Piru Groundwater Subbasin Annual Report Water Year 2022

Submitted to

California Department of Water Resources

Submitted by

Fillmore and Piru Basins Groundwater Sustainability Agency

Prepared by

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DRAFT

Certification

This GSP annual report was prepared in accordance with generally accepted professional hydrogeologic principles and practices. This annual report makes no other warranties, either expressed or implied as to the professional advice or data included in it. This annual report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

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Acronyms and Abbreviations

Acronym	Definition
AF	acre-feet
AFY	acre-feet per year
Ag	agriculture
amsl	above mean sea level
Basin	Fillmore subbasin of the Santa Clara River Valley basin
CCR	California Code of Regulations
DBS&A	Daniel B. Stephens & Associates, Inc.
DWR	[CA] Department of Water Resources
FPBGSA	Fillmore and Piru Basins Groundwater Sustainability Agency
FT	feet
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
MO	Measureable Objective
MT	Minimum Threshold
RMP	Representative Monitoring Point
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SWRCB	State Water Resources Control Board
United	United Water Conservation District
WLE	water level elevation
WY	water year

Executive Summary

Water year (WY) 2022 was a critically dry year for California, and the third dry year in a row resulting in widespread drought conditions throughout the state. Although total WY 2022 precipitation measured at the California Irrigation Management Information System (CIMIS) Santa Paula station (#198) was 13.67 in, or 126% of the annual average of 10.8 in from 2006-2021, most of this fell during the month of December as short, intense atmospheric river events. These typically result in a much greater proportion of surface runoff than groundwater recharge. Due to the lack of recharge entering the aquifer system, groundwater levels in the Basin declined by an average of 13.26 ft from October 2021 to October 2022. Groundwater in storage decreased by an estimated 18,400 acre-ft (AF). Groundwater extractions and surface water diversions were estimated to be 9,507 AF and 8,642 AF, respectively, totaling 18,149 AF of water used beneficially in the basin during WY 2022. Activities that progressed the Basin towards its established sustainability goals over the last year include preparation and successful submission of a Round 2 GSP Implementation Grant; research into improving monitoring networks for groundwater dependent ecosystems (GDEs) and groundwater-surface-water (GW-SW) interactions; consideration of updates to the well permit application review workflow; installation of shallow monitoring wells at the Cienega Springs Ecological Reserve (CSER) project area; installation of a nested monitoring well at the East Grove location (western end of Fillmore basin near the Fillmore-Santa Paula basin boundary); and functionality improvements to the database management system (DMS).

1. Introduction

The Piru Subbasin (the Basin) is managed with the adjacent Fillmore Subbasin by the Fillmore and Piru Basins Groundwater Sustainability Agency (the Agency). Following the submittal of the Piru Subbasin Groundwater Sustainability Plan (GSP) on January 31, 2022, the Agency is required to submit an annual report for the preceding Water Year (October 1 through September 30) to DWR by April 1 (23 CCR 356.2). These annual reports provide a summary of hydrologic conditions and water use in the Basin (Figure 1) using observed data from monitoring networks and/or estimated using best available methods. This annual report provides a brief summary of Basin water use and changes in groundwater storage during the period from October 1, 2021 to September 30, 2022, and provides context for Basin conditions relative to the sustainable management criteria developed for the Basin. This report has been prepared in accordance with the requirements for annual reports as identified in the Sustainable Groundwater Management Act (SGMA). More detailed analysis and discussion of long-term hydrologic trends will be included in the periodic evaluation of the GSP the Agency is required to perform at least every five years (23 CCR 356.2).

For additional clarification or more detailed information on the basin plan area or conditions, please refer to the Piru Subbasin GSP. As acknowledged by the Department of Water Resources, it is important to note that there are still some data gaps and missing information as the Agency continues to gather information for better analysis and decisions.

2. Groundwater Elevations

Groundwater elevation contour maps for the spring and fall of 2022 are shown in Figure 2 and Figure 3, respectively. These maps depict the seasonal high (spring) and low (fall) water level elevations in the Basin. Spring and fall water level elevations are defined as observations within a four week period centered on April 1st or October 1st. If a well has multiple observations within this period, then the value collected nearest to April 1st or October 1st is used. The Basin is conceptualized as a single aquifer, and therefore subsetting water level data by well screen depth was not required.

Observed spring groundwater elevations (Figure 2) ranged from 491.33 to 653.55 ft above mean sea level (amsl), with an average elevation of 541.81 ft amsl. Fall groundwater elevations (Figure 3) ranged from 482.30 to 619.04 ft amsl, with an average elevation of 521.07 ft amsl. Flow is generally from east to west, but is influenced by recharge along the margins of the valley and drawdown in the vicinity of high-capacity irrigation wells. Observed groundwater elevation changes from October 2021 to October 2022 ranged from -60.84 to +2.50 ft with an average change of -13.26 ft.

Hydrographs for representative monitoring points (RMPs) in the Basin are shown in Figure 4. Apart from well 04N19W36D01S, located in the west-central portion of the basin, groundwater levels at RMPs are near their respective measurable objectives. Although well 04N19W36D01S has shown declines in water levels since March 2021, recent observations show that this decline had slowed. The most recent groundwater elevation measured in the well was 381.27 ft amsl on December 7th, 2021. If the current trend continues, then well 04N19W36D01S is not expected to reach the minimum threshold elevation of 376 ft amsl.

3. Groundwater Extractions

Groundwater pumpers that produce groundwater from the Basin pay United Water Conservation District (UWCD) an extraction fee based on the number of acre-ft they pump. Prior to 2022, this was reported on a 6-month basis (reporting to UWCD twice per calendar year). Period 1 covers January through June, and period 2 covers July through December of each year. A description of the historical groundwater extraction monitoring in Piru Basin is provided in Section 3.5.1.4 of the Piru Subbasin GSP. To better comply with SGMA reporting requirements, the Agency is requesting growers voluntarily report groundwater extractions on a quarterly (3-month) basis.

Groundwater pumpers are required to self-report groundwater extractions by well to UWCD using one of three methods: domestic multiplier, electrical meter (based on Southern California Edison efficiency testing), or water flow meter. For non-reporters, an estimate from historical usage is entered in the groundwater production database for accounting and basin volume calculation purposes. For wells with water meters, reporting typically involves filing out a form and submitting an accompanying photograph of the digital totalizer reading. The extent to which "smart meters" or automated (advanced) metering infrastructure (AMI) technology is used by individual well owners to quantify their groundwater production is unknown in the Piru Basin. There is not currently a mechanism by which well owners can automatically report groundwater production from their water meters to UWCD or the Agency. De minimis domestic pumping can be reported to UWCD using a multiplier of 0.2 AF per person per 6-month period with a minimum of 0.5 AF (e.g., if there are 1 or 2 people reporting domestic usage on a well, then 0.5 AF minimum is assessed). De minimis pumpers (extractors) that have a meter on their well discharge have the option of calculating their usage based on the meter reading which may show less than 0.5 AF usage, and are billed based on actual usage.

Estimated groundwater extractions for WY 2022 grouped by water use sector and measurement method are shown in Table 1. Quarterly reporting of groundwater extraction volumes was not requested by United until January 2022, so pumping from October through December 2021 was estimated for each well by scaling the reported volumes from period 2 of that year by the fraction of reference ET from the Santa Paula CIMIS station that occurred during that time. Using this method, an estimated 1,935 AF (34%) of 2021 period 2 (July - December) groundwater pumping occurred during WY 2022. Due to the timing of the 6-month measurement and billing cycle described above, only voluntarily reported quarterly extractions during period 2 (July -

Table 1. Groundwater Extractions

Sector	Method	GW Extraction Volume (AF)	Accuracy (%)	Range (AF)
Agriculture	Electrical Efficiency	1,576	± 20	1,261 - 1,892
	Estimated	2,599	± 33	1,742 - 3,457
	Water Meter	4,988	± 5	4,739 - 5,238
Agriculture Subtotal		9,163		7,742 - 10,587
Municipal and Industrial	Domestic	10	± 20	8 - 13
	Electrical Efficiency	9	± 20	7 - 11
	Estimated	111	± 33	75 - 148
	Water Meter	229	± 5	218 - 241
Municipal and Industrial Subtotal		359		308 - 413
Total		**9,522**		**8,050 - 11,000**

December) of 2022 were available at the time this annual report was developed. Voluntarily reported extractions for July through September 2022 were estimated to represent approximately 72% of total extractions during that period using the complete 2022 period 1 (January - June) data set for reference. The difference between the reported and estimated total extraction volume was assigned to wells that did not voluntarily report using proportions obtained from the complete 2022 period 1 (January - June) data set.

