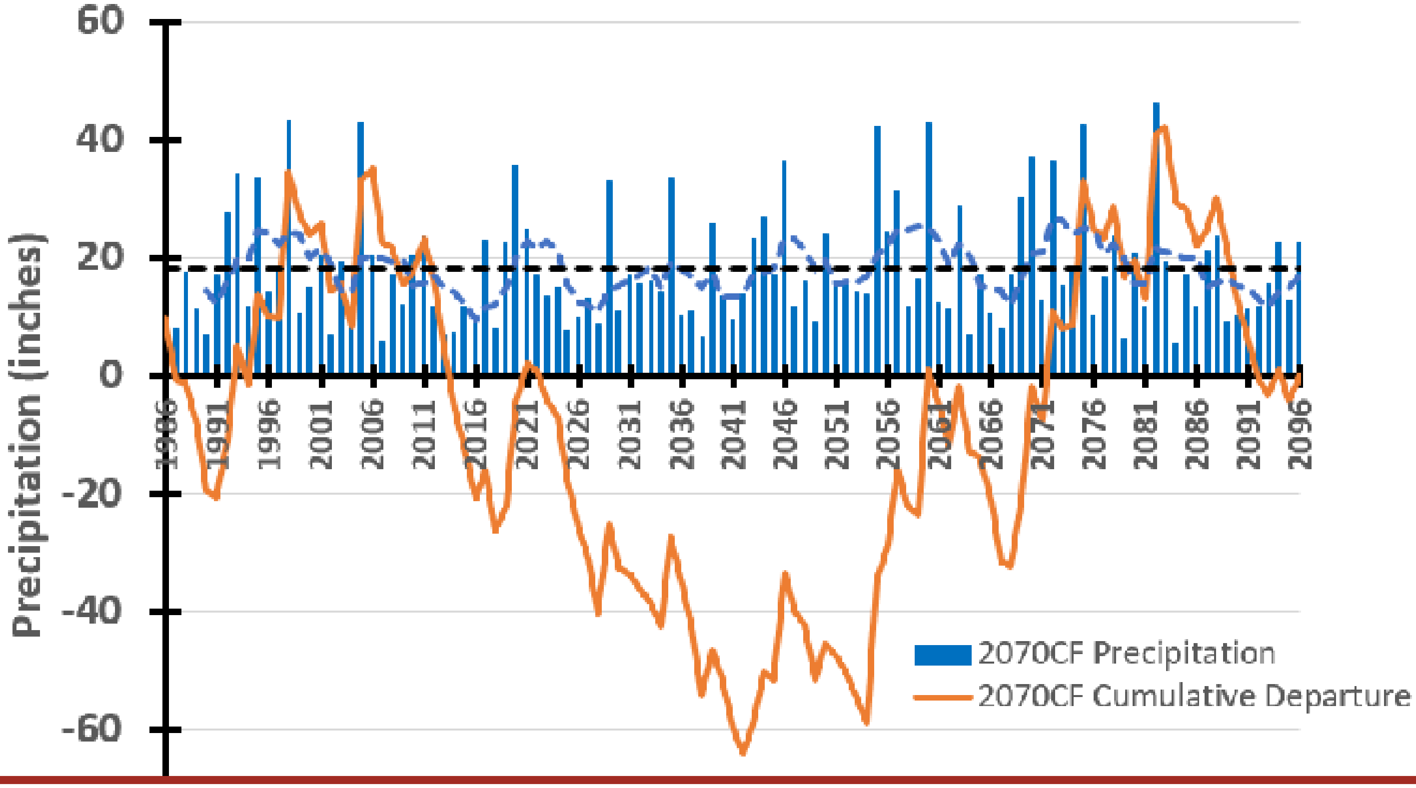
PIRU BASIN


# Groundwater Sustainability Plan
# Final - Revised




December 16, 2021 (Revised July 8, 2024)

Prepared for

Fillmore and Piru Basins Groundwater Sustainability Agency

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Prepared by

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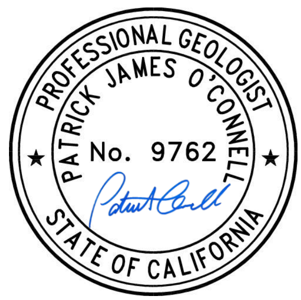
# Certification

This groundwater sustainability plan was prepared in accordance with generally accepted professional hydrogeologic principles and practices. This plan makes no other warranties, either expressed or implied as to the professional advice or data included in it. This plan 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.

**DANIEL B. STEPHENS & ASSOCIATES, INC.**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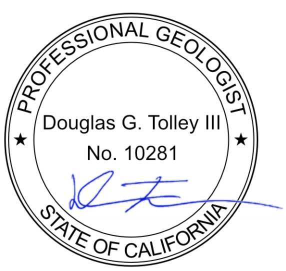


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# Table of Contents

# List of Figures

# List of Tables

# List of Appendices

# Acronyms and Abbreviations

| | |
|---|---|
| AB | assembly bill |
| ADCP | acoustic doppler current profiler |
| AF | acre-feet |
| AFY | acre-feet per year |
| Ag | agriculture |
| AMI | automated (or advanced) metering infrastructure |
| APN | assessor parcel number |
| B | boron |
| Basin | Piru subbasin of the Santa Clara River Valley Basin |
| bgs | below ground surface |
| BMP | best management practice |
| CA | California |
| CASGEM | California Statewide Groundwater Elevation Monitoring |
| CCR | California Code of Regulations |
| CDFW | California Department of Fish and Wildlife |
| CDPH | California Department of Public Health |
| cfs | cubic feet per second |
| CIMIS | California Irrigation Management Information System |
| Cl | chloride |
| COC | chemical of concern |
| CWC | California Water Code |
| DBS&A | Daniel B. Stephens & Associates, Inc. |
| DDW | [SWRCB] Division of Drinking Water |
| DQO | data quality objective |
| DTSC | [CA] Department of Toxic Substances Control |
| DTW | depth to water |
| DWR | [CA] Department of Water Resources |
| ENSO | El Niño Southern Oscillation |
| ESA | Endangered Species Act of 1973 |
| ET | evapotranspiration |
| $ET_0$ | reference evapotranspiration |
| FCGMA | Fox Canyon Groundwater Management Agency |

| | |
|---|---|
| FERC | Federal Energy Regulation Commission |
| FICO | Farmers Irrigation Company |
| FPBGSA | Fillmore and Piru Basins Groundwater Sustainability Agency |
| GAMA | [USGS] Groundwater Ambient Monitoring & Assessment program |
| GIS | geographic information system |
| GPS | global positioning system |
| GSP | groundwater sustainability plan |
| HCM | hydrogeologic conceptual model |
| Hwy | [CA] State Highway |
| Hydrodata | [VCWPD] hydrologic data server |
| ID | identification |
| InSAR | Interferometric Synthetic Aperture Radar |
| IRWM | Integrated Regional Water Management |
| IRWMP | Integrated Regional Water Management Plan |
| LARWQCB | Los Angeles Regional Water Quality Control Board |
| LNAPL | light nonaqueous-phase liquid |
| M&I | municipal and industrial |
| MCL | maximum contaminant level |
| MO | measurable objective |
| MOU | memorandum of understanding |
| MS4 | municipal separate storm sewer system |
| msl | above mean sea level |
| MT | minimum threshold |
| NAVD88 | North American Vertical Datum of 1988 |
| ND | non-detect |
| NDVI | Normalized Difference Vegetation Index |
| NDMI | Normalized Difference Moisture Index |
| NGVD29 | National Geodetic Vertical Datum of 1929 |
| NMFS | National Marine Fisheries Service |
| $NO_3$ | nitrate |
| NWIS | National Water Information System |
| OFR | open file report |
| PDO | Pacific Decadal Oscillation |
| PLSS | Public Land Survey System |
| Prop 1 | Proposition 1 |

| | |
|---|---|
| psi | pounds per square inch |
| PVC | polyvinyl chloride |
| QA | quality assurance |
| QC | quality control |
| RASA | regional aquifer-system analysis |
| Reg. | SGMA Regulation |
| Regional Model | Ventura Regional Groundwater Flow Model |
| RMSE | root mean squared error |
| RP | reference point (elevation) |
| RWQCB | [CA] Regional Water Quality Control Board |
| SAP | sampling and analysis plan |
| SCE | Southern California Edison |
| SCVGSA | Santa Clarita Valley Groundwater Sustainability Agency |
| SCV Water | Santa Clarita Valley Water Agency |
| Section | Section of a Township and Range (PLSS) |
| SFEI | San Francisco Estuary Institute |
| SGMA | [CA] Sustainable Groundwater Management Act of 2014 |
| $SO_4$ | sulfate |
| SUM | summation |
| SWN | [CA DWR] state well number |
| SWP | State Water Project |
| SWRCB | [CA] State Water Resource Control Board |
| TD | total depth |
| TDS | total dissolved solids |
| TRS | Township-Range-Section |
| TFR | total filterable residue |
| TMDL | total maximum daily load |
| TNC | The Nature Conservancy |
| United | United Water Conservation District |
| U.S. EPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Services |
| USGS | U.S. Geological Survey |
| VC | Ventura County |
| VCWPD | Ventura County Watershed Protection District |
| VCWD 16 | Ventura County Waterworks District Number 16 |

| | |
|---|---|
| VRSD | Ventura Regional Sanitation District |
| WCVC | Watersheds Coalition of Ventura County |
| WL | water level |
| WLE | water level elevation |
| WQ | water quality |
| WRP | water reclamation plant |
| WWTP | wastewater treatment plant |
| WY | water year |
| WYT | water year type (DWR) |

# Executive Summary

***Prelude:*** *In January 2024, the California Department of Water Resources (DWR) informed the Fillmore and Piru Basins Groundwater Sustainability Agency (FPBGSA or Agency) that the Groundwater Sustainability Plan (GSP) submitted to DWR in January 2022 for the Piru Basin was deemed incomplete and provided the Agency with a 180-day period to address the deficiencies. In consultation with DWR, the Agency Board of Directors, and stakeholders, the Piru Basin GSP has been revised to address the deficiencies. This revised version of the GSP is not a complete update of the GSP; rather, it only revises those sections of the GSP (and associated appendices) to address the DWR-identified deficiencies. A more robust revisit of the GSP will be a part of the 5-year update due in 2027.*

The Piru Basin (the Basin) is managed (along with the downslope Fillmore Basin) by theFPBGSA. The Basin is projected to remain sustainable over the Sustainable Groundwater Management Act (SGMA) implementation and sustainability period, based on the current understanding of historical, current (2019), and projected (2022 through 2072) groundwater conditions in relation to the sustainability indicators specified in SGMA. A sustainability indicator refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results. The Agency, with consideration of feedback from active stakeholder engagement, has identified and planned for the prevention of significant and unreasonable undesirable results.

Five of the six sustainability indicators apply to the Basin in varying degrees and are outlined below with identified undesirable results to avoid:

- *Chronic lowering of groundwater levels*: Maintain sufficient groundwater elevations such that extraction wells and key groundwater dependent ecosystems (GDEs) in rising groundwater areas are not significantly and unreasonably impacted.
- *Reduction of groundwater in storage:* Maintain groundwater pumping at rates and extraction volumes that do not chronically reduce the volume of groundwater in storage.
- *Land subsidence:* Prevent inelastic (non-recoverable) land elevation declines due to groundwater pumping that interfere with critical infrastructure (canals, roads, utilities, etc.).
- *Degraded water quality:* Avoid projects or management actions that degrade water quality beyond historical conditions.

- *Depletions of interconnected surface water:* Avoid significant and unreasonable adverse impacts on beneficial uses and users of surface water.

The Agency has benefited from the historical groundwater monitoring and management that has taken place in the Piru Basin. The hydrology of the Basin has been quantified over several decades with mandatory, self-reporting of groundwater extractions being a required element of groundwater management since the 1980s. Monitoring of groundwater levels and water quality by United Water Conservation District (UWCD or United) and/or Ventura County Watershed Protection District (VCWPD or the County) has been a staple in the Basin for several decades.

The Basin is characterized by highly variable intra- and inter-annual precipitation and runoff patterns. Runoff into the basin is augmented by managed releases from Lake Piru and Castaic Lake, as well as effluent discharges from wastewater treatment plants upstream in the neighboring Santa Clara River Valley East subbasin. These variable precipitation and runoff patterns generally result in short term declines in water levels on the order of months during the summer and fall months, which can persist for several years during drought periods. However, water levels recover during subsequent normal to wet periods. Consequently, the Piru Basin exhibits a repetitive, cyclic behavior in water levels that is characteristic of a sustainable basin. There is no evidence of chronic, long-term (>5 years) declines in water levels.

The relationship between water level changes and changes in groundwater storage indicates that the absence of chronic, long-term declines in water levels also excludes the potential for long-term declines in groundwater storage, as the two share a direct positive correlation.

The primary GDEs in the Basin are located at the Fillmore/Piru basin boundary and the Piru/Santa Clara River Valley East basin boundary. The GDEs are supported by effluent discharges from wastewater treatment plants and/or rising groundwater in these areas. The majority of the Santa Clara River in the Basin consists of losing reaches, which consequently go dry for many months of the year.

Depletion of interconnected surface water and groundwater storage by groundwater extractions has been identified in the Piru Basin using the UWCD groundwater flow model. The model helped the Agency determine how water levels during prolonged drought periods were impacted by the drought itself versus how those water levels were altered by groundwater extractions. Modeling results indicated that water levels were likely to decline below critical elevations for vegetation in the Cienega Springs GDE area duringprolonged droughts despite extensive (~50 percent) reductions in groundwater extractions.

Water quality changes in the Basin are not expected due to the implementation of this groundwater sustainability plan (GSP). Major anthropogenic water quality challenges have not been identified in the Basin, with the exception of the elevated chloride concentrations in the wastewater effluent from upstream treatment plants. While the Agency does not have regulatory authority over water quality, it is committed to continuing the extension of the water level and water quality program that has been in place for many years, and will work cooperatively with regulatory agencies that have authority over water quality issues.

Seawater intrusion is not applicable to this basin. The Piru Basin is located over 25 miles inland and at an elevation substantially higher than the coastline.

The Agency has elected to develop and implement mitigation plans for the impact groundwater extractions have in exacerbating the water declines associated with prolonged drought periods. The first mitigation plan is to address potential impacts to the Cienega Springs vegetative GDE. It will be developed in consultation with the California Department of Fish and Wildlife (CDFW) and/or The Nature Conservancy (TNC), with input from stakeholders. It will be memorialized in a formal document that will describe how, when, and where the Agency will provide supplemental water from a deep water supply well(s) to the Cienega Springs restoration project during a prolonged drought. This restoration project has the potential to be a seed reservoir/bank that can be important to the revegetation of GDE areas impacted by droughts.

The second mitigation plan is to address shallow water supply wells that go dry during a prolonged drought period. In order to adequately inform the development of this mitigation plan, a more detailed domestic well drought vulnerability assessment will be performed. This is anticipated to use an updated version of the UWCD groundwater-surface water model that will have finer resolution and will more accurately represent groundwater levels in the Basin. The shallow dry well mitigation plan will ultimately be developed by the FPBGSA with input from stakeholders and memorialized in a formal document.

# 1. Introduction

This groundwater sustainability plan (GSP) covers the Piru Basin (the Basin) located in Ventura County, California in the Santa Clara River Valley. This GSP was developed with extensive stakeholder engagement to ensure that the interests of the beneficial users and uses of groundwater were taken into consideration as the program to achieve sustainability was being established.

## 1.1 Purpose of the Groundwater Sustainability Plan

In 2014, the State of California enacted the Sustainable Groundwater Management Act (SGMA). This law requires that groundwater basins in California designated as medium or high priority be managed sustainably. The Fillmore subbasin was assigned a high priority status by the Department of Water Resources (DWR). The Fillmore and Piru Basin Groundwater Sustainability Agency (FPGSA or the Agency) was formed, and its directors have elected to prepare a GSP and to use awarded grant funds to support the sustainable management effort.

Satisfying the requirements of SGMA generally requires four basic activities:

- Forming one or multiple groundwater sustainability agency(ies) (GSAs) to fully cover a basin
- Developing one or multiple groundwater sustainability plan(s) (GSPs) that fully cover the basin
- Implementing the GSP and managing to achieve quantifiable objectives
- Regular reporting to DWR

This document fulfills the GSP requirement for the Piru Basin. This GSP describes the Basin, develops quantifiable management objectives that account for the interests of the areas beneficial groundwater uses and users, and identifies a group of projects and management actions that will allow the Basin to achieve sustainability within 20 years of plan adoption.

The GSP was developed specifically to comply with SGMA's statutory and regulatory requirements. As such, the GSP uses the terminology set forth in these requirements (e.g., Water Code Section 10721 and 23 CCR Section 351), which is often different from the terminology used in other contexts (e.g., past reports or studies, past analyses, judicial rules or findings). The definitions from the relevant statutes and regulations are attached to this report for reference.

This GSP is a planning document. The numbers in this GSP are not meant to be the basis for final determinations of individual water rights or safe yield. This GSP also does not define water rights, and none of the numbers in the GSP should be considered definitive for water rights determination purposes. The GSP does, however, take into consideration the beneficial uses and users of groundwater resources in the Basin.

## 1.2 Sustainability Goal

The FPBGSA board of directors approved their guiding principles at the November 2019 board meeting. These principles describe commitments and common interests that combined leadership from the FPBGSA have agreed on as a way to influence current and future compliance with the SGMA. The FPBGSA Joint Exercise of Powers Agreement (JPA) (Appendix A) is the legal foundational document for the GSA. These guiding principles are intended to be consistent with and in furtherance of the JPA. In the event of a conflict between the JPA and these principles, the JPA takes precedence.

Furthermore, the FPBGSA will act in support of the following mission statement and strategies:

> Mission Statement: The Fillmore and Piru Basins Groundwater Sustainability Agency safeguards the sustainability of the Fillmore and Piru basins through locally tailored management of groundwater resources to protect and sustain the environment, local residents and communities, agriculture, and the economy.
>
> FPBGSA Strategies:
>
> 1. Prepare and implement a Groundwater Sustainability Plan (GSP) as described in the Sustainable Groundwater Management Act (SGMA).
>
> 2. Establish standards and criteria for sustainable groundwater conditions and management within the Basin.
>
> 3. Implement groundwater management policies, regulations, and projects of the GSP consistent with the authorities granted under SGMA.
>
> 4. Monitor groundwater resources as prescribed in the GSP, assess changes in the groundwater basin using best available models and data, and adjust or modify management practices when needed to achieve or maintain sustainability.

5. Report annually and as needed to the FPBGSA Board of Directors and public on groundwater uses and conditions in the Basin.

6. Ensure local resident and stakeholder voices including Federal and State recognized tribes are heard through effective public engagement that invites deliberation, collaboration, and action on groundwater management issues of common importance.

## 1.3 Agency Information (Reg. § 354.6)

The Piru Basin GSP has been developed under the direction of the FPBGSA. Contact information for the FPBGSA is as follows:

Fillmore and Piru Basins Groundwater Sustainability Agency
P.O. Box 1110
Fillmore, CA 93016
Website: www.fpbgsa.org
ATTN: Anthony Emmert, Executive Director
805-525-4431
tonye@Unitedwater.org

### 1.3.1 Organization and Management Structure of the Groundwater Sustainability Agency

The FPBGSA Board of Directors is composed of a single appointed representative from each of the following public agencies and stakeholder entities:

- Public agencies
  - County of Ventura
  - City of Ventura
  - United Water Conservation District (United)
- Stakeholder entities
  - Fillmore Basin Pumpers Association
  - Piru Basin Pumpers Association
  - Environmental organizations

The County of Ventura Board of Supervisors appoints a supervisor to the FPBGSA Board of Directors.

The City of Fillmore represents the municipal water users of the largest city in the Fillmore Basin. The City of Fillmore City Council appoints a councilperson as its representative to the FPBGSA Board of Directors.

United is a special district that is charged with managing, protecting, conserving, and enhancing the water resources of the Santa Clara River, its tributaries, and associated aquifers. The Fillmore and Piru Basins are located within the United service area. The United Board of Directors appoints one of its members as its representative to the FPBGSA Board of Directors.

The Fillmore Basin Pumpers Association represents the groundwater water extractors in that basin. The association is open to all groundwater extractors (i.e., municipal, domestic, irrigation, industrial). The stakeholders of the Fillmore Basin Pumpers Association appoint one of its members as its representative to the FPBGSA Board of Directors.

The Piru Basin Pumpers Association represents the groundwater water extractors in that basin. The Association is open to all groundwater extractors (i.e., municipal, domestic, irrigation, industrial). The stakeholders of the Piru Basin Pumpers Association appoint one of its members as its representative to the FPBGSA Board of Directors.

The interests of environmental organizations engaged in the enhancement or protection of the environment over the Fillmore Basin or Piru Basin, or both, are represented by the Environmental Stakeholder Director. This director is nominated by the Santa Clara River Environmental Groundwater Committee, which consists of the following organizations: The Nature Conservancy, Friends of the Santa Clara River, California Trout, Wishtoyo Foundation, Keep the Sespe Wild, Santa Clara River Watershed Conservancy, Sierra Club, Central Coast Alliance United for a Sustainable Economy (CAUSE), Citizen for Responsible Oil and Gas (CFROG), Surfrider Foundation, Los Padres Forest Watch, and National Audubon Society.

The supporting staff to the FPBGSA board of directors includes the following:

- Contract legal counsel.
- Contract Executive Director that oversees the routine operations of the FPBGSA and is currently an employee of United.
- Contract Clerk of the Board who is currently an employee of United.
- Groundwater modeling services are provided by United Water Resources Department personnel.

- Contract GSP/technical staff are provided by Daniel B. Stephens & Associates, Inc.

### 1.3.2 Legal Authority of the GSA

The FPBGSA JPA (Appendix A) is the legal foundational document for the FPBGSA.

### 1.3.3 Estimated Cost of Implementing the GSP and the GSA's Approach to Meet Costs

The estimated costs of implementing this GSP are under development by the FPBGSA board of directors and staff, and are dependent on the projects and management actions (Section 4). As detailed in other sections of this document, the Basin is in a sustainable condition, with only limited projects or management actions deemed appropriate for mitigating the impacts of groundwater extraction on groundwater dependent ecosystems (GDEs) during prolonged drought periods (Section 3 and Appendix J). The estimated costs of that mitigation program will be developed post-submittal of the GSP to DWR in January 2022 in consultation with the California Department of Fish and Wildlife (CDFW) and stakeholders. The FPBGSA board of directors will consider other actions (Section 3) that have the potential to augment the groundwater management program in the Basin, but are not necessarily needed to achieve sustainability.

The FPBGSA board of directors has typically financed its operation via a groundwater extraction charge (i.e., fee per feet/acre-foot of groundwater pumped). The agency has other financial mechanisms that could be employed, if needed (e.g., ad valorem charges). The FPBGSA board of directors are and will continue to explore grant opportunities, as well.

## 1.4 GSP Organization

This GSP is organized according to DWR's "GSP Annotated Outline" for standardized reporting (DWR, 2016). The Preparation Checklist for GSP Submittal is provided as Table 1.4-1 (DWR, 2016).

## Table 1.4-1. Preparation Checklist for GSP Submittal
### Page 1 of 9

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| *Article 3. Technical and Reporting Standards* | | | | |
| 352.2 | | Monitoring Protocols | ▪ Monitoring protocols adopted by the GSA for data collection and management<br>▪ Monitoring protocols that are designed to detect changes in groundwater levels, groundwater quality, inelastic surface subsidence for basins for which subsidence has been identified as a potential problem, and flow and quality of surface water that directly affect groundwater levels or quality or are caused by groundwater extraction in the basin | Section 3.5<br>Appendices F, J, K, and L |
| *Article 5. Plan Contents, Subarticle 1. Administrative Information* | | | | |
| 354.4 | | General Information | ▪ Executive Summary<br>▪ List of references and technical studies | ES-1<br>Section 6 |
| 354.6 | | Agency Information | ▪ GSA mailing address<br>▪ Organization and management structure<br>▪ Contact information of Plan Manager<br>▪ Legal authority of GSA<br>▪ Estimate of implementation costs | Section 1.3 |
| 354.8(a) | 10727.2(a)(4) | Map(s) | ▪ Area covered by GSP<br>▪ Adjudicated areas, other agencies within the basin, and areas covered by an Alternative<br>▪ Jurisdictional boundaries of federal or State land<br>▪ Existing land use designations<br>▪ Density of wells per square mile | Figures 2.1-2, 2.1-3, 2.1-5, 2.1-6, 2.1-7, 2.1-12, and 2.1-13 |

## Table 1.4-1. Preparation Checklist for GSP Submittal
Page 2 of 9

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| 354.8(b) | | Description of the Plan Area | Summary of jurisdictional areas and other features | Section 2.1 |
| 354.8(c)<br>354.8(d)<br>354.8(e) | 10727.2(g) | Water Resource Monitoring and Management Programs | ▪ Description of water resources monitoring and management programs<br>▪ Description of how the monitoring networks of those plans will be incorporated into the GSP<br>▪ Description of how those plans may limit operational flexibility in the basin<br>▪ Description of conjunctive use programs | Section 2.1.2<br>Section 3.5<br>Appendix K |
| 354.8(f) | 10727.2(g) | Land Use Elements or Topic Categories of Applicable General Plans | ▪ Summary of general plans and other land use plans<br>▪ Description of how implementation of the GSP may change water demands or affect achievement of sustainability and how the GSP addresses those effects<br>▪ Description of how implementation of the GSP may affect the water supply assumptions of relevant land use plans<br>▪ Summary of the process for permitting new or replacement wells in the basin<br>▪ Information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management | Section 2.1.3<br>Section 4.1<br>Appendices J and K |

**Table 1.4-1. Preparation Checklist for GSP Submittal**
**Page 3 of 9**

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| 354.8(g) | 10727.4 | Additional GSP Contents | Description of actions related to:<br>▪ Control of saline water intrusion<br>▪ Wellhead protection<br>▪ Migration of contaminated groundwater<br>▪ Well abandonment and well destruction program<br>▪ Replenishment of groundwater extractions<br>▪ Conjunctive use and underground storage<br>▪ Well construction policies<br>▪ Addressing groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects<br>▪ Efficient water management practices<br>▪ Relationships with State and federal regulatory agencies<br>▪ Review of land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity<br>▪ Impacts on groundwater dependent ecosystems | Section 2.1.4 |
| 354.10 | | Notice and Communication | ▪ Description of beneficial uses and users<br>▪ List of public meetings<br>▪ GSP comments and responses<br>▪ Decision-making process<br>▪ Public engagement<br>▪ Encouraging active involvement<br>▪ Informing the public on GSP implementation progress | Section 2.1.5 Appendices B and C |

## Table 1.4-1. Preparation Checklist for GSP Submittal Page 4 of 9

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| Article 5. Plan Contents, Subarticle 2. Basin Setting | | | | |
| 354.14 | | Hydrogeologic Conceptual Model | ▪ Description of the Hydrogeologic Conceptual Model<br>▪ Two scaled cross-sections<br>▪ Map(s) of physical characteristics: topographic information, surficial geology, soil characteristics, surface water bodies, source and point of delivery for imported water supplies | Section 2.2<br>Figures 2.2-1, through 2.2-13<br>Appendix K |
| 354.14(c)(4) | 10727.2(a)(5) | Map of Recharge Areas | Map delineating existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas | Section 2.2.1.5<br>Figure 2.2-9 |
| 354.14(c)(4) | 10727.2(d)(4) | Recharge Areas | Description of how recharge areas identified in the plan substantially contribute to the replenishment of the basin | Section 2.2<br>Appendices E, G, H, and I |
| 354.16 | 10727.2(a)(1)<br>10727.2(a)(2) | Current and Historical Groundwater Conditions | ▪ Groundwater elevation data<br>▪ Estimate of groundwater storage<br>▪ Seawater intrusion conditions<br>▪ Groundwater quality issues<br>▪ Land subsidence conditions<br>▪ Identification of interconnected surface water systems<br>▪ Identification of groundwater-dependent ecosystems | Section 2.2.2<br>https://fillmore-piru.gladata.com/<br>Appendices D, E, F, J, and K |
| 354.18 | 10727.2(a)(3) | Water Budget Information | ▪ Description of inflows, outflows, and change in storage<br>▪ Quantification of overdraft<br>▪ Estimate of sustainable yield<br>▪ Quantification of current, historical, and projected water budgets | Sections 2.2.2 and2.2.3<br>Appendices E, G, H, and I |

