude: -120 Deg. 40 Min. 56.316 Sec. W
Dec. Lat.: 35.629603
Dec. Long.: -120.68231
Vertical Datum:
Horizontal Datum: WGS84
Location Accuracy:
Location Determination Method: GPS
APN: 009-401-018
Township: 26 S
Range: 12 E
Section: 33
Baseline Meridian: Mount Diablo
Ground Surface Elevation:
Elevation Accuracy:
Elevation Determination Method:

## Borehole Information

Orientation: Vertical
Specify:
Drilling Method: Sonic
Drilling Fluid: None
Total Depth of Boring: 146 Feet
Total Depth of Completed Well: 140 Feet

## Water Level and Yield of Completed Well

Depth to first water: 44 (Feet below surface)
Depth to Static Water Level: (Feet)
Date Measured: 03/18/2021
Estimated Yield*: (GPM)
Test Type: Bailing
Test Length: 1 (Hours)
Total Drawdown: (feet)
*May not be representative of a well's long term yield.

## Geologic Log - Free Form

| Depth from Surface Feet to Feet | | Description |
|---|---|---|
| 0 | 146 | See attached Lithologic Log |

## Casings

| Casing # | Depth from Surface Feet to Feet | | Casing Type | Material | Casings Specificatons | Wall Thickness (inches) | Outside Diameter (inches) | Screen Type | Slot Size if any (inches) | Description |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 110 | Blank | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | | | |
| 1 | 110 | 140 | Screen | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | Milled Slots | 0.02 | |

## Annular Material

| Depth from Surface Feet to Feet | | Fill | Fill Type Details | Filter Pack Size | Description |
|---|---|---|---|---|---|
| 0 | 1.5 | Other Fill | See description. | | Concrete Ready Mix |
| 1.5 | 100 | Cement | Portland Cement/Neat Cement | | |
| 100 | 146 | Filter Pack | 8 x 20 | | |

**Other Observations:**

## Borehole Specifications

| Depth from Surface Feet to Feet | | Borehole Diameter (inches) |
|---|---|---|
| 0 | 146 | 8.5 |

## Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: A B C LIOVIN DRILLING INC
Person, Firm or Corporation

| Address | City | State | Zip |
|---|---|---|---|
| 1180 E BURNETT STREET | SIGNAL HILL | CA | 90755 |

| Signed | C-57 Licensed Water Well Contractor | Date Signed | C-57 License Number |
|---|---|---|---|
| | *electronic signature received* | 04/30/2021 | 422904 |

## Attachments

101 Creston Rd Location Map WP1026984.pdf - Location Map

101 Creston Rd Paso Robles permit WP1026984.pdf - Permit

101 Creston Rd Lithologic Log WP1026984.pdf - Geologic Log

101 Creston Rd Well Construction WP1026984.pdf - Well Construction Diagram

WP1026984 completion Creston Rd.pdf - Other

## DWR Use Only

| CSG # | State Well Number | Site Code | Local Well Number |
|---|---|---|---|
| | | | |

| Latitude Deg/Min/Sec | Longitude Deg/Min/Sec |
|---|---|
| N | W |

TRS:

APN:

# 13TH STREET INTERMEDIATE MONITORING WELL
# SUPPLEMENTAL ENVIRONMENTAL PROJECT
# CITY OF PASO ROBLES

Date: March 15 - March 18, 2021
Location: 101 Creston Road, Paso Robles, California
Elevation: Approximately 723 feet above Mean Sea Level (based on topographic map)
Latitude: 35.629603°, Longitude: 120.682310°
Geologist: Andrea Berge, Cleath-Harris Geologists
Drilling Company: ABC Liovin Drilling, Inc
Drilling Method: Sonic
Borehole Diameter: 8.5 inches; 0 to 146 feet depth
Total Depth: 146 feet

**Lithologic Log (page 1 of 2)**

Depth to top and bottom in feet

| Top | Bottom | Thickness | Description |
|---|---|---|---|
| 0 | 5 | 5 | **Clay;** dark gray brown; stiff, inclusions of organic matter. |
| 5 | 22.5 | 17.5 | **Sand, Gravel,** trace cobbles; light grayish brown; fine to very coarse, poorly sorted, subangular gray, brown, cream chert sand; subrounded, up to 3/4-inch chert and volcanic gravel; 3 to 5 inch diameter volcanic cobbles from 21- 21 feet depth. |
| 22.5 | 36 | 13.5 | **Clay;** light grayish brown; stiff to hard, trace fine to medium chert sand between 29-33 feet depth. |
| 36 | 40 | 4 | **Gravelly Sand;** light gray; fine to very coarse, poorly sorted, chert, shale and quartz sand; up to 1-inch diameter, subrounded shale and chert gravel. |
| 40 | 46 | 6 | **Clay,** trace gravelly sand; light gray; stiff clay, inclusions of shale gravelly sand between 43 and 45 feet depth. |
| 46 | 47 | 1 | **Sand and Gravel,** trace clay; light brownish gray; medium to very coarse, subrounded shale and quartz sand; up to 1/2-inch diameter subrounded shale gravel; firm clay. |
| 47 | 50 | 3 | **Sandy Clay;** light brownish gray; firm to stiff, friable dry clay intermixed with coarse, subrounded to subangular shale, chert, quartz sand. |
| 50 | 54 | 4 | **Clay;** pale brown; stiff to hard clay. |
| 54 | 55 | 1 | **Sand, Gravel and Clay;** medium to very coarse, rounded olive gray shale and pale brown chert sand; up to 3/4-inch shale gravel; soft to firm clay. |
| 55 | 56 | 1 | **Clay;** pale brown; stiff clay. |
| 56 | 59 | 3 | **Sandy Clay,** trace gravel; very coarse, subangular and subrounded shale and chert sand; firm to stiff clay; trace 1/2-inch shale gravel. |
| 59 | 60 | 1 | **Clay;** light yellowish brown; stiff clay. |
| 60 | 63 | 3 | **Clayey Sand,** trace travel; light yellowish brown; very coarse, subangular shale and chert sand; friable, firm clay; trace 1/2-inch shale gravel. |