Groundwater pumping within each public land survey (PLSS) section (1 mi^2) shows the spatial distribution of agricultural (Figure 5), municipal & industrial (Figure 6), and total (Figure 7) groundwater extractions within the Basin. Groundwater pumping totaled approximately 9,522 AF, with agricultural beneficial uses accounting for about 96% of total groundwater extractions for WY 2022.

4. Surface Water Supply

Surface water used in the Basin grouped by source and measurement method is summarized in Table 2. All surface water diversions are used beneficially for agricultural irrigation. Not all diversions for WY 2022 were reported to the State Water Resources Control Board (SWRCB) at the time this report was written. Unreported diversion volumes were estimated by averaging reported diversion volumes for the previous five years (WY 2017 through WY 2021). Total surface water used in the Basin during WY 2022 was estimated to be 2,274 AF.

Table 2. Surface Water Use

Surface Water Source	Method	Annual Volume Used (AF)	Accuracy (%)	Range (AF)
Local Supplies	Water Meter	1,030	± 33	979 - 1,082
	Estimated from previously reported diversions	1,244	± 33	833 - 1,654
Total		**2,274**		**1,812 - 2,736**

5. Total Water Use

Total water use in the Basin grouped by water use sector and measurement method is shown in Table 3. Total water volumes used in the Basin during WY 2022 was estimated to be 11,796 AF.

6. Change in Groundwater Storage

Change in groundwater storage for WY 2022 was estimated using differences in water level elevations from Fall 2021 to Fall 2022. Observed differences in water levels were interpolated to a 65x65 ft (20x20 m) grid using the universal kriging method. Volume was calculated by multiplying the area of each cell by the estimated change in water level and vertically integrated aquifer storage coefficient for each respective cell. The vertically integrated aquifer storage coefficients were calculated as the thickness weighted average of each model grid cell in the UWCD groundwater model, and ranged from 0.09 to 0.15. The total change in storage for the Basin was calculated by summing estimated change in volume for all cells. Since the interpolation area does not cover the entire basin due to the location of the monitoring wells,

Table 3. Total Water Use

Sector	Method	Total Annual Volume (AF)	Accuracy (%)	Range (AF)
Agriculture	Electrical Efficiency	1,576	± 20	1,261 - 1,892
	Estimated	2,599	± 33	1,742 - 34,57
	Estimated from previously reported diversions	1,244	± 33	833 - 1,654
	Water Meter	6,018	± 5	5,718 - 6,320
Agriculture Subtotal		11,437		9,554 - 13,323
Municipal and Industrial	Domestic	10	± 20	8 - 13
	Electrical Efficiency	9	± 20	7 - 11
	Estimated	111	± 33	75 - 148
	Water Meter	229	± 5	218 - 241
Municipal and Industrial Subtotal		359		308 - 413
Total		**11,796**		**9,862 - 13,736**

the total change in storage was scaled by the ratio of the interpolation area to the basin area. This assumes that water level changes in areas on the basin with no observations are similar to those with observations.

A map of the change in storage for WY 2022 with contour lines showing water level differences is shown in Figure 8. Estimated total change in storage for WY 2022 is -18,400 AF. Figure 9 shows annual groundwater pumping and change in storage, along with cumulative storage since WY 2000. Current storage condition relative to WY 1988 is -52,100 AF. Negative change is storage is expected due to critically dry conditions that have persisted for the last three years.

7. Progress Towards GSP Implementation

The Piru Subbasin GSP provided seven Projects or Management Actions that the FPBGSA Board of Directors would implement or consider implementing to facilitate the maintenance of sustainable conditions in the basin (see Section 4 of the GSP). Below is a description of activities related to each project that occurred during WY 2022. The FPBGSA has focused its attention on Projects #1-#3 and #7 in the past year. The remaining Project or Management Actions (Projects #4 - #6 detailed in the GSP) have yet to be discussed by the FPBGSA Board of Directors. These projects or management actions may be considered by the Board of Directors over the next year and it is anticipated that more substantive updates will be included in future Annual Reports.

7.1 Project #1: Supporting the Cienega Springs Restoration Project as a Drought Refuge

Post submittal of the GSP to the California Department of Water Resources (DWR), staff and the consultant team for the Fillmore and Piru Basins Groundwater Sustainability Agency (FPBGSA) have had limited additional discussions/meetings with representatives from California Department of Fish and Wildlife (CDFW) and researchers from University of California, Santa Barbara (UCSB) to further explore how the mitigative actions proposed in the GSP might be implemented.

The discussions with CDFW to date have focused on:

- Refining the mitigative project description
- Identifying which land parcels in the restoration project area would most benefit from receiving supplemental waters during a drought
- Exploring possible existing deep groundwater wells in proximity to the site that could be used as a water source; and
- Discussing the practicality and potential benefits of including adjacent land parcels owned by The Nature Conservancy (TNC) into the mitigation plan.

Ongoing action items with respect to this management action include:

- Establish communication with TNC to determine their interest in participating in the mitigation program
- Field verification of the operational condition of potential existing wells that are candidates to supply the supplement water
- Contact well/land owners to determine their willingness to allow access to their well(s) and establish terms of an access agreement
- Preparation of a Mitigation Plan that will detail, for example:

- Triggers for starting and stopping the delivery of the supplemental waters
- Quantities of supplemental water to be supplied
- Source(s) of the supplemental water
- Parties responsible for conveyance of the supplemental water from the source to the desired land parcel
- Responsible parties for making decisions regarding the beneficial use of the water
- Cost reimbursal and extraction fee waiver mechanisms for use of existing wells owned by others
- Vegetative monitoring protocols to document the success of the mitigation program.

In addition, the Mitigation Plan will estimate the cost to the FPBGSA for the implementation of the mitigative actions. Funding to support this Project was included in the *Round 2 SGMA Implementation Grant* application submitted by the GSA.

7.2 Project #2: Construction of Shallow Monitor Wells at the Cienega Springs Restoration Project Site

Over the past year, FPBGSA staff oversaw the installation of three shallow monitoring wells (*insert link to well construction report from UWCD*) at the Cienga Springs Restoration Project Site. The wells were funded by the GSAs Groundwater Sustainability Planning Grant and were installed on property owned by California Dept. of Fish and Wildlife. Two of the single completion wells were approximately 100 ft deep with the third well constructed a little shallower. These wells have been included in the well network monitored by UWCD and will be equipped with pressure transducers to record short- and long-term water level trends.

7.3 Project #3: Construction of Shallow Monitor Wells

The GSA recognized the need for additional subsurface hydrogeologic data near the west end of the Fillmore basin, and using funds provided by the GSAs Groundwater Sustainability Planning Grant, has installed a quad-completion (4 nested monitoring wells in a single borehole) at the East Grove site (*insert link to well construction report from UWCD*). The exploratory borehole at the East Grove site was advanced to a depth of about 800 ft below ground surface. This nested monitoring well has 1 well completed in each of the A and C groundwater model layers with the remaining two wells completed in the upper and lower portions of the B layer, respectively. This monitoring well is the only C-zone monitoring well in Fillmore basin. These wells have been included in the well network monitored by UWCD and will be equipped with pressure transducers to record short- and long-term water level trends.

7.4 Project #7: Subsidence Infrastructure Vulnerability Evaluation

The FPBGSA contracted DBS&A to prepare an updated land subsidence evaluation (*insert link to tech memo*) that included an evaluation of InSAR data sets, Continuous Global Positioning Station (CGPS) data, a comparison of water levels v. estimated historical low water levels, and review of water levels and the Subsidence Minimum Threshold established in the GSP. Additional monitoring locations for land displacement measured remotely via satellite (InSAR) were selected based on proximity to critical infrastructure that may be negatively impacted by subsidence (e.g., bridges, railroads). The update concluded that no net subsidence has been observed since InSAR data became available in June 2015, therefore no further infrastructure vulnerability evaluations are planned. The FPBGSA will continue the annual subsidence data review and reporting.