### Table 1.4-1. Preparation Checklist for GSP Submittal Page 5 of 9

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| 354.18 | 10727.2(d)(5) | Surface Water Supply | Description of surface water supply used or available for use for groundwater recharge or in-lieu use | Section 2.2.1<br>Appendices G, I, and H |
| 354.20 | | Management Areas | ▪ Reason for creation of each management area<br>▪ Minimum thresholds and measurable objectives for each management area<br>▪ Level of monitoring and analysis<br>▪ Explanation of how management of management areas will not cause undesirable results outside the management area<br>▪ Description of management areas | Section 2.2.4<br>Appendices G, J, and K |
| Article 5. Plan Contents, Subarticle 3. Sustainable Management Criteria | | | | |
| 354.24 | | Sustainability Goal | Description of the sustainability goal | Section 1.2 and 3.1<br>Appendix B |
| 354.26 | | Undesirable Results | ▪ Description of undesirable results<br>▪ Cause of groundwater conditions that would lead to undesirable results<br>▪ Criteria used to define undesirable results for each sustainability indicator<br>▪ Potential effects of undesirable results on beneficial uses and users of groundwater | Section 3.2<br>Appendix J |

## Table 1.4-1. Preparation Checklist for GSP Submittal
## Page 6 of 9

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| 354.28 | 10727.2(d)(1)<br>10727.2(d)(2) | Minimum Thresholds | ▪ Description of each minimum threshold and how they were established for each sustainability indicator<br>▪ Relationship for each sustainability indicator<br>▪ Description of how selection of the minimum threshold may affect beneficial uses and users of groundwater<br>▪ Standards related to sustainability indicators<br>▪ How each minimum threshold will be quantitatively measured | Section 3.3<br>Appendix J<br>https://fillmore-piru.gladata.com/ |
| 354.30 | 10727.2(b)(1)<br>10727.2(b)(2)<br>10727.2(d)(1)<br>10727.2(d)(2) | Measurable Objectives | ▪ Description of establishment of the measurable objectives for each sustainability indicator<br>▪ Description of how a reasonable margin of safety was established for each measurable objective<br>▪ Description of a reasonable path to achieve and maintain the sustainability goal, including a description of interim milestones | Section 3.4<br>Appendix J<br>https://fillmore-piru.gladata.com/ |

## Table 1.4-1. Preparation Checklist for GSP Submittal Page 7 of 9

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| *Article 5. Plan Contents, Subarticle 4. Monitoring Networks* | | | | |
| 354.34 | 10727.2(d)(1)<br>10727.2(d)(2)<br>10727.2(e)<br>10727.2(f) | Monitoring Networks | ▪ Description of monitoring network<br>▪ Description of monitoring network objectives<br>▪ Description of how the monitoring network is designed to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features; estimate the change in annual groundwater in storage; monitor seawater intrusion; determine groundwater quality trends; identify the rate and extent of land subsidence; and calculate depletions of surface water caused by groundwater extractions<br>▪ Description of how the monitoring network provides adequate coverage of Sustainability Indicators<br>▪ Density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends<br>▪ Scientific rational (or reason) for site selection<br>▪ Consistency with data and reporting standards<br>▪ Corresponding sustainability indicator, minimum threshold, measurable objective, and interim milestone | Section 3.5<br>Appendices K and L<br>https://fillmore-piru.gladata.com/ |
| 354.36 | | Representative Monitoring | ▪ Description of representative sites<br>▪ Demonstration of adequacy of using groundwater elevations as proxy for other sustainability indicators<br>▪ Adequate evidence demonstrating site reflects general conditions in the area | Section 3.5.3<br>Appendix K<br>https://fillmore-piru.gladata.com/ |

## Table 1.4-1. Preparation Checklist for GSP Submittal
## Page 8 of 9

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| 354.38 | | Assessment and Improvement of Monitoring Network | ▪ Review and evaluation of the monitoring network<br>▪ Identification and description of data gaps<br>▪ Description of steps to fill data gaps<br>▪ Description of monitoring frequency and density of sites | Appendix K<br>Sections 3.5.4 and 5.4 |
| *Article 5. Plan Contents, Subarticle 5. Projects and Management Actions* | | | | |
| 354.44 | | Projects and Management Actions | ▪ Description of projects and management actions that will help achieve the basin's sustainability goal<br>▪ Measurable objective that is expected to benefit from each project and management action<br>▪ Circumstances for implementation<br>▪ Public noticing<br>▪ Permitting and regulatory process<br>▪ Time-table for initiation and completion, and the accrual of expected benefits<br>▪ Expected benefits and how they will be evaluated<br>▪ How the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.<br>▪ Legal authority required<br>▪ Estimated costs and plans to meet those costs<br>▪ Management of groundwater extractions and recharge | Section 4 |

**Table 1.4-1. Preparation Checklist for GSP Submittal**
**Page 9 of 9**

| GSP Regulations Section | Water Code Section | Requirement | Description | Section(s) or Page Number(s) in GSP |
|---|---|---|---|---|
| 354.44(b)(2) | 10727.2(d)(3) | | Overdraft mitigation projects and management actions | Not Applicable (basin not in overdraft) |
| *Article 8. Interagency Agreements* | | | | |
| 357.4 | 10727.6 | | ▪ Coordination Agreements shall describe the following: A point of contact<br>▪ Responsibilities of each Agency Procedures for the timely exchange of information between Agencies<br>▪ Procedures for resolving conflicts between Agencies<br>▪ How the Agencies have used the same data and methodologies to coordinate GSPs<br>▪ How the GSPs implemented together satisfy the requirements of SGMA<br>▪ Process for submitting all Plans, Plan amendments, supporting information, all monitoring data and other pertinent information, along with annual reports and periodic evaluations<br>▪ A coordinated data management system for the basin<br>▪ Coordination agreements shall identify adjudicated areas within the basin, and any local agencies that have adopted an Alternative that has been accepted by the Department | Not Applicable (Single GSA with single GSP) |

# 2. Plan Area and Basin Setting

This section describes the plan area (e.g., land uses, zoning, jurisdictions, and planning areas) and the Basin setting (e.g., hydrogeological conceptual model and groundwater conditions).

## 2.1 Description of the Plan Area (Reg. § 354.8)

Each Plan shall include a description of the geographic areas covered, including the following information:
(a) One or more maps of the basin that depict the following, as applicable:
(1) The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.
(2) Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.
(3) Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.
(4) Existing land use designations and the identification of water use sector and water source type.
(5) The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.

### 2.1.1 Summary of Jurisdictional Areas and Other Features (Reg. § 354.8[b])

Each Plan shall include a description of the geographic areas covered, including the following information:
(b) A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.

The Piru Basin is a subbasin (DWR Bulletin 118 No. 4-4.06) of the Santa Clara River Valley Basin, located within Ventura County, California (Figure 2.1-1) (DWR, 2006). The Basin is one of a series of subbasins, adjacent to the upslope East Santa Clara River Valley subbasin (No. 4-4.07) to the east and downslope Fillmore subbasin (No. 4-4.05) to the west. In 2019, the Basin boundaries were modified for three components: (1) to align the western boundary with the adjudicated area of the adjacent Santa Paula subbasin, (2) to align the western boundary with adjacent Fillmore subbasin to match the location of a steep groundwater gradient inflection point, and

(3) external boundaries were modified to follow geologic contacts per a qualified (Dibblee) map. The Basin area covers approximately 17 square miles (10,900 acres).

The Basin is under the jurisdiction of Ventura County (District 3) and United, with the exception of a small area of state controlled land (Figure 2.1-2). The Basin is exclusively managed by the Agency, which also manages the Fillmore Basin (Figure 2.1-1). The Agency is a JPA, composed of three local public agencies: (1) County of Ventura, (2) City of Fillmore, and (3) United. VCWPD has water resources and management jurisdiction over the entire Basin area, while United has jurisdiction over the majority of the area (with the exception of western portions of the Basin). State controlled land in the Basin includes the Cienega Springs Ecological Reserve in the western portion of the Basin, which is under the jurisdiction of the CDFW. Surface water (e.g., streams) is subject to oversight by the State Water Resources Control Board (SWRCB). Federal controlled lands include streams (e.g., Santa Clara River and Sespe Creek) under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), per the Endangered Species Act (ESA).

A map of agricultural and urban land use designations from the statewide 2018 crop mapping dataset (Land IQ, 2021) is shown on Figure 2.1-3. The majority of land use is agricultural (46 percent), followed by just over 1 percent that is urban landscape (Table 2.1-1), with the exception of the majority of the Basin area not classified in the dataset. The predominant crop classes in the Basin are citrus and subtropical (e.g., lemons and avocadoes) and truck nursery and berry (e.g., box tree and strawberry) crops, young perennials, grain and hay crops, unclassified crops, and minor crops (i.e., pasture, urban, vineyard).

### Table 2.1-1. Land Use Acreages in Piru Basin

| Land Use | Acres | Percent of Land |
|---|---|---|
| Not Classified | 5,709 | 52% |
| Citrus and Subtropical | 2,104 | 19% |
| Truck Nursery and Berry Crops | 1,761 | 16% |
| Young Perennial | 379 | 3% |
| Grain and Hay Crops | 361 | 3% |
| Unclassified | 281 | 3% |
| Pasture | 159 | 1% |
| Urban | 131 | 1% |
| Vineyard | 11 | 0% |

Crop classes and acreages are for those within the Basin from the 2018 Crop Mapping dataset (Land IQ, 2021) provided by DWR. "Not classified" represents the Basin area that was not assigned a land use classification.

Additionally, a map showing the distribution of disadvantaged communities (DACs) (provided by DWR as of 2018), domestic wells, and drinking water systems (provided by the SWRCB as of October 25, 2021) are included on Figure 2.1-4. The DACs are designated for U.S. Census geographies (e.g., places, tracts, and block groups) based on the Proposition 1 (Prop 1) 2016 Integrated Water Resources Management (IRWM). DACs constitute about 10,416 acres (96 percent) of the Basin, covering all the area except for a sliver of land north of Highway 126 in the northwestern area of the Basin. The town of Piru and nearby surrounding area is designated as a DAC place. The DACs are served by various individual well owners and water companies.

The density of active water wells per square mile (i.e., per township range section) are shown on Figure 2.1-5 for agricultural wells, Figure 2.1-6 for domestic wells, and Figure 2.1-7 for municipal and industrial (M&I) wells. The highest densities of agricultural wells (11 to 20 wells per square mile) are in the western and central areas of the Basin and one section (T04N R18W 27) toward the eastern Basin area. Domestic wells exist in densities ranging from mostly 1 to 2 wells per square mile in various sections of the Basin, and relatively higher densities (3 to 5 wells per square mile) in a few sections in the western half of the Basin. The highest densities of M&I wells are found in the area of the Town of Piru (1 to 2 wells per square mile). Wells used for industrial beneficial use near the western Basin boundary with the Fillmore Basin have historically been associated with aquaculture at the Fillmore Fish Hatchery.

### 2.1.2 Water Resources Monitoring and Management Programs (Reg. § 354.8[c], 354.8[d], and 354.8[e])

Each Plan shall include a description of the geographic areas covered, including the following information:
(c) Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.
(d) A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.
(e) A description of conjunctive use programs in the basin.

The Basin has benefited from robust surface water and groundwater resources monitoring and management programs that have been in place since the 1980s. This GSP adopts the programs implemented by VCWPD and United, as described in the following subsections.

#### *2.1.2.1 Watershed Protection District of Ventura County*

VCWPD is a department within the Ventura County Public Works Agency (VCPWA) that provides for the control and conservation of flood and storm waters and for the protection of watercourses, watersheds, public highways, life, and property. The County of Ventura exercises water management and land use authority on land overlying the entire unincorporated county including Fillmore and Piru Basins. The VCWPD monitoring programs for groundwater levels and groundwater quality are shown on Figures 2.1-8 and 2.1-9, respectively. VCWPD monitors surface water flows in conjunction with the U.S. Geological Survey (USGS) at the recording stream gages shown on Figure 2.1-10. More information on the VCWPD water resources monitoring program can be found in the Monitoring Program and Data Gaps technical memorandum (Appendix K).

#### *2.1.2.2 United Water Conservation District*

United is a special district that monitors and manages water resources of the Santa Clara River and its tributaries and associated aquifers of the Santa Clara River Valley and Coastal Basins. United is authorized under the California Water Code to conduct water resource investigations, acquire water rights, build facilities to store and recharge water, construct wells and pipelines for water deliveries, commence actions involving water rights and water use, and prevent interference with, or diminution of, stream/river flows and their associated natural subterranean supply of water (California Water Code, section 74500 et al.). United has robust surface water and groundwater resources monitoring and management programs. The United groundwater level and groundwater quality monitoring programs are shown on Figures 2.1-8 and 2.1-9, respectively. United monitors surface water flows at the in-stream measurement sites shown on Figure 2.1-10, as well as surface water quality at the sites shown on Figure 2.1-11. Details of the United water resources monitoring program are described in the Monitoring Program and Data Gaps technical memorandum (Appendix K).

Important United operated management programs for primarily groundwater replenishment purposes include conservation releases from Lake Piru through Santa Felicia Dam, flood flow releases from Castaic Lake, and State Water Project (SWP) imports via Pyramid Lake or Castaic Lake (United, 2017) (Figure 2.1-1). These are the most significant conjunctive use programs in the Basin. United is the lead member of a water conservation agreement between DWR and the Downstream Water Users (DWUs), which consist of United, Los Angeles County, FivePoint Holdings (formerly Newhall Land and Farming), and Santa Clarita Valley Water Agency (SCV Water). The program is designed to hold natural runoff from the Castaic Creek watershed in Castaic Lake for later release in a manner that allows the flows to percolate in the basins downstream of the dam, benefiting the DWUs. United takes the lead role for the DWUs in requesting the storage and release of flood flows, and in monitoring releases to make sure that flows benefit the DWUs in both Los Angeles and Ventura Counties. The conservation releases from Santa Felicia Dam are performed by United for groundwater replenishment purposes, and these releases are performed in a way that meets regulatory requirements. Releases of SWP water from Pyramid Lake are currently limited to 3,150 acre-feet per year (AFY) and to the period from November 1 through the end of February the following year. United is establishing relationships with other water purveyors, such as SCV Water, to diversify surface water supplies. These conjunctive use programs enable greater operational flexibility of groundwater resources in the Basin than would otherwise be possible.

#### *2.1.2.3 State Water Resources Control Board*

The SWRCB oversees two groundwater resource monitoring programs: (1) Groundwater Ambient Monitoring and Assessment (GAMA), California's comprehensive groundwater quality monitoring program created in 2000, and (2) GeoTracker, the State's data management system for sites that impact, or have the potential to impact, water quality in California, with an emphasis on groundwater. The data available on GAMA come from the existing monitoring programs of VCWPD and United. Supplemental groundwater level and water quality data from primarily shallow subsurface depths are available for some sites scattered throughout the Basin.

### 2.1.3 Land Use Elements or Topic Categories of Applicable General Plans (Reg. § 354.8[f])

> Each Plan shall include a description of the geographic areas covered, including the following information:
> (f) A plain language description of the land use elements or topic categories of applicable general plans that includes the following:
> (1) A summary of general plans and other land use plans governing the basin.
> (2) A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects.
> (3) A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.
> (4) A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.
> (5) To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.

The County of Ventura exercises land use authority on unincorporated land in the Piru Basin.

Land use zoning designations come from the Ventura County 2040 General Plan (Ventura County, 2020). Land zoning in the Basin (Figure 2.1-12 and Table 2.1-2) is predominantly (52 percent) agricultural, followed by (45 percent) open space and (3 percent) urban.

#### Table 2.1-2. Land Zoning Acreages in Piru Basin

| Land Use | Acres | Percent of Basin Area |
|---|---|---|
| Agricultural | 5,658 | 52% |
| Open Space | 4,965 | 45% |
| Urban | 272 | 3% |

Acreages are based on land zoning information from the Ventura County 2040 General Plan.

Within Ventura County, greenbelt agreements exist between cities and the County to limit urban sprawl development in agricultural and/or open space areas within the unincorporated County (Figure 2.1-13). Through greenbelt agreements, cities commit to not annex any property within a greenbelt, while the County agrees to restrict development to uses consistent with existing zoning. The western portion of the Basin is included in the Fillmore-Piru Greenbelt.

The Ventura County Save Open Space & Agricultural Resources (SOAR) ordinance is a series of voter initiatives that adopted individual jurisdictions to protect open space and agricultural land, originally in 1998. The SOAR ordinance requires countywide voter approval of any change to the General Plan involving the Agricultural, Open Space, or Rural land use designations, or any changes to a General Plan goal or policy related to those land use designations (Ventura County, 2020).

In addition to the County SOAR ordinance, most cities in the County, including the Cities of Fillmore and Santa Paula, have enacted SOAR ordinances/initiatives to establish voter-controlled urban growth boundaries, known as city urban restriction boundaries (CURBs). CURBs are lines around each city that require voter approval to allow city annexation and development of land outside of the CURB boundary (Figure 2.1-13). In November 2016, the voters of Ventura County and 8 of the County's 10 cities (including the City of Fillmore) renewed the SOAR ordinances and extended their controls through 2050.

In summary, agricultural and open space land zoning (Figure 2.1-12) are planned to be preserved, while urban (i.e., city) land use is planned to grow by about 241 housing units by 2045, which equates to about 500 AFY in additional groundwater demand (SCAG, 2017).

#### *2.1.3.1 Description of How Implementation of the GSP May Change Water Demands or Affect Achievement of Sustainability and How the GSP Addresses Those Effects*

This GSP does not specify changes in water demands, but does plan for a modest increase in water demand for GDEs at the Cienega Springs Restoration Site, by allowing groundwater to be pumped from this area for soil moisture mitigation for GDEs during periods of drought (see Section 4.1).

#### *2.1.3.2 Description of How Implementation of the GSP May Affect the Water Supply Assumptions of Relevant Land Use Plans*

The implementation of this GSP does not intend to affect the water supply assumptions of relevant land use plans (i.e., the Ventura County 2040 General Plan).

#### *2.1.3.3 Summary of the Process for Permitting New or Replacement Wells in the Basin*

The process for permitting new or replacement wells in the Basin is under the jurisdiction of VCWPD and described in Ventura County Ordinance No. 4468. The Ventura County 2040 General Plan states that "The County shall coordinate with the local groundwater management agencies and local groundwater sustainability agencies to update County of Ventura Ordinance 4468 and related guidelines on the location, construction, and abandonment of water wells, if necessary" in the 2021-2040 time frame. In addition, the FPBGSA is currently developing a well permitting review process to comply with Executive Orders N-7-22 and N-3-23. This is anticipated to be completed by September 2024.

#### *2.1.3.4 Information Regarding the Implementation of Land Use Plans Outside the Basin that Could Affect the Ability of the Agency to Achieve Sustainable Groundwater Management*

Land use plan(s) covering the East Santa Clara River Valley sub-basin (Figure 2-1.1) in Los Angeles County could have the greatest effect on the ability of the Agency to achieve sustainable groundwater management, due to treated wastewater effluent discharges from SCV Water to the Santa Clara River. These effluent discharges have historically contributed to perennial baseflow across the county line that mitigates the impacts of droughts on groundwater levels/storage (see Appendix K). However, these flows contain elevated chloride concentrations that are a recognized source of groundwater quality degradation in the east Piru Basin (see Section 2.2.2.5.1).

### 2.1.4 Additional GSP Elements (Reg. § 354.8[g])

> Each Plan shall include a description of the geographic areas covered, including the following information:
> (g) A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.

Water Code Section 10727.4 states that the GSP shall include, where appropriate and in collaboration with the appropriate local agencies, the following:

- Wellhead protection
    - Per the Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4812, "Wellhead protection area" means the surface and subsurface area surrounding a water well or well field that supplies a public water system through which contaminants are reasonably likely to migrate toward the water well or well field. Examples of wellhead protection areas include avoiding well construction in floodplain areas and shallow subsurface intervals where contamination (i.e., elevated nitrates) is known.

   - The Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4817.c.8 requires well seal inspection reports to include information on the method of protection of wellhead or open (engineering test) bore hole.
- Migration of contaminated groundwater
   - Potential migration of groundwater containing elevated chloride concentration in east Piru Basin along historical groundwater gradients in the direction of Fillmore Basin is of local concern (see Section 2.2.2.5); however, migration of contaminated groundwater is not a noteworthy concern in the Basin.
- Well abandonment and well destruction program
   - Well abandonment and well destruction are overseen by VCWPD per Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4812.
- Replenishment of groundwater extractions
   - Replenishment of groundwater extractions (beyond that provided by precipitation) is provided by United via Lake Piru releases and SWP water imports. Groundwater replenishment of these surface water flows are attained through Santa Clara River channel percolation. United owns property in the Piru Basin that was historically used for groundwater replenishment (Piru Spreading Grounds), but has not been in operation for at least the past 10 years due to diversion permitting issues on Piru Creek.
- Conjunctive use and underground storage
   - Conjunctive use of surface water and groundwater is managed by United (i.e., via replenishment of groundwater supplies from Lake Piru releases and SWP water imports).
- Well construction policies
   - Well construction policies are specified per Ventura County Code of Ordinances, Division 4, Chapter 8, Article 1, Section 4812 and overseen by VCWPD.
- Groundwater contamination cleanup, recharge, diversions to storage, conservation, water recycling, conveyance, and extraction projects
   - There are no active groundwater contamination cleanup cases in the Basin.
   - Recharge projects include United surface water releases of natural runoff and imported water stored behind Santa Felicia Dam in Lake Piru. During most years, United also

receives surface water runoff from Castaic Lake releases that flow through Santa Clara River Valley East basin (i.e., Santa Clarita) (Figure 2.1-1).

- Surface water diversions: accounted for in the United (2021a, 2021b, and 2021e) surface water and groundwater models. Surface water diversions (Figure 2.2-12) take (or have taken) the following forms:
  - Camulos diversions from Santa Clara River
  - Piru Mutual diversions from Piru Creek
  - Rancho Temescal diversions from two locations along Piru Creek
  - Up to within 2008: United diversions from Piru Creek to the Piru spreading grounds
  - Up to within 2004: Isola diversion from Piru Creek.

  The Town of Piru discharges approximately 170 AFY on average to percolation ponds (located near the north bank of the Santa Clara River) from the wastewater treatment plant (WWTP) located near Hopper Creek (see Section 2.2.1.5.6).

  The Town of Piru does not have a recycled water program.

- Efficient water management practices
  - Efficient water management practices are encouraged in the Ventura County 2040 General Plan for agricultural land practices and municipal uses.
- Relationships with state and federal regulatory agencies
  - United has the necessary water rights from the SWRCB to divert water from Piru Creek for storage in Lake Piru and for generating hydropower at Santa Felicia Dam. United operates the Santa Felicia Dam Project under a Federal Energy Regulatory Commission (FERC) license. License requirements include habitat releases and migration releases for southern California steelhead. United funds USGS stream gaging stations upstream of the Basin in the Santa Clara River, Piru Creek, and at Lake Piru. USGS also maintains the Sespe Creek stream gaging station in Fillmore Basin. United is a SWP contractor and is able to import State Water via releases from Pyramid Lake or Castaic Lake.

#### 2.1.4.1 *Land Use Plans and Efforts to Coordinate with Land Use Planning Agencies to Assess Activities That Potentially Create Risks to Groundwater Quality or Quantity*

Activities that potentially create risks to groundwater quality or quantity should be assessed in coordination with the 2040 Ventura County General Plan and Watersheds Coalition of Ventura County (WCVC) Integrated Regional Water Management Plan (IRWMP), along with the associated Lower Santa Clara River Watershed (LSCR) Salt and Nutrient Management Plan (SNMP) (LWA, 2015).

#### 2.1.4.2 *Impacts on groundwater dependent ecosystems*

Vegetative GDEs depend on shallow groundwater occurrence. The health and extent of GDEs vary with climate and groundwater conditions (e.g., bountiful shallow groundwater during wet periods and less groundwater availability during droughts). The historical and current GDE conditions are evaluated in Section 2.2.2.8. Based on the evaluation by Stillwater Sciences (Stillwater) (Appendix D), the Cienega Riparian Complex GDE unit near the Fish Hatchery and Basin boundary with the Fillmore Basin is most susceptible to vegetation die-off. This is due to a combination of effects of climatic and beneficial uses (i.e., groundwater pumping) on groundwater levels that are most significant during droughts. The FPBGSA proposes a mitigation project measure to protect this high priority GDE unit (see Section 4).

### 2.1.5 Notice and Communication (Reg. § 354.10)

Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:
(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.
(b) A list of public meetings at which the Plan was discussed or considered by the Agency.
(c) Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.
(d) A communication section of the Plan that includes the following:
(1) An explanation of the Agency's decision-making process.
(2) Identification of opportunities for public engagement and a discussion of how public input and response will be used.
(3) A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.
(4) The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

#### *2.1.5.1 Beneficial Uses and Users*

SGMA identifies beneficial user/use categories to be considered in the GSP as follows:

> 10723.2. CONSIDERATION OF ALL INTERESTS OF ALL BENEFICIAL USES AND USERS OF GROUNDWATER
>
> The groundwater sustainability agency shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans. These interests include, but are not limited to, all of the following:
>
> (a) Holders of overlying groundwater rights, including:
>
> (1) Agricultural users.
>
> (2) Domestic well owners.
>
> (b) Municipal well operators.
>
> (c) Public water systems.
>
> (d) Local land use planning agencies.
>
> (e) Environmental users of groundwater.
>
> (f) Surface water users, if there is a hydrologic connection between surface and groundwater bodies.
>
> (g) The federal government, including, but not limited to, the military and managers of federal lands.
>
> (h) California Native American tribes.
>
> (i) Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems.
>
> (j) Entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency.

As described in Section 2.1.1, land use in the Basin is predominantly agricultural, followed by open space, and urban. By acreage, agricultural use makes up the largest developed portion of the Basin.

Beneficial users and uses in the Basin include the following:

- Agricultural and domestic well owners.
- The Town of Piru (municipal well operator).

- United and a number of mutual water companies (public water systems).
- Santa Clara River GDEs, primarily the Del Valle and Cienega Riparian Complex areas (see Section 2.2.2.8 for a summary and Appendix D for a detailed description).
- Ventura County planning departments.
- Disadvantaged communities, such as the Town of Piru and the immediately surrounding area. Nearly all of the Basin is designated a DAC place, DAC block group, or DAC tract (Figure 2.1-4).

There are no California Native American tribal lands, federal lands with groundwater use, users of surface water with a hydrologic connection to groundwater, or monitoring and reporting entities (per SGMA Section 10927) within the Basin.

The following sections describe the FPBGSA's stakeholder representation, outreach, and engagement activities, and how these encourage active involvement of diverse stakeholder groups within the Basin.

#### 2.1.5.2 *Beneficial User Representation*

The FPBGSA board represents beneficial users and uses as shown on Table 2.1-3.

### Table 2.1-3. FPBGSA Stakeholder Representation

| Board Director | Stakeholders/Beneficial Users and Uses |
|---|---|
| Ventura County Director | Ventura County, Ventura County Planning Division, disadvantaged communities in the County, domestic well owners, municipal and agricultural well operators |
| City of Fillmore Director | City of Fillmore, Fillmore Planning Department, disadvantaged communities within the City |
| United Director | United Water Conservation District, all groundwater users |
| Fillmore Pumpers Association Director | All well owners (including agricultural and domestic) within the Fillmore Basin |
| Piru Pumpers Association Director | All well owners (including agricultural and domestic) within the Piru Basin |
| Environmental Stakeholder Director | Environmental organizations engaged in the enhancement or protection of the environment over the Fillmore Basin or Piru Basin, or both, are represented by the Environmental Stakeholder Director. This Director is nominated by the Santa Clara River Environmental Groundwater Committee, which consists of the following organizations: CalTrout, The Nature Conservancy, Friends of the Santa Clara River, Wishtoyo Foundation, Keep the Sespe Wild, Santa Clara River Watershed Conservancy, Sierra Club, Central Coast Alliance United for a Sustainable Economy (CAUSE), Citizens for Responsible Oil and Gas (CFROG), Surfrider Foundation, Los Padres Forest Watch, and National Audubon Society |

### 2.1.5.3 *Stakeholder Outreach and Engagement*

#### *2.1.5.3.1 Communications and Engagement Plan*

The FPBGSA made stakeholder engagement a priority during the entire GSP preparation process. At the outset of GSP development, the FPBGSA prepared a communications and engagement (C&E) plan to identify methods, resources, and tools for conducting stakeholder outreach and engagement consistent with SGMA requirements. The C&E plan is provided as Appendix B.

The FPBGSA compiled a stakeholder list including beneficial users (including all United rate payers/well owners in the Basins) and other interested parties. It notified the public about GSP development status and upcoming stakeholder workshops and board meetings on the GSP using the following methods:

- E-mails and mailings to the stakeholder list
- Social media postings on the FPBGSA Facebook page (https://www.facebook.com/FPBGSA/)
- Updates on the Agency's website (https://www.fpbgsa.org/)
- Information provided at meetings held by other local agencies and organizations, described further below

#### *2.1.5.3.2 Stakeholder Workshops and Engagement at Board Meetings During GSP Development*

Stakeholder education, engagement, and input opportunities were provided at numerous FPBGSA board meetings and stakeholder workshops throughout GSP development, beginning in July 2019 and continuing through adoption of the GSP in December 2021. See Appendix C for a list of these meetings and the topics discussed at each meeting.