**Lithologic Log (page 2 of 2)**

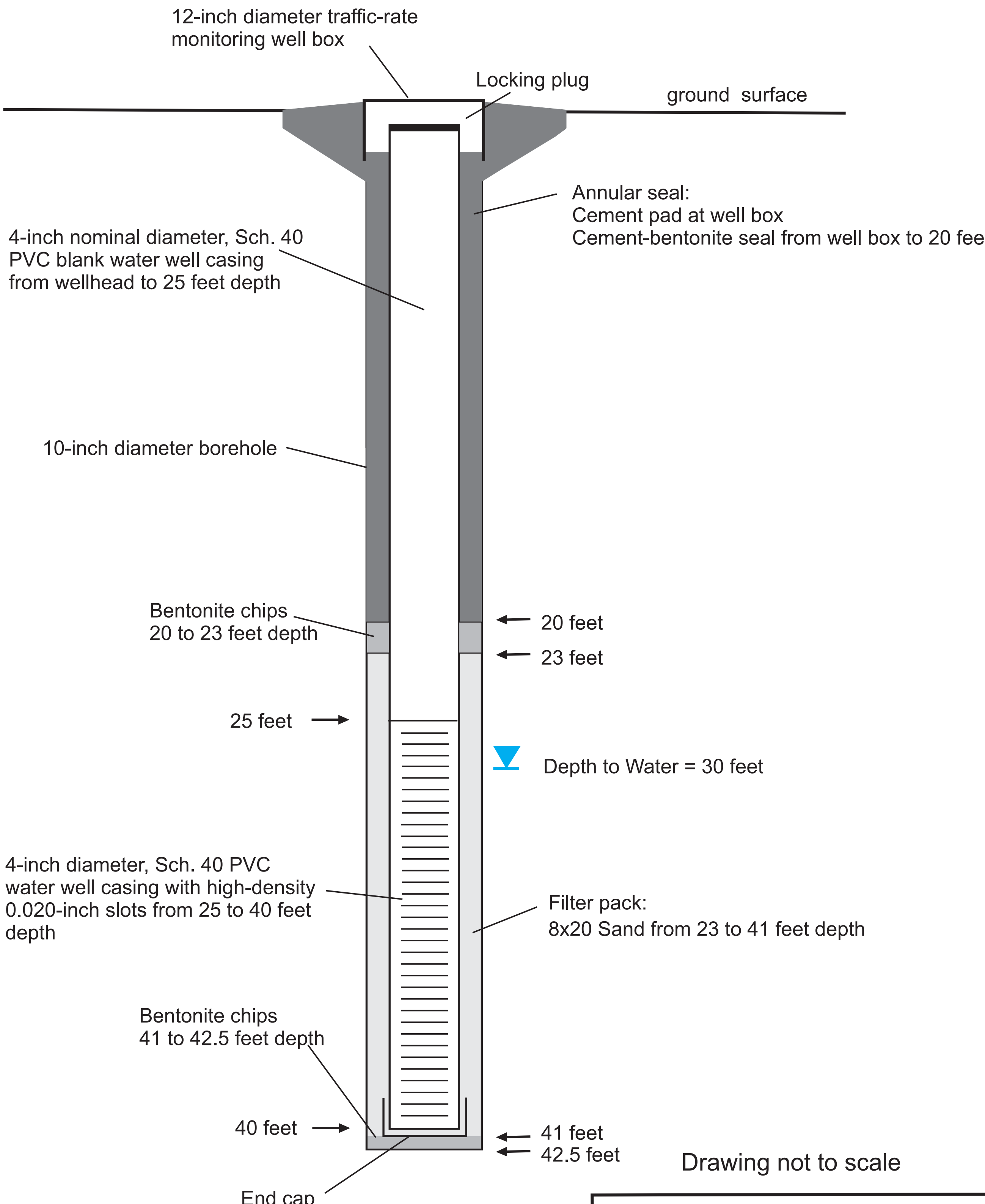
Depth to top and bottom in feet

| Top | Bottom | Thickness | Description |
|---|---|---|---|
| 63 | 64 | 1 | **Clay;** light yellowish brown; stiff clay. |
| 64 | 67 | 3 | **Sand, t**race clay; light yellowish brown; very coarse, subangular shale and chert sand; friable, firm clay. |
| 67 | 81 | 14 | **Gravelly and Sandy Clay;** light yellowish brown; stiff to hard clay; medium to coarse, subangular and subrounded shale and chert sand; subrounded, up to 1/2-inch shale gravel. |
| 81 | 85 | 4 | **Clayey Sand,** trace gravel; dark gray; medium to very coarse, subrounded and subangular quartz and chert sand; stiff clay; trace 1/2-inch shale gravel. |
| 85 | 92 | 7 | **Clay;** dark gray, stiff to hard clay. |
| 92 | 96 | 4 | **Sandy Clay,** trace gravel; dark gray; stiff clay; subrounded to rounded shale sand; up to 3/4-inch rounded shale gravel. |
| 96 | 105 | 9 | **Clay;** very stiff to hard clay. |
| 105 | 106 | 1 | **Sandy Clay** trace gravel; gray; frim clay; subrounded and subangular shale and quartz sand; rounded 1/2-inch shale gravel. |
| 106 | 112 | 6 | **Clay;** gray; very stiff to hard. |
| 112 | 114 | 2 | **Gravelly Clay;** gray; very stiff to hard clay; inclusions of up to 3/4-inch rounded gravel. |
| 114 | 117 | 3 | **Clay;** grayish brown; hard clay. |
| 117 | 122 | 5 | **Sand and Gravel with Clay;** gray; medium to very coarse, subangular chert and shale sand; up to 3/4-inch shale gravel; soft clay, with some hard layers. |
| 122 | 126 | 4 | **Clay;** bluish gray; firm grading to hard within interval. |
| 126 | 133 | 7 | **Sand and Gravel** trace cobbles; gray; subangular, medium to coarse shale, chert and sandstone sand, presence of pyrite; 3/4-inch diemeter rounded shale gravel; trace 3-inch diameter volcanic cobbles. |
| 133 | 134 | 1 | **Sandy Clay;** gray; stiff bluish gray clay; coarse subangular chert and shale sand. |
| 134 | 134.5 | 0.5 | **Sand and Gravel** trace cobbles; gray; subangular, medium to coarse shale, chert and sandstone sand, presence of pyrite; up to 3/4-inch rounded shale gravel; trace 3-inch volcanic cobbles. |
| 134.5 | 146 | 11.5 | **Clay,** trace sand; gray; stiff to hard bluish gray clay; inclusions of coarse subangular shale sand; rare 1/2-inch gravel. |

Total Depth: 146 feet

CHG

*Site 9 – Airport Road Shallow*




Drawing not to scale

Shallow Well Final Design
Site 9 - Airport Road
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

State of California

# Well Completion Report

## Form DWR 188 Submitted 4/28/2021

## WCR2021-005076

Owner's Well Number: MW1
Date Work Began: 03/23/2021
Date Work Ended: 03/24/2021
Local Permit Agency: San Luis Obispo County Environmental Health Services
Secondary Permit Agency:
Permit Number: 2021-007
Permit Date: 03/11/2021

### Well Owner (must remain confidential pursuant to Water Code 13752)

Name: HAMMOND VINEYARDS, LP,
Mailing Address: 7200 Airpost Road
City: Paso Robles
State: Ca
Zip: 93446

### Planned Use and Activity

Activity: New Well
Planned Use: Monitoring

### Well Location

Address: 7200 Airport RD
City: Paso robles
Zip: 93446
County: San Luis Obispo
Latitude: 35 Deg. 42 Min. 19.5127 Sec. N
Longitude: -120 Deg. 38 Min. 7.5353 Sec. W
Dec. Lat.: 35.7054202
Dec. Long.: -120.6354265
Vertical Datum:
Horizontal Datum: WGS84
Location Accuracy:
Location Determination Method:
APN: 027191050
Township: 25 S
Range: 12 E
Section: 36
Baseline Meridian: Mount Diablo
Ground Surface Elevation:
Elevation Accuracy:
Elevation Determination Method:

### Borehole Information

Orientation: Vertical
Specify:
Drilling Method: Auger
Drilling Fluid: None
Total Depth of Boring: 42.5 Feet
Total Depth of Completed Well: 40 Feet

### Water Level and Yield of Completed Well

Depth to first water: 30 (Feet below surface)
Depth to Static Water Level: (Feet)
Date Measured:
Estimated Yield*: (GPM)
Test Type:
Test Length: (Hours)
Total Drawdown: (feet)
*May not be representative of a well's long term yield.