7.5 Improvement of Groundwater Dependent Ecosystem and Groundwater-Surface-Water Interactions Monitoring Networks

DBS&A have had discussions regarding monitoring GW-SW interactions and the GDE monitoring network. In certain areas of the Fillmore and Piru Groundwater Basins, ephemeral groundwater discharges to surface flow. Measuring these interactions can be important for quantifying groundwater flow rates into surface water.

DBS&A has begun evaluating techniques for gathering additional information regarding surface water – groundwater interactions near the prominent GDEs. A promising evaluative technique requires measuring groundwater temperature differentials to determine rising groundwater flux in areas near the prominent GDEs. Thermal probes have been used to determine groundwater infiltration rates in previous studies (e.g., Racz et al, 2011; Schmidt et al, 2011). A similar method can be used to determine rising groundwater flux. Design of the temperature measurement array (e.g., up to 20 locations in a 300 by 300 ft grid) and the equipment required to implement the temperature monitoring program is being developed and was included in the *Round 2 SGMA Implementation Grant* application submitted by the GSA.

8. References

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Fillmore and Piru Basins
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Location Map

Figure 1

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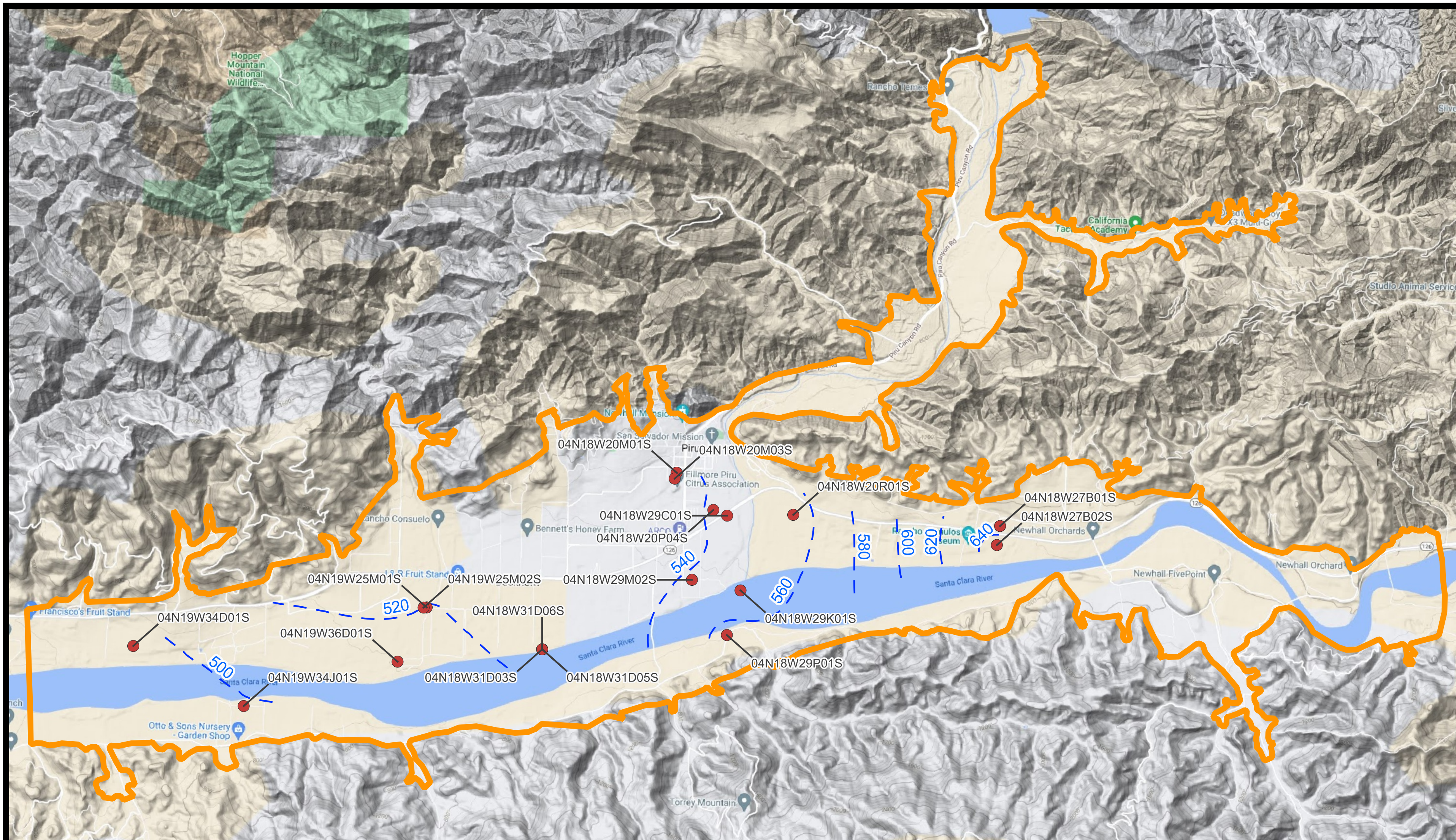

Source: https://fillmore-piru.gladata.com/

Explanation

- Monitoring Well
- Water Level Contour (ft amsl)
- Groundwater Basin Boundary

N

0 0.5 1 mi

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PIRU SUBBASIN ANNUAL REPORT
Groundwater Elevation Contours
Spring 2022

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Figure 2

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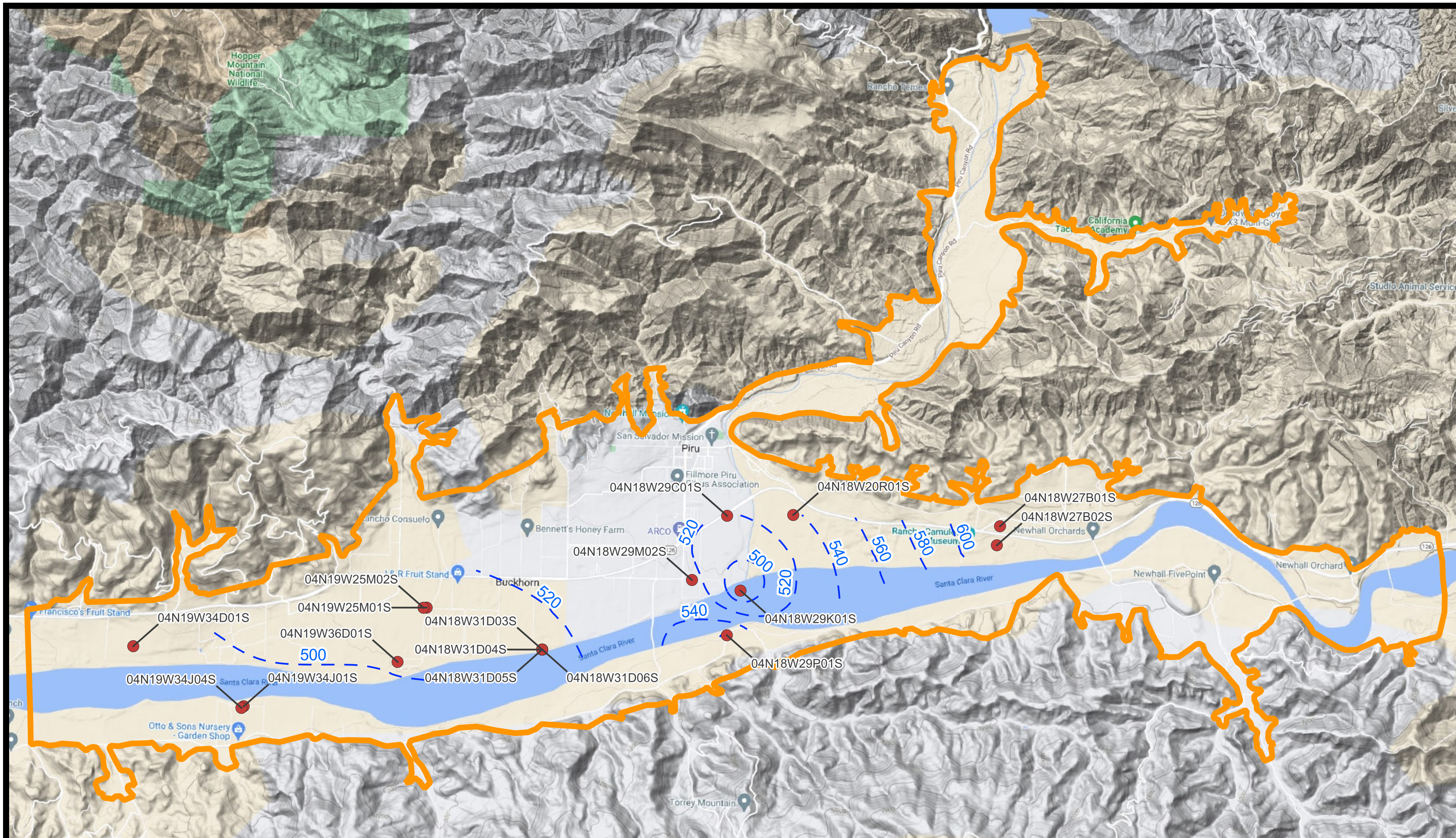