Seven stakeholder workshops covered the following topics (in addition to a GSP update at each workshop):

- June 25, 2020
  - Introduction to SGMA
  - Hydrogeological conditions
  - Groundwater model
  - Water budget
- October 1, 2020
  - Sustainable management criteria (SMCs) definitions
  - Potential criteria for the Fillmore and Piru Basins
- December 9, 2020
  - Groundwater model results
  - Groundwater model technical session
- March 18, 2021
  - GDE technical report
  - Draft SMCs
- April 1, 2021

- ◇ GDE technical report
- ◇ Draft SMCs

- September 17, 2021: Draft GSPs
- September 23, 2021: Draft GSPs

Board meetings in the early stages of GSP development included educational and informational presentations on the following topics:

- Roles and responsibilities of the GSA and Board
- Groundwater model
- SMCs
- GDE
- Water budget
- Future conditions

Basin setting information was presented as it was developed to allow for early input from Stakeholders and the FPBGSA Board. Draft technical reports and data were made available for public review early in the process.

Development of SMCs began in an ad hoc committee. The committee prepared a strawman SMC matrix that was presented to the board for consideration in November 2020. The board considered stakeholder input and deliberated on the development and selection of appropriate SMCs for each of sustainability indicator in numerous Board meetings (in addition to the March and April workshops listed above) through June 2021 (see Appendix C for a list of these meetings).

#### *2.1.5.3.3 FPBGSA Website*

The FPBGSA maintains its website (https://www.fpbgsa.org/) to provide a transparent and comprehensive resource and record as well as educational information, including the following:

- Information about the Agency, the entities comprising the GSA (Ventura County, City of Fillmore, and United), its Board of Directors, stakeholder representation
- Agency administrative documents (JPA, bylaws, budget, DWR grant application)
- Agency contact information (phone number and e-mail form)

- SGMA information and resource documents
- Notice of board of directors meetings and stakeholder workshops
- Meeting materials, including agendas, board packets, minutes, and presentations, and recordings of online meetings
- Technical reports
- Database (https://fillmore-piru.gladata.com/)

#### *2.1.5.3.4 Other Outreach, Engagement, and Local Meetings*

In addition to the FPBGSA's outreach and public meetings listed in Appendix C, each board director and the Agency's executive director provided education and updates about the FPBGSA at meetings held by other local agencies and organizations, including the following:

- Ventura County Director: The Ventura County Director provided updates and information about the FPBGSA and GSP development at meetings of the following entities:
  - Ventura County Board of Supervisors
  - Ventura County Watersheds Coalition/Integrated Regional Water Management (IRWM)
  - Santa Clara River Watershed Committee
- United Director: The United FPBGSA Director provided updates and information about the FPBGSA and GSP development at:
  - United public board meetings and Water Resources Committee meetings.
  - Farm Bureau of Ventura County monthly board meetings.

  He also gave regular updates of FPBGSA activities to the stakeholders he works with and represents, typically prior to and following FPBGSA board meetings.
- City of Fillmore Director: City of Fillmore FPBGSA Board Directors provided GSP updates at each Fillmore City Council meeting and announced FPBGSA stakeholder-specific meetings scheduled by the board to get input from the community. Outreach also included communication One Step a la Vez, a nonprofit organization in Fillmore, providing background information on GSP technical memoranda and SMCs and encouraging their submittal of comments.
- Fillmore and Piru Pumpers Associations Stakeholder Directors: The Fillmore and Piru Basin Pumpers Associations Directors, as presidents of these associations, conducted outreach to

and encouraged the involvement of all well-owners (including domestic well owners in DACs) in GSP development. The pumpers associations were established in 2016 for this purpose. During formation of the associations, repeated outreach was conducted to all well owners, including:

- ◇ Multiple letters from the associations and from United invited well owners to informational meetings and to join the associations.
- ◇ Members of the associations' boards of directors used a United well map to identify well owners who were not yet members and contacted them directly.
- ◇ Association membership information was available at public meetings about the GSA held by United.
- ◇ Information and contact information for the pumpers associations was included United mailings with FPBGSA invoices.

Since their formation, they have held monthly board of directors meetings to inform and update their members about FPBGSA activities and progress on the GSPs, as well as soliciting their input and feedback. At least annually, they held membership meetings which included presentations and updates from United, Consulting Hydrogeologist Bryan Bondy, FPBGSA Executive Director Tony Emmert, and the associations' legal counsel.

Pumpers association meetings were in the form of open discussion to ensure all members questions were answered and concerns were heard, documented and addressed. Board members (representing small pumpers, large pumpers, mutual water companies and other pumping interests) continually engage in one-on-one discussions with pumper stakeholders to answer questions and solicit feedback. This feedback is then shared with association presidents. Updates on the GSP were also provided through board members at Mutual Water Company meetings.

- Environmental Stakeholder Director: The Environmental Stakeholder Director engaged with the following organizations about the FPBGSA and GSP development:
  - ◇ Santa Clara River Environmental Groundwater Committee
  - ◇ Friends of the Santa Clara River
  - ◇ Santa Clara River Watershed Committee
  - ◇ Santa Clara River Steelhead Coalition

  - Greater Ventura County Groundwater Sustainability Agency Environmental Stakeholder Collaborative
  - California Non-Governmental Groundwater Collaborative
  - Watersheds Coalition of Ventura County Integrated Regional Water Management Program (Disadvantaged Community stakeholder outreach and education meetings - "WaterTalks" Meetings)
  - Fox Canyon Groundwater Facilitated Process
- Executive Director: The FPBGSA's executive director attended numerous local organization and community meetings throughout the GSP's preparation to provide information and updates. He also coordinated with agencies managing upstream and downstream basins and regulatory agencies. These outreach and coordination meetings included the following:
  - Santa Clara River Watershed Committee meetings: six meetings per year, every other month, with an agendized update on groundwater sustainability agency issues
  - Community Water Talks: targeted outreach to disadvantaged communities in the watershed (sponsored by Watershed Coalition of Ventura County, Disadvantaged Communities Program)
    - Piru Community Water Talks (sponsored by Friends of the Santa Clara River): initial in-person public meeting, March 10, 2020
    - Fillmore Community Water Talks (sponsored by Friends of the Santa Clara River): initial Zoom public meeting, October 21, 2020
  - Fillmore and Piru Basins Pumpers Associations: updates to groundwater pumpers in the two basins, attended by invitation approximately once per year.
  - Coalition of Agriculture, Labor and Business of Ventura County: monthly coordination meetings with an agendized water update item.
  - Santa Clarita Valley Water Agency and GSA: monthly coordination meetings with agencies managing the upstream basin, covering planning, projects development, permitting and implementation.
  - Santa Paula Basin Pumpers Association: coordination with pumpers association representing downstream basin, attended by invitation approximately once per two years.

- CDFW: coordination with state regulatory agency, check-in meeting with South Coast Region regulatory manager twice per month
- United Water Resources Committee: coordination with committee, staff, and stakeholders, approximately 11 meetings per year (monthly) with an agendized update on groundwater sustainability agency issues.

##### *2.1.5.3.5 Comments and Responses on the Draft GSP*

A draft GSP was completed on August 9, 2021. Public comments were received during a 60-day review period, from August 9 through October 9, 2021. The document was accessible in electronic format at the FPBGSA website and paper copies were available at the Fillmore Library, Piru Community Center, and United office. Two stakeholder workshops on the draft GSP were held during the public review period. At these workshops, stakeholders received a presentation on the contents and conclusions of the draft GSP and had an opportunity to ask questions and provide their comments. No comments on draft GSP were received at the workshop; attendees opted to submit their comments in writing. Comments on the draft GSP and responses to those comments are provided in Appendix C.

Early drafts of the technical memoranda (Appendices D, E-1, E-2, F, G, K, and M) were released for public review as they became available during GSP preparation. The technical memoranda provided in this draft GSP were revised in response to comments received on those early drafts, as appropriate. Responses to comments on these early drafts are also provided in Appendix C.

#### *2.1.5.4 Decisions-Making Process*

Key to the FPBGSA's decision-making process is its transparent deliberation of decisions at board meetings and extensive opportunity for public education and input, as described above, on issues before the board.

The FPBGSA board receives information, deliberates, takes public comment, and makes decisions about the GSP at its official meetings. The board operates and provides notice for these meetings consistent with the Brown Act (California Government Code 54950 et seq.).

The FPBGSA is governed by a JPA. The JPA and the Agency's bylaws set forth voting procedures that used to make decisions on the GSP and its implementation (JPA Section 9,2 and bylaws Section 3.4).

According to these procedures, voting by the board of directors is made on the basis of one vote for each director, provided, however, that if the matter to be voted on exclusively concerns one of the Basins and not the other, the pumper stakeholder director representing pumper interests in the unaffected Basin may participate in board discussions of the matter but shall not vote on the matter. All decisions of the board require the affirmative vote of at least four directors, unless one or more directors is absent or conflicted from voting on the matter, or a pumper stakeholder director is prohibited from voting per this section, in which case a decision of the board requires the affirmative vote of at least three directors.

The FPBGSA has developed a set of guiding principles that describe commitments and common interests Agency leaders have agreed to follow as they implement SGMA. These guiding principles are posted on the Agency's website (https://s29420.pcdn.co/wp-content/uploads/2019/11/2019-11-21-FPBGSA-Guiding-Principles-FINAL-Approved-on-11-21-19.pdf). They include general principles of understanding and specific principles related to governance, communication and education, funding and finances, and SGMA implementation and sustainability. A key principle related to stakeholder involvement in the GSP process is:

> The FPBGSA will have an open, transparent process for GSP development and SGMA implementation. Extensive outreach is a priority of FPBGSA members to inform Beneficial Users about implementation and potential effects of SGMA, and to ensure the FPBGSA is informed of all Beneficial User input as a means to support GSA decision-making.

#### 2.1.5.5 *Informing and Engaging the Public During GSP Implementation*

The FPBGSA will continue to use the methods identified above to inform the public about progress implementing the GSP, including the status of projects and actions, and to incorporate public input as an integral element of its decision-making process.

## 2.2 Basin Setting

This section describes the physical setting, hydrogeologic characteristics, and historical, current, and projected conditions of the Basin, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions.

### 2.2.1 Hydrogeologic Conceptual Model (Reg. § 354.14)

The Piru Basin is a subbasin (4-004.06) of the greater Santa Clara River Valley Basin (DWR, 2006), which is within the tectonically active Transverse Ranges geomorphic province and the Santa Clara River Watershed (Hydrologic Unit [HU]-8), one of the northernmost watersheds within the South Coast Hydrologic Region of California (Figure 2.1-1). The hydrogeology of the Basin is described in detail in reports by California Department of Public Works (1933), DWR (1974a and 1974b), SWRB (1956), Mann (1959), Mukae and Turner (1975), Hanson et al. (2003), and United (2021a). The hydrogeologic conceptual model (HCM) for the Basin is described beginning with the regional geologic setting, followed by descriptions of the aquifers and aquitards, and lastly, the surface features of the Basin.

#### *2.2.1.1 Regional Geologic and Structural Setting (Reg. § 354.14[b][1])*

The Transverse Ranges are one of the most rapidly rising regions on earth due to north-to-south compression associated with the San Andreas Fault (CGS, 2002), which has resulted in the east-to-west trending series of mountain ridges and valleys that are oblique to the predominant northwest-to southeast trend of coastal California. The history of ongoing faulting and folding has resulted in the complex synclinal structure of the Ventura basin that encompasses the Basin (Yeats et al., 1981). The mountains are composed of a variety of consolidated and unconsolidated marine and terrestrial sedimentary and volcanic rocks of Late Cretaceous to Quaternary in age (Figure 2.2-1) (Hanson et al., 2003). Similarly, the subbasins of the Santa Clara River Valley basin are filled with a mixture of consolidated (deeper, Tertiary and older) marine deposits and unconsolidated (shallower, Quaternary) terrestrial and coastal deposits. The unconsolidated Quaternary material is classified into (water bearing) aquifers and aquitards, while the consolidated Tertiary and older material is considered (non-water-bearing) bedrock.

The surface expression of these various deposits is shown with detailed (Dibblee) quadrangle geologic maps on Figure 2.2-2. Many of the formations found in the mountain ranges that bound the Basin—Topatopa Mountains to the north and South Mountain anticline to the south—have been folded to the degree of overturned bedding and offset by reverse/thrust faults. The sedimentary rocks of Cretaceous age are exposed in the Topatopa Mountains north of the groundwater basin (Hanson et al., 2003). A simplified geologic map is shown on Figure 2.2-3, based on the following:

- The geologic formation groupings of the Southern California Regional Aquifer-System Analysis (RASA) program (Predmore et al.,1996)
- Faulting information from Dibblee and Nichols and Buchanan-Banks (1974)
- Structural information from CGS (2012)

The most prominent faults near the Basin are (1) the San Cayetano (thrust) Fault, oriented parallel to the northern Basin boundary, and (2) Oak Ridge (reverse) Fault, oriented parallel to the southern Basin boundary. Both faults are covered by a thin amount of Recent alluvium

(SWRB, 1956). These faults offset the mountainous terrain upward and toward one another (i.e., toward the axis of the Basin), and have effectively dropped the Basin bedrock along the Santa Clara River synclinal structure and provided capacity for the deposition of alluvium and Saugus Formation (upper San Pedro Formation) material over 2,000 feet thick in the Basin (Hanson et al., 2003).

#### *2.2.1.2 Lateral Basin Boundaries (Reg. § 354.14[b][2])*

The Dibblee geologic maps (Figure 2.2-2), along with analysis of aerial photographs, were used by DWR and the Agency to modify Bulletin 118 basin boundaries for this Basin and neighboring Fillmore and Santa Clara River Valley East Basins (DWR, 2018a). The Basin is bounded at the north and south by the contacts between unconsolidated alluvium and the exposed bedrock. Bedrock to the north and east of Piru Creek consists of Pico Formation, while bedrock to the north and west of Piru Creek is composed of Monterey Formation and the Sisquoc Shale. Bedrock along the south side of the Basin consists of the Pico Formation (along the eastern half of the Basin) and Sespe Formation, Topanga Sandstone, and Rincon Shale (along the western half of the Basin).

Faults located along the former Bulletin 118 (DWR, 2006) Basin boundaries have been determined to significantly limit or divert groundwater flow. The Oak Ridge Fault to the south has been identified by (Mukae and Turner, 1975; Mann, 1959) to restrict groundwater flow in the Basin. The San Cayetano Fault is located in the northern part of the Basin (Figure 2.2-3), and generally separates the alluvium from the non-water-bearing formations.

#### *2.2.1.3 Definable Bottom of the Basin (Reg. § 354.14[b][3])*

The upper Cretaceous and Tertiary consolidated formations are virtually non-water-bearing, and form the base of the Basin (Hanson et al., 2003). Mann (1959) offers that permeable sand and gravel deposits of the San Pedro Formation may extend to depths as great as 8,800 feet below ground surface (bgs). While these depths correspond with the extents of relatively permeable deposits (i.e., the San Pedro Formation), the depth to which freshwater exists within the basin is likely shallower. Hanson et al. (2003) stated that the depth to the bottom of water-bearing deposits is at least 2,000 feet at the axis of the Santa Clara syncline, while SWRB (1956) conceptualized the Basin to be as deep as 4,000 feet (DWR, 2006). Overall, there is uncertainty in how deep water-bearing deposits occur in the Basin, but this does not have a material impact of this GSP's ability to ensure sustainable conditions because water wells are typically constructed less than 2,000 feet bgs and the substantial changes in groundwater in storage occur at shallower depths. Only a few water wells are deeper than 700 feet (United, 2021a).

The bottom of the principal aquifer is based on the depth to the bottom of Aquifer System (Zone) B per the United (2021a) HCM.

### 2.2.1.4 *Principal Aquifers and Aquitards (Reg. § 354.14[b][4])*

As defined in the SGMA Regulations (Reg. § 351[aa]), principal aquifers are "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." The SGMA regulations provide local agencies with discretion to determine what constitutes "significant or economic" when identifying the principal aquifer(s) in a basin. In this GSP, one principal aquifer is designated for the Basin, corresponding to Aquifer Zones A and B (referred to as Aquifer Systems A and B in United [2021a]) as shown on Figure 2.2-4, while Aquifer Zone C is considered a non-principal aquifer in the Basin because relatively little groundwater is pumped from this zone. For purposes of this GSP, aquifer "systems" as labeled in United (2021a) are considered aquifer "zones." These zones and aquifer designations are described further in the following subsections.

#### 2.2.1.4.1 *Formation Names (Reg. § 354.14[b][4][A])*

The geologic formations pertinent to the Basin are categorized as water-bearing (alluvium and the Saugus [upper San Pedro] Formation) and non-water-bearing (e.g., Pico Formation). Water-bearing means that significant and economical quantities of groundwater, with sufficient water quality, can be extracted from these formations. Non-water-bearing describes deposits that do not produce groundwater of sufficient quantity or quality to meet typical water demands. The geologic formations are subdivided into hydrostratigraphic units (strata or layers) (Figure 2.2-4), which are grouped into aquifer zones based on the HCM (developed by and presented in United [2021a]) and further grouped into the principal aquifer (Zones A and B) and the non-principal aquifer (Zone C). Descriptions of each hydrostratigraphic unit from youngest to oldest (i.e., generally shallowest to deepest) are provided below.

The surficial deposits and colluvium unit (United [2021a] model layer 1) (Figure 2.2-4) exists along the flanks of the basins and is generally absent in the vicinity of the Santa Clara River channel. Lithology is characterized by interbedded, poorly sorted surficial deposits including colluvium, landslide deposits, and alluvial fan material. Thickness ranges from 0 to about 360 feet. During prolonged droughts, this unit becomes dewatered in the upper reaches of the Santa Clara River (Hanson et al., 2003).

The recent alluvium (United [2021a] model layer 3) (Figure 2.2-4) lies at the base of the Holocene deposits and consists of sand and gravels, with some finer-grained interbeds, deposited by the Santa Clara River and its major tributaries. The basal deposits range in thickness from less than 10 to 190 feet, and are a major source of water to wells in the Piru and Fillmore Basins.

According to Hanson et al. (2003), there are few if any clay layers separating the shallow and recent alluvium in the Basin, allowing groundwater to move freely between the two units. The United (2021a) HCM depicts a discontinuous aquitard that separates Surficial Deposits (model layer 1) and recent (younger) alluvium (model layer 3) in the western and eastern Basin areas.

The older alluvium lithologic unit (United [2021a] model layer 5) (equivalent of Mugu aquifer [Mukae and Turner, 1975] in the Coastal basins [Hanson et al., 2003]) is composed of the basal part of the unnamed upper Pleistocene deposits. The older alluvium is similar material to the underlying Saugus (upper San Pedro) Formation because the Santa Clara River was the primary source of sediment for both deposits; however, there is an erosional gap (unconformity) that separates the two formations. The older alluvium is differentiated from the Saugus Formation because it is less indurated and relatively undisturbed (Hanson et al., 2003). The older alluvium extends from about 200 to 400 feet bgs and consists of sand and gravel interbedded with silt and clay. In the subbasins downriver from the Fillmore and Piru Basins, the silt and clay layers retard the vertical movement of water through the Mugu aquifer and confine or partly confine the aquifer (Hanson et al., 2003). This confining characteristic associated with the Coastal Plain basins is the basis for separating United (2021a) Aquifer Zone A (younger alluvium) from Aquifer Zone B (older alluvium); however, these aquifers are considered hydraulically connected (merged) in the Basin based on similar heads modeled in both zones in United (2021a). Wells perforated in the older alluvium and the underlying Saugus Formation obtain most of their water from the shallower older alluvium (Hanson et al., 2003).

The Saugus Formation (equivalent of Hueneme aquifers in Coastal basins)—beneath the Santa Clara River Valley subbasins mapped by Dibblee (1988, 1990a, 1990b, 1991, 1992a, 1992b, 1992c, and 1992d) and Dibblee and Ehrenspeck (1990)—consists of lenticular layers of sand, gravel, silt, and clay of marine and continental origin. The sediments constituting the aquifers have experienced considerable folding, faulting, and erosion since deposition. These deposits are divided into upper (United [2021a] model layer 7) and lower (United [2021a] model layer 9) units of the Saugus Formation, based on data from electric logs, which show a decrease in electrical resistivity at the contact between the aquifers (Hanson et al., 2003) that is attributed to the presence of fine-grained (aquitard) deposits. In areas of the Basin that have been uplifted since deposition (e.g., Basin boundaries with neighboring sub-basins), much of the sediments have been removed by erosion.

United (2021a) conceptualizes these various deposits with three aquifer zones—A, B, and C—in the Santa Paula, Fillmore, and Piru Basins (Figure 2.2-4); however, the hydraulic properties of the hydrostratigraphic units are less stratified in the Fillmore Basin. Aquifer System A is considered merged with Aquifer System B in the Basin as a result of facies change in the depositional environments, where more clays of continuous extent have deposited at the lower (e.g., Oxnard, Mound and Santa Paula) subbasins of the Santa Clara River Valley basin and less fine-grained (aquitard) material and more coarse-grained (aquifer) material deposited in the upper (e.g., Fillmore and Piru) subbasins as a result of higher energy processes (i.e., flood flows) that occur closer to the source rock material (i.e., mountains of the Santa Clara River Watershed). United (2021a) simulates head differences on the order of about 0 to 20 feet between the A and B zones and the C zone (less at the Basin boundary with Piru basin and more toward the Basin boundary with the Santa Paula Basin); therefore, for this GSP, the hydrostratigraphic units are grouped into a principal aquifer comprising aquifer zones A and B.

#### *2.2.1.4.2 Physical Properties (Reg. § 354.14[b][4][B])*

The thickness of the principal aquifer varies between about 30 and 700 feet, shallowest toward the eastern Basin boundary and deepest below the Town of Piru, Piru Creek, and along the Santa Clara River in the western one-third of the Basin (where the valley constricts). The principal aquifer becomes just a few hundred feet thick toward the northern and southern Basin boundaries. For the majority of the Basin area, groundwater is considered unconfined in the principal aquifer with the exception of (1) an aquitard (United [2021a] model layer 8) that semi-confines the Non-Principal (model layers 9 and 10) and (2) a semi-continuous aquitard (model layer 2) that occurs at shallow depths within the principal aquifer. The layer 2 aquitard exists near the flanks of the Basin and is generally absent near the stream channels. The hydrostratigraphy from United (2021a) is described in cross-sectional view from upstream to downstream below.

The Piru-Fillmore Basin Boundary cross section (Figure 2.2-5) (United, 2021a) depicts the following:

> At the Piru-Fillmore basin boundary, the basin narrows in the area upstream of the Fillmore Fish Hatchery. A deposit of finer-grained material of relatively limited extent, mapped as Layer 6, separates the alluvial aquifers from the underlying Upper Saugus/San Pedro Formation, as identified in log signatures from wells (named using each well's State Well Number [SWN]):

04N19W33M08S, 04N19W33F01S, and 04N19W33D05S. This change in stratigraphy, as well as the constriction of the basin, contributes to groundwater being discharged in the SCR as surface flow. A thinner, less extensive deposit of finer-grained material (Layer 4) was also identified in the resistivity log of well 04N19W32L02S, separating the alluvial aquifers.

This change in stratigraphy, as well as the constriction of the basin, contributes to groundwater being discharged in the Santa Clara River as surface flow.

The Piru Basin Buckhorn cross section (Figure 2.2-6) (United, 2021a) shows the predominantly coarse-grained (aquifer) formations—alluvium and the San Pedro Formation—along the synclinal axis (Figure 2.2-3) of the Basin. The confluence of Piru Creek and the Santa Clara River marks a transition from relatively thick (over 1,200 feet thick) aquifer material in the western and central Basin areas to thinner (about 100 feet thick) deposits in T04N R18W Section 27 (where the Upper Saugus [San Pedro] Formation is absent and only the surficial deposits and recent river alluvium exist) and even thinner within the constricted eastern Basin boundary area (less than 100 feet thick where only the surficial deposits exist). The thin amount of aquifer material in the eastern Basin area causes much of the surface and groundwater from the upstream East Santa Clara River Valley basin to flow into the Basin as surface water (i.e., little groundwater underflow as described in Section 2.2.3.2.1). In the western and central Basin areas, the principal aquitard is conceptualized to hydraulically separate the principal aquifer and aquifer Zone C to the degree that it creates semi-confined conditions in the deeper (non-principal) aquifer (described more in Section 2.2.2.2.2).

Hydraulic properties of each of these formations are estimated per the calibrated groundwater flow model developed by United (2021a) and summarized in Table 2.2-1. Horizontal hydraulic conductivity ($K_h$), a measure of the ease of ability for aquifer material to transmit groundwater laterally (in feet per day [ft/d]), is generally higher in the shallower deposits that occur upstream and along stream channels (e.g., Santa Clara River and Piru Creek). The lowest $K_h$ materials are found along the Basin boundaries, farther from the high energy depositional environment of the stream channels. All deposits have a uniform anisotropy value of 10, representing the ratio of hydraulic conductivity in the horizontal direction ($K_h$) versus the hydraulic conductivity in the vertical direction ($K_v$), meaning that groundwater flows 10 times easier laterally compared to vertically. Specific yield ($S_y$), the volumetric fraction of saturated material that yields groundwater under gravity forces (i.e., unconfined aquifer conditions), is generally also higher in the shallower deposits. The SWRB (1956) considered the average $S_y$ of the Basin to be 0.17. The aquifer and aquitard deposits have uniform specific storage ($S_s$) values of 0.00001.

### Table 2.2-1. Hydraulic Properties of Piru Basin

| Aquifer | United (2021a) Aquifer Zone | $K_h$ (ft/d) Aquifer | $K_h$ (ft/d) Aquitard | $S_y$ Aquifer | $S_y$ Aquitard |
|---|---|---|---|---|---|
| Principal aquifer | A | 1,200 | 0.1 | 0.15 | 0.15 |
| | B | 200–1,000 | 1 | 0.1–0.15 | 0.05 |
| Non-principal aquifer | C | 100 | 0.01 | 0.05–0.1 | 0.05 |

Source of hydraulic properties: United (2021a).
ft/d = Feet per day

#### *2.2.1.4.3 Structural Properties (Reg. § 354.14[b][4][C])*

The structural properties of the Basin include the predominant east-to-west oriented Santa Clara syncline (Figure 2.2-3), with mountains to the north and south composed of non-water-bearing formations. Faults that restrict groundwater flow include the Oak Ridge fault on the southern side of the alluvial basin and the San Cayetano and Camulos faults to the north.

#### *2.2.1.4.4 General Water Quality (Reg. § 354.14[b][4][D])*

General groundwater quality data are available for over one-half of the wells in the well inventory file (Appendix K). Groundwater is typically of a high quality and used for domestic, agricultural crop irrigation, municipal, and environmental beneficial uses. In the Piru Basin, 316 wells have at least one historical water quality sample.

Groundwater is typically calcium sulfate in character, although groundwater in a few wells east of Piru Creek (2 wells) and west of Piru Creek (3 wells) have elevated chlorides and sodium and calcium values similar to the sodium/calcium-sulfate water type of the Santa Clara River near the Los Angeles/Ventura county boundary. These wells have likely been impacted by the WWTP effluent discharged to the Santa Clara River from upstream Santa Clarita treatment plants, which accounts for their elevated sodium and chloride values (United, 2013 and 2016a).

Overall, groundwater quality in the youngest alluvium of Santa Clara River and Sespe Creek is relatively consistent near the upslope Basin boundaries and becomes more variable as water flows along the channels (mainstems). The young permeable alluvial deposits permit high rates of groundwater flow. This groundwater has similar characteristics of the surface waters that percolate into the shallow aquifer. The quality of the surface water that percolates from the Santa Clara River varies depending on whether or not stormflows are present. During stormflows, chemical concentrations are low and the freshwater replenishes the groundwater. Groundwater mixing with other chemical processes, such as interaction with sediment and leaching of salts from irrigation activities, causes certain chemical characteristics of the groundwater to increase. As groundwater flows through the Basin, from east to west, water quality generally degrades due to the accumulation of salts; however, this water quality is still sufficient for the designated beneficial uses of groundwater. When this groundwater discharges (rises) to above ground surface and becomes surface water, the surface water quality closely resembles that of groundwater.

#### *2.2.1.4.5 Primary Beneficial Uses (Reg. § 354.14[b][4][E])*

Groundwater is beneficially used in two primary forms: (1) pumping for agricultural, domestic, municipal and industrial users, and (2) evapotranspiration (ET) by vegetation (i.e., GDEs). Beneficial pumping uses in the Basin are designated in Chapter 2 of the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (LARWQCB, 1994). The average annual water demand reported for each beneficial use category that pumps groundwater is included in Table 2.2-2.