### Geologic Log - Free Form

| Depth from Surface Feet to Feet | | Description |
|---|---|---|
| 0 | 13.5 | Sand |
| 13.5 | 15 | Clay |
| 15 | 17.5 | Sand |
| 17.5 | 20 | clayey Sand |
| 20 | 25 | Gravelly Sand |
| 25 | 30.5 | Sand with Gravel |
| 30.5 | 32 | Sand with clay |
| 32 | 35 | Clayey Sand |
| 35 | 38 | Clay |
| 38 | 40 | Sand with Clay |
| 40 | 42.5 | Clay |

## Casings

| Casing # | Depth from Surface Feet to Feet | | Casing Type | Material | Casings Specificatons | Wall Thickness (inches) | Outside Diameter (inches) | Screen Type | Slot Size if any (inches) | Description |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 25 | Blank | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | | | |
| 1 | 25 | 40 | Screen | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | Milled Slots | 0.02 | |

## Annular Material

| Depth from Surface Feet to Feet | | Fill | Fill Type Details | Filter Pack Size | Description |
|---|---|---|---|---|---|
| 0 | 20 | Cement | Portland Cement/Neat Cement | | |
| 20 | 23 | Bentonite | Non Hydrated Bentonite | | Bentonite chips |
| 23 | 41 | Filter Pack | 8 x 20 | | |
| 41 | 42.5 | Bentonite | Other Bentonite | | Bentonite chips |

**Other Observations:**

## Borehole Specifications

| Depth from Surface Feet to Feet | | Borehole Diameter (inches) |
|---|---|---|
| 0 | 42.5 | 10 |

## Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name S/G TESTING LABORATORIES INC
Person, Firm or Corporation

308 NORTH 1ST STREET — LOMPOC — CA — 93436
Address — City — State — Zip

Signed *electronic signature received* — 04/28/2021 — 611394
C-57 Licensed Water Well Contractor — Date Signed — C-57 License Number

## Attachments

location map.pdf - Location Map

Well log.pdf - Geologic Log

2021-007.pdf - Permit

## DWR Use Only

| CSG # | State Well Number | Site Code | Local Well Number |
|---|---|---|---|
| | | | |

| | | | N | | | | | | W |

Latitude Deg/Min/Sec — Longitude Deg/Min/Sec

TRS:

APN:

**AIRPORT ROAD SHALLOW MONITORING WELL**
**SUPPLEMENTAL ENVIRONMENTAL PROJECT**
**CITY OF PASO ROBLES**

Date: March 23-24, 2021
Location: 7200 Airport Road, Paso Robles, California
Elevation: Approximately 681 feet above Mean Sea Level (based on topographic map)
Latitude: 35.71717°, Longitude: -120.63992°
Geologist: James Carlson, Cleath-Harris Geologists
Drilling Company: S/G Drilling Company
Drilling Method: Hollow Stem Auger 0-42.5 feet depth
Borehole Diameter: 8.25 inches (pilot hole); 10 inches (ream)
Total Depth: 42.5 feet

**Lithologic Log (page 1 of 2)**

Depth to top and bottom in feet

| Top | Bottom | Thickness | Description |
|---|---|---|---|
| 0 | 13.5 | 13.5 | **Sand;** yellowish brown; fine to medium, subrounded, quartz and chert sand; slightly calcaerous. |
| 13.5 | 15 | 1.5 | **Clay**, trace sand; brown; medium clay; strongly calcareous. |
| 15 | 17.5 | 2.5 | **Sand;** yellowish brown; fine to medium, subrounded, quartz and chert sand. |
| 17.5 | 20 | 2.5 | **Clayey Sand**, trace gravel**;** yellowish brown; fine to coarse, subrounded, quartz, and chert sand; soft clay and 0.5 feet of dark yellowish brown, medium, strongly calcareous clay. |
| 20 | 25 | 5 | **Gravelly Sand;** yellowish brown; fine to coarse, quartz and chert sand; up to 2-inch diameter, subrounded, shale, chert, and metamorphic gravel. |
| 25 | 30.5 | 5.5 | **Sand with Gravel;** brownish yellow; fine to coarse, subrounded, quartz and chert sand; up to 1-inch diameter, subrounded, shale, chert, and metamorphic gravel. |
| 30.5 | 32 | 1.5 | **Sand with Clay;** dark gray; fine, subrounded, quartz, chert, mica, and mafic sand; soft clay and 0.5 feet of very stiff clay |
| 32 | 35 | 3 | **Clayey Sand;** dark gray; fine, quartz, chert, mica, and mafic sand; soft clay. |

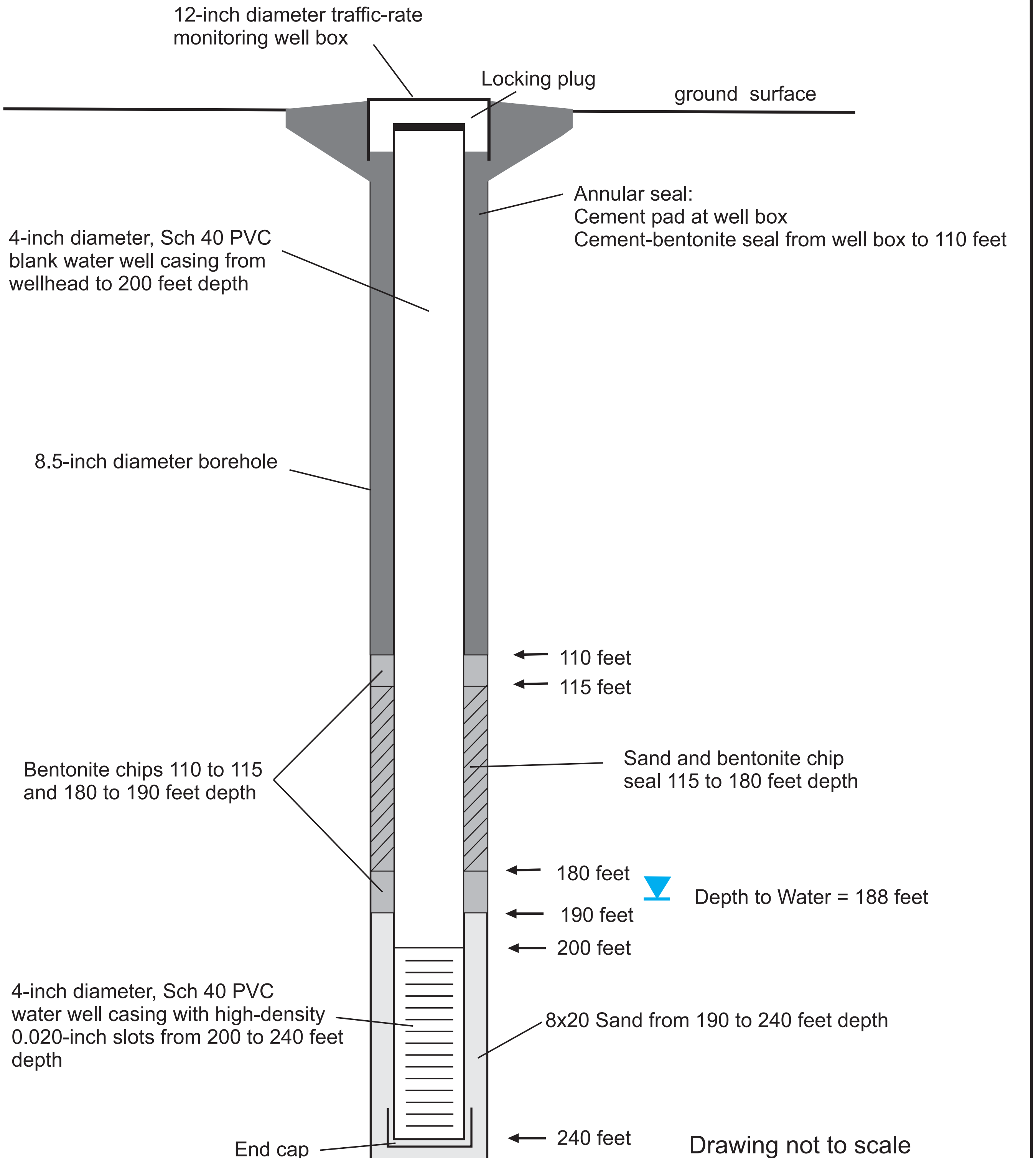
**Lithologic Log (page 2 of 2)**

Depth to top and bottom in feet

| Top | Bottom | Thickness | Description |
|---|---|---|---|
| 35 | 38 | 3 | **Clay**, trace sand**;** dark gray; stiff clay; very fine to fine sand; slightly calcareous. |
| 38 | 40 | 2 | **Sand with Clay;** dark gray; very fine to fine, quartz, mica, and mafic sand; soft clay. |
| 40 | 42.5 | 2.5 | **Clay;** dark gray; stiff clay; 0.5 feet of very fine sand; strongly calcareous. |