Source: https://fillmore-piru.gladata.com/

Explanation

- Monitoring Well
- Water Level Contour (ft amsl)
- Groundwater Basin Boundary

N

0 0.5 1 mi

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Groundwater Sustainability Agency

PIRU SUBBASIN ANNUAL REPORT

Groundwater Elevation Contours
Fall 2022

Figure 3

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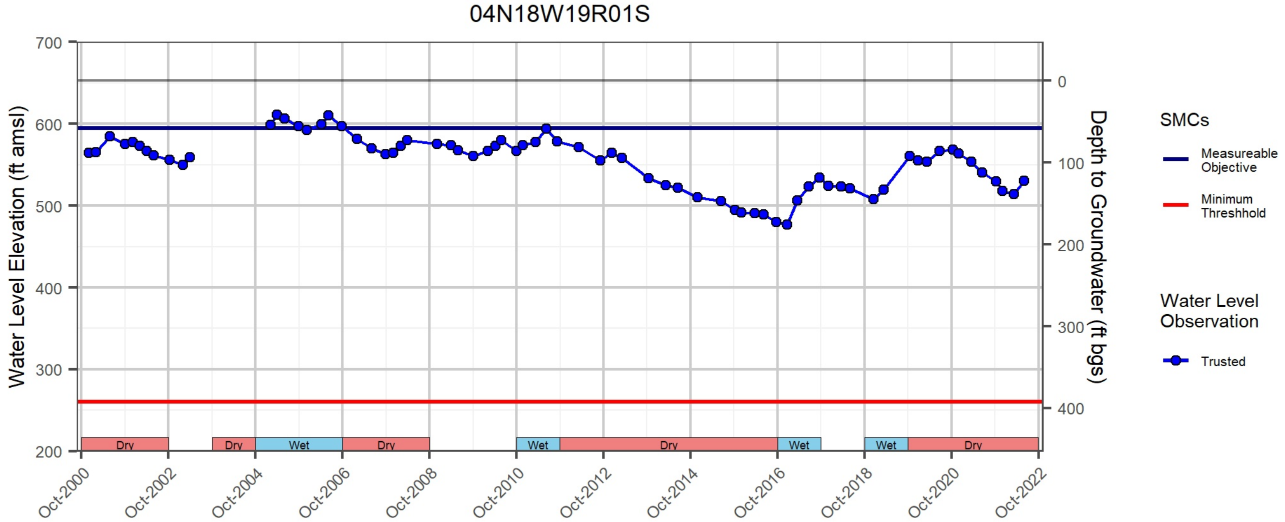

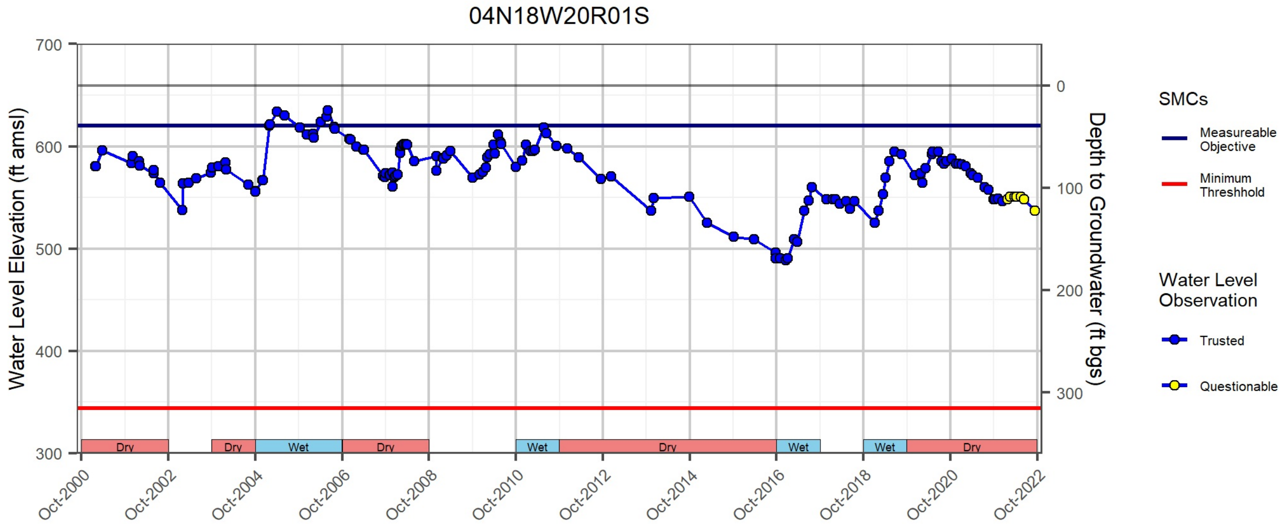

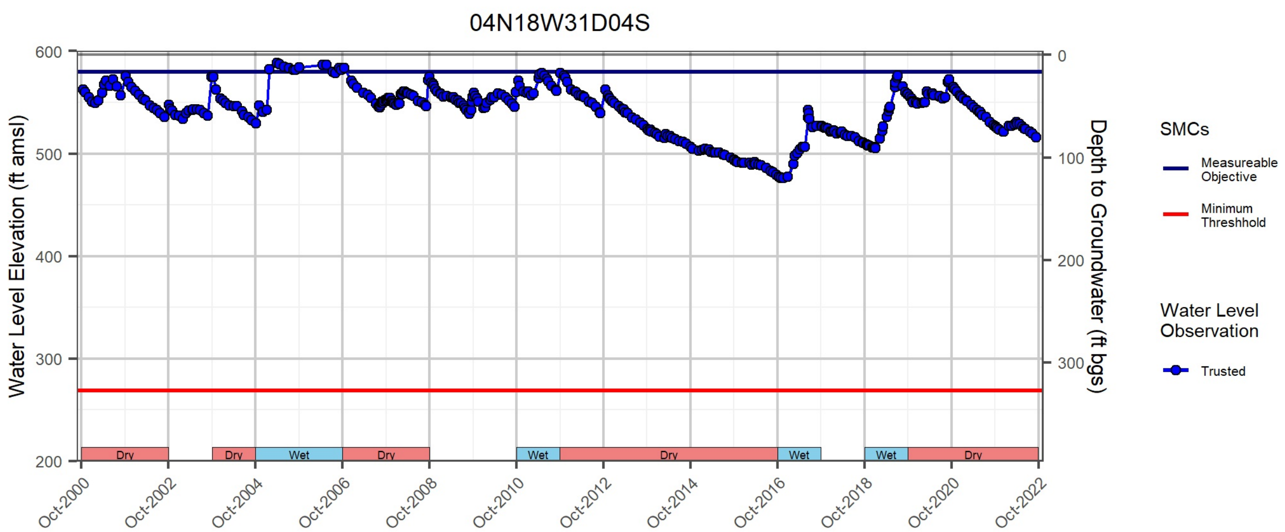

Notes:
1. Red and blue colored bars at bottom of graph indicate dry/critical and wet water year types, respectively, from San Joaquin Valley Water Year Hydrologic Classification Indices.
2. See Figure 2 for well locations.