**Table 2.2-2. Average Reported Pumping Rate per Year per Beneficial Use and Principal Aquifer in Piru Basin**

| Aquifer | Agricultural | Domestic | Industrial | Municipal | Total | Percent of Total |
|---|---|---|---|---|---|---|
| Principal (Zones A and B) | 5,970 | 79 | 1 | 626 | 6,675 | 59% |
| Principal/Zone C | 2,195 | 42 | 0 | 0 | 2,237 | 20% |
| Zone C | 410 | 0 | 1 | 0 | 411 | 4% |
| Unknown | 1,954 | 22 | 0 | 0 | 1,975 | 17% |
| Total | 10,528 | 142 | 2 | 626 | 11,298 | — |
| Percent of Total | 93% | 1% | 0% | 6% | — | 100% |

Average pumping rate is in acre-feet per calendar year (AFY), based on records collected between 2015 and 2019.
Principal/Zone C designation represents wells that are perforated in both the Principal Aquifer and Aquifer Zone C. The relative contributions from the principal aquifer versus Zone C is uncertain, but more groundwater is likely sourced from the principal aquifer based on the generally more permeable hydraulic properties of Zones A and B and common observation of water wells sourcing a major portion of flow from the upper perforated intervals (Hanson et al., 2003).
Unknown principal aquifer designation represents wells without screen depth information and/or total depth of casing or borehole.

GDE beneficial uses are considered to occur where GDE units have been identified by Stillwater (2021a) (Appendix D), as described in Section 2.2.2.8. Water demand associated with ET by GDE units is considered to be sourced from the shallow depths of the principal aquifer. The typical annual groundwater demand of GDEs is estimated by the ET component of the United groundwater flow model (Appendix E) and discussed in greater detail in Section 2.2.3.2.2.

### 2.2.1.5 Physical Characteristics of the Basin (Reg. § 354.14[d])

The following subsections discuss physical characteristics of the Basin focusing on land surface features.

#### 2.2.1.5.1 Topography (Reg. § 354.14[d][1])

The Basin is within the Santa Clara River Watershed (Figure 2.1-1), which has a total area of 1,625 square miles and a channel length (for the Santa Clara River) of approximately 83 miles that flows from headwaters on the north slope of the San Gabriel Mountains, near Acton Valley in the east to the Pacific Ocean in the west. The Basin (Figure 2.2-7) is bounded by the Topatopa Mountains to the north and South Mountain to the south. The northern mountains are higher and drain more watershed area than the mountains to the south (Figure 2.2-7). The land surface topography of the Basin can be classified by three smaller scale (HUC-10) watersheds:

- Upper Santa Clara River
- Lower Piru Creek
- Middle Santa Clara River

These watersheds drain various amounts of runoff from land into tributaries, which ultimately discharge into the Santa Clara River. The surface water hydrology is discussed in more detail in Section 2.2.1.5.5.

#### 2.2.1.5.2 Surficial Geology (Reg. § 354.14[d][2])

Detailed and generalized surficial geologic maps are shown on Figures 2.2-2 and 2.2-3, respectively, and discussed in Section 2.2.1.1.

#### 2.2.1.5.3 Soil Characteristics (Reg. § 354.14[d][3])

The Basin land surface is primarily composed of permeable soils, as shown by green (Group A) and blue (Group B) hydrologic soil group areas on Figure 2.2-8 (NRCS, 2009). The most permeable material occurs along the Santa Clara River and its various tributaries (see Section 2.2.1.5.5 for more discussion about surface water bodies). These soil groups are conducive to recharge of surface water into the groundwater system.

#### *2.2.1.5.4 Recharge and Discharge Areas (Reg. § 354.14[d][4])*

Groundwater recharge and discharge areas within the Basin are shown on Figure 2.2-9. The areas that typically contribute recharge of surface water to the groundwater system in the Basin coincide with the following:

- Infiltration of runoff along the channels of the Santa Clara River, Piru Creek, and associated tributaries
- Return flows from agricultural and municipal and industrial land use (e.g., irrigation and leaking pipes)
- Infiltration of WWTP treated effluent into percolation ponds southwest of the Town of Piru

A groundwater discharge (rising groundwater) area (i.e., the Fish Hatchery or Cienega area) occurs at the western Basin boundary with the downstream Fillmore Basin, where constrictions in the volume of water-bearing deposits contribute to groundwater levels that intersect and occur above the invert (lowest) elevation along the Santa Clara River channel, resulting in rising groundwater conditions (i.e., surface water). During storm runoff events or artificial releases of water from Santa Felicia Dan, abundant groundwater recharge occurs upstream of this rising groundwater area, within the Santa Clara River and Piru Creek. Water budget estimates of each of the recharge (inflow) and discharge (outflow) components are described in Section 2.2.3.

#### *2.2.1.5.5 Climate*

Climate conditions, namely precipitation and temperature, have a significant effect on the occurrence of surface water and groundwater. The climate type of the Basin region is classified as “Csb (warm-summer Mediterranean),” based on the updated Köppen-Geiger global climate classification system (United, 2021a), where summers are generally warm and dry and winters are cool with variable precipitation (sometimes wet). Precipitation in the Santa Clara River watershed (and much of California) varies due to phenomena, namely the Pacific Decadal Oscillation (PDO) and El Niño Southern Oscillation (ENSO), that vary over different time scales. The PDO tends to drive wet and dry periods—characterized by positive and negative PDO index values, respectively—on the decadal (i.e., 10s of years) scale, while ENSO tends to drive wet (“El Niño”) and dry (“La Niña”) periods on cycles less than 10 years. The longest drought period on record in the region (based on reconstructed tree ring and precipitation data) was 44 years, from 1841 through 1884 (Hanson et al., 2003). Projected climate change is expected to exhibit more frequent and severe droughts and intense wet periods.

#### *2.2.1.5.6 Surface Water Bodies (Reg. § 354.14[d][5])*

The primary surface water bodies in the Basin (Figure 2.2-10) comprise the mainstem Santa Clara River and its main tributary, Piru Creek. The most significant tributary besides Piru Creek is Hopper Creek. All of the major tributaries to the Santa Clara River are gauged (United, 2017). There are several areas along the length of the Santa Clara River and Piru Creek where surface water flow often percolates entirely, resulting in dry riverbed conditions (United, 2017), represented by the stream channel recharge areas shown on Figure 2.2-9 (United, 2021a). Flow in the Santa Clara River can be described as interrupted perennial (i.e., intermittent to ephemeral) flow, with certain reaches being predictably wet or dry in most years (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017). Perennial flow describes streams with water year-round. Intermittent flow conditions represent streams that periodically flow depending on the season (i.e., winter versus spring) and climate conditions (i.e., drought cycles). Ephemeral streams are those that typically only flow during major storm (i.e., high precipitation) events. United (2017) demonstrates this predictable pattern of dry reaches developing during dry years with their observations of wetted stream extents and associated surface water flow measurements between years 2011 and 2015 (Figure 2.2-11).

There are two general surface water flow conditions commonly associated with wet and dry periods: (1) storm flows and (2) base flows. During wet periods, precipitation and related surface water flow (including any conservation releases from Lake Piru and SWP deliveries) is the major source of groundwater recharge. Runoff from precipitation primarily occurs during winter and spring (December through April). The effect large storm flows have on the geometry of the Santa Clara River is evident by the wash deposits extent shown on Figure 2.2-10. During major storm events, the wetted area of the Santa Clara River expands to accommodate the (ephemeral) flows that are orders of magnitude higher than typical baseflow conditions, leaving behind a scoured channel with most all vegetation stripped away and a reconfigured channel geometry for the river to flow through thereafter until the next major storm.

During most climate conditions, rising groundwater near the western Basin boundary keeps this reach of the Santa Clara River flowing (Figure 2.2-11); however, during multiyear droughts, this Cienega (Fish Hatchery) area has been observed to go dry. The manual surface water monitoring sites shown in red at both of these rising groundwater areas (Figure 2.2-10) are monitored by United. Flows measured here by United are used to estimate benefits (recharge) to the Basin during conservation and SWP releases and groundwater recharge/discharge rates (United, 2017).

Other notable surface water features include surface water diversions and treated wastewater. Surface water diversions in the Basin exist on the upper reaches of the Santa Clara River and Piru Creek (Figure 2.2-12) (United, 2021a and 2021e). Based on records for the Santa Clara River, Isola ceased diverting surface water by 2005, but Camulos continues to divert surface water. Along Piru Creek, Rancho Temescal diverts surface water at two locations between Lake Piru and the Town of Piru. Piru Mutual diverts surface water near the Town of Piru. United used to divert water off of Piru Creek into the Piru Spreading Grounds (up until 2008), but no longer does due to the lack of fish screen on the intake and the ability for the Santa Clara River to percolate large quantities of water. A WWTP for Piru Basin exists along Hopper Creek (Figure 2.2-13), and consistently discharges about 170 AFY of treated wastewater to percolation ponds near the confluence with Santa Clara River. More details on these operations are provided in United (2021a and 2021e).

Beneficial users of surface water in the Basin are listed in the Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (LARWQCB, 1994) for various reaches of the Santa Clara River and Piru Creek. The beneficial uses for aquatic features and groundwater vary between aquatic features and include the following:

- Groundwater recharge (GWR)
- Freshwater replenishment (FRSH)
- Warm freshwater habitat (WARM)
- Cold freshwater habitat (COLD)
- Wildlife habitat (WILD)
- Preservation of biological habitats of special significance (BIOL)
- Support of habitat for rare, threatened, or endangered species (RARE)
- Warm and cold migration habitat (MIGR)
- Warmwater spawning habitat (SPWN)
- Wetland habitat (WET)
- Aquaculture (AQUA)

Beneficial uses include those that directly benefit groundwater conditions (e.g., GWR), those supported directly by groundwater via interconnected surface waters (e.g., FRSH, RARE [e.g., for support of southern California steelhead, California condor]), and those that apply to groundwater beneficial uses (i.e., AQUA).

#### 2.2.1.5.7 *Imported Water Supplies (Reg. § 354.14[d][6])*

Imported water supplies from the SWP, operated by DWR, are significant yet variable sources of water that benefit the Basin. SWP imports come to the Basin via imports and releases from United's Santa Felicia Dam (Lake Piru) or Lake Castaic, which is above the Upper Santa Clara River Valley (East) basin (Figure 2.1-1). Imported water routed from Lake Castaic flows through and partially percolates in Upper Santa Clara Valley prior to making it to the Basin. Based on monitoring during flood flow and SWP releases during 2017 and 2019, it is estimated that 5 to 20 percent of surface water that flows from Castaic Lake to the eastern boundary of Piru Basin is lost to (recharges) the Upper Santa Clara River Valley East groundwater basin (United, personal communications).

Ventura County has a 20,000 acre-foot (AF) allocation for State Water. United's share of the allocation is 5,000 AF (1,850 AF of which is used by Port Hueneme Water Agency). United's remaining 3,150 AF of water is permitted to be released from Pyramid Lake (Figure 2.1-1) into Lake Piru for eventual conservation releases into the Santa Clara River via Piru Creek (United, 2017). The full allocation is not received most years, but has been occasionally supplemented by purchase of a portion of the allocation belonging to either the City of Ventura or Casitas Municipal Water District to maximize deliveries to the County. Due to environmental constraints, United may only receive delivery of this SWP water from Pyramid Lake between November 1 and the end of February.

### 2.2.1.6 *Data Gaps and Uncertainty (Reg. § 354.14[b][5])*

Data gaps in the HCM comprise a lack of groundwater level data in the shallow groundwater of the principal aquifer along the streams (e.g., Santa Clara River and Piru Creek). The shallow groundwater data gaps in the stream areas will be addressed with the installation of monitor wells by the Agency (per DWR Grant Funding) and installation of shallow monitor wells by the University of California Santa Barbara (UCSB) (Stillwater, 2021b). The surface water and groundwater model (United, 2021a and 2021e) has the potential to be refined in the future (i.e., grid density increased) in the GDE areas to better understand interconnectedness of surface waters and groundwater.

Data gaps exist in surface water flow monitoring of the Santa Clara River at the Basin boundaries due to the difficulties of maintaining recording gauging stations on the river, which flows with frequent sediment deposition and erosion events, braided stream channels, and large streamflow variability. United has consulted with the USGS in the past regarding augmenting the stream gauging locations along the SCR; however, there is a lack of suitable locations that would provide high-quality information (United, 2011 and 2016b). Additional stream gauging locations on the Santa Clara River are considered infeasible according to DWR and USGS (United, 2011 and 2016b). United (2021a and 2021e) shows that groundwater model simulated surface water flows are somewhat well calibrated to limited rising groundwater flow measurements (collected during dry months between 2011 and 2019), but improvements can be made in the future with shallow groundwater level data collected at more locations.

### 2.2.2 Current and Historical Groundwater Conditions (Reg. § 354.16)

This section describes current and historical groundwater conditions pertaining to each of the six undesirable results specified by SGMA, along with climate conditions. Current groundwater conditions are represented by information available for water years 2016 through 2019 and historical conditions are represented by information available through water year 2015.

#### *2.2.2.1 Climate*

Precipitation is an important variable to consider when evaluating groundwater conditions, because it is a major driver of inflows to the Basin. The longest measured precipitation record near the Basin is from Santa Paula gauges 245, 245a, and 245b, for which United has data going back to 1850 (Figure 2.2-14). On Figure 2.2-14, United (2021a) applies a five-year running moving average (red line) to annual precipitation (blue bars) to highlight trends in climate variability (i.e., wet and dry periods). Wet periods are indicated by years when the moving average is increasing or has plateaued at relatively high values of precipitation (i.e., above the historical average); and vice versa, dry periods are represented by declining periods or when the moving average remains relatively low (i.e., below average precipitation). The longer term (decades long) and intermediate (about five-year long) wet and dry periods are consistent with the climate variability of the region (i.e., Section 2.2.1.5.5). Groundwater level hydrographs from wells with long-term records in the Basin (and the Fillmore Basin) show similar trends.

It is worth noting that additional precipitation gauges (VCWPD 25, 036A, 101A, 106A, and 235A) exist within the Piru Basin (VCWPD 25 has a record that goes back to 1928) and were used in groundwater modeling (United, 2021a and 2021e).

#### *2.2.2.2 Groundwater Elevation Data (Reg. § 354.16[a])*

Groundwater elevation data from the existing United and VCWPD monitoring networks are presented in map view, as contours (lines of equal value) of seasonal groundwater elevations in the principal aquifer, and as hydrographs at wells with long-term records. All of the groundwater elevation data are available on the FPBGSA online database and map viewer (https://fillmore-piru.gladata.com/). The contour maps are useful for understanding groundwater flow directions and how groundwater levels vary throughout the Basin during wet (e.g., winter and spring) and dry (e.g., summer and fall) seasons. Water flows from areas of higher groundwater elevations toward lower groundwater elevations. Long-term hydrographs are shown to illustrate how deep groundwater levels have historically declined during droughts and recovered following each drought. Hydrographs of paired wells located near each other and perforated at different aquifer depths are presented to illustrate head differences (i.e., hydraulic gradients).

- Contour maps (Reg. § 354.16[a][1])
    - Contours of groundwater elevations throughout the principal aquifer are presented on Figures 2.2-15 and 2.2-16 to represent current seasonal high (spring 2019) and seasonal low (fall 2019) conditions, respectively. Groundwater generally flows to the west from Lake Piru and Santa Clara River Valley East and discharges to Fillmore basin. Spring groundwater levels are typically expected to be higher than fall levels due to the Mediterranean climate (i.e., wet winters and dry summers); however, in 2019, groundwater levels in the Basin were about 20 feet higher in the fall (Figure 2.2-16) than in the spring (Figure 2.2-15) due to a significant (i.e., 38,800 AF) conservation release of surface water by United from Lake Piru (i.e., Santa Felicia Dam). Land surface elevation contours are mapped with the groundwater elevation contours to compare depth to groundwater (i.e., groundwater elevations are typically close to land surface in the western Basin area and deeper in the central part of the Basin).
- Hydrographs (Reg. § 354.16[a][2])
    - A plate of long-term groundwater level hydrographs in map view (Figure 2.2-17) shows periods of stable Basin "full" conditions, interrupted by periods of water level declines and subsequent periods of recovery that are associated with drought cycles. The lowest groundwater elevations at the end of the recent five-year (2012 through 2016) drought are higher than historical lows of prior droughts (e.g., late 1950s to mid-1960s)—from about 20 feet higher in the eastern area (e.g., 04N18W27B02S) to as little as 5 to 10 feet higher in the western and central Basin area (e.g., 04N19W26P01S). Groundwater levels have varied the greatest (about 120 feet) in the northern and eastern portions of the central Basin area, less so (about 40 feet) toward the western edge (e.g., 04N19W33D04S). There is no evidence of chronic groundwater level declines based on the recovery of groundwater levels observed in the long-term groundwater level records.

Hydrographs for all wells in and near the Basin with water level data are included in Appendix K.

- Hydrographs from a USGS (RP1) nested monitor well (see Figure 1-4 from Appendix K) in the central part of the Basin shows similar groundwater levels within the A and B aquifer zones (principal aquifer), and approximately 5- to 10-foot differences in groundwater levels between these principal aquifer monitor wells and the deepest monitor well screened in aquifer zone C (non-principal aquifer), indicating a downward gradient.

#### 2.2.2.3 *Change in Groundwater in Storage (Reg. § 354.16[b])*

Water budget results are reported and evaluated as annual changes between fall (i.e., late September) groundwater conditions, which generally coincide with the beginning and end of each water year. A water year (e.g., 2019) is defined as the year duration between October 1 of the preceding calendar year (e.g., 2018) and September 30 of the reference calendar year (e.g., 2019). The change in groundwater in storage is positive or negative largely depending on the water year type (e.g., dry or wet). Evaluating changes in groundwater in storage based on differences between average fall groundwater levels (i.e., for each water year) is ideal for this GSP because flows are representative of the water year type and fall groundwater levels are the basis for evaluating undesirable results for the Basin (as further explained in Section 3).

Estimates of the annual and cumulative changes in volume of groundwater in storage in the Basin (Figure 2.2-18) are based on water budget results from the United (2021a and 2021e) calibrated groundwater flow model (Regional Model). The Regional Model was used to simulate groundwater levels and estimate changes in groundwater storage for the 35 calendar year period, 1985 through 2019. The initial two water years of the historical groundwater water budget, 1986 and 1987, are not included because falling groundwater levels in the northern boundary area of the model (in the Fillmore basin) indicate that the model was equilibrating from initial heads (Section 3.6 of United, 2021a) that were specified higher than available groundwater level data suggest is realistic (FPGSA, 2021). While this does not affect the Piru Basin, this GSP uses the 1988 to 2019 period to be consistent with the Fillmore Basin GSP. The Regional Model is considered an accurate method for estimating changes in groundwater in storage because it demonstrates an overall low error (i.e., a low average root-mean-squared error [RMSE]) between simulated and observed groundwater elevations that meets industry standards (i.e., RMSE less than 10 percent of the range of groundwater levels) and has been reviewed/approved by an expert panel (United, 2018, 2021a, and 2021e; Porcello et al., 2021).

The change in groundwater in storage estimates (Figure 2.2-18) include estimates of annual Basin pumping and water year types designated by DWR for the Santa Clara River watershed. Annual and cumulative changes in groundwater in storage show periods of decline during two five-year long drought periods (e.g., 1987 through 1991 and 2012 through 2016), that are characterized by consecutive dry and critical (critically dry) water years. The Basin was able to recover fully (as demonstrated by the rebound in the cumulative change in groundwater in storage to zero) within two years of the late 1980s drought due to two consecutive wet years. The difference of having several dry years (i.e., 1987 through 1991) during a drought versus several critical years (i.e., 2013 through 2016) during a drought—on groundwater in storage loss—is evident based on the more rapid rate of decline that occurred during the more recent, severe drought. Climate trends since about the year 2000 indicate that the Basin (and greater southwestern U.S.) are in the midst of a long-term drought period, which means full recovery from the recent severe drought may occur later than sooner. The historical, current, and projected Basin water budgets are described in Section 2.2.3, which demonstrate the Basin's ability for groundwater levels to recover in the context of climate change.

Pumping volumes per water year are estimated (using an inverse relationship with precipitation) (United, 2021a) because pumping volumes are reported to United on a semiannual calendar year basis. Use of meters generally results in lower reported pumping volumes than methods like crop coefficients, based on comparison of reported pumping volumes before and after a user switches to using a meter or electrical efficiency. Currently, over one-half of Basin groundwater pumping is reported using water meters; over one-third is reported using electrical meters. A minor portion is reported using the crop factor method (United, 2016a).

#### 2.2.2.4 *Seawater Intrusion Conditions (Reg. § 354.16[c])*

Seawater intrusion conditions are not applicable to this GSP because the Basin is about 15 miles inland from the Pacific Ocean and groundwater levels within the Basin have always been at least 170 feet above (approximate) mean sea level (feet msl) (i.e., the National Geodetic Vertical Datum of 1929 [NGVD29]).

#### 2.2.2.5 *Groundwater Quality Issues (Reg. § 354.16[d])*

Groundwater quality in the Piru Basin is generally of a high quality and is consumed for a variety of beneficial uses in the Basin that include, but are not limited to, domestic, agricultural crop irrigation, industrial, and environmental uses. The FPBGSA does not have regulatory authority over groundwater quality and is not charged with improving groundwater quality in the Piru Basin. However, any potential projects or management actions implemented by the Agency must not degrade groundwater quality in the Basin.  There are no unique water quality impacts to wells in the DACs (Figure 2.1-4), and the FPBGSA has committed to collaborating with the appropriate water quality regulatory agencies (e.g., the RWQCB and Division of Drinking Water [DDW]).

Historical and current groundwater issues in the Piru Basin (and relevant issues in the down-gradient Fillmore Basin) are presented in this subsection.  SGMA baseline 2015 (i.e., legislation enactment year) groundwater quality in the Basin is detailed in the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report (United, 2016a).  An analysis of historical and short-term (2000 through 2018) groundwater quality trends can be found in the FPBGSA Monitoring Program and Data Gap technical memorandum (Appendix K).  The monitoring network and sources of data collection in the Basin are described in Section 3.5.1.2.

##### *2.2.2.5.1 Historical Chemicals of Concern (COCs)*

From 1951 to 1968, elevated concentrations of total dissolved solids (TDS), sulfate, chloride, and boron were recorded near the Ventura/Los Angeles County Line in east Piru Basin, and are generally attributed to the surface discharge of oil field brines prior to the enactment of the federal Clean Water Act (United, 2016a).  However, high TDS and chloride persisted in the Santa Clara River in surface water sampled near the county line and in local groundwater after passage of the Clean Water Act.

The main water quality concern over the past couple of decades for agricultural users in Piru Basin has been impacts associated with Santa Clara River perennial surface water baseflows sourcing from Los Angeles County (United, 2016a).  These baseflows percolate to groundwater in east Piru Basin and contain elevated chloride tertiary treated water from the Valencia Reclamation Plant that discharges to the Upper Santa Clara River.  The elevated chloride concentrations in Valencia plant discharge in the Upper Santa Clara River are influenced by chloride in imported SWP water, as Castaic Lake Water Agency delivers SWP water to water retailers in the greater Santa Clarita area (United, 2016a).

Historically water quality chemicals (analytes or constituents) of concern (COCs) in the Fillmore and Piru Basins have generally included, but are not necessarily limited to, the following analytes:

- TDS
- Sulfate
- Chloride

- Nitrate
- Boron

The U.S. EPA regulations and California Code of Regulations (CCR) identify maximum contaminant levels (MCLs) for drinking water for a wide range of chemicals. The U.S. EPA also provides secondary MCLs (non-enforceable guidelines) for contaminants that may cause cosmetic (e.g., skin or tooth discoloration) or aesthetic (e.g., taste, odor, or color) effects. The MCLs and secondary MCLs (where applicable) for the five COCs and additional potential COCs summarized in the following subsection are shown in Table 2.2-3.

The five primary historical COCs identified in this subsection have been used historically as water quality indicators of the "health" of the Fillmore and Piru Basins. Both United and VCWPD have traditionally reported on the trends of these analytes in annual or biennial reports, with the exception of boron, for which only United has systematically sampled and reported.

### Table 2.2-3. Selected U.S. EPA Primary and Secondary Standards (May 2009) and California Code of Regulations, Title 22 Maximum Contaminant Levels (February 2012)

| Constituent | Chemical Formula | U.S. EPA MCL (mg/L [a]) | CCR, Title 22 MCL (mg/L) |
|---|---|---|---|
| Gross alpha | | 15 pCi/L | — |
| Lead | Pb | 0.015 [b] | — |
| Nitrate (as N) | N | 10 | 10 |
| Nitrate | $NO_3$ | — | 45 |
| Selenium | Se | 0.05 | 0.05 |
| Uranium | U | 0.03 (~20 pCi/L) | — |
| Boron | B | | 1 [c] |
| Chloride | Cl | 250 [d] | — |
| Iron | Fe | 0.3 [d] | — |
| Manganese | Mn | 0.05 [d] | — |
| Sulfate | $SO_4$ | 250 [d] | — |
| TDS | TDS | 500 [d] | — |

[a] Unless otherwise noted.
[b] 0.015 mg/L (15 micrograms per liter [µg/L]) is the action level for lead; the public health goal is zero.
[c] California State notification level; boron is an unregulated chemical without an established MCL.
[d] Secondary MCL.
MCL = Maximum contaminant level
mg/L = Milligrams per liter
pCi/L = Picocuries per liter

#### *2.2.2.5.2 Distribution and Concentrations of COCs in Groundwater*

This subsection describes the distribution and concentration of diffuse or natural groundwater quality in Piru Basin with respect to Title 22 MCLs and water quality objectives (WQOs) identified by the LARWQCB Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (LARWQCB, 1994).

The LARWQCB Basin Plan generally designates two areas (e.g., Figure 2.2-19) in the Piru Basin with varying WQOs for the five COCs. Two additional Fillmore Basin areas (i.e., Pole Creek Fan area and south side of Santa Clara River) protrude a short distance into west Piru Basin based on current DWR Bulletin 118 mapping. The two Piru Basin areas include the following:

- Lower area west of Piru Creek
- Lower area east of Piru Creek

The 2015 maximum groundwater quality results (distribution and concentrations) with respect to the WQOs are discussed in this subsection. SGMA legislation was enacted into law on January 1, 2015, which resulted in 2015 as a SGMA starting point (potential baseline) year for California's groundwater basins even though many basins had experienced antecedent drought conditions the previous three years. The 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report Figures 31 through 35 (not duplicated in this GSP) show the maximum-recorded concentrations for TDS, sulfate, chloride, nitrate and boron, respectively, for wells sampled in the 2015 calendar year (United, 2016a). In addition, a summary of the trend analysis results (detailed in the FPBGSA Monitoring Program and Data Gap technical memorandum) is provided here with respect to the distribution of groundwater quality issues and historical maximum concentrations in the Basin. The trend analysis evaluated historical record sets for wells with sufficient data for the five historical primary COCs. Short-term trends identified are from available data since the year 2000, and long-term trends are from available data from 1983 to 2018. The water quality time-series graphs in Appendix K show historical concentrations and identified trends for 54 wells in Piru Basin. In addition to the five primary COCs, additional potential COCs were considered as part of the evaluation and are identified in this subsection.

- *Total dissolved solids (TDS):* TDS is the aggregate concentration of dissolved chemicals in water. TDS can be reported by either total filterable residue (TFR) or by summation (SUM), which is calculated by summing the mass of the major anions and cations in a water sample. TDS by SUM commonly yields a slightly higher value than the TDS by TFR. The wet chemistry evaporative method (i.e., TFR) is now the standard laboratory analysis for TDS, and is recommended method for water sample analysis in the basin. Historically, VCWPD reported TDS as SUM for the groundwater samples they collected, but have moved to reporting results as TFR in recent years.

  The secondary MCL for TDS (no Title 22 MCL) is 500 milligrams per liter (mg/L). The LARWQCB Basin Plan WQOs for TDS for both of the main designated areas in the Piru Basin are as follow:

  - ◇ Lower area west of Piru Creek (WQO limit = 1,200 mg/L)
  - ◇ Lower area east of Piru Creek (WQO limit = 2,500 mg/L)

Historical TDS concentrations in the Piru Basin range 380 to 5,440 mg/L in samples collected in the 1930s to 2018. Figure 31 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum TDS by SUM concentrations ranging 894 to 2,410 mg/L and TDS by TFR concentrations ranging 618 to 1,580 mg/L. Elevated TDS by SUM above the WQO is shown in eight wells in the Lower area west of Piru Creek and TDS by TFR in one well (farthest west Piru Basin yellow triangle) is about equal to the WQO limit (1,200 mg/L). One well shows TDS by TFR above the WQO limit in lower area east of Piru Creek. Note that there is a greater number of active wells in the lower area west of Piru Creek, so there are correspondingly routinely more wells sampled in this area than in the lower area east of Piru Creek.

The water quality time-series graphs for TDS in the FPBGSA Monitoring Program and Data Gap technical memorandum show historical concentrations of TDS by TFR and SUM laboratory results plotted as independent series, as an invalid trend may be inadvertently identified from plotting a combination of TFR and SUM results as a single series. However, a single short-term trend is reported for TDS and shown graphically on Figure 2.2-19 plotted in map view for the Fillmore and Piru Basins.