Total Depth: 42.5 feet

*Site 9 – Airport Road Intermediate*




Intermediate Well Final Design
Site 9 - Airport Road
Supplemental Environmental Project
City of Paso Robles

Cleath-Harris Geologists

State of California

# Well Completion Report

**Form DWR 188 Submitted 4/30/2021**

**WCR2021-005191**

| | | | | | |
|---|---|---|---|---|---|
| Owner's Well Number | 02 | Date Work Began | 03/18/2021 | Date Work Ended | 03/20/2021 |
| Local Permit Agency | San Luis Obispo County Environmental Health Services | | | | |
| Secondary Permit Agency | | Permit Number | WP 1027016 | Permit Date | 03/10/2021 |

## Well Owner (must remain confidential pursuant to Water Code 13752)

Name: HAMMOND VINEYARDS, LP,

Mailing Address: 7200 Airport Road

City: Paso Robles  State: CA  Zip: 93446

## Planned Use and Activity

Activity: New Well

Planned Use: Monitoring

## Well Location

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Address | 7200 Airport RD | | | | | | |
| City | Paso Robles | Zip | 93446 | County | San Luis Obispo | | |
| Latitude | 35 Deg. | 43 Min. | 2.172 Sec. N | Longitude | -120 Deg. | 38 Min. | 22.8479 Sec. W |
| Dec. Lat. | 35.71727 | | | Dec. Long. | -120.63968 | | |
| Vertical Datum | | | | Horizontal Datum | WGS84 | | |
| Location Accuracy | | | | Location Determination Method | | | |

APN: 27-191-050

Township: 25 S

Range: 12 E

Section: 36

Baseline Meridian: Mount Diablo

Ground Surface Elevation:

Elevation Accuracy:

Elevation Determination Method:

## Borehole Information

Orientation: Vertical  Specify:

Drilling Method: Sonic  Drilling Fluid: None

Total Depth of Boring: 240 Feet

Total Depth of Completed Well: 240 Feet

## Water Level and Yield of Completed Well

Depth to first water: 185 (Feet below surface)

Depth to Static Water Level: (Feet)  Date Measured: 03/20/2021

Estimated Yield*: (GPM)  Test Type: Bailing

Test Length: (Hours)  Total Drawdown: (feet)

*May not be representative of a well's long term yield.

## Geologic Log - Free Form

| **Depth from Surface** Feet to Feet | | **Description** |
|---|---|---|
| 0 | 240 | see attached log |

## Casings

| Casing # | Depth from Surface Feet to Feet | | Casing Type | Material | Casings Specificatons | Wall Thickness (inches) | Outside Diameter (inches) | Screen Type | Slot Size if any (inches) | Description |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 200 | Blank | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | | | |
| 1 | 200 | 240 | Screen | PVC | OD: 4.500 in. \| Thickness: 0.337 in. | 0.337 | 4.5 | Milled Slots | 0.02 | |

## Annular Material

| Depth from Surface Feet to Feet | | Fill | Fill Type Details | Filter Pack Size | Description |
|---|---|---|---|---|---|
| 0 | 1.5 | Other Fill | See description. | | Concrete |
| 1.5 | 110 | Cement | Portland Cement/Neat Cement | | |
| 110 | 115 | Bentonite | Other Bentonite | | Chips |
| 115 | 180 | Other Fill | See description. | | Sand/Chips mix |
| 180 | 190 | Bentonite | Other Bentonite | | Chips |
| 190 | 240 | Filter Pack | 8 x 20 | | |

**Other Observations:**

## Borehole Specifications

| Depth from Surface Feet to Feet | | Borehole Diameter (inches) |
|---|---|---|
| 0 | 240 | 8.5 |

## Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name: A B C LIOVIN DRILLING INC
Person, Firm or Corporation

| Address | City | State | Zip |
|---|---|---|---|
| 1180 E BURNETT STREET | SIGNAL HILL | CA | 90755 |

Signed

| C-57 Licensed Water Well Contractor | Date Signed | C-57 License Number |
|---|---|---|
| *electronic signature received* | 04/30/2021 | 422904 |

## Attachments

7200 Airport Rd Paso Robles permit WP1027016.pdf - Permit

WP1027016 completion Airport Rd.pdf - Other

7200 Airport Rd Lithologic Log WP1027016.pdf - Geologic Log

7200 Airport Rd Location Map WP1027016.pdf - Location Map

7200 Airport Rd Well Const WP1027016.pdf - Well Construction Diagram

## DWR Use Only

| CSG # | State Well Number | Site Code | Local Well Number |
|---|---|---|---|
| | | | |

| | | | N | | | | | | W |

**Latitude Deg/Min/Sec** **Longitude Deg/Min/Sec**

TRS:

APN:

**AIRPORT ROAD INTERMEDIATE MONITORING WELL**
**SUPPLEMENTAL ENVIRONMENTAL PROJECT**
**CITY OF PASO ROBLES**

Date: March 18 - March 20, 2021
Location: 7200 Airport Road, Paso Robles, California
Elevation: Approximately 681 feet above Mean Sea Level (based on topographic map)
Latitude: 35.71727°, Longitude: -120.63968°
Geologist: James Carlson, Cleath-Harris Geologists
Drilling Company: ABC Liovin Drilling, Inc
Drilling Method: Sonic: 0-240 feet depth
Borehole Diameter: 8.5 inches; 0 to 240 feet depth
Total Depth: 240 feet

**Lithologic Log (page 1 of 2)**
Depth to top and bottom in feet

| Top | Bottom | Thickness | Description |
|---|---|---|---|
| 0 | 8 | 8 | **Sand;** brownish yellow; fine sand; slightly calcareous, |
| 8 | 14 | 6 | **Clay;** trace sand; brown; very stiff clay; strongly calcareous. |
| 14 | 16 | 2 | **Sand;** trace gravel; very pale brown; fine to coarse, subrounded, quartz sand. |
| 16 | 17 | 1 | **Clayey Sand;** yellowish brown; fine to coarse, subrounded, quartz sand; stiff clay; slightly calcareous. |
| 17 | 18 | 1 | **Clay;** trace sand; dark yellowish brown; medium clay; slightly calcaerous. |
| 18 | 19 | 1 | **Sand;** trace gravel; yellowish brown; fine to coarse, subrounded, quartz and chert sand. |
| 19 | 21 | 2 | **Gravelly Sand;** yellowish brown; fine to coarse, subrounded, quartz and chert sand; up to 3-inch diameter, subrounded to rounded, chert, shale, and sandstone gravel. |
| 21 | 25 | 4 | **Sand;** yellowish brown; coarse, subrounded, quartz and chert sand. |
| 25 | 28 | 3 | **Sand with Gravel;** trace clay; yellowish brown; fine to coarse, subrounded, quartz and chert sand; up to 0.5-inch diameter, subrounded to round, chert, shale, and sandstone gravel; slightly calcareous. |
| 28 | 34 | 6 | **Sand;** trace clay; brown, fine to coarse, subrounded, quartz, chert, and mafic sand. |
| 34 | 66 | 32 | **Clay with Sand;** dark gray; very stiff clay, moderately calcaerous; fine sand; mostly clay with 0.5-1 foot sand lenses at 55 and 59 feet depth. |
| 66 | 73 | 7 | **Sand;** trace gravel; brown; fine to coarse, quartz, chert, mica, and mafic sand. |