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Representative Monitoring Points Hydrographs

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Figure 4a

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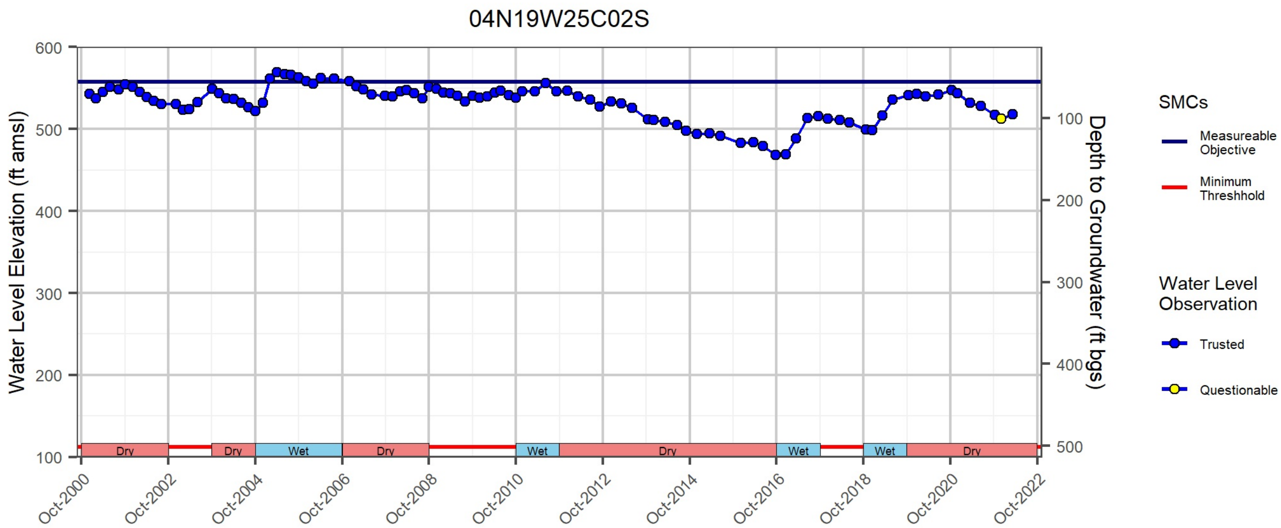

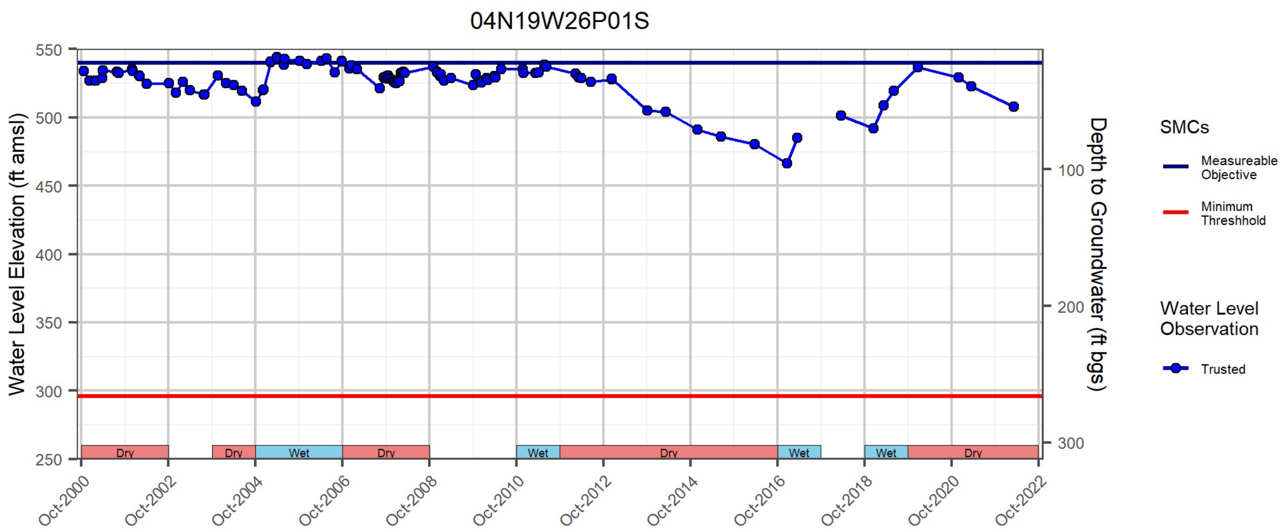

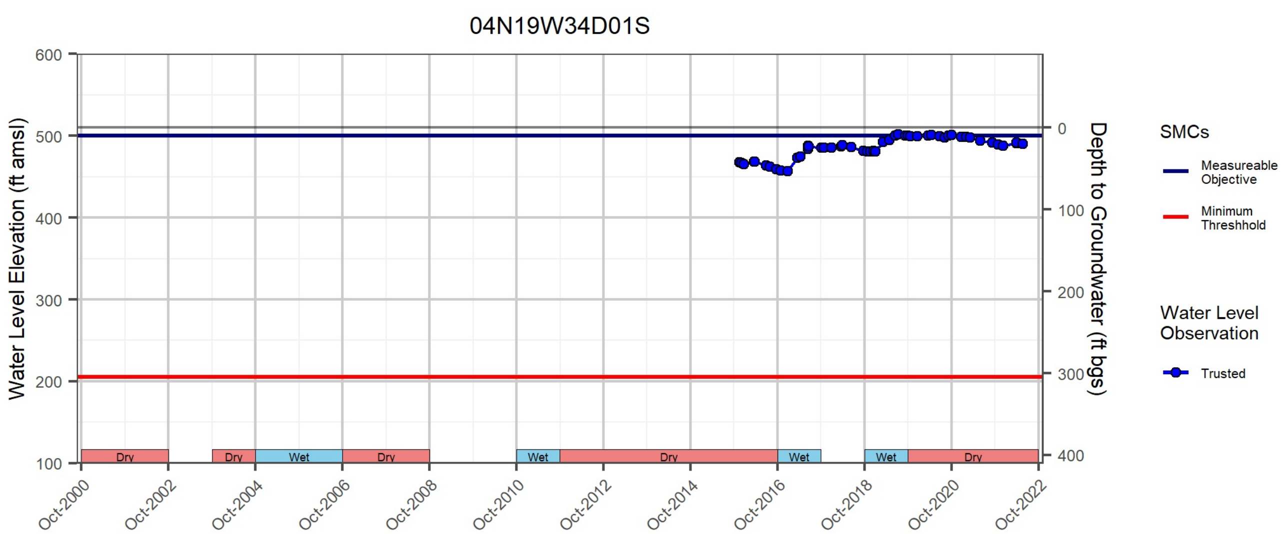

Notes:
1. Red and blue colored bars at bottom of graph indicate dry/critical and wet water year types, respectively, from San Joaquin Valley Water Year Hydrologic Classification Indices.
2. See Figure 2 for well locations.

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Representative Monitoring Points Hydrographs

Figure 4b

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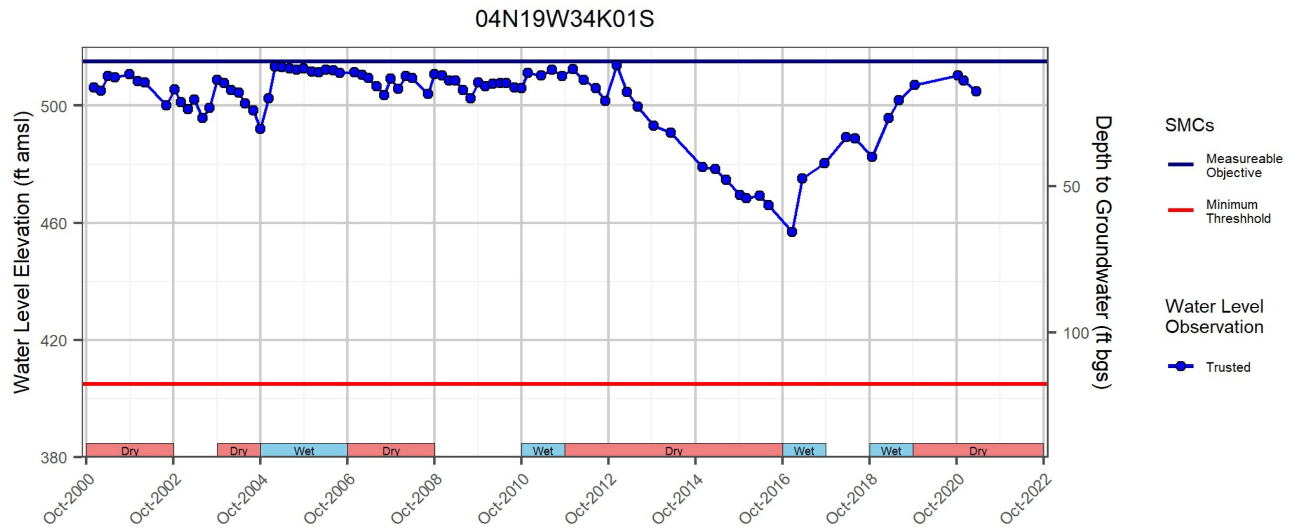