TDS short-term trend results show reported concentration to be increasing (degrading) or relatively stable overall at 20 of 25 wells (increasing in 11 wells and relatively stable in 9 wells) tested in Piru basin. A total of 2 wells shown on Figure 2.2-19 did not meet the criteria for testing and were reported as "insufficient data" (these wells are included for ease of map comparison since at least one of the other primary chemical of concern include a reported trend). The RP1 multiple-well (nested) groundwater monitoring site (facility) in Lower area west of Piru Creek (technical memorandum Figure 1-1 for location and Figure 1-4 for groundwater level hydrograph) is shown to be increasing in TDS concentration in two of the monitoring site's completions, decreasing in one completion, and relatively stable concentration in the deepest and shallowest completions (technical memorandum Table 4-4).

TDS concentrations are above the WQO in a number of wells throughout the Basin, but there is a lack of reported impacts to drinking water wells, which indicates that this is not currently a significant impact in the Basin. Continued monitoring will provide additional information on the significance of this trend if it persists into the future.

- *Sulfate:* The secondary MCL for sulfate (no Title 22 MCL) is 250 mg/L. The LARWQCB Basin Plan WQOs for sulfate for both of the main designated areas in the Piru Basin are as follow:

- ◇ Lower area west of Piru Creek (WQO limit = 600 mg/L)
- ◇ Lower area east of Piru Creek (WQO limit = 1,200 mg/L)

Historical sulfate concentrations in the Piru Basin range from 48 to 2,644 mg/L in samples collected in the 1930s to 2018. Figure 32 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum sulfate concentrations ranging from 212 to 1,240 mg/L. Elevated sulfate above the WQO is shown in 6 wells (620–1,240 mg/L) in the lower area west of Piru Creek in the vicinity of Hopper Creek. Note that there is a greater number of active wells in the lower area west of Piru Creek, so there are correspondingly routinely more wells sampled in this area than in the lower area east of Piru Creek.

Sulfate is commonly the largest component of TDS in water samples collected in the Piru Basin, and therefore often tracks with a similar trend. This was a consideration when determining to plot TDS and sulfate on the same graph for each well in the figures included in Appendix K.

Figure 2.2-20 shows sulfate short-term trend results plotted in map view for the Fillmore and Piru Basins. Sulfate short-term trend results show reported concentration to be relatively stable overall at 16 of 26 wells (increasing in 5 wells and decreasing in 5 wells) tested in the Piru Basin. One well shown on Figure 4-5 did not meet the criteria for testing, and was reported as "insufficient data." The RP1 multiple-well groundwater monitoring site in Lower area west of Piru Creek is shown to be increasing in sulfate concentration in one completion, decreasing in another, and relatively stable concentration in three completions (i.e., shallowest, deepest, and middle piezometers).

The significance of elevated sulfate in the lower area west of Piru Creek (in the vicinity of Hopper Creek) to drinking water wells is unknown, and there is a lack of reported impacts (if any). Expanded groundwater monitoring may be necessary in this localized area to provide additional information on the significance of this trend if it persists into the future.

- *Chloride:* The secondary MCL for chloride (no Title 22 MCL) is 250 mg/L. A lower value of 117 mg/L is locally recognized in the Basin as a toxicity threshold for avocados (CH2M Hill, 2006). Chloride coming into the Piru Basin from Santa Clarita is a common nuisance in the eastern part of the Basin, but is not unique to DACs. The LARWQCB Basin Plan WQOs for chloride for both of the main designated areas in the Piru Basin are as follow:
  - ◇ Lower area west of Piru Creek (WQO limit = 100 mg/L)

- Lower area east of Piru Creek (WQO limit = 200 mg/L)

Historical chloride concentrations in the Piru Basin range 18 to 1,410 mg/L in samples collected in the 1930s to 2018. Figure 33 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum chloride concentrations ranging from 41 to 158 mg/L. Elevated chloride above the WQO is shown in 4 wells (101–116 mg/L) in the Lower area west of Piru Creek. All 3 wells (117–158 mg/L) sampled in 2015 show chloride below the WQO limit, but at or above the toxicity threshold for avocados in lower area east of Piru Creek.

Figure 2.2-21 shows chloride short-term trend results plotted in map view for the Fillmore and Piru Basins. Chloride short-term trend results for Piru Basin show concentrations to be increasing in 14 wells, decreasing in 1 well, and relatively stable in 4 wells. A total of 6 wells were reported as "no clear trend," and 2 wells shown on Figure 2.2-21 were reported as "insufficient data" because the available record sets for these wells do not meet the technical memorandum established criteria for testing. Chloride short-term trend results show reported concentration to be increasing overall (14 of 25 wells tested) in the Piru Basin. The RP1 multiple-well groundwater monitoring site in Lower area west of Piru Creek is shown to be increasing in chloride concentration in three completions, relatively stable in one completion, and reported as "no clear trend" in the shallowest completion. A number of wells in the Fillmore and Piru Basins had sufficient datasets for chloride seasonal variance trend analysis, but none of the water quality results analyzed showed a strong seasonal variance trend.

Much of the Santa Clara River high chloride baseflows that enter Ventura County from Los Angeles County originate as discharge from the Valencia Reclamation Plant in Santa Clarita (United, 2016a), and other sources include urban and stormwater runoff (VCWPD, 2016). Long-term groundwater recharge to the Piru Basin of this water has been recognized to be degrading the groundwater in the lower area east of Piru Creek. These high chloride groundwater concentrations have made a steady advance westward with groundwater flow down the Piru Basin (United, 2016a). A chloride total maximum daily load (TMDL) for the Upper Santa Clara River was adopted in 2004, but while the proposed TMDL actions to reduce and mitigate chloride impacts in the Piru Basin have not yet been fully implemented, actions to comply with the TMDL implementation plan to reduce and mitigate chloride impacts in the Upper Santa Clara River and east Piru Basin are underway. The Sanitation District has begun operating the UV disinfection facilities at the Saugus and Valencia water reclamation facilities (WRFs), and anticipates that the advanced water treatment facility will be operational by December 2022, which will bring the Valencia and Saugus WRPs into full compliance with the requirements of the Upper Santa Clara River chloride TMDL.

- *Nitrate:* The historical Title 22 MCL for nitrate ($NO_3$) is 45 mg/L. For EPA drinking water standards compliance, it is now required to be reported as nitrate as nitrogen (nitrate as N, MCL = 10 mg/L) but nitrate as $NO_3$ is reported here for consistency and for comparison with the LARWQCB Region's Basin Plan WQOs and United historical reporting in the Fillmore and Piru Basins. Nitrate and nitrate as N can be approximately converted from one form to the other based on the atomic weight of nitrogen. The LARWQCB Region's Basin Plan WQOs for nitrate for both of the main designated areas in the Piru Basin are as follow:

  - Lower area west of Piru Creek (WQO limit = 45 mg/L)
  - Lower area east of Piru Creek (WQO limit = 45 mg/L)

  Historical nitrate concentrations in the Piru Basin range from non-detect to 244 mg/L in samples collected in the 1930s to 2018. Figure 34 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum nitrate concentrations ranging from 0.5 to 74 mg/L.

  Elevated nitrate above the WQO is shown in three wells (50–74 mg/L) in the lower area west of Piru Creek. Neither of the two wells sampled in 2015 shows nitrate above the WQO limit in Lower area East of Piru Creek. Note that there is a greater number of active wells in the Lower area west of Piru Creek so there are correspondingly routinely more wells sampled in this area than in Lower area east of Piru Creek.

  The elevated nitrate concentration in a shallow well (screened from 50 to 95 feet bgs) in the lower area west of Piru Creek south of Santa Clara River may be related to agricultural practices and/or septic systems. The shallow depths to water and correspondingly shallow wells in this area make them somewhat vulnerable to near-surface nitrogen sources such as septic tanks and fertilizer. Deeper wells with improperly constructed sanitary seals or older wells with degraded seals can also make them vulnerable to near-surface contamination.

  Figure 2.2-22 shows nitrate short-term trend results plotted in map view for the Fillmore and Piru Basins. Nitrate short-term trend results show reported concentration to be increasing or relatively stable overall (21 of 27 wells tested) in the Piru Basin. Nitrate short-term trend results for the Piru Basin show concentrations to be increasing in 13 wells, decreasing in 5 wells, relatively stable in 8 wells, and 1 well was reported as "no clear trend." The RP1 multiple-well groundwater monitoring site in Lower area West of Piru Creek is shown to be increasing in nitrate concentration in three completions, including the shallowest and deepest piezometers. Two completions are reported as exhibiting relatively stable short-term trends. Nitrate is a health concern and continued monitoring will provide additional information on the significance of this increasing trend if it persists into the future.

- *Boron:* The California state notification level for boron is 1 mg/L. It is an unregulated chemical without an established Title 22 MCL. The LARWQCB Basin Plan WQOs for boron for both of the main designated areas in the Piru Basin are as follow:

  - Lower area west of Piru Creek (WQO limit = 1.5 mg/L)
  - Lower area east of Piru Creek (WQO limit = 1.5 mg/L)

  Historical boron concentrations in the Piru Basin range from non-detect to 21.4 mg/L in samples collected in the 1930s to 2018. As mentioned previously, historical elevated concentrations of boron in the eastern Piru Basin are generally attributed to historical surface discharge of oil field brines. Anecdotally, there tends to be more concern among citrus growers than avocado growers with respect to detrimental impacts associated with elevated concentration of boron in irrigation water pumped from the Fillmore and Piru Basins. Figure 35 from the 2014/2015 Piru and Fillmore Basins Biennial Groundwater Conditions Report shows 2015 maximum chloride concentrations ranging from 0.5 to 0.9 mg/L. Elevated boron concentrations above the WQOs are not shown for any wells in Piru Basin.

  Figure 2.2-23 shows boron short-term trend results plotted in map view for the Fillmore and Piru Basins. Boron short-term trend results show reported concentration to be relatively stable overall (17 of 26 wells tested) in the Piru Basin. Boron short-term trend results for the Piru Basin show concentrations to be increasing in 6 wells, decreasing in 2 wells, and relatively stable in 17 wells. A total of 1 well each was reported as “no clear trend” or “insufficient data.” The RP1 multiple-well groundwater monitoring site in the lower area west of Piru Creek is shown to be increasing in boron concentration in two completions, decreasing in one completion and relatively stable concentrations in the deepest and shallowest completions. These are similar to the trend results reported for TDS for RP1.

  As mentioned above, VCWPD does not routinely sample for boron in the Fillmore and Piru Basins, so there are fewer record sets that meet the criteria for trend analysis (shown as “insufficient data” on the figure) than for the other four primary COCs. Boron does not appear to be a significant concern in Piru Basin; however, it is recommended that VCWPD include this analyte on future analysis of the samples they collect in the Basin.

- *Additional Potential COCs:* Additional potential COCs in the Piru Basin were identified in the FPBGSA Monitoring Program and Data Gap technical memorandum (Appendix K) from a review of available groundwater quality data, the most recent Annual Report of Groundwater Conditions (VCWPD, 2016), and Piru/Fillmore Basins Groundwater Conditions report (United, 2016a). These additional chemicals include the following:
  - Radiochemistry (gross alpha and uranium)
  - Selenium
  - Lead
  - Iron and manganese

  Systematic trend analysis was not performed for these analytes in the technical memorandum because sufficient datasets were not available or the chemical has not historically been raised as a prominent concern in the Fillmore and/or Piru Basins (i.e., iron and manganese). With the exception of iron and manganese concentration mapping, a wide evaluation time period window was required to assemble adequate analytical data for geospatial evaluation. Narrower time-period windows are preferred for comparative analysis from well to well than were used in the technical memorandum evaluation, but the exercise was useful in detecting potential areas in the Basins that may have elevated chemical concentrations that should be investigated further. The technical memorandum includes four figures (not duplicated in this GSP) that show maximum concentration plotted in map view.

  Gross alpha is a measure of the overall radioactivity of radium and uranium in water. Alpha radiation exists in the soil and can also be present in the air and groundwater. These naturally occurring radioactive elements emit alpha particles as they decay, which can pose health risks when exposed to prolonged elevated levels. In the vicinity of Hopper Creek in the Piru Basin, elevated gross alpha has been detected in a few wells (orange circles on the technical memorandum figure), but none of these samples exceeded the drinking water MCL. There are at least three wells known in the downgradient Fillmore Basin that have reported elevated gross alpha (16.7 to 17.8 picocuries per liter [pCi/L]) or uranium (15.4 to 22.2 pCi/L). Additional radiochemistry sampling is likely appropriate in the Fillmore and Piru

Basins to corroborate sparse groundwater sample results and to determine the potential extent of elevated gross alpha and uranium in wells, especially in the Fillmore Basin.

An area in the Piru Basin just west of Hopper Creek has reported high selenium that exceed the primary MCL for drinking water of 0.05 mg/L (50 micrograms per liter [µg/L]) from the available water quality sample record sets from 2005 to 2018 that is several times the MCL in three wells. VCWPD reports that "[o]ne well located south of Highway 126 has consistently been found to have selenium levels that exceed the primary MCL for drinking water of 0.05 mg/l (50 µg/l). Elevated selenium concentrations occur in wells perforated in the interval between approximately 125 to 250 feet below ground surface" (VCWPD, 2016). Two wells screened below 250 feet bgs (i.e., approximately screened 400 to 650 feet bgs) in the same vicinity of Hopper Creek do not have reported elevated selenium levels.

A well in the Piru Basin west of Piru Creek is shown with elevated lead above the U.S. EPA action level of 15 µg/L (note that the public health goal is 0 for lead in drinking water). This well was destroyed in 2017 and nearby wells screened at similar depths do not show elevated lead. It appears from the limited analysis in the technical memorandum that elevated concentration of lead in the Piru Basin is not common or widespread.

Iron and manganese are commonly considered together when evaluating groundwater sample results. The chemicals are often found at elevated concentration in older (more mineralized) groundwater accessed from deep wells and is predominately associated with aesthetic water quality concerns from a public health perspective.

A well in Piru Basin east of Piru Creek is the only well in the Basin with iron at concentrations above the U.S. EPA secondary MCL for drinking water of 0.3 mg/L from the available water quality sample record sets from 2015 to 2018. This sample laboratory result from 2016 is suspect, as two samples from the previous year show iron to be non-detect, and subsequent samples show concentrations to be below 0.2 mg/L. It appears from this limited analysis that elevated concentration of iron in the Piru Basin is not common or widespread.

Manganese concentrations above the U.S. EPA secondary MCL of 0.05 mg/L were detected in 7 wells in Piru Basin from the available record sets from 2015 to 2018. These elevated manganese wells generally have bottom screened depths below 250 feet bgs.

#### 2.2.2.5.3 *Point Sources of Groundwater Pollutants*

- *Wastewater Treatment Plants:* There is one WWTP in the Piru Basin (Figure 2.2-13) that discharges treated wastewater to percolation ponds near the north bank of the Santa Clara River. The Piru WWTP is located near Hopper Creek and Highway 126 in the Piru Basin. The plant is operated by Ventura County Waterworks District No. 16 (VCWD 16). Improvements to the existing Piru WWTP were completed in March 2010 to satisfy LARWQCB permit requirements (United, 2016a). High chloride (approximately 150 mg/L) effluent percolated in the Piru WWTP ponds is likely not of sufficient volume to significantly impact the groundwater quality of the basin (LWA, 2015). VCWD 16 maintains that if all controllable sources of TDS and chloride were removed, the uncontrollable sources would still cause the levels of TDS and chloride to exceed the LARWQCB imposed discharge limits of 1,200 mg/L and 100 mg/L, respectively (VCWD 16, 2016).

There are also two upgradient large WWTPs operated by the Los Angeles County Sanitation Districts that discharge tertiary treated water to Upper Santa Clara River. The Saugus and Valencia WWTPs are part of the Santa Clarita Valley Joint Sewerage System, which serves Santa Clarita and adjacent portions of unincorporated Los Angeles County.

The Saugus WWTP is located approximately 3.0 miles east of the Valencia WWTP. Both the Saugus and Valencia WWTPs discharge tertiary treated water directly into the Santa Clara River east of the Ventura/Los Angeles County line. Staff from the sanitation districts report that discharge from the Saugus WWTP commonly percolates entirely in the channel of the Santa Clara River in the reach downstream of the point of discharge, which implies that elevated chloride in the effluent is not directly impacting surface water or groundwater in the Basin.

The Valencia WWTP is located approximately 1.2 miles southeast of Castaic Junction on Interstate 5 (I-5), just north of Six Flags Magic Mountain and west of I-5. Chloride concentrations in the Santa Clara River near the Los Angeles County line are influenced by chloride in imported SWP water, as Castaic Lake Water Agency delivers SWP water to water retailers in the greater Santa Clarita area. Nearly 50 percent of the chloride load in wastewater discharges is from the chloride load in delivered water (LACSD, 2008). Additional chloride loading occurs during beneficial use of the delivered water, but loading was significantly reduced from a Los Angeles County Sanitation District managed campaign to successfully remove thousands of self-regenerating water softeners from the community. The Valencia WWTP effluent percolates in the eastern portion of the Piru Basin, causing elevated chloride concentrations observed in surface water and groundwater of the Basin.

- *Other Point Sources:* A review of contamination sites on the SWRCB's GeoTracker and DTSC's Envirostor databases identified no active (open) cases in the Piru Basin (Figure 2.2-24).

#### *2.2.2.5.4 Groundwater Quality Summary*

The historical primary COCs are currently monitored for in the existing monitoring network (see Section 3.5.1.2). Based on the water quality information presented in the previous subsections, they will continue to be monitored in the Piru Basin. Expanded monitoring may provide additional information on the significance of identified short-term generally Basin-wide increasing trends (i.e., chloride and nitrate) and for interpreting the significance of the lower area west of Piru Creek localized increasing short-term trends in water quality concentrations (e.g. sulfate). The additional potential COCs will be considered for expanded monitoring, as appropriate (e.g., additional groundwater sampling from existing wells surrounding known radiochemistry "hot spots"). Constructing one or two new shallow monitor wells in the lower area east of Piru Creek will provide more uniform monitoring coverage across the Basin. However, there are few active groundwater producing wells in this area.

The constituents described above may not be COCs for all aquifers in the Piru Basin, and additional analysis should be included in the first five-year update to include appropriateness of monitoring for these constituents in all aquifers. The Agency is currently in the planning phase of constructing additional shallow (i.e., 100 feet deep) aquifer Zone A monitor wells to augment the existing monitoring network.

A water quality monitoring network data gap exists by including VCWPD's monitoring program. VCWPD annually samples production wells within the Basin in the fall, and does not currently sample for boron. They also do not always sample the same wells on their list. They historically have sampled a nearby well that is pumping if one of their core group wells is unavailable during their annual sampling event (VCWPD, 2020). It is important to sample the same wells from year to year and to collect at least a spring and fall sample each year. However, over a period of years that include both dry and wet precipitation years, if groundwater quality seasonal variability is demonstrated to be minimal in a particular well, annual sampling may be sufficient for GSP purposes.

There are no recognized water quality issues that critically impact the beneficial uses of groundwater in Piru Basin or the Human Right to Water (Assembly Bill [AB 685]). In addition, there are no known water quality issues associated with groundwater that discharges as surface water at the Basin boundaries. Expanding the monitoring network to fill data gaps will provide additional data for analysis in the first GSP five-year update and decrease sustainable management criteria evaluation uncertainty in the Basin.

### *2.2.2.6 Land Subsidence (Reg. § 354.16[e])*

Land subsidence is characterized by declines in ground surface elevation. Land subsidence typically occurs due to extraction of fluids (e.g., oil or water) from aquifers and aquitards that are not replenished. Land elevation declines can occur as elastic or inelastic subsidence. Elastic subsidence involves temporary and insignificant changes in land surface elevation that recover as water levels do, while inelastic subsidence is characterized by more significant, generally irreversible, land elevation declines due to compaction of clay (i.e., aquitard) materials as groundwater levels (pressure) in the subsurface decrease. Inelastic subsidence is considered an undesirable result in SGMA, particularly as it relates to groundwater pumping, as it indicates a loss of groundwater storage capacity and can pose risks to infrastructure (e.g., roads and canals).

Land subsidence conditions in the Basin region indicate a low risk of subsidence based on previous studies (Hanson et al., 2003; DWR, 2014) and evaluation of more recent datasets (i.e., Interferometric Synthetic Aperture Radar [InSAR]) (Appendix F). Numerical groundwater flow modeling by Hanson et al. (2003) simulated a maximum subsidence value of just over 0.1 foot (0.00098 foot per year [ft/yr]) of subsidence between 1891 and 1993 in the Basin area. DWR (2014) lists the Fillmore Basin with low potential for future subsidence. The cumulative change in land elevation from 2015 through 2019 (Figure 2.2-25), as measured with InSAR, is insignificant (less than the ±0.1 foot error range of DWR-provided datasets [Towill, 2021]). Annual land elevation changes are similarly insignificant (DBS&A, 2021b). These findings are consistent with the Basin HCM, which indicates that the Basin is composed largely of coarse-grained aquifer material, making it resistant to inelastic land subsidence.

### *2.2.2.7 Interconnected Surface Water Systems (Reg. § 354.16[f])*

Two significant interconnected surface water systems have been identified along the Santa Clara River channel (Figure 2.2-26): (1) at the western Basin boundary with the Fillmore Basin (i.e., Cienega or Fillmore Fish Hatchery area) and (2) at the eastern Basin (i.e., Del Valle) area near the East Santa Clara River Valley East Basin. The Cienega area is commonly referred to as an area of rising groundwater where the Santa Clara River is considered to gain flow from groundwater (Figure 2.2-27a). During dry periods, surface flows are often entirely sourced from groundwater. Although storm events are less frequent, they tend to make up the largest portion of annual streamflow (see Section 2.2.3 for surface water budget), along with conservation releases from Lake Piru. In other words, groundwater contributes a smaller volume of water to streamflow over a longer period of time compared to direct runoff from storm events, which is generally much higher flow volumes but for a shorter duration.

Surface water flows (Figure 2.2-28a) are estimated based on strong empirical correlations between groundwater level measurements and occasional instream (i.e., manual) surface water flow measurements (see Figures 2-7 and 2-8 from United, 2021a [Appendix E]) made by United during dry periods (mostly between late spring and late fall). High flows (i.e., above 50 cubic feet per second [cfs]) vary significantly within small ranges of groundwater levels are considered too sensitive to be considered reliable estimates; therefore, these estimates (that are limited to 50 cfs) typically underestimate annual flows, especially during wet years. This correlation is important for deriving estimates of continuous (i.e., monthly) surface water flow estimates along the Santa Clara River at the Basin boundaries because it is infeasible to install and maintain automated stream gages in the River given its wide range of flow conditions (i.e., varying from no flow during droughts to intense floods that scour and reconfigure the channel geometry during wet years). Surface water flows are higher flows during wetter periods and lower during drought periods. The Cienega area exhibits significantly more variability in high and low flows than the western Fillmore Basin area (Willard Road in the East Grove) near Santa Paula basin (see Fillmore GSP). The Cienega area went dry during the 2014 to 2016 drought (Figure 2.2-11), and is believed to have gone dry during previous historical droughts.

The diversion of surface water and pumping of groundwater resources of the Santa Clara Valley River Basin since the late 1800s is speculated by Hanson et al. (2003) to have resulted in streamflow depletion based on the presence of groundwater pumping in the Santa Clara River Valley and surface water diversions primarily downstream of the Fillmore basin at the Freeman Diversion. However, that study did not offer a quantitative or qualitative estimate of streamflow depletion. SGMA does not require the Basin to restore groundwater conditions to those prior to January 1, 2015. Depletions of interconnected surface water flows (Figure 2.2-28b) due to groundwater pumping are estimated at the Cienega area with use of the Regional Model (United, 2021a and 2021e). Depletions are quantified by running two model scenarios: one with historical pumping rates and another with no pumping from the principal aquifer within a 1-mile band centered along the Santa Clara River channel (corresponding to hypothetical 50 percent reduction in Basin pumping), and subtracting the surface water flows associated with each scenario. Surface water flows are quantified based on groundwater levels simulated at the same well (04N19W25M01S) that is used to derive the correlation between surface water flows and groundwater levels. The Regional Model demonstrates excellent calibration of groundwater levels at this well (United, 2021a and 2021e [Appendix E]).

Surface water depletion estimates (Figure 2.2-28b) at the rising groundwater area along the Santa Clara River (Figure 2.2-9) exhibits wide variability, ranging from zero depletion (when surface water ceases to flow during droughts) to up to 20 cfs. The Santa Clara River at the Fish Hatchery area goes dry during severe droughts, even under a 50 percent pumping reduction scenario (DBS&A, 2021c). The finding that surface water flows cease at the Fish Hatchery during droughts, even with half of pumping reduced, indicates that climate variability (i.e., less runoff and recharge due to less precipitation during droughts) is a significant factor that causes depletion of surface water during dry periods. Surface water depletions are summarized in Table 2.2-4 as AFY equivalents for comparison with water budgets (Section 2.2.3).

**Table 2.2-4. Annual Depletions of Interconnected Surface Water at Fillmore-Piru Basin Boundary**

| Location of Santa Clara River | Depletion (AFY) | | | |
|---|---|---|---|---|
| | Minimum | Average | Median | Maximum |
| Fish Hatchery | 0 | 2,900 | 2,900 | 5,900 |

Information is based on results from United (2021a and 2021e).
Statistics represent annual estimates from between water years 1988 and 2019, excluding zero depletion calculation results that occur at the fish hatchery during high (≥50 cfs) surface water flows (e.g., 1998-1999).

Data gaps remain regarding identifying the extent and timing of interconnectedness of other stream channel areas (e.g., Piru Creek and central and eastern portions of the Santa Clara River), due to a lack of paired groundwater level and surface water level monitoring sites. Stream conditions are considered to vary between all three stream conditions depicted on Figure 2.2-27, except at the Dell Valle potential GDE unit (Figure 2.2-29), where streamflows are sustained perennially by wastewater effluent from the Santa Clara River Valley East. The significance of interconnected surface water and groundwater conditions at these areas is less than that of the area of rising groundwater because surface water exists less often in the Piru Creek and central Santa Clara River reaches (Figure 2.2-11) and surface water flows are sustained in Piru Creek by United releases from Lake Piru. Understanding of groundwater and surface water interactions, and calibration of the groundwater model, can potentially be improved by monitoring wells closer to the areas of rising groundwater.

#### *2.2.2.8 Groundwater-Dependent Ecosystems (Reg. § 354.16[g])*

Stillwater identified five potential GDE units in the Piru Basin (Table 2.2-5, Figure 2.2-29, and Appendix D). Two of these—Cienega Riparian Complex and Del Valle—are associated with the areas of interconnected surface water and are considered of most importance in the Basin. GDEs include terrestrial and aquatic habitats (Stillwater, 2021a).

### Table 2.2-5. Potential Groundwater-Dependent Ecosystem Units in Piru Basin

| Potential GDE Unit | Description | Acres |
|---|---|---|
| Del Valle | Historical Del Valle complex located at the upstream end of the Santa Clara River within the Piru Basin. Unit is predominantly dense riparian forest, with established Freemont cottonwood and red willow. This unit includes interconnected surface water portions of the Santa Clara River that extends from the Basin boundary downstream to approximately Las Brisas Bridge. | 503 |
| Santa Clara River Riparian Shrubland | Riparian zone along the Santa Clara River; dominated by facultative phreatophytes and riparian shrubland habitat. Unit occupies both Fillmore and Piru Basins. Unit is characterized by lower density and low-stature shrubs and is dominated by mulefat. | 549 |
| Cienega | Historical Cienega complex located near the Fillmore Fish Hatchery. Unit occurs in both Fillmore and Piru Basins. Unit is dominated by mulefat and giant reed of variable density throughout. This unit includes interconnected surface water in the Santa Clara River. | 160 |
| Piru Creek Riparian | Riparian zone along Piru Creek from Santa Felicia Dam to Highway 126. Unit is characterized by a thin but dense riparian corridor, dominated by mulefat, Freemont cottonwood and red willow. | 337 |
| Tributary Riparian | Riparian habitat within tributaries to both Fillmore and Piru Basins. Predominantly located to the north of the Santa Clara River draining the Topa Topa mountain range. Unit is dominated by oaks and other hardwoods. | 69 |

Source: Stillwater Sciences (2021a).

The health of GDE units is monitored and evaluated using the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI), along with depth to groundwater records form nearby wells, as described in Stillwater (2021a). NDVI and NDMI metrics track the relative health of vegetation based on the amount of chlorophyll (i.e., greenness) per unit area. The Stillwater (2021a) evaluation of data, representing conditions during the dry (July to September) season for years 1985 through 2018, revealed varying degrees of stress to the various GDE units during drought (e.g., early 1990s and 2012 to 2016) periods. In some areas (i.e., the Cienega), the NDVI/NDMI data indicate that vegetation health in GDE units has not recovered to conditions prior to the 2012 to 2016 drought. This finding is supported by recent research (Kibler, 2021 and Kibler et al., 2021) that used a specific form of NDVI and groundwater level data to identify a “critical” water level (depth) that coincides with dieoff of riparian forests that primarily consist of cottonwood and willow species. This critical water level is defined as equivalent to 10 feet below fall 2011 groundwater elevations. These tree species are considered to have some of the deepest roots of vegetation in GDE units (besides that of the notorious invasive species *Arundo donax*), and therefore are strong indicators of GDE conditions.