**Lithologic Log (page 2 of 2)**

Depth to top and bottom in feet

| Top | Bottom | Thickness | Description |
|---|---|---|---|
| 73 | 76 | 3 | **Clay;** dark gray; very stiff clay; slightly calcareous. |
| 76 | 78 | 2 | **Sand;** dark grayish brown; fine to medium, subrounded, quartz, chert, and mafic sand. |
| 78 | 84 | 6 | **Clay;** gray; very stiff clay; fine quartz, chert, mica, and mafic sand; slightly calcareous. |
| 84 | 86 | 2 | **Clayey Sand;** brown; fine, quartz, chert, mica, mafic sand; medium clay. |
| 86 | 98 | 12 | **Clay;** dark grayish brown; very stiff clay; bottom 2 feet strongly calcareous. |
| 98 | 106 | 8 | **Sand;** yellowish brown; fine to coarse, subrounded, quartz, chert, mica, and mafic sand. |
| 106 | 110 | 4 | **Clay with Sand;** brown; stiff clay; very fine to fine, quartz, mica, and mafic sand. |
| 110 | 206 | 96 | **Clay;** trace sand**;** very dark grayish brown; very stiff clay; moderately calcareous, micaceous; 2 to 3-foot clayey sand lenses at 143, 155, 166, and 196 feet depth. |
| 206 | 220 | 14 | **Sand and Gravel,** trace cobbles**;** yellowish brown; fine to coarse, subrounded, quartz, chert, and mafic sand; up to 4-inch diameter, subrounded to well rounded, chert, shale, and sandstone gravel/cobbles. |
| 220 | 226 | 6 | **Clayey Sand And Gravel;** yellowish brown; soft clay; fine to medium, subrounded, quartz, chert, and mafic sand; up to 1-inch diameter, subrounded, chert, shale, and sandstone gravel. |
| 226 | 234 | 8 | **Clay;** trace sand; dark yellowish brown; very stiff clay. |
| 234 | 240 | 6 | **Sand with Gravel;** yellowish brown; fine to medium, |

Total Depth 240 feet

# STREAM GAGE INSTALLATION COMPLETION REPORT

# PASO ROBLES SUPPLEMENTAL ENVIRONMENTAL PROJECT

# PASO ROBLES AREA GROUNDWATER SUBBASIN
# SAN LUIS OBISPO COUNTY
# CALIFORNIA

June 2021

CLEATH-HARRIS GEOLOGISTS
75 Zaca Lane, Suite 110
San Luis Obispo, California 93401

(805) 543-1413

# TABLE OF CONTENTS

## 1.0 INTRODUCTION

In accordance with the approved scope of work for the City's Supplemental Environmental Project to Install Monitoring Wells and Stream Gages on the Salinas River and Major Tributaries within the Paso Robles Groundwater Basin, and consistent with the Groundwater Sustainability Plan (GSP) adopted by the Groundwater Sustainability Agencies (GSAs) for the Paso Robles Area Subbasin of the Salinas Valley Groundwater Basin[1], three stream gages have been installed to help fill a data gap with respect to the interaction between surface water and groundwater in the basin. This report summarizes the stream gage installation activities.

## 2.0 BACKGROUND

The Paso Robles Area Groundwater Subbasin GSP identified a need to expand the network of stream gages and monitoring wells within alluvial deposits associated with the major drainages in the Subbasin. Per the recommendations set forth in the GSP, "*Definitive data delineating any interactions between surface water and groundwater or a lack of interconnected surface waters is a data gap that will be addressed during implementation of this GSP*".

A critical component of the current groundwater model is streamflow, and available streamflow data is very limited as there are only two existing stream gages operating in the Subbasin. This Supplemental Environmental Project (SEP) begins expanding the network of both stream gages and adjacent monitoring wells in order to better assess the potential for interconnected surface water and groundwater across the Subbasin. Monitoring well construction for the SEP is addressed in a separate Monitoring Well Construction Report.

The stream gages installed for the SEP record stream stage. Stage data is useful for identifying flow/no flow conditions and the timing of stormwater runoff (when analyzed with rainfall and other stream gages in a watershed). The stage data may also be used to evaluate the interconnectivity of surface water and groundwater. Additionally, recorded stream stage data, when combined with a site-specific rating curve, can be converted to streamflow for water budget and groundwater model analyses. Although development of rating curves for each stream gage site was not part of the current project, an analysis can be performed for each site in the future to convert logged stream gage data into streamflow. A brief summary of streamflow measurement in natural channels is include in Appendix A.

[1] Montgomery & Associates, 2020, Paso Robles Subbasin Groundwater Sustainability Plan dated January 31, 2020.

## 2.0 SITE SELECTION PROCESS

Stream gage site selection was completed as part of the SEP and a detailed review is provided in a technical memorandum[2]. Ten locations were identified by the Subbasin GSAs that would help provide hydrologic, geologic and hydrogeologic data with appropriate monitoring equipment installations[3]. These locations represent sites where a stream gage, coupled with a set of nested or paired monitoring wells, would help to fill in data gaps related to surface water/groundwater interactions throughout the Subbasin. The original locations, along with replacements and alternative sites considered for gage installation, are shown in Figure 1. Table 1 presents the results of the site selection process and criteria evaluation for sites that were determined to be viable for the SEP project. Descriptions of these criteria and scoring, along with a discussion of all sites considered, are in the November 2020 memorandum.

**Table 1**
**Stream Gage Site Criteria Evaluation**

| Criteria | SEP SITE | | | | | |
|---|---|---|---|---|---|---|
| | **2a** | 4a | **4b** | 5 | 5a | **10a** |
| Proximity to iGDEs | 3 | 2 | 2 | 2 | 2 | 3 |
| Depth to Groundwater | 3 | 2 | 2 | 3 | 1 | 3 |
| Access for monitoring wells | 3 | 3 | 2 | 3 | 1 | 2 |
| Hydrologic Value* | 3 | 3 | 3 | 2 | 2 | 3 |
| Channel morphology/Rating curve dev. | 1 | 2 | 3 | 2 | 2 | 3 |
| Score (higher = more benefit) | **13** | **12** | **12** | **12** | **8** | **14** |