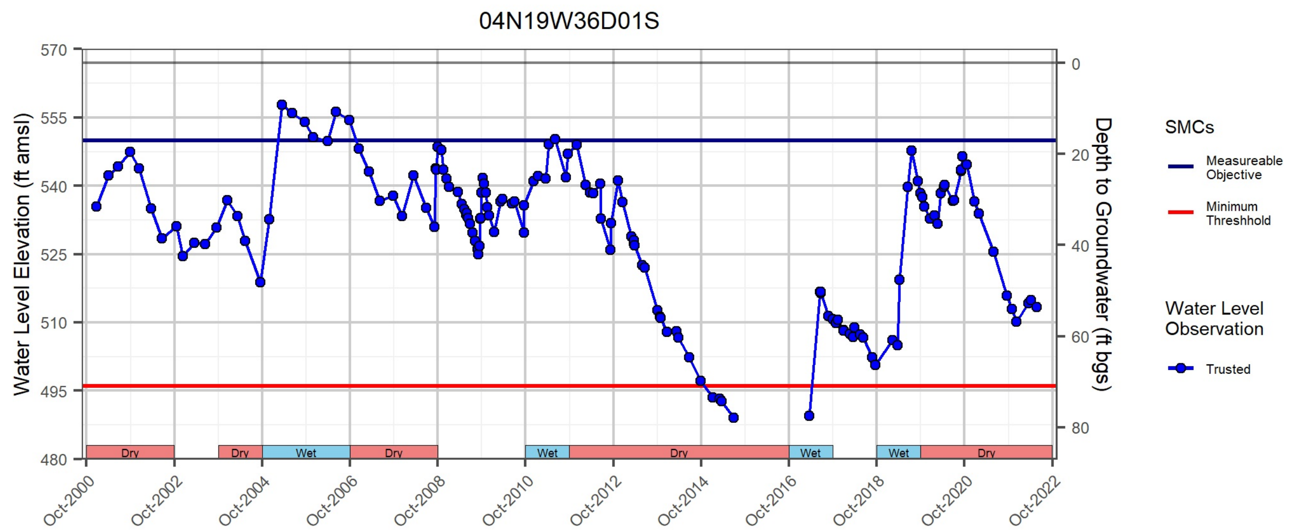

Notes:
1. Red and blue colored bars at bottom of graph indicate dry/critical and wet water year types, respectively, from San Joaquin Valley Water Year Hydrologic Classification Indices.
2. See Figure 2 for well locations.

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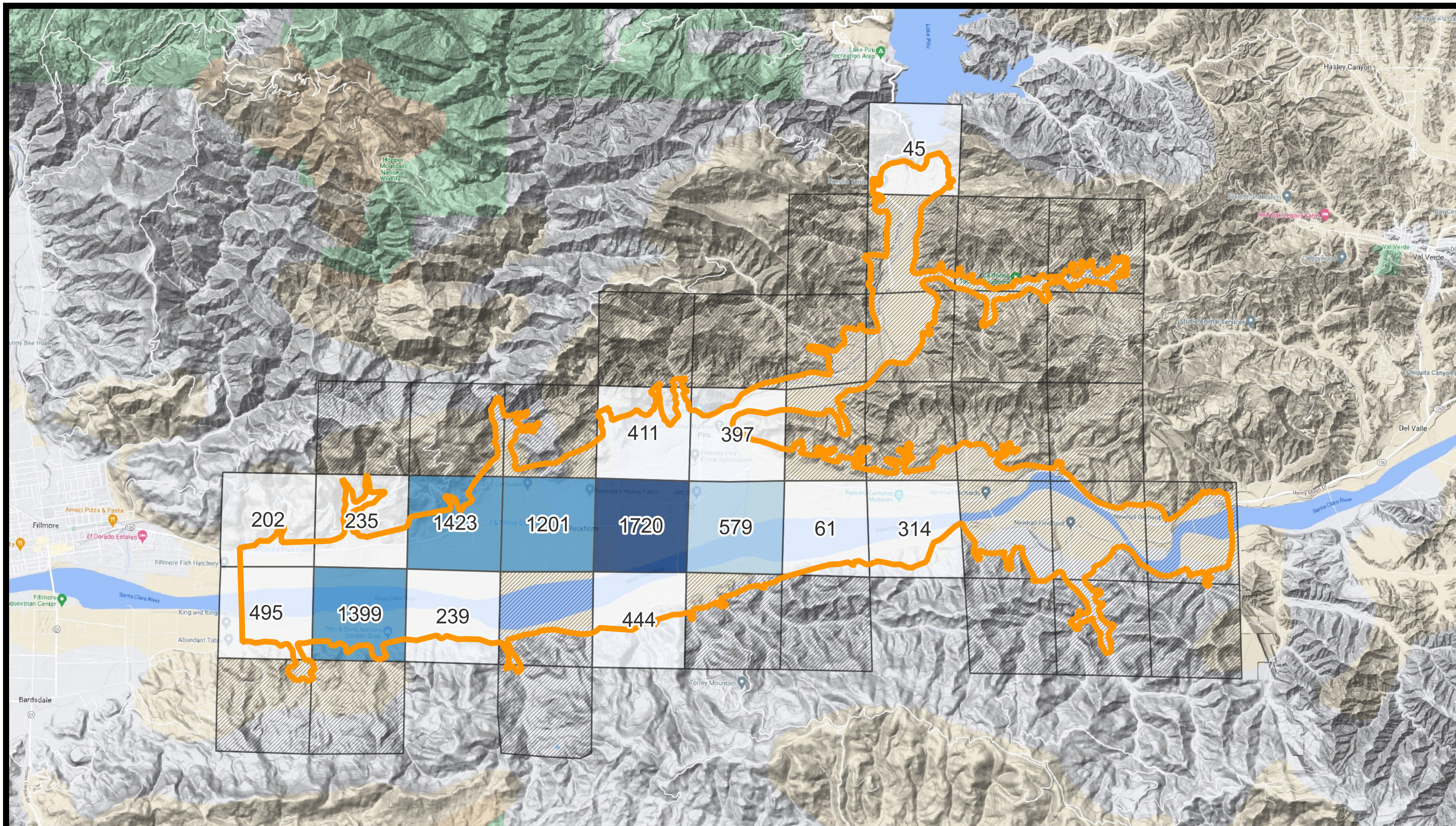
Representative Monitoring Points Hydrographs

Figure 4c



Source: https://fillmore-piru.gladata.com/

Explanation

Extraction Volume (AF)

- No Extractions
- 0 - 500
- 500 - 1,000
- 1,000 - 1,500
- 1,500 - 2,000
- Groundwater Basin Boundary

N

0 1 2 mi

Notes:
1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).