Stillwater (2021a) found no evidence of adverse biological responses to GDE units in relation to groundwater quality; however, GDE units are impacted by invasive species, namely *Arundo donax* and *Tamarisk spp.* (Table 2.2-6 and Figure 2.2-29). Invasive species are present throughout the Basin (Stillwater, 2021a). Removal of these invasive species, particularly *Arundo donax*, can have a two-fold benefit for the Basin GDE units: (1) opportunity for recolonization by native GDE vegetation, and (2) reduced groundwater (i.e., ET) demand.

### Table 2.2-6. Invasive Species in Piru Basin

| Invasive Species | Acres |
|---|---|
| *Arundo donax* | 181 |
| *Tamarisk spp.* and other | 40 |

Source: Stillwater (2021a).

Critical habitat for threatened and endangered species per USFWS and NMFS designations are shown on Figure 2.2-30 with summaries of their extents in Table 2.2-7. Species with substantial critical habitats are the southwestern willow flycatcher (bird), listed by USFWS, and the southern California steelhead (fish), listed by NMFS. As discussed in Section 5.6 of the Monitoring Program and Data Gaps Technical Memorandum (Appendix K), the LARWQCB and FPBGSA disagree with the extent of stream reaches designated by NMFS as critical habitat for steelhead spawning and rearing. Figure 2.2-31 shows reaches designated by the LARWQCB as cold freshwater habitat, warm freshwater habitat, migration, and spawning beneficial uses.

### Table 2.2-7. Critical Habitat in Piru Basin

| Common name<br>Scientific name | Critical Habitat | |
|---|---|---|
| | USFWS (acres) | NMFS (miles) |
| Least Bell's vireo<br>*Vireo bellii pusillus* | 1,443 | — |
| Southwestern willow flycatcher<br>*Empidonax traillii extimus* | 2,612 | — |
| Southern California steelhead<br>*Oncorhynchus mykiss* | — | 15.3 |

Source: Stillwater (2021a).

The only instream flow requirements specified for surface water in the Basin are included in United's Santa Felicia Water Release Plan, implemented to meet requirements of United's Federal Energy Regulatory Commission (FERC) License for the Santa Felicia Project (No. 2153). The Water Release Plan includes minimum habitat flow releases from Santa Felicia Dam to Piru Creek of 7 cfs, with higher release requirements (up to 20 cfs) depending on rainfall. The Water Release Plan also includes migration release requirements of 200 cfs, when certain flow triggers are met at the USGS gauging station 11109000 SANTA CLARA R NR PIRU CA. There are no legal diverters of surface water from the Santa Clara River in the Basin downstream of the Del Valle area.

Habitat management and special-status species recovery plans have been implemented in the Fillmore and Piru Basins, and include protections for special-status species and associated habitats (Stillwater, 2021a). These plans include the following:

- Santa Clara River Enhancement and Management Plan (VCWPD and LADPW, 2005)
- Santa Clara River Upper Watershed Conservation Plan (TNC, 2006)
- Conservation Plan for the Lower Santa Clara River Watersheds and Surrounding Areas (TNC, 2008)
- Southern California Gas Company Multi-Species Habitat Conservation Plan (SoCal Gas, 2020)
- National Marine Fisheries Service Southern Steelhead Recovery Plan (NMFS, 2012)

In addition, United is currently preparing a habitat conservation plan for the Freeman Diversion Rehabilitation Project. The Fillmore and Piru Basins are included in the plan area.

### 2.2.3 Water Budget Information (Reg. § 354.18)

This GSP includes a water budget (reported in tabular and graphical form) for the Basin to provide an accounting and assessment of the total annual volumes of groundwater and surface water that enter and leave the Basin, including historical, current, and projected water budget conditions, and the change in the volume of water stored (Reg. § 354.18[a]). Surface water and groundwater flows are quantified using the historical (United, 2021a and 2021e) and projected (United, 2021b) groundwater models, which have been reviewed by an expert panel (Porcello et al., 2021).

A water budget is a useful tool for tracking the components that contribute to or withdraw from the volume of water in storage, similar to how a bank account balance is monitored for cash deposits and withdraws. A schematic of the Basin water budget components is shown on Figure 2.2-32. A water budget is necessary to tabulate and sum total volumes of inflows (positive values) and outflows (negative values) of water to determine whether a basin experienced an overall (net) increase, decrease, or relatively little change in the volume of water in storage, according to the following equation:

$$Inflows + Outflows = Change\ in\ Water\ in\ Storage$$

The typical unit of measure for a water budget is AFY. A volume of 1 AF represents the volume of water that would be required to cover 1 acre of land (approximately the size of a football field) to a depth of 1 foot, and is equivalent to about 326,000 gallons.

An important component of sustainability involves tracking the cumulative change in groundwater in storage, making sure that the amount of negative changes in groundwater in storage (i.e., during prolonged droughts) is not significantly greater than the total of positive changes in groundwater in storage (i.e., during following wet years). So long as the cumulative change in groundwater in storage balances out (i.e., the total of annual changes tends toward zero), the Basin can be considered to not be experiencing significant overdraft conditions (i.e., average inflows equal average outflows)—a critical component of demonstrating sustainable groundwater conditions.

#### *2.2.3.1 Description of Surface Water Budget*

Surface water primarily flows into the Basin through the mainstem Santa Clara River (from Santa Clarita) and its major tributary, Piru Creek, along with other less significant tributaries (Figure 2.2-9). Of the tributaries, only Piru Creek and Hopper Creek are actively gauged for daily flows. Flows within the Santa Clara River are highly variable, which makes maintenance of accurate recording stream gage stations difficult. Several stream gauges (e.g., VCWPD gauges 720 and 724) are active. Historical and projected surface water flows entering and leaving the Basin are quantified using the corresponding groundwater models by United (2021a, 2021b, 2021c, 2021d, and 2021e). The Basin surface water budget is useful for comparison with its groundwater budget.

###### *2.2.3.1.1 Inflows*

Surface water inflows into the Basin are accounted for by quantifying streamflows associated with the following (Figure 2.2-10):

- Piru Creek (USGS gauging station 11109800 [Pole Creek below Santa Felicia Dam])
- Hopper Creek (USGS gauging station 11110500 [Hopper Creek at Hwy 126 near Piru])
- Santa Clara River near the upstream Basin boundary with East Santa Clara River Valley basin, based on two gauges (at two different time periods):
    - (*inactive*) USGS gauging station 11108500 (Santa Clara River at L.A.-Ventura County Line) (up to year 1996)
    - USGS gauging station 11109000 (Santa Clara River near Piru [Newhall Bridge]) (since 1996)
- Santa Clara River near the downstream Basin boundary with the Fillmore Basin (estimated per the United [2021a, 2021b, and 2021e] groundwater model)

Inflows along the ungauged tributaries are not accounted for in this surface water budget because these streams are not gauged and these flows are minor (United, 2021a and 2021e).

###### *2.2.3.1.2 Outflows*

Streamflow is considered to outflow from the Basin surface water system as three primary components:

- Santa Clara River streamflow to the Fillmore Basin (estimated per the United [2021a, 2021b, and 2021e] groundwater model)
- Stream percolation (i.e., groundwater recharge) along the Santa Clara River, Piru Creek, and Hopper Creek (estimated per the United [2021a, 2021b, and 2021e] groundwater model)
- Surface water diversions (as described per United [2021a, 2021b, and 2021e])

Santa Clara River streamflow from the Piru Basin to the Fillmore Basin is not continuously recorded due to the difficulty of maintaining accurate flow gauges on the Santa Clara Rivers; streamflow at this location is instead estimated based on relationships between observed flows manually measured and percolation rates estimated by United (2021a, 2021b, and 2021e). Surface water diversions are not accounted for as outflows in the surface water budget because diversions are reported by United (2021a) on a calendar year basis (i.e., do not align temporally with water year), but are accounted for in the United (2021a, 2021b, and 2021e) surface water and groundwater models. Surface water diversions (Figure 2.2-12) take the following forms:

- Camulos diversions from Santa Clara River
- Piru Mutual diversions from Piru Creek
- Rancho Temescal diversions from two locations along Piru Creek
- Up to within 2008: United diversions from Piru Creek to the Piru spreading grounds
- Up to within 2004: Isola diversion from Piru Creek

##### *2.2.3.1.3 Differences in Inflows and Outflows*

The differences in the surface water budget inflows and outflows estimated for the Basin represent the outflows from the surface water that include the stream percolation to the groundwater aquifer within the basin and surface water diversions that divert within the Basin. These outflows are accounted for within the numerical model, and are grouped together as "other outflows" for presentation in these surface water budgets.

#### *2.2.3.2 Description of Groundwater Budget*

The components of Basin inflows and outflows (Figure 2.2-32) that result in changes in groundwater in storage are described by typical terminology. Recharge refers to water that infiltrates the land surface, percolates through the subsurface, and replenishes aquifers. Underflow consists of subsurface groundwater flows into and out of the Basin boundaries. Wells extract (pump) groundwater from the subsurface for various beneficial uses. ET is a process related to vegetation (i.e., GDE) use of shallow groundwater, primarily via roots. Stream exchange represents flows between streams and shallow groundwater, where flow from surface water is described as losing stream (e.g., streambed percolation or groundwater recharge) conditions and groundwater flow to the surface is referred to as gaining stream (e.g., rising groundwater or groundwater discharge) conditions.

The Basin water budget is estimated based on flows calculated from the calibrated Regional Model (United, 2021a, 2021b, and 2021e). An advantage of using this groundwater model for water budgeting is that it simulates conditions in the Basin and adjacent basins (Figure 2.1-1) in the same model run, which provides inherent consistencies with adjacent water budgets (e.g., Fillmore Basin).

###### *2.2.3.2.1 Inflows*

Sources of inflow to groundwater in the Basin include:

- Stream percolation (losing streamflows) of surface water sourced from:
  - Runoff from storm events (e.g., Piru Creek and Santa Clara River)
  - Treated wastewater effluent from the Valencia WWTP in East Santa Clara River Valley basin
  - Conservation releases from Lake Piru or Castaic Lake via the Santa Clara River (and Piru Creek for releases from Lake Piru)
- Underflow from Santa Clara River Valley East (i.e., Santa Clarita)
- Recharge in the Basin floor area
- Recharge in the mountain front area within the Basin
- Underflow from the outside the Basin

Losing streamflows (groundwater recharge) are quantified in the Regional Model based on streambed conductance values and relationships with streamflow rates (United, 2021a) that are calibrated to match estimates of groundwater recharge calculated from observed flow rates along the Santa Clara River.

Underflow from East Santa Clara River Valley basin is modelled with a constant average inflow rate of 5,000 AFY, consistent with the conceptual model that the aquifer material connecting Santa Clara River Valley East Basin with the Piru Basin is thin (tens of feet thick) and fully saturated.

Recharge in the Basin floor area consists of several components (Figure 2.2-9)—percolation of precipitation, agricultural return flows (irrigation), M&I return flows and treated wastewater—as detailed in United (2018, 2021a, 2021b, and 2021e).

Recharge within the mountain front and ungauged watershed areas is estimated based on previous water budget studies (DWR, 1956; Mann, 1959; United, 2021a).

#### 2.2.3.2.2 *Outflows*

Outflows from groundwater (in order of typical largest to smallest annual flow volumes) consist of the following:

- Underflow to the downgradient Fillmore Basin
- Pumping from wells for agricultural, domestic, industrial, and municipal beneficial uses
- ET due to consumptive use of groundwater by vegetation (i.e., GDEs)
- Net gaining streamflows (when, overall, more groundwater discharges [rises] to the surface than surface water recharges the groundwater system), which occurs at areas of rising groundwater (i.e., along the Santa Clara River near the Basin boundary with Fillmore)

Groundwater pumping data are collected on a semiannual (calendar year) basis and are converted into water year equivalents for water budget (groundwater model) purposes using an inverse relationship between monthly precipitation and annual pumping (United, 2021a).

Underflow to the Fillmore Basin occurs via the interconnected aquifers (Figure 2.2-4). The Santa Paula Basin hydrogeology is the basis for categorizing the Santa Clara River Valley aquifers and aquitards into aquifer Zones A, B, and C (i.e., where more significant aquitards exist [United, 2021a]); it is therefore useful to categorize underflow by the A, B, and C zones (to match Santa Paula hydrogeology) and by the main and principal aquifers (to match Basin hydrogeology) per Figure 2.2-4.

The ET rates are conceptualized to be at their maximum when groundwater levels are within 3 feet bgs, and decrease as groundwater lowers toward a depth of 5 feet bgs, at which point groundwater levels are no longer considered to be used by vegetation (i.e., GDEs). In the Piru, Fillmore, and Santa Paula Basins, the maximum ET flux was increased to be 0.014 ft/d (5.2 ft/yr) in order to account for higher estimated water use associated with the presence of *Arundo donax* within the Santa Clara River channel corridor along with other vegetation species. To account for seasonal variation in ET, the maximum ET rates were adjusted according to percentages for each month that were calculated based on monthly average reference ET data obtained from DWR California Irrigation Management Information System (CIMIS) Santa Paula station (ID 198) for April 2005 to December 2019.

Gaining streamflows (stream exchanges) are simulated using similar hydraulic properties (i.e., streambed conductance) as losing streamflows, but differ from losing streamflows because gaining streamflows occur when hydraulic gradients cause groundwater to flow toward the land surface.

##### *2.2.3.2.3 Change in Storage*

The annual change in volume of groundwater stored in the Basin is a result of the difference between total annual inflows and outflows. Positive change in groundwater in storage values mean an increase in the volume of groundwater in storage (higher overall groundwater levels), while negative values signify a decrease in the volume of groundwater in storage (lower overall groundwater levels). Each year, changes in groundwater in storage are positive or negative largely depending on the water year type (e.g., dry or wet). Gaining and losing streamflows are represented for the entire Basin by a stream exchange term that accounts for net (overall) groundwater discharge (outflow) conditions (typically during wet periods of high groundwater levels) or net groundwater recharge (inflow) conditions (typically during and immediately following dry periods of low groundwater levels). The Piru Basin shows a cyclic pattern for groundwater storage with higher storage values associated with above normal to wet precipitation periods and lower values aligned with multiple years of dry and critically dry water year types. There are annual fluctuations in the groundwater storage values; however, the long-term (multi-decadal) pattern is neutral, with no long-term decline in groundwater storage values.

#### *2.2.3.3 Quantification of Historical Water Budget Conditions (Reg § 354.18[c][2])*

Historical water budget conditions are quantified for a 28-year period (water years 1988 through 2015), based on the surface water and groundwater budgets calculated using the Regional Model (United, 2021a), to evaluate aquifer responses to water supply and demand trends relative to water year type. This historical period is chosen because it represents as far back as the United model simulates (minus the first couple of years due to groundwater level equilibration), which represents groundwater conditions during two droughts (i.e., early 1990s and the most recent, 2012–2016 drought). The annual temperature and precipitation and land use information used in the historical groundwater budget are described in United (2021a). The past availability and reliability of surface water supply deliveries (e.g., SWP imports to Lake Piru and Castaic Lake) are evaluated in the context of water year types.

##### *2.2.3.3.1 Availability of Surface Water Supply Deliveries (Reg § 354.18[c][2][A])*

Imported water supplies consist of United's SWP Table A allocations during most years, but occasionally also of Article 21 water, water transfers and exchanges obtained by United. United has a SWP allocation of 5,000 AFY (United, 2020a)—1,850 AFY of which is allocated to Port Hueneme Water Agency to offset groundwater pumping on the Oxnard Plain, with the remaining 3,150 AFY available to be imported from Pyramid Lake into Lake Piru, or from Castaic Lake, for the benefit of the Santa Clara River Valley basin (Figure 2.1-1). Water released from Lake Piru or Castaic Lake reaches the Santa Clara River, where it contributes to streamflow and groundwater recharge. The full 3,150 AFY allocation is not received most years. DWR determines what percentage of the allocation that is available for purchase each year, depending on the actual and forecast water supply and demand, which relates in part to recent water year types. United does not purchase its full allocation of SWP water on very wet years due to the lack of available storage. United has increased imports of supplemental SWP water (Article 21, exchanges and transfers) since 2017.

Historical imported surface water supply deliveries and releases to each basin are shown in Table 2.2-8.

Most of the releases directly benefit (recharge) groundwater the Piru Basin, which contribute to underflow into the Fillmore Basin and sometimes as surface water. United optimizes releases from Lake Piru to benefit certain subbasins of the Santa Clara River Valley (including the Fillmore Basin) within its boundary. For instance, when groundwater levels are low in the coastal Oxnard Basin, United will optimize their releases to convey water in the Santa Clara River to be diverted at the Freeman Diversion to provide recharge to groundwater through artificial recharge in their spreading grounds in the Oxnard Forebay (of the Oxnard Basin). United typically releases surface water during late summer or early fall, providing significant groundwater recharge in the Piru and Fillmore Basins through the permeable Santa Clara River stream channel.

Historical SWP Table A allocations have varied—from zero to 60 percent (of the 3,150 AFY allocation for United) during dry years, to more than 60 percent and even more than 100 percent during above average and wet years.

### Table 2.2-8. Recent Historical and Current Surface Water Deliveries

| Calendar Year | Imported State Water Project Water (acre-feet) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Water Deliveries | | Releases from | | Recharge into | | |
| | Table A | Article 21 | Lake Piru | Castaic Lake | Piru Basin | Fillmore Basin | Lower Basins |
| 2010 | 3,150 | 0 | 3,150 | 0 | 606 | 311 | 2,233 |
| 2011 | 2,520 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2012 | 3,150 | 0 | 5,670 | 0 | 1,392 | 378 | 3,900 |
| 2013 | 2,242 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2014 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2015 | 630 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2016 | 1,890 | 0 | 970 | 0 | 970 | 0 | 0 |
| 2017 | 2,678 | 10,000 | 6,470 | 10,000 | 5,094 | 795 | 581 |
| 2018 | 1,103 | 0 | 1,103 | 0 | 1,103 | 0 | 0 |
| 2019 | 8,988 [a] | 15,000 | 15,000 | 0 | 0 | 0 | 15,000 |

Information is from United (2021c).
Information is available prior to 2010, but information presented here is limited to the most recent 10 years of data.
Releases can be greater than or less than imports due to carry-over (i.e., leftover) storage from previous deliveries or local water storage.
[a] This amount includes exchanges and transfers.

#### *2.2.3.3.2 Quantitative Assessment of the Historical Water Budget (Reg § 354.18[c][2][B])*

The annual surface water budget for the Basin is shown with water year types on Figure 2.2-33, summarized with average, minimum, and maximum flows in Table 2.2-9, and tabulated in Appendix H-1. The water budget reveals a wide range of surface water conditions that depend on the water year type (Figure 2.2-34). During critical, dry, and below average years, surface water flows within the Basin average about 51,000 AFY, 51,000 AFY, and 73,000 AFY, respectively, while average flows increase drastically during above average (95,000 AFY) and wet (230,000 AFY) years.

For this historical period between water years 1988 and 2015, estimated total annual groundwater inflows and outflows within the Basin (Figure 2.2-35 and Appendix H-2) have averaged around 63,900 AFY and 65,400 AFY, respectively, resulting in an average deficit of about 1,500 AFY of groundwater in storage (Table 2.2-10). Annual changes in groundwater in storage vary with climatic conditions (i.e., water year types), as shown on Figure 2.2-36.

### Table 2.2-9. Historical Surface Water Budget Summary

| Flow | Component | Annual Flow (AFY) | | |
|---|---|---|---|---|
| | | Average | Minimum | Maximum |
| Inflow | Santa Clara River (into Piru basin) | 59,100 | 20,700 | 274,300 |
| | Piru Creek | 47,200 | 5,300 | 191,400 |
| | Hopper Creek | 6,700 | 100 | 48,200 |
| | Subtotal | 113,000 | | |
| Outflow | Santa Clara River (to Fillmore basin) | –58,200 | –700 | –400,600 |
| | Other flows | –54,700 | –27,100 | –113,300 |
| | Subtotal | –112,900 | | |

The historical water budget is based on information from water years 1988 through 2015 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Other flows = Difference in Inflows and outflows (i.e., typically inflows from ungauged tributaries, or sometimes stream losses).

### Table 2.2-10. Historical Groundwater Budget Summary

| Flow | Component | Annual Flow (AFY) | | |
|---|---|---|---|---|
| | | Average | Minimum | Maximum |
| Inflow | Stream percolation | 42,900 | 21,500 | 76,200 |
| | Recharge (mountain front) | 5,600 | 600 | 15,900 |
| | Recharge (basin floor) | 10,400 | 4,300 | 26,600 |
| | Underflow from SCRVE | 5,000 | 5,000 | 5,000 |
| | Underflow from outside basin | 0 | 0 | 0 |
| | Subtotal | 63,900 | | |
| Outflow | Underflow to Fillmore Basin | –47,600 | –34,100 | -53,900 |
| | Wells | –12,400 | –8,400 | -17,500 |
| | Evapotranspiration | –5,400 | –2,500 | -11,200 |
| | Subtotal | –65,400 | | |
| Change in Groundwater in Storage | | –1,500 | –24,200 | 48,700 |

The historical water budget is based on information from water years 1988 through 2015 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Change in Groundwater in Storage = Inflow + Outflow + Inflow/Outflow (stream exchange).
SCRVE = Santa Clara River Valley East subbasin (i.e., Santa Clarita)

Stream percolation (the largest source of inflow to groundwater in storage) consistently results in net inflow (i.e., losing stream [Figure 2.2-28b]) conditions (Figures 2.2-35) in the Piru Basin. At the Basin scale, more surface water tends to recharge groundwater (than discharge to the surface), especially following droughts during wet periods (e.g., 1992–1993), when low groundwater levels as result of the drought provide more capacity for surface water to infiltrate and percolate into groundwater in storage. Stream percolation correlates well with the water year type, from as low as 30,000 AFY during critically dry years to as high as about 55,000 AFY during wet years, on average. This is due to the increased availability of surface water associated with precipitation (and imported water). It should be noted that some groundwater does discharge at the western Basin boundary (i.e., see Section 2.2.2.7), but these flows are small compared to the amount of stream percolation that occurs in the central and upper parts of the Piru Basin. Underflow from upslope Santa Clara River Valley East basin (i.e., Santa Clarita) is considered to be a constant average inflow of 5,000 AFY (United, 2021a), with variability of inflows from Santa Clarita accommodated by Santa Clara River streamflow that eventually percolate into the Basin. Underflow from outside the Basin boundaries (besides those with adjacent Santa Clara River Valley East and Fillmore Basins) is considered insignificant (modeled as essentially zero).

Average rates of groundwater underflow to the Fillmore Basin (the largest outflow in the Basin) generally correlate with water year types, varying from about 42,000 AFY during critical and dry years, to about 46,000 AFY during below normal years, and up to about 49,000 AFY and 51,000 AFY during above normal and wet years, respectively. This relationship between underflow out of the Basin and water year type is due to higher groundwater levels that cause larger hydraulic gradients that drive more groundwater flow from the Piru Basin into the Fillmore Basin. Pumping, the second largest outflow component, generally decreases as water year types become wetter (from about 14,000 AFY during critical and dry years to about 10,000 AFY during below normal, above normal and wet years) due to increased availability of precipitation. Higher average pumping rates during dry periods (Figure 2.2-34) is biased, largely due to wells that pumped during the early 1990s drought but have since become inactive or destroyed. On the other hand, ET rates increase during wetter periods (from about 8,000 AFY during critical and dry years to about 5,000 AFY during below normal years and about 4,000 AFY during above normal and wet years) due to the increased extent of shallow groundwater conditions (i.e., higher groundwater levels) in the Basin for uptake by vegetation roots.

Overall, these water budget components add up to and result in annual increases or decreases of groundwater storage (Figure 2.2-36) that average near zero change over the long-term. Typical annual changes in groundwater storage range between increases and decreases of about 10,000 AFY, but increases as great as 20,000 AFY can occur during the wettest (e.g., 1993 and 2005) years, and decreases as low as about 15,000 AFY can occur during drought (e.g., 1990) years.

###### *2.2.3.3.3 Ability of the Agency to Operate the Basin Within Sustainable Yield (Reg § 354.18[c][2][C])*

In the context of observed long-term groundwater levels (Figure 2.2-17) and the historical water budget, the Basin has historically operated sustainably. Temporary groundwater budget deficits occur during drought periods (i.e., dry and critical water years), but recover during subsequent wet periods when groundwater budget surpluses occur (Figure 2.2-36). After even just one wet year (e.g., 1993 and 2005), groundwater level (storage) conditions reach Basin “full” conditions. At this point, the Basin (overall) ceases to incorporate additional groundwater in storage and instead discharges surplus water as surface water flow (i.e., via the Santa Clara River) into the Fillmore Basin. The historical (1988 through 2015) water budget indicates an overall decrease in groundwater in storage; however, in the context of long-term groundwater levels (Figure 2.2-17) the Basin will likely continue to recover (as described further based on current and projected water budgets).

### 2.2.3.4 *Quantification of Current Water Budget Conditions (Reg § 354.18[c][1])*

Current water budget conditions are represented in this Plan by the four most recent water years, 2016 through 2019, which also coincide with the United (2021a) model update period. This period represents a transition in observed climate conditions from the peak of the drought (during 2016) and toward less dry conditions (during 2017 through 2019), corresponding to a partial recovery of groundwater levels in the Basin.

The current surface water budget is shown on Figure 2.2-33 (in addition to the historical water budget) and summarized in Table 2.2-11.

**Table 2.2-11. Current Surface Water Budget Summary**

| Flow | Component | Annual Flow (AFY) | | |
|---|---|---|---|---|
| | | Average | Minimum | Maximum |
| Inflow | Santa Clara River (into Piru Basin) | 38,600 | 17,200 | 274,300 |
| | Piru Creek | 22,600 | 5,900 | 191,400 |
| | Hopper Creek | 4,300 | 200 | 48,200 |
| | Subtotal | 65,500 | | |
| Outflow | Santa Clara River (to Fillmore Basin) | –21,700 | –1,000 | –47,800 |
| | Other flows | –43,800 | –22,400 | –69,000 |
| | Subtotal | –65,500 | | |

The current water budget is based on information from water years 2016 through 2019 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Other flows = Difference in Inflows and outflows (i.e., typically inflows from ungauged tributaries, or sometimes stream losses).

The current groundwater budget is shown on Figure 2.2-35 (with the historical water budget) and summarized in Table 2.2-12.

### Table 2.2-12. Current Groundwater Budget Summary

| Flow | Component | Annual Flow (AFY) | | |
|---|---|---|---|---|
| | | Average | Minimum | Maximum |
| Inflow | Stream percolation | 41,100 | 18,900 | 69,100 |
| | Recharge (mountain front) | 5,200 | 2,600 | 7,800 |
| | Recharge (basin floor) | 7,600 | 5,700 | 9,400 |
| | Underflow from SCRVE | 5,000 | 5,000 | 5,000 |
| | Underflow from outside basin | 0 | 0 | 0 |
| | Subtotal | 58,900 | | |
| Outflow | Underflow to Fillmore Basin | –33,700 | –31,300 | –36,000 |
| | Wells | –12,200 | –10,700 | –14,500 |
| | Evapotranspiration | –3,000 | –2,500 | –3,500 |
| | Subtotal | –48,900 | | |
| Change in Groundwater in Storage | | 10,000 | –17,800 | 40,400 |

The current water budget is based on information from water years 2016 through 2019 from the United (2021a and 2021e) Regional Model.
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in acre-feet per year [AFY]) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Change in Groundwater in Storage = Inflow + Outflow + Inflow/Outflow (stream exchange)
SCRVE = Santa Clara River Valley East subbasin (i.e., Santa Clarita)

Currently, there has not been significant enough above normal or wet year(s) to completely offset the historical deficit in groundwater in storage and “fill” the Basin. Although the historical average 1,500 AFY deficit rate is less than the current average 10,000 AFY surplus, these changes in groundwater in storage do not completely offset one another, because the historical average represents a significantly longer duration than the current average change in storage (i.e., 28 years vs. 4 years). This is why tracking changes in groundwater in storage as the cumulative (total) of annual changes is useful for comparing different time periods. The current estimated rate of recovery of groundwater in storage is similar to rates of recovery that occurred in the past, prior to full recovery of groundwater levels.

This current water budget information was developed with consideration of available evapotranspiration and sea level rise information (Reg. § 354.18[d][2]) included in United (2018, 2021a) groundwater model documentation, water year type information provided by DWR (2021), and precipitation and temperature data from Parameter-elevation Relationships on

Independent Slopes Model (PRISM) Climate Group. The land use information used in the historical water budget is consistent with that shown on Figure 2.2-9.