*requires rating curve to achieve full benefit

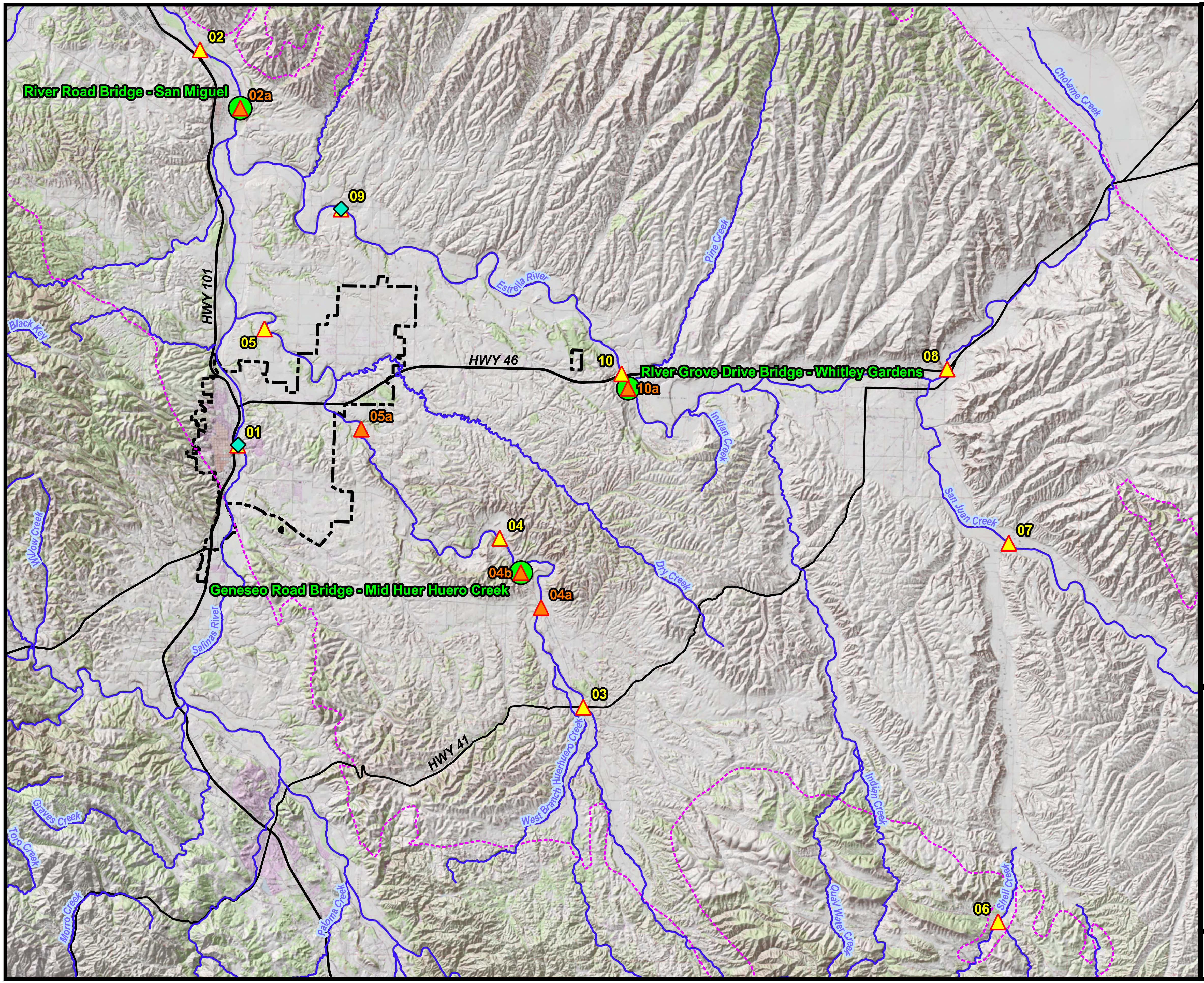
Site 10a (Estrella River at Whitley Gardens) received the highest ranked score for a gage location under the criteria used, with a greater than average relative benefit of all criteria except access for monitoring wells (average rank). Site 2a (Salinas at San Miguel) was second in the rankings, with a greater than average relative benefit of all criteria except channel morphology/rating curve development (below average rank).

The remaining locations were all on Huer Huero Creek, with a tie between Sites 4a, 4b, and 5. Assuming future GSP project phases will construct Site 3 to represent Upper Huer Huero Creek, Site 4b was considered the best alternative for a Mid Huer Huero gage site. This resulted in the following three top-ranked sites:

---

2 CHG, 2020, Stream Gage Siting Memorandum dated November 10, 2020.

3 Monsoon Consultants, 2019. Figure 1 - Paso Robles Groundwater Basin - Proposed Monitoring Sites, Paso Robles GSP Data Gap Assessment dated September 6, 2019.




## Explanation

Paso Robles City Limits

Paso Robles Groundwater Subbasin Boundary

Major Stream

Existing Stream Gage

SEP Gage Site

**Evaluated Stream Gage Site**

Originally Proposed (Conceptual Phase)

Replacement/Alternate

0 2.5 5 mi

N

**Figure 1**
**Site Locations**

**Stream Gage Installation Report**

**Paso Robles Groundwater Basin Supplemental Environmental Project**

**City of Paso Robles**

**Cleath-Harris Geologists**

- Site 10a (Estrella River at River Grove Bridge, Whitley Gardens)
- Site 2a (Salinas River at San Miguel Bridge)
- Site 4b (Mid Huer Huero Creek at Geneseo Road Bridge near Eagle Oak Ranch Way)

Agency review concurred with the site selections, and the three top-ranked sites were brought forward into the design and installation phase.

## 3.0 STREAM GAGE INSTALLATIONS

Equipment used for the stream gages, including enclosures, were sourced in consultation with San Luis Obispo County Public Works (Water Resources Division). All three stream gages are radar sensors with Alert 2 protocol and can be linked with existing base stations operated by San Luis Obispo County Flood Control and Water Conservation District.

The following is a list of equipment included with the stream gages:

- Alert 2 transmitter with integrated communications and web-based user interface.
- 12V, 12 amp-hour battery
- Weather-proof canister for transmitter and battery
- GPS antenna with surge suppressor
- Omni-directional VHF antenna with surge suppressor
- Radar water level sensor
- 10-watt solar panel

All equipment has been installed, with the radar and data loggers tested and operational. The transmitter and integrated communications for the "Alert 2" communication functionality can be activated pending further coordination between the GSAs.

The stream gage enclosures (boxes) are aluminum, with aluminum masts and corrosion resistance hardware (stainless steel and galvanized steel). These aluminum enclosures are locked and secured to the bridges with locking cables.

Stream profiles for the three sites are included in Appendix B. The gages are positioned over the lowest stream bed elevation along the profile, where low flow would be most likely to occur. No surface flow was present during the installations, however, evidence of flow from prior seasonal runoff was noted at the sites and confirmed that the radar sensors are optimally positioned to detect low flow. Individual stream gage installations are summarized below.

## 3.1 Site 10a: Estrella River, Whitley Gardens / River Grove Drive Bridge

The stream gage at Site 10a was installed on April 14, 2021. Following installation, the radar sensor and data logger were tested and are operational, recording the Estrella River channel bottom at 21.20 feet below the enclosure (confirmed with tag line). The installation is shown in Figure 3.

*Figure 2. Whitley Gardens (Estrella River) radar sensor stream gage installation*

## 3.2 Site 2a – Salinas River, River Road Bridge at San Miguel

The stream gage at Site 2a was installed on April 9, 2021. Following installation, the radar sensor and data logger were tested and are operational, recording the Salinas River channel bottom at 47.46 feet below the enclosure (confirmed with tag line). The installation is shown in Figure 4.

*Figure 3. San Miguel (Salinas River) radar sensor stream gage installation*

## 3.3 Site 4b – Mid Huer Huero Creek, Geneseo Road Bridge

The stream gage at Site 4b was installed on April 9, 2021. Following installation, the radar sensor and data logger were tested and are operational, recording the Huer Huero Creek channel bottom at 17.23 feet below the enclosure (confirmed with tag line). An image of the installation is presented in Figure 5.

*Figure 4. Creston (Huer Huero Creek) radar sensor stream gage installation*

## 4.0 DATA COLLECTION AND SYSTEM MAINTENANCE

The stream gages are operational and set to record stream stage at 15-minute intervals, consistent with San Luis Obispo County Flood Control and Water Conservation District practice. Until the transmitters at each site are linked with a base station, the stage data will need to be manually downloaded. There is ample storage capacity (equivalent to multiple years). Given the seasonal nature of stream flow in the basin, the City or GSA monitoring and maintaining the gages may also consider removing the radar sensors and electronics canisters from the enclosures for safe keeping during the dry season.

# APPENDIX A

## Streamflow Measurement in Natural Channels

**Streamflow Measurement in Natural Channels**

The most practical method for measuring streamflow in natural channels is the velocity-area method, which has the following computation[4]:

$$Q = \sum_{i=1}^{n} (a_i v_i)$$

where:

Q = total discharge (reported in cubic feet per second).