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Estimated Agricultural Groundwater Extractions

WY 2022

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Figure 5

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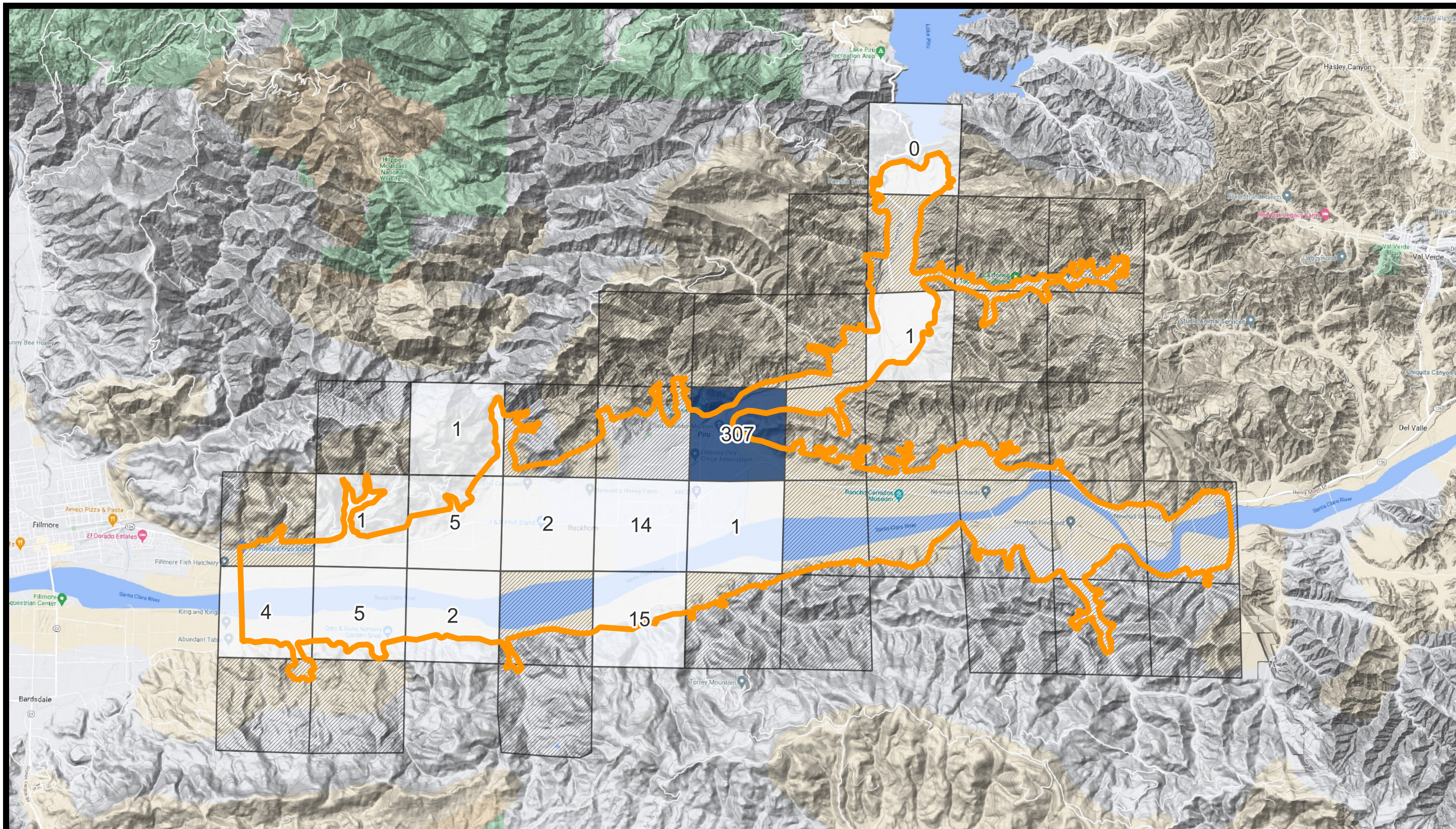

Explanation

Extraction Volume (AF)

- No Extractions
- 0 - 100
- 100 - 200
- 200 - 300
- 300 - 400
- Groundwater Basin Boundary

N

0 1 2 mi

Source: https://fillmore-piru.gladata.com/

Notes:
1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).

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Estimated Municipal & Industrial Groundwater Extractions

WY 2022

Figure 6

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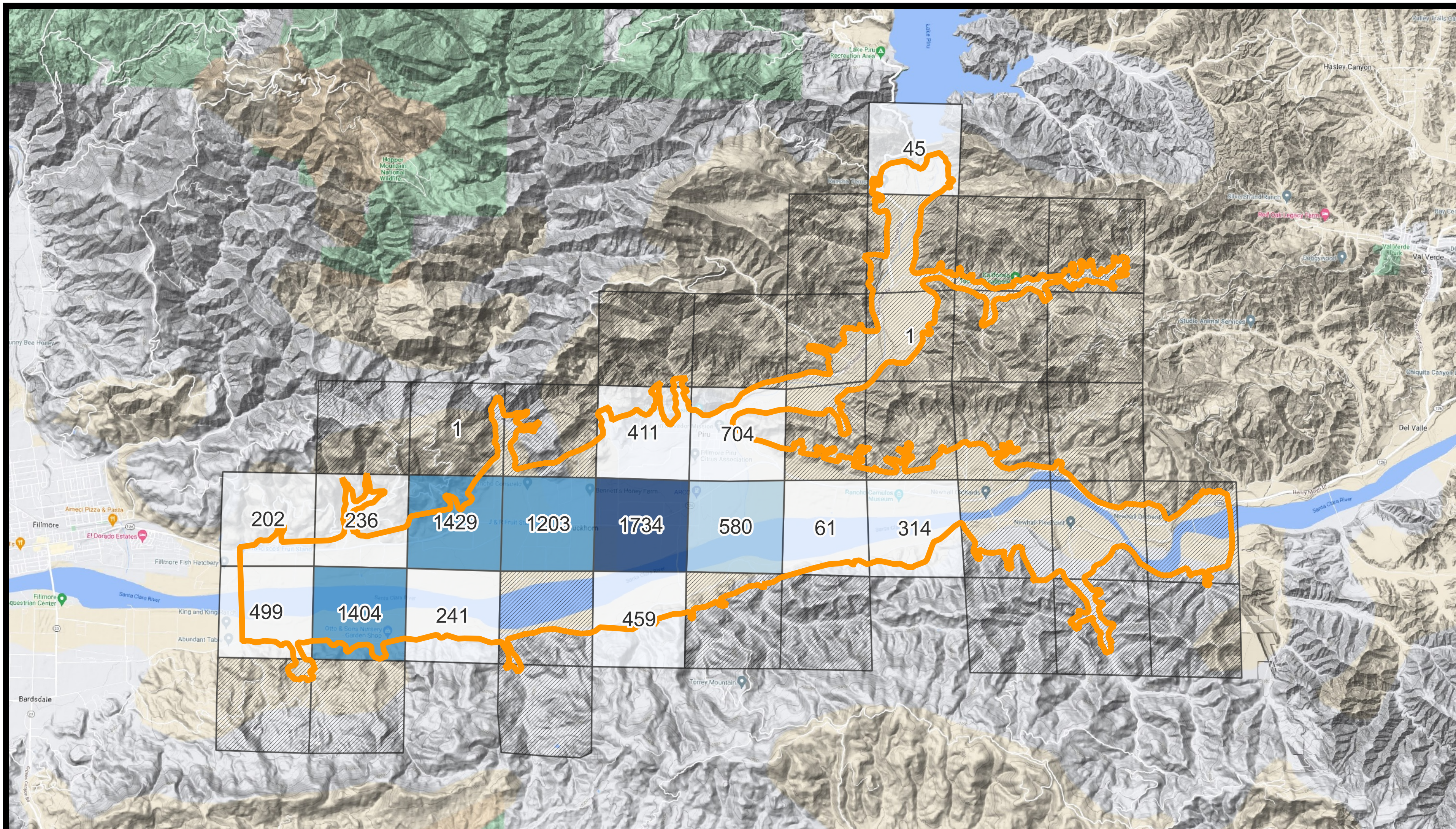

Explanation

Extraction Volume (AF)
- No Extractions
- 0 - 500
- 500 - 1,000
- 1,000 - 1,500
- 1,500 - 2,000

Groundwater Basin Boundary

N

0 1 2 mi

Notes:
1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).