### 2.2.3.5 *Quantification of Projected Water Budget Conditions (Reg § 354.18[c][3])*

It is important to note that the projected water budget is based on assumptions of events that may occur in the future, and is not intended to represent a prediction of future conditions. Instead, the projected water budget is constructed to simulate a "what-if" scenario and evaluate the FPBGSA's ability to operate the Basin sustainably (discussed in Section 3). The projected water budget represents a scenario analogous to the water year 1944 to 2019 (76-year long) historical record, modified with changes in projected climate change and water demand and supply. This 76-year long historical period was simulated to evaluate projected Basin conditions during the initial 50-year SGMA implementation period (initial 20 years) and planning (remaining 30 years) period (i.e., the 1944 through 1992 historical time period representing the 2022 through 2071 projected time period), followed by 26 more water years (i.e., the 1993 through 2019 historical time period representing the 2072 through 2097 projected time period). The extra years projected beyond the 50 years required by SGMA is useful for comparing the projected water budget with the historical and current water budgets because they represent similar hydrologic patterns.

#### 2.2.3.5.1 *Projected Hydrology (Reg § 354.18[c][3][A])*

The baseline hydrology used as the basis for the projected water budget is based on applying precipitation and ET change factors from the Variable Infiltration Capacity (VIC) 2070 central tendency (CT) climate scenario, provided by DWR (2018b, and 2018c), to historical hydrology of years 1943 through 2019 (United, 2021b). DWR climate change factors were provided for the historical period, 1915 through 2011, so hydrology for projected water years (i.e., 2090 through 2097) that are equivalent to the historical 2012 through 2019 period were developed by United (2021b) by using analogous water years from the 2011 and earlier historical record that had similar precipitation and ET values. This historical period experienced long-term (i.e., 23-year) drier climate during the initial years followed by a transition to wetter climate (Figure 2.2-14). This assumption is useful for evaluating Basin sustainability in the context of a "mega-drought," considering the long-term dry climate period (analogous to the 1945 to 1967 period [Figure 2.2-14]) ,is being simulated soon after the most recent (i.e., 2012 through 2016) severe drought. This assumption is considered appropriate given current concerns that the American southwest is in the midst of a long-term drought cycle that started around 2000 (Figure 2.2-14). These long-term climate cycles are likely attributed to PDO climate cycles that tend to last decades.

Daily flows from tributaries and drainage areas were adjusted using the VIC 2070 CT projected streamflow change factors provided by DWR (see detailed description in Section 4.8 of United, 2021b [Appendix E-2]). Because DWR change factors are only available for 1916 through 2011, 2070 CT change factors for the years 2012 through 2019 were determined by identifying analogous water years in the historical record and using their associated DWR change factors. Analogous water years were identified by United (2021b) by calculating RMSE between monthly precipitation of each year from 2012 to 2019 with each year prior to 2012. Analogous years were generally those with the lowest RMSE based on the similarity of monthly rainfall patterns and quantities. The United groundwater model uses a 45-centimeter (cm) (approximately 1.5-foot) increase in sea level to represent 2070 CT climate change conditions, consistent with guidance from DWR (2018b,c).

The 2070 CT climate change factors were determined to exhibit more variability (i.e., more severe droughts and intense wet years) than the 2030 CT climate change factors, indicating that the 2070 CT climate change assumptions are more conservative from a water supply and demand planning perspective.

#### *2.2.3.5.2 Projected Water Demand (Reg § 354.18[c][3][B])*

Projected water demands consist of similar outflow components as the historical model, with adjustments to account for potential increases in agricultural demands associated with a prolonged drought period and modest land use changes (i.e., urbanization). Projected water demands were generated using an approach similar to the localized constructed analog (LOCA) method (DWR, 2018b), by using pumping rates associated with historical years that had similar precipitation and temperature as the projected years with climate change factors applied. Projected agricultural water demand (13,300 AFY) during the 50-year SGMA implementation and planning period could be about 16% higher than the historical average (11,200 AFY) due to the assumption of more droughts. Urban water demand is expected to increase by about 500 AFY by 2045 (SCAG, 2017). Urban growth is anticipated to be limited due to the 2040 Ventura County General Plan CURB and Greenbelt zoning designations (Figure 2.1-13).

#### *2.2.3.5.3 Projected Surface Water Supply (Reg § 354.18[c][3][C])*

United (2021b) used hydrological models to simulate reservoir operations and streamflow routing using historical datasets and DWR adjustment factors. United (2021b) used historical surface water delivery schedules and amounts, adjusted with DWR provided factors, to develop projected surface water deliveries and releases. Wastewater discharge from Santa Clarita is assumed to remain constant, consistent with assumptions used in the Upper Santa Clara River

Valley water budget (United, 2021b). The wastewater discharge from Santa Clarita is an important component that directly benefits (recharges) Piru basin and the significant underflows from the Piru Basin into the Fillmore Basin. These projected surface water supplies are incorporated into the Regional Model (United, 2021a and 2021b) to calculate the projected groundwater budget.

The projected annual surface water budget is shown on Figure 2.2-37 and summarized in Table 2.2-13. The projected surface water budget is tabulated in Appendix I-1.

### Table 2.2-13. Projected Surface Water Budget Summary

| Flow | Component | Annual Flow (AFY) | | |
|---|---|---|---|---|
| | | Average | Minimum | Maximum |
| Inflow | Santa Clara River (into Piru Basin) | 58,500 | 21,900 | 267,500 |
| | Piru Creek | 38,800 | 5,100 | 201,000 |
| | Hopper Creek | 4,200 | 100 | 26,500 |
| | Subtotal | 101,500 | | |
| Outflow | Santa Clara River (to Fillmore Basin) | –46,600 | 0 | –394,100 |
| | Other flows | –54,900 | –27,100 | –100,800 |
| | Subtotal | –101,500 | | |

The projected water budget summary is based on information from 50 projected water years (2022 through 2071), corresponding to the historical water years (1943 through 1992) that were the basis for the projected water budget, adjusted for climate change using DWR (2019) 2070 CT change factors, as implemented by United (2021b).
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Other flows = Difference in Inflows and outflows (i.e., typically inflows from ungauged tributaries, or sometimes stream losses).

The projected annual groundwater budget is shown on Figure 2.2-38 and summarized in Table 2.2-14. The projected groundwater budget is tabulated in Appendix I.

### Table 2.2-14. Projected Groundwater Budget Summary

| Flow | Component | Annual Flow (AFY) | | |
|---|---|---|---|---|
| | | Average | Minimum | Maximum |
| Inflow | Stream percolation | 46,000 | 22,900 | 76,200 |
| | Recharge (mountain front) | 5,700 | 1,200 | 14,800 |
| | Recharge (basin floor) | 9,500 | 6,400 | 16,900 |
| | Underflow from SCRVE | 5,000 | 5,000 | 5,000 |
| | Underflow from outside basin | 0 | 0 | 0 |
| | Subtotal | 66,200 | | |
| Outflow | Underflow to Fillmore Basin | –47,000 | –33,800 | -55,400 |
| | Wells | –14,900 | –10,600 | -20,100 |
| | Evapotranspiration | –4,100 | –2,200 | -8,600 |
| | Subtotal | –66,000 | | |
| Change in Groundwater in Storage | | 200 | | |

The projected water budget summary is based on information from 50 projected water years (2022 through 2071), corresponding to the historical water years (1943 through 1992) that were the basis for the projected water budget, adjusted for climate change using DWR (2019) 2070 CT change factors, as implemented by United (2021b).
Inflows are represented by positive values; outflows are represented by negative values.
Minimum and maximum values represent the smallest and largest magnitudes of annual flows, respectively.
Annual flow values (in AFY) are rounded to the nearest 100 AFY; therefore, a discrepancy of 100 AFY may occur.
Change in Groundwater in Storage = Inflow + Outflow + Inflow/Outflow (stream exchange)
SCRVE = Santa Clara River Valley East subbasin (i.e., Santa Clarita)

#### *2.2.3.6 Quantification of Overdraft (if applicable) (Reg. § 354.18[b][5])*

The Basin is considered by DWR to not exhibit critical long-term overdraft. DWR's analysis of long-term groundwater hydrographs used a base period of water years 1989 to 2009 for this determination, which includes wet and dry periods and has the same mean precipitation as the long-term mean per California's Groundwater - Update 2020 (Bulletin 118). This finding is supported by the observed recovery of groundwater levels following each drought, as shown on Figure 2.2-17, and the insignificant cumulative change in storage estimated with the historical and projected water budgets.

Temporary overdraft occurs during periods of multiple years of below average or dry precipitation trends; however, following an above average or (especially) wet year, the Basin "resets" (refills) quickly. While beneficial uses (i.e., pumping) of groundwater contribute to steeper groundwater level (storage) declines during drier periods, the climate variability that is responsible for less precipitation is another significant factor that reduces groundwater levels during these periods, even in the absence of groundwater pumping.

#### 2.2.3.7 *Estimate of Sustainable Yield (Reg. § 354.18[b][7])*

Estimating sustainable yield for the Basin is based on evaluation of current and historical groundwater conditions and the projected water budget in relation to SMCs described in Section 3. Sustainable yield is defined in SGMA legislation and refers to the maximum quantity of water, calculated over a base period representative of long-term conditions in the Basin (including any temporary surplus), that can be withdrawn annually from a groundwater supply without causing an undesirable result. Historical trends in groundwater levels have shown declines during decades-long drought (i.e., 1943–1967) periods that repeatedly recover within shorter periods of time when conditions become wetter (i.e., 1967–2000). The sustainable yield can be calculated by adjusting the average pumping rate by the average change in groundwater in storage:

$$Sustainable\ Yield = Pumping + Change\ in\ Groundwater\ in\ Storage$$

The estimated minimum sustainable yield for the Basin is calculated to be about 15,000 AFY, based on the first 50 years of the projected groundwater budget (Table 2.2-14), which shows an average annual surplus of 200 AFY in the change in groundwater in storage when the average pumping rate is 14,900 AFY. This sustainable yield estimate is considered a minimum, because additional groundwater model simulations with higher pumping volumes were not conducted and are not currently available as a basis for estimating the actual sustainable yield of the Basin. The current lower end sustainable yield is rounded down by 100 AFY from the average pumping rate to account for water budget uncertainty. This sustainable yield represents the average pumping rate for the 50-year SGMA planning horizon that corresponds with an estimate of no net change in groundwater in storage. Year-to-year rates of pumping are expected to vary less than or greater than the long-term sustainable yield value. For example, the projected groundwater budget (Appendix I-2) incorporated annual pumping rates as high as 20,100 AFY and as low as 10,600 AFY. Based on this projected water budget, the Basin can pump (on average) 2,600 AFY more than historical (which was about 12,400 AFY) and not experience chronic declines in groundwater elevations or changes in groundwater in storage. Consideration of this low-end sustainable yield estimate in the context of other undesirable results is discussed in Section 3.

### 2.2.4 Management Areas (as Applicable) (Reg. § 354.20)

(a) Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.
(b) A basin that includes one or more management areas shall describe the following in the Plan:
(1) The reason for the creation of each management area.
(2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.
(3) The level of monitoring and analysis appropriate for each management area.
(4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.
(c) If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.

A management area is designated for the GDE unit, the Cienega Riparian Complex (Stillwater, 2021a), located along the Santa Clara River at the rising groundwater area at the Basin boundary with Fillmore Basin (Figure 2.2-29), which has historically shown the greatest degradation due to groundwater conditions (i.e., groundwater elevations). This management area extends equally into the Fillmore Basin and the Piru Basin; both basins are managed by the FPBGSA. The Agency considered a management area necessary here to mitigate the declines in groundwater levels that occur during drought periods and drop below the “critical water level” and contribute to vegetation die-off (Kibler, 2021; Kibler et al., 2021), as described in Section 2.2.2.7 of this GSP. A site-specific water budget is in development for the Cienega Springs Restoration Project (Stillwater, 2021b).

# 3. Sustainable Management Criteria (Subarticle 3)

> This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.

SMCs define conditions that constitute sustainable groundwater management for the Basin, including the process by which the FPBGSA shall characterize undesirable results and establish minimum thresholds (MTs) and measurable objectives (MOs) for each applicable sustainability indicator. Undesirable results and the associated sustainability indicators are evaluated based on metrics (e.g., groundwater elevations).

"Sustainable groundwater management" (Water Code Section 10721[v]) means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results. The SGMA planning horizon for high priority basins (i.e., Fillmore Basin) is 50 years into the future (i.e., 2022 through 2071), of which the first 20 years is considered the GSP implementation period. Six undesirable results are defined in Water Code Section 10721(x)(1-6), each of which is determined based on one or more sustainability indicators and may or may not be applicable to a basin (based on the basin setting).

A "sustainability indicator" (Reg. § 351[ah]) refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when and where significant and unreasonable, cause undesirable results (e.g., loss of the ability to pump groundwater or die-off of GDEs due to declines in groundwater elevations). The development of SMC relies upon Basin setting information related to the HCM (Section 2.2.1), description of current and historical groundwater conditions (Section 2.2.2), and water budget (Section 2.2.3).

The FPBGSA developed SMCs (Tables 3.0-1 and 3.0-2) for the Piru Basin over several months, beginning with an ad hoc committee of the Board of Directors that served to develop an initial framework for evaluating undesirable results, followed by months of open discussion with stakeholders and the entire board of directors during several board meetings (Appendix C) to finalize the SMCs. A detailed description of the SMC development process is provided in Appendix J.

## Table 3.0-1. Sustainable Management Criteria (SMC) Matrix

| Sustainable Management Criteria | Undesirable Result | Metric | Minimum Threshold | Measurable Objective |
|---|---|---|---|---|
| Groundwater Elevation | Loss of ability to pump groundwater | Groundwater elevations | 75 feet below average 2011 groundwater levels | 2011 groundwater levels |
| | Significant and unreasonable GDE die-off | Groundwater elevations | 10 feet below average 2011 groundwater levels | 2011 groundwater levels |
| Groundwater Storage Reduction | Inadequate groundwater volume in storage to last through multi-year drought without pumping reductions | Groundwater elevations | 75 feet below average 2011 groundwater levels | 2011 groundwater levels |
| Surface Water Depletion | Surface water flow declines due to groundwater extractions that interfere with beneficial uses and users | Groundwater elevations linked to rising groundwater rates | Groundwater elevation equal to 493.98 feet msl at 04N18W31D04S | 2011 groundwater levels |
| Land Subsidence | Land subsidence amounts that interfere with surface infrastructure | Subsidence Rates and Total Displacements from InSAR | Subsidence rates of 1 ft/yr or total displacements of 1 foot over 5 years anywhere in the Basin | Subsidence rates within InSAR measurement error (±0.07 foot) |
| Degraded Water Quality | Water quality degradation that impairs beneficial uses and users | Water Quality Values | Water quality parameters established in existing or future regulations | FPBGSA is not a water purveyor and lacks regulatory authority for water quality compliance, but will cooperate with appropriately empowered entities |
| Seawater Intrustion | NA | NA | NA | NA |

InSAR = Interferometric synthetic aperture radar
GDE = Groundwater dependent ecosystem
msl = Above mean sea level

**Table 3.0-2. Minimum Thresholds and Measurable Objectives for Groundwater Level Representative Monitoring Sites in Piru Basin**

| Well Name | Elevation (feet msl) | |
|---|---|---|
| | Minimum Threshold (MT) | Measureable Objective (MO) |
| 04N18W19R01S | 507.43 | 582.43 |
| 04N18W20R01S | 521.37 | 596.37 |
| 04N18W31D04S | 493.98 | 568.98 |
| 04N19W25C02S | 474.11 | 549.11 |
| 04N19W26P01S | 459.44 | 534.44 |
| 04N19W34D01S | 423.45 | 498.45 |
| 04N19W34K01S | 436.2 | 511.2 |
| 04N19W36D01S | 471.01 | 546.01 |
| RGW-002 | 800 | 810 |
| RGW-003 | 815 | 825 |

## 3.1 Sustainability Goal (Reg. § 354.24)

> Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.

"Sustainability goal" means the existence and implementation of one or more GSPs that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the Basin is operated within its sustainable yield (California Water Code Section 10721[u]). Based on the evaluation of historical, current, and projected water budgets (Section 2.2.3), the sustainable yield for the Basin is estimated to be 15,000 AFY.

The sustainability goal for the Basin is memorialized in the guiding principles (https://bit.ly/3sQp8LR) that were adopted by the FPBGSA Board of Directors in November 2019. The guiding principles include principles of understanding covering the governance, communication and education, funding and finances, and SGMA implementation and sustainability. These guiding principles are intended to be consistent with the JPA (Appendix A), which is the legal foundational document for the GSA. In the event of any conflict between the guiding principles and the JPA, the JPA takes precedence. Two of the general principles ("Gen") from the guiding principles that are most pertinent to the sustainability goal are:

- *Gen 6:* Sustainable groundwater conditions in the Basins are critical to support, preserve, and enhance the economic viability, social well-being, environmental health, and cultural norms of all beneficial users and uses including Tribal, domestic, municipal, agricultural, environmental and industrial users
- *Gen 7:* FPBGSA is committed to conduct sustainable groundwater practices that balance the needs of and protect the groundwater resources for all Beneficial Users in the Basins

The beneficial uses of water pertaining to water rights (CCR §659-672) include domestic, irrigation, power, municipal, mining, industrial, fish and wildlife preservation, and heat control. Additional beneficial uses are specified for surface water and groundwater in the LARWQCB [1994] Basin Plan for Coastal Watersheds in Los Angeles and Ventura Counties. Based on FPBGSA stakeholder engagement over the past couple of years, the beneficial uses of surface water and groundwater include domestic, agricultural (i.e., irrigation), municipal, industrial, and fish and wildlife preservation and enhancement.

The sustainability indicators that were identified by the Agency for each (applicable) undesirable result (Section 3.2) are shown in Table 3.0-1. Corresponding MTs (Section 3.3) and MOs (Section 3.4) are presented in Table 3.0-2.

## 3.2 Undesirable Results (Reg. § 354.26)

An "undesirable result" means one or more of the following effects caused by groundwater conditions occurring throughout the basin (Water Code Section 10721[x]):

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.
2. Significant and unreasonable reduction of groundwater storage (i.e., supply).

3. Significant and unreasonable seawater intrusion.
4. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
5. Significant and unreasonable land subsidence that substantially interferes with surface land uses.
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

The criteria (i.e., SMCs) for determining when and where (and if at all) any of these undesirable results occur are specified based on FPBGSA's definitions of "significant and unreasonable." The following sections describe the processes and criteria used to develop SMCs and evaluate undesirable results.

### 3.2.1 Processes and Criteria to Define Undesirable Results (Reg. § 354.26[a])

Undesirable results occur when significant and unreasonable effects in relation to the sustainability indicators are caused by groundwater conditions (e.g., groundwater levels). Applicable undesirable results were identified by the FPBGSA based on the Basin setting (Section 2.2) and feedback from stakeholders during public meetings (Appendix C) that were held at least monthly. DACs were considered equally as other areas in the Basin during the definition of undesirable results for each sustainability indicator (e.g., all production wells were evaluated for the potential to go dry in the future).

The Agency deliberated extensively (refer to Section 2.1.5.3.2) to determine if undesirable results related to the depletion of interconnected surface water, namely loss of *O. mykiss* rearing and spawning habitat along the Santa Clara River, is a significant and unreasonable effect of groundwater conditions resulting from groundwater extraction. In the context of the SGMA using available information, the Agency does not consider depletions of interconnected surface water a significant and unreasonable effect for the following reasons:

- The large variability of the ephemeral flows associated with streams in the Basin (observed prior to and up to year 2015) ranging from no flow conditions during extended dry periods to hundreds of cfs during occasional wet periods make surface water depletions irrelevant (when no surface water exists) and insignificant (when surface water flows are orders of magnitude greater than depletions due to groundwater pumping).

- While there are no in-stream flow requirements for streams in the Basin, there are required conservation releases from Lake Piru into Piru Creek.
- The Public Trust Doctrine does not apply to streams in the Basin because they are not navigable waterways and do not contribute to downstream navigable waterways (USDOT, 1987).
- There is no designated existing or potential beneficial use for spawning and rearing along the streams in the Basin per the LARWQCB Basin Plan and the habitat is considered poor for spawning and rearing (Stoecker and Kelley, 2005). The studies supporting these beneficial use designations appear to have been far more localized and detailed than those conducted by NMFS in their determination of beneficial uses.
- There is no evidence of *O. mykiss* residing in streams in the basin outside of wet periods when the Santa Clara River is fully connected, where it is used as a transient migratory corridor.
- Elimination of groundwater extractions within about 1 mile of the Santa Clara River (the equivalent of a severe 50 percent pumping reduction) would not prevent the surface water at Cienega Riparian Complex from going dry during severe droughts (Appendix J).
- Consultation with DWR staff, DBS&A and United (personal communication with DWR, 2021) ended with agreement from DWR staff that the following lines of evidence make it difficult to enforce MTs and MOs in regards to surface water depletions.

### 3.2.2 Description of Undesirable Results (Reg. § 354.26[b])

The following undesirable results have been identified by the Agency:

- Groundwater level declines that result in either of the following:
  - Loss of ability to pump groundwater from water wells (i.e., consideration of the Human Right to Water [AB 685])
  - Die-off of riparian vegetation (e.g., cottonwood or willow species in the Cienega Riparian Complex GDE unit [Appendix K]), due to groundwater levels declines below the critical water level (Kibler, 2021; Kibler et al., 2021) that are attributable to groundwater pumping
    - Significant reductions in groundwater in storage are related to the loss of ability to pump groundwater (sustainability indicator)

- Inelastic land subsidence that damages critical infrastructure (water distribution systems, roads, railways, bridges, etc.)
- Water quality degradation beyond historical conditions

Undesirable results related to surface water depletions were considered significant, yet not unreasonable, because natural climate variability (i.e., prolong droughts) is the predominant cause of depleted surface waters (i.e., dry streams). These impacts are not eliminated during prolonged droughts, even with substantial (50 percent) pumping reductions (Appendix J). Climate conditions are considered to have a more significant impact on surface water flows than groundwater pumping.

Undesirable results related to seawater intrusion are not applicable to this Basin due to the large horizontal and vertical distances separating groundwater levels from seawater.

### 3.2.3 Cause of Groundwater Conditions that Would Lead to Undesirable Results (Reg. § 354.26[b][1])

Two primary causes of groundwater conditions that would lead to undesirable results are considered: (1) climate variability and (2) groundwater pumping. Less precipitation (inflow) and more pumping (outflow) generally results in lower groundwater levels. A third and likely less significant cause of groundwater conditions that would lead to undesirable results is the presence of invasive species (e.g., *Arundo donax*), which are thought to use a greater amount of groundwater (via ET) and outcompete native vegetation. These causes of groundwater level changes (i.e., declines) can extend to any of the applicable undesirable results.

#### *3.2.3.1 Criteria to Define When and Where Undesirable Results Occur (Reg. § 354.26[b][2])*

Undesirable results due to lowering of groundwater levels begin to occur when water levels in the Basin drop 75 feet below the 2011 average, or 10 feet below the 2011 average within and immediately adjacent to the Cienega Springs or Del Valle GDE areas. The 75-foot decline scenario resulted in an estimated total of 20 severely impacted and dry wells, or approximately 18 percent of wells analyzed. Of these 20 wells, 7 are monitoring wells. The Agency does not consider a small number of monitoring wells temporarily going dry during a drought period to be an undesirable result. Critical water levels for vegetative GDEs were defined using the system suggested by Kibler (2021) and Kibler et al. (2021). Results from these studies indicated that vegetative stress begins to occur when water levels in the Cienega Springs GDE area decline

10 feet below the 2011 water level. For more detail on analyses performed to determine when are where undesirable results may occur, see Section 3.3.1 of Appendix J.

### 3.2.3.2 *Potential Effects of Undesirable Results (Reg. § 354.26[b][3])*

The potential effects on beneficial uses and users and/or land uses and property interests associated with each applicable undesirable result include the following:

- Chronic lowering of groundwater levels:
  - Inability to pump groundwater would negatively impact DACs and the local economy. There are no particular threats to DACs in regards to water supply availability, but impacts to them are generally felt disproportionately compared to non-disadvantaged areas.
  - Groundwater levels below the critical water level (Kibler, 2021; Kibler et al., 2021) in the GDE (rising groundwater) Basin boundary areas along the Santa Clara River have the potential effect of vegetation die-off. Die-off is considered significant and unreasonable because the GDE units do not fully recover following recovery of groundwater levels, except until after the next major storm occurs to scour away debris and provide new habitat for recolonization (i.e., germination of seeds).
- Significant reduction in groundwater in storage has similar potential effects as chronic lowering of groundwater levels do on the ability to pump groundwater.
- Inelastic subsidence can cause the following issues:
  - Damage to infrastructure
  - Loss of aquifer storage (i.e., compaction of pore spaces)
- Significant and unreasonable water quality degradation would result if water quality exceeds MCLs (e.g., nitrate above the MCL can result in Blue Baby Syndrome) or water quality significantly exceeds historical concentrations.

## 3.2.4 Multiple Minimum Thresholds Used to Determine Undesirable Results (Reg. § 354.26[c])

Groundwater elevations are monitored and evaluated at several well sites throughout the Basin to evaluate groundwater conditions in relation to undesirable results, comprising namely the ability to pump groundwater (i.e., the Human Right to Water) and GDE die-off. Significant and unreasonable undesirable results are considered to occur when water levels at three production well RMPs or two GDE RMPs reach or fall below established minimum thresholds (see Table 3.0-2).

The FPBGSA evaluates multiple water quality parameters (e.g., Section 3.5.1.2) against the MTs associated with the WQOs and MCLs, but does not assume responsibility or have any authority to enforce water quality standards. The FPBGSA acknowledges that it will cooperate with existing regulatory authorities (e.g., the RWQCB and DDW) and will not implement projects or management actions that further degrade water quality beyond historical conditions (i.e., Section 2.2.2.5).

### 3.2.5 Undesirable Results Related to Sustainability Indicators that Are Not Likely to Occur (Reg. § 354.26[d])

Undesirable results related to the potential for GDE die-off outside of the Cienega GDE unit area (Figure 2.2-29) are considered not likely to occur because Stillwater (2021a) NDVI and NDMI analysis indicate that the other GDEs recovered following the recent (2012 to 2016) severe drought and projected groundwater levels are not expected to be materially deeper than historical. Undesirable results related to chronic groundwater level declines that would result in dry domestic wells are not likely to occur because projected groundwater modeling indicates groundwater levels will be similar in the future as they have historically (DBS&A, 2021c) and no domestic wells are known to have gone dry historically.

Undesirable results in relation to degraded water quality are not likely to occur because GSP implementation is not expected to result in groundwater levels deeper than historical lows and there is no historical evidence of significant and unreasonable (i.e., undesirable) results to beneficial uses.

Undesirable results related to subsidence are not likely to occur because future groundwater levels are not expected to be deeper than historical.

## 3.3 Minimum Thresholds (Reg. § 354.28)

(a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.
(b) The description of minimum thresholds shall include the following:
(1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.
(2) The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.
(3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.
(4) How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.
(5) How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.
(6) How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.

The FPBGSA took considerable time (see Section 2.1.5.3) to develop the MTs described in the following subsections, which are described in greater detail in Appendix J.

### 3.3.1 Chronic Lowering of Groundwater Levels

The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:
(A) The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.
(B) Potential effects on other sustainability indicators.

MTs related to chronic lowering of groundwater levels are proposed for two sustainability indicators: (1) ability to pump and (2) protection of vegetative GDEs. The metric for measuring ability to pump is groundwater elevation in representative monitoring wells. Undesirable results have been evaluated with consideration of the recommendations made by *Summary*

*Analysis of 31 Groundwater Sustainability Plans in Critically Overdrafted Basins February 19, 2021 Consideration of Selected Beneficial Users – Key Findings and Examples*.

#### 3.3.1.1 Minimum Thresholds Protective of Ability to Pump Groundwater

A 75 foot decline in groundwater levels from the 2011 average was determined to be the point at which impacts to production (e.g., domestic, municipal, and agricultural) wells became significant and unreasonable. This condition results in an estimated total of 20 severely impacted (water levels in the lower 50 percent of the well's screen interval) and dry wells, or approximately 18 percent of wells analyzed. Of these 20 wells, 7 are monitoring wells. The FPBGSA does not consider monitoring wells temporarily going dry during a drought period to be an undesirable result. Production wells estimated to be severely impacted included 9 agricultural irrigation wells and 2 domestic wells. Wells estimated to be dry if water levels declined 75 feet from 2011 average elevations include 1 industrial well and 1 well of unknown use. The FPBGSA considered impacts to this number of wells to be reasonable. Furthermore, the Agency has committed to developing a mitigation program for wells that do go dry (see Section 4.8 of the GSP).

It should be noted that according to the DWR Dry Well Reporting System and UWCD (Tony Emmert, personal communication), no production wells, including domestic wells, have been reported as going dry in the Basin as of June 2024. This suggests that while wells may have been impacted by water level declines during previous drought periods, they were still able to provide water for their respective beneficial uses and users.