$a_i$ = cross-sectional area of flow for the *i*th segment of the *n* segments into which the cross section is divided (square feet), and

$v_i$ = the corresponding mean velocity of flow normal to the *i*th segment (feet per second).

The conceptual model for the velocity area-method is shown below. A stream is divided into segments, each with an individual area and velocity, which are then multiplied and summed using the above equation.

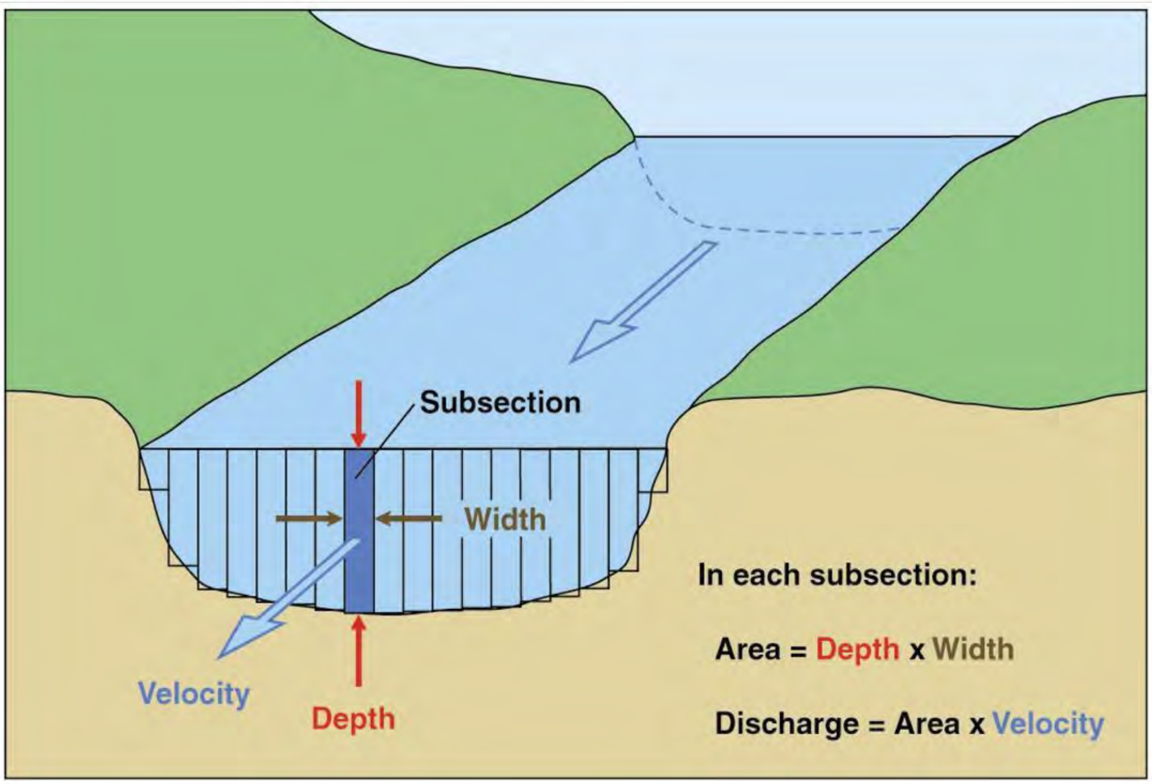



*Diagram of Channel cross-section with segments for discharge computation (USGS)*

4 Turnipseed, D.P. and Sauer, V.B., 2010. Discharge Measurements at Gaging Stations, USGS Techniques and Methods 3-A8.

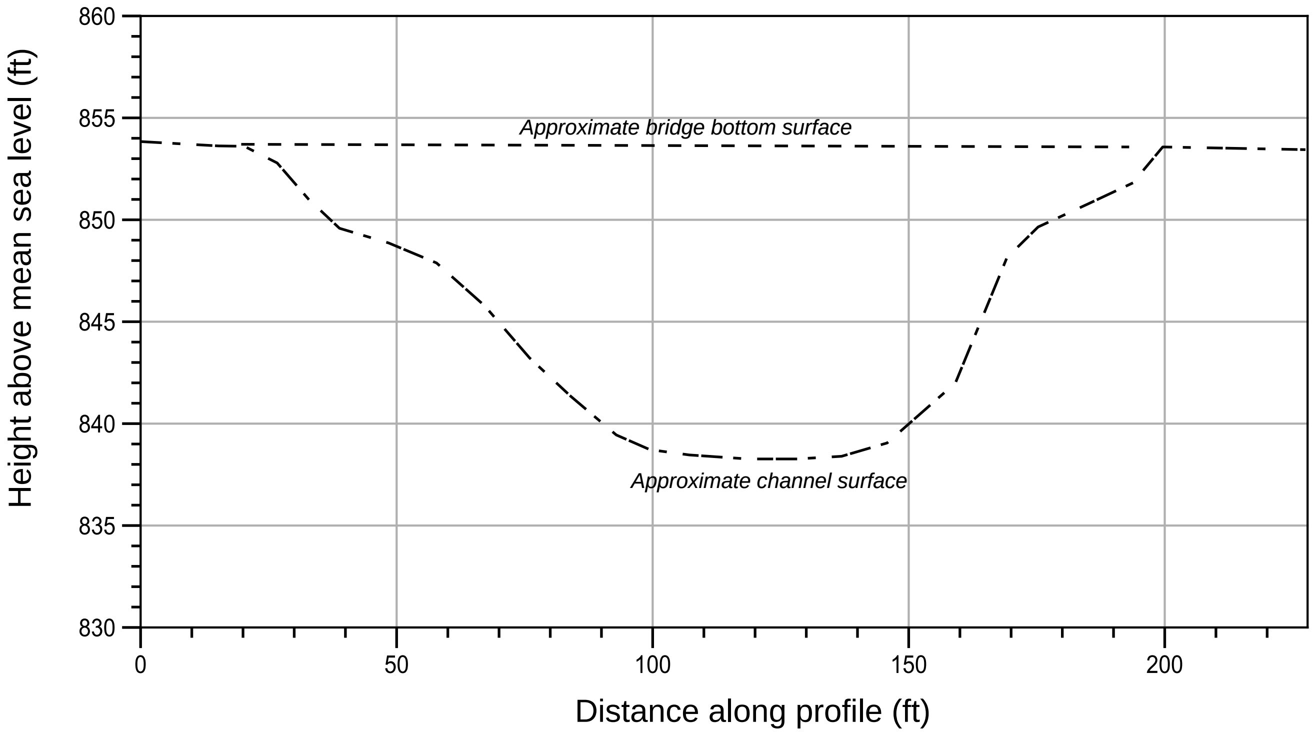
In natural channels, stream gages are used to record stage (feet), which is the height of water in the stream above an arbitrary point, usually at or below the stream bed. The stage is then converted to streamflow through the use of a rating curve, or stage-discharge relation. A rating curve incorporates information collected that is specific to each site, including the cross-sectional area of the channel and the average velocity for a given flow stage. These rating curves are developed using depth profiles and average flow velocity measurements during storm-runoff events. Rating curves may need to be revised periodically as they can shift due to changes in channel geometry. Measuring average flow velocity across a channel at different stream stages is the most challenging part of developing a rating curve.