Source: https://fillmore-piru.gladata.com/

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU SUBBASIN ANNUAL REPORT

Estimated Total Groundwater Extractions WY 2022

DBS&A a Geo-Logic Company

02/12/2023 DB22.1164

Figure 7

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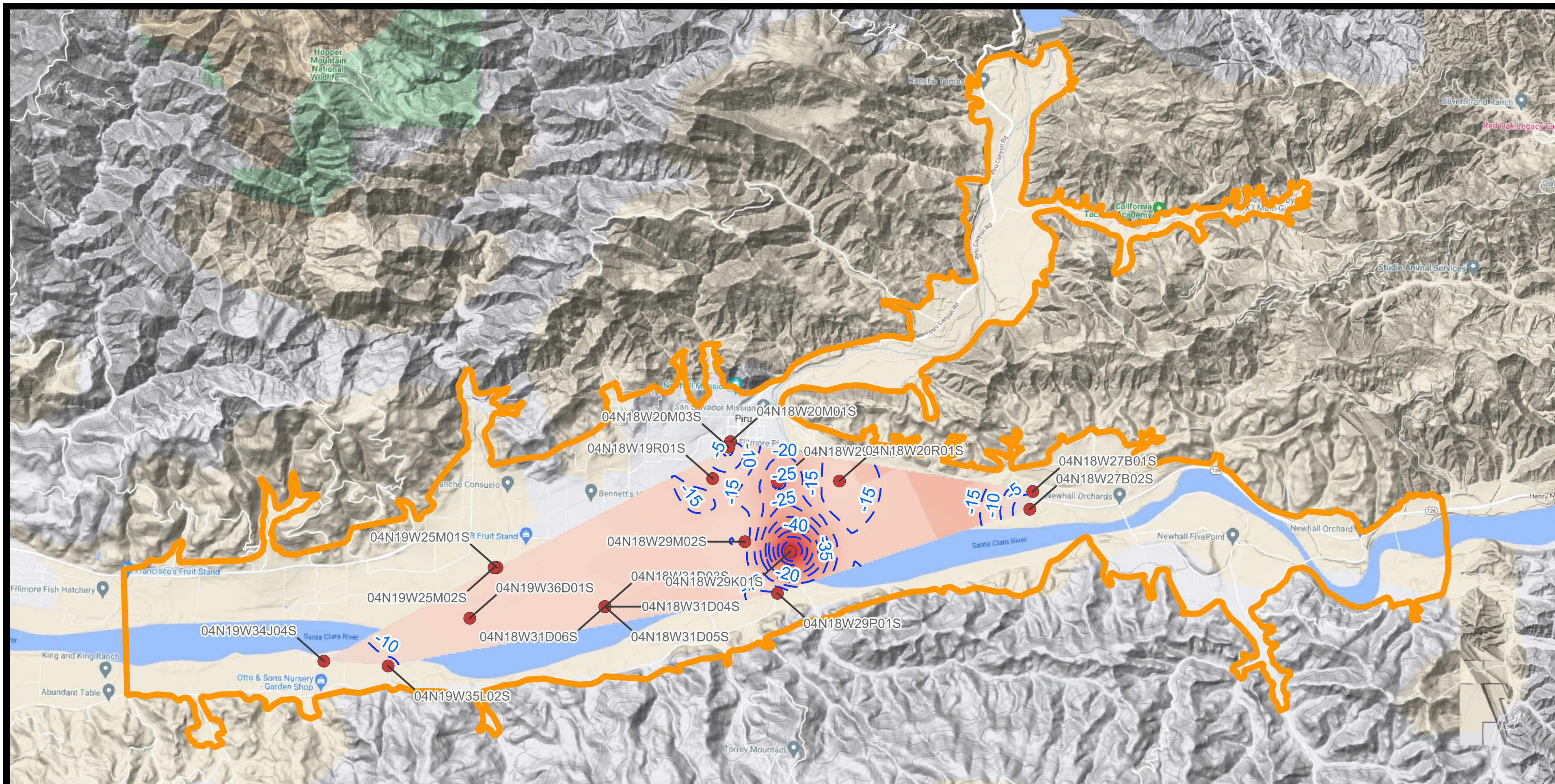

Explanation

Estimated Groundwater Storage Change (AF)

+0.7

-0.7

Monitoring Well

Water Level Elevation Change Contour (ft)

Groundwater Basin Boundary

N

0 1 2 mi

Notes:
1. Storage change estimated by interpolating changes in observed water levels to a 65 x 65 ft grid and multiplying by the vertically integrated aquifer storage coefficient for each grid cell.
2. Vertically integrated aquifer storage coefficient calculated as the thickness weighted average of aqufier storage coefficients for each model layer used in the United groundwater model.
3. Estimated WY 2022 total groundwater storage change is -18,400 AF.

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Estimated Change in Groundwater in Storage WY 2022

Figure 8

DBS&A a Geo-Logic Company

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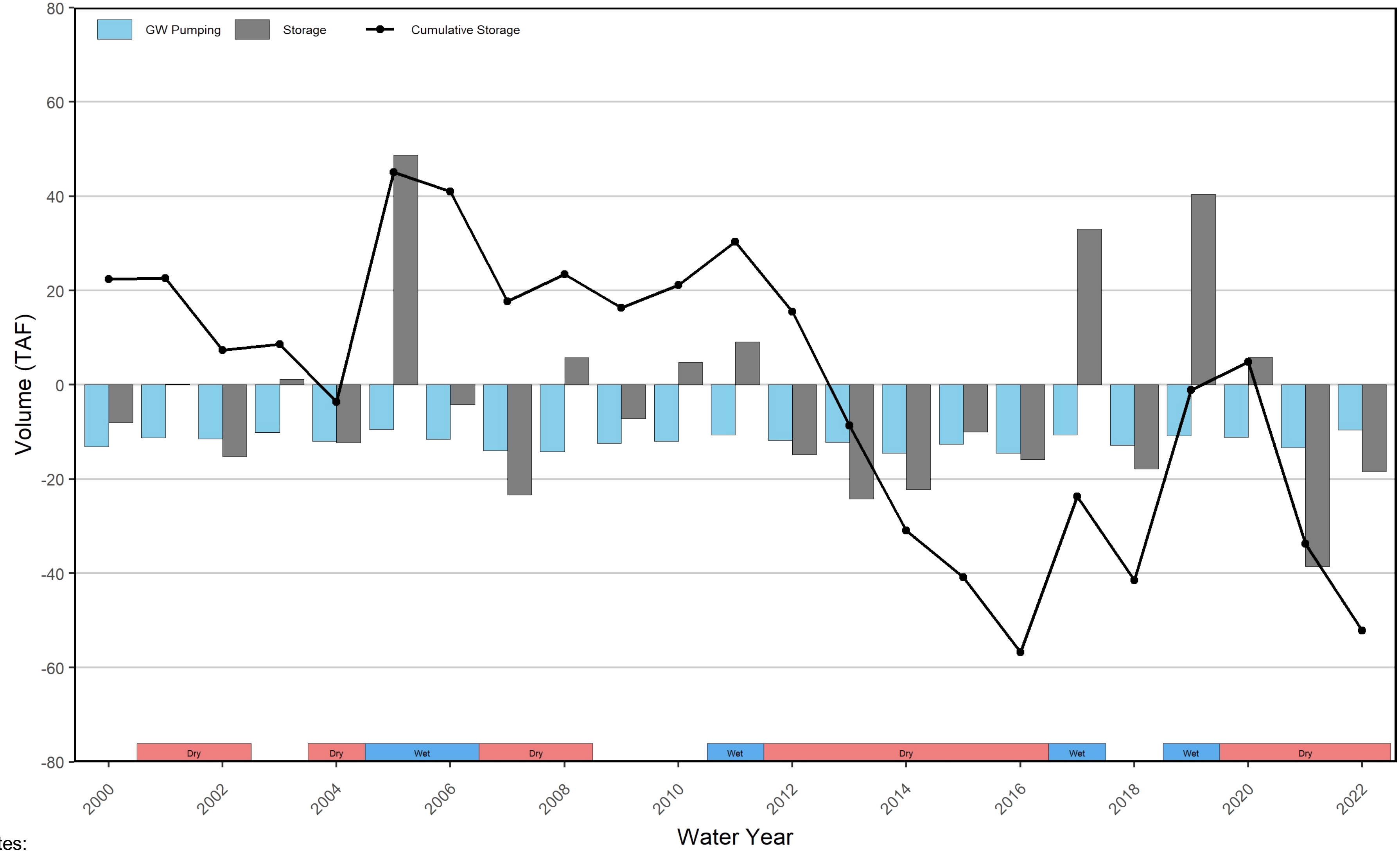
Annual Groundwater Pumping and Change in Storage



Notes:

1. Negative GW pumping values indicate extractions from groundwater aquifer.
2. Positive storage values indicate increasing groundwater levels.
3. GW pumping and change in storage volumes estimated for WY 2021-2022.
4. Red and blue colored bars at bottom of graph indicate dry/critical and wet water year types, respectively, from San Joaquin Valley Water Year Hydrologic Classification Indices.

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Groundwater Pumping and Change in Storage
WY 2000-2022

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Figure 9

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