CHG

# APPENDIX B

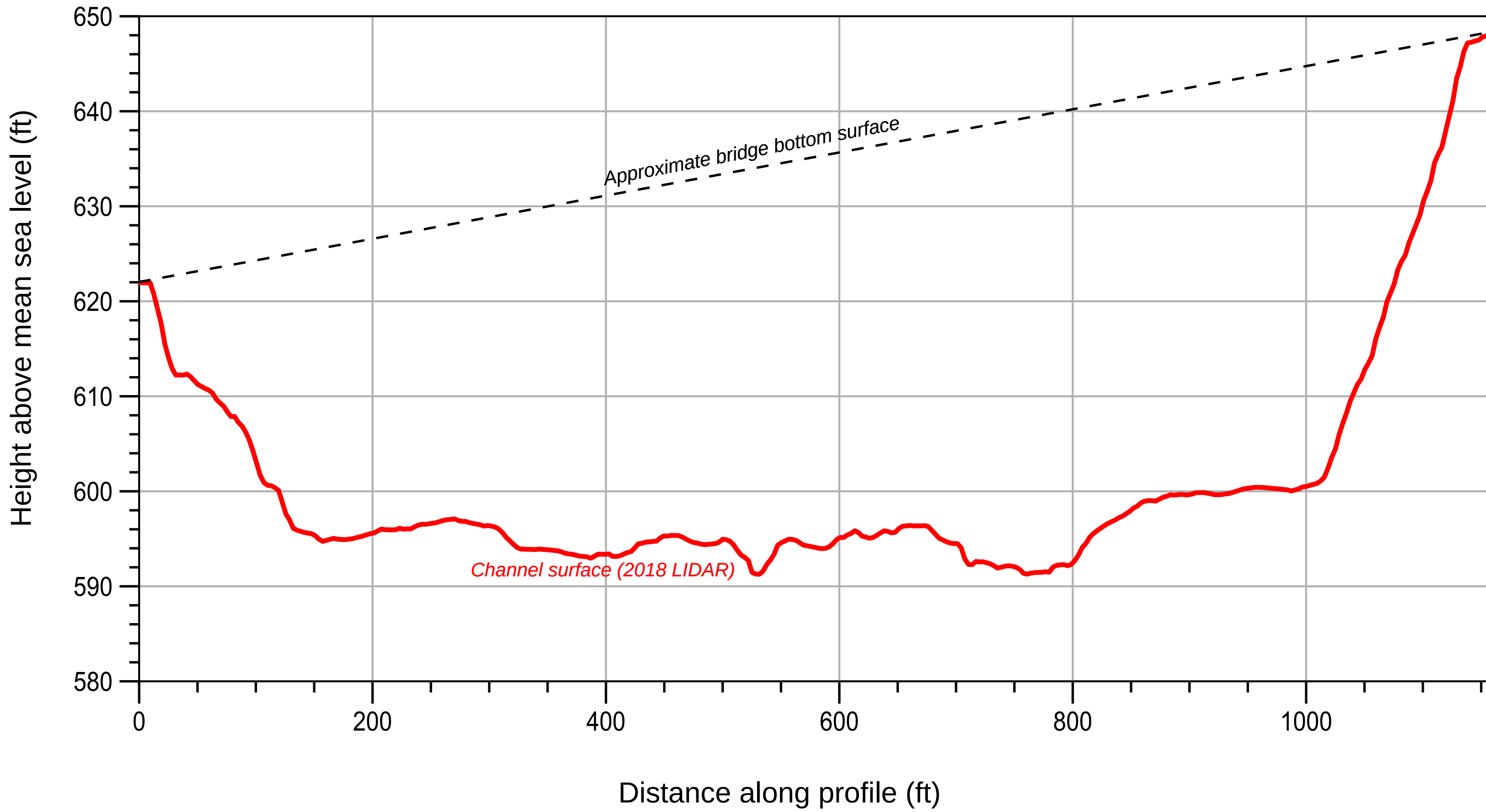
## Stream Profiles at SEP Stream Gage Sites


Note: Aerial imagery reflects conditions prior to the renovation of bridge 49C0307




**Appendix B1**

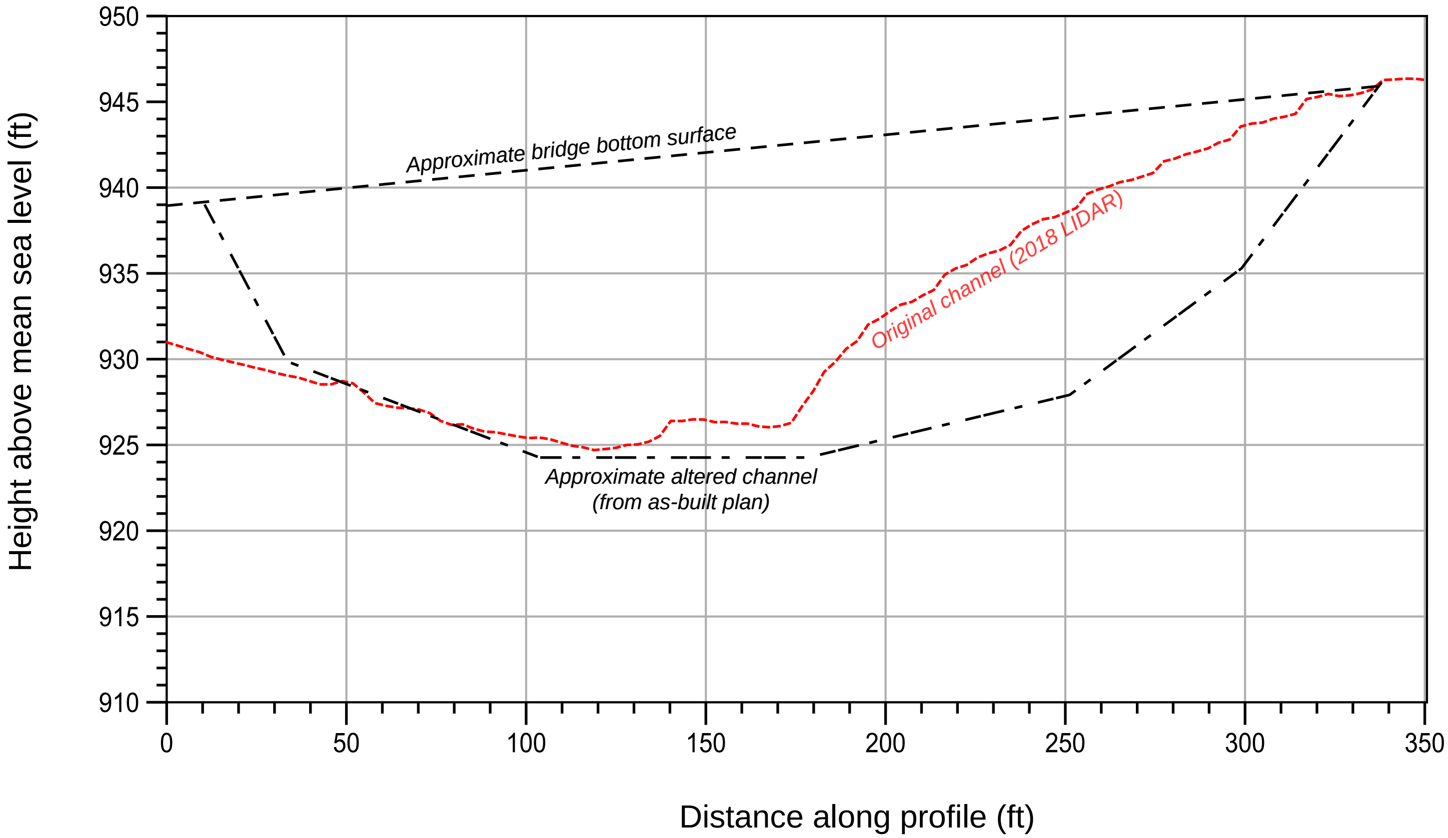
**Channel Profile Site 10a**


**Appendix B2**

**Channel Profile Site 2a**


Note: Aerial imagery reflects conditions prior to the construction of bridge 49C0431




**Appendix B3**

**Channel Profile**
**Site 4b**