#### 3.3.1.2 Minimum Thresholds Protective of Vegetative GDEs

For shallow wells within and immediately adjacent to GDEs, minimum thresholds were set at 10 feet below 2011 average groundwater elevations. This value was based on research conducted by scientists at UCSB (Kibler, 2021; Kibler et al., 2021) and a presentation given to the Agency by Dr. Christopher Kibler on January 21, 2021. Model results indicate that groundwater levels are likely to fall below this level in the Cienega Springs area during prolonged droughts. A mitigation plan (see Section 4.1) is being developed to provide supplemental groundwater to offset the undesirable result of vegetation die-off that would occur without adequate soil moisture during these periods. It is important to note that the concept of this mitigation program is not expected to restore groundwater levels above the MT (because it is believed this would require an unreasonable amount of supplemental water) but, more importantly, provide assurance that adequate soil moisture is sustained in the vadose/root zone of the GDEs to prevent die-off (i.e., prevent an undesirable result) related to groundwater level declines.

### 3.3.2 Reduction of Groundwater Storage

> The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.

The minimum threshold for the reduction of groundwater storage is the same as that for chronic lowering of groundwater levels (Tables 3.0-1 and 3.0-2).

### 3.3.3 Seawater Intrusion

> The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:
> (A) Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.
> (B) A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.

A minimum threshold for seawater intrusion is not applicable for this Basin.

### 3.3.4 Degraded Water Quality

> The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.

The MTs for degraded water quality correspond to WQOs and MCLs established by the LARWQCB Basin Plan and California DDW, respectively. The FPBGSA does not assume responsibility for enforcing these water quality objectives/regulations, but will continue to monitor water quality (i.e., to make sure water quality is not degrading further due to GSP projects and/or management actions) and will coordinate with the applicable authorities to prevent water quality degradation.

### 3.3.5 Land Subsidence

> The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:
> (A) Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.
> (B) Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.

An MT of 1 foot per year or 1 foot cumulative displacement over 5 years was approved by the FPBGSA board of directors with the condition that the agency would consider performing a subsidence vulnerability evaluation for critical infrastructure in the basin. The FPBGSA board of directors extensively discussed the distinction between differential subsidence and basin-wide ground surface movement and recognized that differential subsidence is a more problematic phenomenon to critical infrastructure (e.g., pipelines, roadways, bridges).

### 3.3.6 Depletions of Interconnected Surface Waters

> The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:
> (A) The location, quantity, and timing of depletions of interconnected surface water.
> (B) A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.

As discussed in Section 2.2 of this GSP, Section 4.3 of Appendix D, Section 3.6 of Appendix J, and Section 5.6 Appendix K, groundwater and surface water have varying degrees of interconnectedness due to the hydrogeologic regime of the Basin. The Santa Clara River is naturally ephemeral for the majority of its length in the Basin due to flashy inflows from generally short-duration, high-intensity winter storm events (atmospheric rivers). Reaches with perennial flows (i.e., Cienega Springs and Del Valle) are either entirely supported by rising groundwater in the dry summer months except during exceptionally wet years, or discharges from wastewater treatment plants upstream in the Santa Clara River Valley East Basin.

Groundwater and surface water are believed to be interconnected along the perennial reaches of Piru Creek within Piru Canyon, but there are few wells located in Piru Canyon from which to collect groundwater elevation measurements. Flows in Piru Creek are primarily regulated by releases from Santa Felicia Dam licensed under the Federal Energy Regulatory Commission (FERC; Project No. 2153), which requires minimum releases for habitat and migration (UWCD, 2012). The small number of wells in Piru Canyon have reported total extractions ranging from 0 to 100 AFY over the last decade (2014-2023), with an average of 10.4 AFY. Reported surface water diversions in Piru Canyon from 2010-2023 ranged from about 414 to 2,100 AFY and averaged about 1,020 AFY. The relatively low groundwater extraction volume compared with surface water diversion volumes, combined with required releases from Santa Felicia Dam, result in a very low probability that groundwater extractions are significantly and unreasonably impacting streamflow in Piru Canyon.

MTs for depletions of interconnected surface water were set using the empirical relationship between groundwater levels in 04N18W31D04S and streamflow measured near the Cienega Springs GDE (see Figure 2-4 in Appendix K of this GSP). A groundwater elevation equal to 493.98 feet msl at 04N18W31D04S was set as the minimum threshold for depletions of interconnected surface waters. No empirical relationship has been developed for the Del Valle GDE area due to lack of data, which has been identified as a data gap that is planned to be addressed during GSP implementation. This MT is believed to be protective of existing beneficial uses and users for the following reasons:

- Groundwater elevations near 04N18W31D04S have historically fallen well below the MT (see 04N18W30G02S, 04N19W25K02S, 04N18W30M02S, and 04N18W31C01S)
- Current understanding is that *O. mykiss* use streams in the Basin primarily as migratory corridors during the wet winter months when pumping is not occurring, not for spawning and rearing during the spring, summer, and fall months when pumping occurs.
- Beneficial uses when pumping occurs are primarily for vegetative GDEs, as there are no legal surface water diversions from the Santa Clara River in the Basin. A mitigation plan for the Cienega Springs GDE (see Section 4.8 of this GSP) is being developed if water levels drop below MTs in that area, which model results suggest is likely during a prolonged drought even when pumping within 1 mile of the Santa Clara River is eliminated.
- Previous studies found anadromous steelhead passage in the mainstem Santa Clara River within the Piru Basin required discharges of 700 cfs between the confluences of Sespe Creek and Piru Creek. The groundwater model suggests eliminating groundwater pumping within

1 mile of the Santa Clara River (50 percent overall pumping reduction) would only supply approximately 3 percent of the discharge required for anadromous steelhead passage (see Appendix G of this GSP).

## 3.4 Measurable Objectives (Reg. § 354.30)

(a) Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.
(b) Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.
(c) Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.
(d) An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.
(e) Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.
(f) Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.
(g) An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.

The MOs for each sustainability indicator are listed in Tables 3.0-1 and 3.0-2. For groundwater levels and groundwater in storage, the MOs are equivalent to average 2011 groundwater elevations, which represent "basin full" conditions. The MO for degraded water quality is the same as the MTs (i.e., MCLs and WQOs) for each constituent. The MO for subsidence is equivalent to the InSAR measurement error of ± 0.07 foot.

## 3.5 Monitoring Network (Subarticle 4)

The monitoring network is described in detail in the FPBGSA Monitoring Program and Data Gap technical memorandum (Appendix K) and summarized in this subsection. This subsection includes descriptions of existing monitoring networks that will continue to be relied on during

GSP implementation, monitoring protocols and representative monitoring points (RMPs) for SMC evaluation. An assessment of FPBGSA's monitoring network and planned improvements is also described in this subsection.

The monitoring network is used to measure metrics against monitoring objectives (e.g., measurable objectives, minimum thresholds, and interim milestones) associated with sustainability indicators (Reg. § 354.34 c), as described in the Fillmore and Piru Basins SMC technical memorandum (Appendix J), per the monitoring protocols and data reporting requirements described in the sampling and analysis plan (SAP) (Appendix L). The monitoring network promotes the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Basin and evaluate changing conditions that occur through implementation of this Plan in accordance with Reg. § 354.34. Data gaps and plans to address them are also described in this subsection.

### 3.5.1 Description of Monitoring Network (Reg. § 354.34)

This GSP adopts existing water resources monitoring and management programs (Reg. § 354.34 e) implemented by public agencies (see GSP Section 2.1.2 for general descriptions) active in Ventura County and include data collection in Fillmore Basin. United and VCWPD have existing long-standing monitoring networks, and FPBGSA's monitoring network relies heavily upon these agencies' existing monitoring activities. Where available, additional data from other sources, including the SWRCB's GAMA and GeoTracker groundwater monitoring programs, are used as a component of the FPBGSA's monitoring network. The USGS has historically conducted studies in the Basin, but does not routinely monitor for water quality or groundwater level in wells in the Basin.

The purpose of the monitoring network is to gather representative data of sufficient quantity (e.g., spatial and temporal coverage) and accuracy (see FPBGSA SAP) to demonstrate sustainable management with respect to the SMCs developed for the Fillmore Basin. Basin-specific data quality objectives (DQOs) are described in the FPBGSA Monitoring Program and Data Gap technical memorandum and summarized in GSP Section 3.5.2. Collecting data that meet the DQOs ensures that the analysis level of confidences is known and documented. Implementation of the monitoring network objectives will demonstrate progress toward achieving the measurable objectives, monitors impacts to beneficial uses or users of groundwater, monitors changes in groundwater conditions, and gathers the necessary data for quantifying annual changes in water budget components (Reg. § 354.20 b).

Spatial groundwater quality and level monitor well (monitoring points) density included in existing monitoring networks is evaluated in Sections 5.3 and 5.4, respectively, in Appendix K and summarized here. The evaluation includes consideration of the frequency of monitoring, number, and distribution of monitor wells screened discretely in a single aquifer zone in the Piru Basin.

### *3.5.1.1 Groundwater Level Monitoring Network*

The complete groundwater level monitoring network for the Basin is shown on Figure 3.5-1. The United and VCWPD monitoring program lists include substantial monitoring and reporting of groundwater level measurements in wells in the Piru Basin. The California Statewide Groundwater Elevation Monitoring (CASGEM) Program is a collaboration between local monitoring parties and the DWR to collect statewide groundwater elevation measurements from wells in each basin throughout the State. Much of the water level data directly collected or gathered from other sources (e.g., Ventura County Waterworks District No. 16) by United and VCWPD is reported to the state and made publicly available as part of the program. VCWPD acts as the CASGEM submitting agency for water level data collected in Ventura County (VCWPD, 2016).

#### *3.5.1.1.1 United and VCWPD Networks*

The United and VCWPD active monitoring networks in the Fillmore and Piru Basins are shown in Figure 2.1-8. VCWPD monitors groundwater levels in wells on a quarterly basis, and United conducts its monitoring on monthly, bimonthly, semiannual or event-based schedules. There is 1 well in the Piru Basin (and 4 in Fillmore Basin) shown on Figure 2.1-8 (red circles) monitored by both United and VCWPD staff. The overlap between the United and VCWPD monitoring networks is useful as a quality assurance/quality control (QA/QC) measure to ensure consistency between data collected by the different entities (United, 2016a).

From the United and VCWPD monitoring program 2019 lists (shown graphically in Figure 2.1-8), 30 unique wells are monitored for water level in Piru Basin. VCWPD monitors 8 wells, and there is 1 overlap well included in the 23 wells United monitors. Groundwater level monitoring protocols for data collection are summarized in Section 3.5.2.1.

#### *3.5.1.1.2 Recording Groundwater Level Devices*

Pressure transducers and data loggers can be used for recording water level measurements in wells on user defined or event-based schedules. Field procedures and the DWR's recommendations are described in the FPBGSA's SAP (Appendix L) and summarized in

Section 3.5.2.1.2). Frequency of pressure transducer data collection and data uses (e.g., trend evaluation) are described in Section 3.5.4.1.2.

United has eight pressure transducers and data loggers deployed in wells (locations shown in Figure 2.1-8). Data obtained from the United deployment of pressure transducers and data loggers is an important component of the groundwater level monitoring network in the Piru Basin. There are no known pressure transducers employed for groundwater level monitoring in the Piru Basin that are connected to a telemetry system.

##### *3.5.1.1.3 Well Spatial Density*

Table 3.5-1 is a tabulated summary of the number of wells in the Piru Basin included in the United and VCWPD groundwater level monitoring networks as of summer 2020, as well as the theoretical number of wells per 100 square miles (the combined surface area of the Basins is less than 100 square miles). Note that well density is reported here as number of wells per 100 square miles for consistency for comparison with BMP #2 recommended standards for groundwater level monitoring programs (DWR, 2016). Additional information on monitoring network well spatial density and DWR recommendations are included in Appendix K.

**Table 3.5-1. Number of Wells in the Piru Basin Included in the United and VCWPD Groundwater Level Monitoring Networks**

| | Number of Wells | Theoretical Number of Wells per 100 square miles |
|---|---|---|
| Zone A and/or B (principal aquifer) | 20 | 117.6 |
| Zone C | 1 | 2.9 |
| Screened across multiple zones | 5 | 29.4 |
| Unknown construction | 4 | 23.5 |
| Total | 30 | 176.5 |

The number of wells in the Basin divided by the ground surface area in square miles yields the monitoring site density. The Piru Basin surface area is approximately 17 square miles. The horizontal distribution of wells sampled for groundwater level in the Piru Basin is extensive when considering its size. There are 176.5 wells per 100 square miles (1.8 wells per square mile) in the

Piru Basin. The value includes the five piezometers in the RP1 multiple-well groundwater monitoring site as individual wells.

A data gap assessment of well density with respect to the number of monitored wells in the Piru Basin completed discretely in a single aquifer is summarized in Section 3.5.4.1 (see Appendix K Section 5.4 for the detailed discussion). Monitoring network measurement frequency and planned improvements to the FPBGSA monitoring network are also included in Section 3.5.4.1.

#### 3.5.1.2 Groundwater Quality Monitoring Network

The complete groundwater quality monitoring network for the Basin is shown on Figure 3.5-2. Groundwater quality monitoring in Piru Basin is conducted by several organizations in addition to the monitoring programs administered by United and VCWPD. For water purveyors' wells that produce groundwater for human use and consumption, monitoring of a variety of regulated constituents, including biological constituents, is required by law and ensures that groundwater is safe for potable uses. These data are available from the SWRCB (DDW) (United, 2016a) for water systems with 15 or more connections. Other sources of groundwater quality monitoring include the following:

- California Department of Water Resources
- Water Purveyors (e.g., Warring Water)
- WWTPs (i.e., Piru Plant operated by Ventura County Waterworks District No. 16)
- Consultant reports and technical studies
- Individual well owners

##### 3.5.1.2.1 United and VCWPD Networks

The United and VCWPD active groundwater quality monitoring networks in the Fillmore and Piru Basins are shown on Figure 2.1-9. United samples monitoring and production wells in the Basins biannually (in the spring and fall), and VCWPD annually samples production wells within the Basins in the fall. VCWPD's list of groundwater sampling wells is somewhat dependent on availability of staff time and the Agency's annual budget. There are a core group of wells VCWPD prioritizes to be sampled almost every year, and if one of these wells is unavailable for some reason, they will often sample a nearby well that is pumping.

A total of 24 unique wells are sampled for groundwater quality within the Piru Basin as part of the United and VCWPD 2019 monitoring program lists (Figure 2.1-9). VCWPD samples 10 wells (and has 2 alternate wells shown as an orange square on Figure 2.1-9) and United samples 14 wells.

#### *3.5.1.2.2 Well Spatial Density*

Note that Figure 3.5-2 shows two alternate VCWPD sampling wells in Piru Basin (orange squares in the figure). These alternate wells are not included in the tabulated number of wells per basin in Table 3.5-2 because it is only sampled as an alternate well if a VCWPD core group well is unavailable.

**Table 3.5-2. Number of Wells in the Piru Basin included in the United and VCWPD Groundwater Quality Monitoring Networks**

| | Number of Wells |
|---|---|
| Zone A and/or B (principal aquifer) | 19 |
| Zone C | 2 |
| Screened across multiple zones | 2 |
| Unknown construction | 1 |
| Total | 24 |

The number of wells in the basin divided by the ground surface area in square miles yields the monitoring site density. Piru Basin surface area is approximately 17 square miles. The horizontal distribution of wells sampled for groundwater quality in the Piru Basin is extensive when considering the size of the Basin. There are 1.4 wells per square mile in Piru Basin. The value includes the five piezometers in the RP1 multiple-well groundwater monitoring site as individual wells. Note that well density here is reported as wells per square mile and well density is reported in Section 3.5.1.1.3 as wells per 100 square miles for consistency with BMP #2 recommended standards for groundwater level monitoring programs (DWR BMP 2, 2016).

A data gap assessment of well density with respect to the number of monitored wells in the Piru Basin completed discretely in a single aquifer is summarized in Section 3.5.4.2 (see technical memorandum Section 5.3 for the detailed discussion). Monitoring network measurement frequency and planned improvements to the FPBGSA monitoring network are also described in Section 3.5.4.2.

#### *3.5.1.3 Trend Analysis: Short-Term, Seasonal and Long-Term*

FPBGSA's monitoring network gathers data for use in demonstrating short-term, seasonal and long-term trends in groundwater conditions (Reg. § 354.20 a). A trend analysis was performed and detailed in the Appendix K. Appendix K includes evaluation of water level observations and groundwater quality analytes (chemicals) from select wells in Piru Basin.

Evaluation of trend types (i.e., short-term, seasonal and long-term) requires data collected at varying frequencies, although high-frequency data can be pared down for analyses that require less frequent data. Short-term and seasonal trend evaluations may require higher-frequency data than long-term trends, and therefore require a greater level of effort and cost to gather the necessary data. Wells equipped with data loggers (e.g., pressure transducers and water quality sensors) can be useful tools for assessing short-term and seasonal trends. Collection of higher-frequency data from newly established monitoring sites is often necessary to assess site-specific short-term and seasonal trends. Over time, once these trends are understood, it may be determined from the data that less frequent monitoring is adequate for collecting representative data for describing local groundwater conditions. "An understanding of the full range of monitor well conditions should be reached prior to establishing a long-term monitoring frequency" (DWR BMP 2, 2016).

Seasonal trends (e.g., minimum and maximum annual fluctuation or separating spring and fall collected data for independent evaluation) can be assessed using semiannual, quarterly, or higher-frequency data. Less frequent (e.g., annual or biennial) data collection can be leveraged for assessing long-term trends. Trend analysis results may be somewhat dependent on the time period selected for data evaluation. Commonly, data availability influences the time period selected for analysis in historical evaluations. The trend analysis in Appendix K used existing datasets, and will inform potential revisions to FPBGSA's monitoring program.

The technical memorandum trend analysis used the following trend type general criteria for analysis of select groundwater data:

- Short-term: Available data since the year 2000
- Seasonal (short-term): Available semiannual or higher frequency data
- Long-term: Last 36 years (1983–2018)

The long-term time period of water years 1983 through 2018 employed for the purpose of data trend analysis in the technical memorandum was selected with consideration of available annual precipitation data. The time period includes both wet and dry cycles including recent drought years. Water year 1983 is among the wettest on record, and the ensuing period through 2018 includes several above average years, some of which are over twice the long-term average (i.e., 1998 and 2005). A standardized period of analysis is used in the technical memorandum for assessing trends to facilitate better comparison of trend spatial distribution from well to well. Complete record sets (i.e., including data prior to 1983) for the groundwater data analyzed in the trend analysis are included in the appendix of the technical memorandum.

Additional time periods could be used in future analysis of data trends. At the time of writing of the technical memorandum, complete datasets were available through calendar year 2018, and more recent data were presented in the technical memorandum where available. Trends were assessed through 2018 to provide context of groundwater conditions leading into the potential adoption and initiation of the GSP implementation period. Future analysis may include the identification of base periods that differ from the time periods used in the technical memorandum, and may include stakeholder input and additional current data, if available.

However, the evaluation summarized here from the technical memorandum is useful for demonstrating that FPBGSA's monitoring program is capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and to yield representative information about groundwater conditions as necessary to evaluate GSP implementation.

#### *3.5.1.4 Groundwater Extraction Monitoring*

Locations of active water wells for which groundwater extraction volumes are monitored (currently on a semiannual calendar year basis) are shown on Figure 3.5-3. Piru Basin-wide groundwater production record keeping began with the advent of a United funding mechanism tied to groundwater produced within their boundary. Detailed pumping records by well are available for nearly a 40-year period in Piru Basin and the other basins within United's boundary. Groundwater extractions were first reported to United in 1979, with 1980 constituting the first relatively complete calendar year of record.

Following the formation of the FPBGSA in 2017, pumpers in the Fillmore and Piru Basins have been required to report their groundwater extractions to the Agency. As an administration cost savings measure, the Agency has used United's reported pumping records from wells in the Fillmore and Piru Basins and an accounting system to invoice well operators on a semiannual calendar year basis for the Agency's levied groundwater extraction fee. Groundwater extraction measuring protocols are summarized in Section 3.5.2.3.

#### 3.5.1.5 *Surface Water Monitoring*

Streamflow and surface water quality monitoring in the Piru Basin is summarized in the following subsections. Detailed descriptions are included Sections 2.2 and 3.2 of Appendix K.

##### 3.5.1.5.1 *Streamflow Monitoring*

The FPBGSA's streamflow monitoring network includes manual in-stream measurements at established locations and permanent fixed recording gauges. Available streamflow discharge data for the Piru Basin includes measurements from the Santa Clara River and tributaries. Figure 2.1-10 shows the location of streamflow gauging sites in the Basin and nearby areas. Streamflow measurements have been used by United to estimate percolation rates within various reaches of the stream channels of the Fillmore and Piru Basins (Appendix K).

The Santa Clara River reach of perennial rising groundwater that exists near the Basin boundaries (i.e., Fillmore/Piru Basins) is intermittently monitored by United. They measure streamflow discharges and collect global positioning system (GPS) point data of the distal upstream extent where water is flowing in the river channel. United has established monitoring points where they have determined the approximate location of peak flow at the Fillmore/Piru Basins boundary.

Figure 2.1-10 shows the active and historical recording streamflow gauges in Fillmore and Piru Basins operated by the USGS or VCWPD. Streamflow datasets are available for download through the USGS NWI Web Interface (https://waterdata.usgs.gov/ca/nwis/). These datasets include, but are not necessarily limited to, the following:

- Daily streamflow data and statistics
- Average monthly (statistics)
- Average annual (statistics)
- Annual streamflow peak

Streamflow datasets are also available for download through the VCWPD's Hydrologic Data Server (Hydrodata). These datasets include, but are not necessarily limited to, the following:

- Average daily streamflow
- Annual and event streamflow peaks

A summary of streamflow monitoring protocols is included in Section 3.5.2.4.

#### 3.5.1.5.2 Surface Water Quality Monitoring

United's existing surface water monitoring network has been adopted by the FPBGSA. The historical surface water monitoring point inventory includes 13 historical sites located within Piru Basin. Of these sites, 5 (and 4 alternate sites), shown on Figure 2.1-11, are included in United's current surface water quality monitoring. There are over 3,100 surface water quality records in FPBGSA's database with a date range of 1951 through 2018. Additional sources of surface water quality data contained in FPBGSA's database (transferred from United) generally originated from the following entities:

- DWR
- SWRCB DDW (formally under California Department of Public Health [CDPH])
- USGS

United conducts monthly surface water sampling for TDS, chloride, and nitrate in the Santa Clara River downstream of the Ventura/Los Angeles County Line (see Figure 2.1-11). On a quarterly basis, surface water samples are collected for general mineral analysis from the Santa Clara River and tributaries at approximately 8 locations in the Fillmore and Piru Basins and nearby areas. On alternate quarters, United has a reduced suite of analytes run for some sample locations (United, 2016a).

The Ventura County Stormwater Resources Group coordinates surface water sampling for all MS4 permittees (Cities and County), and they collect wet and dry weather runoff samples in storm drains and rivers. For the Santa Clara River watershed, they sample at United's Freeman Diversion Facility in Saticoy and one storm drain each in the Cities of Santa Paula and Fillmore. Annual reports are published and can be downloaded from their website (www.vcstormwater.org).

### 3.5.1.6 Meteorological Monitoring

Piru Basin has historically experienced a Mediterranean type climate (mild wet winter and dry summer). The timing and intensity of precipitation throughout the wet season impacts both surface water runoff (to rivers and streams) and groundwater recharge. Meteorological (climate) conditions information (i.e., measured precipitation gauge and evaporation data) are available for download through VCWPD's Hydrodata online portal. Available datasets and active Piru Basin monitoring points are described in Appendix K. These atmospheric datasets are important inputs in United's Regional Model which served as a vital groundwater conditions assessment tool in preparing this GSP.

Precipitation datasets accessed through VCWPD's Hydrodata portal include hourly totals for recording gauges and daily rainfall totals for standard (i.e., manually measured) gauges. Data can also be downloaded by summed monthly or water year totals. There are five active sites (stations) within the Piru Basin.

ET is a water budget component that combines the processes of plant transpiration, surface water and soil moisture evaporation. ET can be estimated from weather station measured parameters that include, but are not necessarily limited to, the following components:

- Wind speed
- Air temperature
- Humidity
- Solar radiation

Site-specific ET is dependent on the parameters listed above, but also includes factors such as vegetation ground cover and soil moisture. Fillmore Fish Hatchery Site (171) located near the Fillmore/Piru Basins boundary and the Piru-Temescal Guard Station Site 160 (located north of Piru Basin near Lake Piru) are the two stations near Piru Basin that record monthly evaporation data.

#### *3.5.1.7 Land Elevation Monitoring*

Land elevation monitoring related to the undesirable result of land subsidence is conducted using InSAR datasets provided by TRE Altimira and DWR. Figure 2.2-25 shows the extent of land subsidence monitoring (i.e., the entire Basin). Annual changes in land surface elevation are measurable with InSAR within 0.07 feet (Towill, 2021; DBS&A, 2021a). Cumulative changes in land subsidence have larger errors that increase over time (to at least 0.1 foot for cumulative changes that are estimated between 2015 and 2019).

### 3.5.2 Monitoring Protocols for Data Collection and Monitoring (Reg. § 352.2)

Robust and reliable data collection protocols are used to gather monitoring network data for assessing groundwater and related surface water conditions in the Piru Basin. The SAP (Appendix L) details groundwater level and water quality (groundwater and surface water) data collection standardized field and reporting methods. Monitoring protocols described in detail in the SAP are summarized in this section along with groundwater production measuring and streamflow monitoring protocols.

The SAP includes:

- Water sample collection procedures
- Analytical methods to be used
- Groundwater level measurement protocol in water wells
- Data QA and QC procedures

#### *3.5.2.1.1 Groundwater Elevation Monitoring Protocols*

The FPBGSA SAP (Appendix L) describes groundwater data collection procedures that will produce reliable basin-specific water level data that can be used to evaluate sustainability in the Fillmore and Piru Basins with respect to the SGMA legislation sustainability indicators.

This subsection summarizes protocols for measuring water levels in wells and steps that are undertaken to ensure the adequacy of the data collection activities. Refer to Section 3 of Appendix L for detailed descriptions of the FPBGSA groundwater level monitoring program protocols that include, but are not necessarily limited to, the following SAP components:

- Field documentation and record keeping
- Scheduling of groundwater level monitoring events
- Equipment testing, inspection, and maintenance requirements
- Measurements and related field activities
- QA/QC

#### *3.5.2.1.2 Manual Groundwater Level Measurements*

Manual groundwater level measurements collected in Piru Basin wells made by United and VCWPD are with either a steel survey tape, acoustic sounder (VCWPD only), dual-wire or single-wire electric sounder. Permanently installed airlines are also utilized by United to gather water level measurements in a few production wells that are difficult to measure with an electric sounder or steel tape. Depth to groundwater is measured to a minimum accuracy of 0.1 foot (Reg. § 352.4) relative to the reference point (RP).

Wells exhibiting naturally flowing (artesian) conditions are able to be monitored where this occurs (i.e., at the fish hatchery) due to the top of casing being completed several feet above ground surface, allowing for a groundwater elevation at or above ground surface to be measured.

#### 3.5.2.1.3 Recording Groundwater Level Device Measurements

As mentioned in Section 3.5.1.1.2, United has an established pressure transducer and data logger monitoring network in Piru Basin. These devices can be used for recording water level measurements in wells on user defined or event-based schedules. When installing pressure transducers, care must be exercised to ensure that the data recorded by the transducers is confirmed with hand measurements.

The electronic components of the device are sealed in a housing that is installed below the water level surface in the well. They measure pressure (commonly in psi) above the sensor and a simple linear correction (coefficient) can be applied to adjust output readings to depth-to-water in the well or water level elevation referenced to mean sea level (given a RP elevation has been surveyed for the site). The devices can be downloaded during well-site visits or can be connected to telemetry systems to transmit data remotely.

Office-based data processing includes tying the pressure transducers to manual water level measurements and periodically checking (i.e., QA/QC) the reliability of the high-frequency pressure transducer measurements against periodic manual measurements to ensure a high level of confidence in these data. A detailed description of how raw data are collected, processed, and stored is included in Appendix K.

### 3.5.2.2 Water Quality Monitoring Protocols

Groundwater and surface water sample collection protocols are described in the FPBGSA SAP (Section 2) in GSP Appendix L that yield reliable basin-specific water quality data. These data are used to evaluate sustainability in the Piru Basin with respect to the water quality sustainability indicator set forth in the SGMA legislation.

This subsection summarizes activities associated with data collection, including field sampling methods, documentation, analytical requirements of the SAP, and steps to ensure the adequacy of the data collection activities. All samples collected are analyzed by a laboratory certified under the Environmental Laboratory Accreditation Program (ELAP). The specific sample collection procedure will reflect the type of analysis to be performed and DQOs.

#### 3.5.2.2.1 Groundwater Quality

Before purging and collecting a sample for laboratory analysis, groundwater level elevation should be measured in the well (see Section 3.5.2.1.1). Each well not equipped with low-flow or passive sampling equipment will be purged of a minimum of three casing volumes, if practicable, prior to sampling to ensure that a representative groundwater sample is obtained.

Professional judgment will be used to determine the proper configuration of the sampling equipment with respect to well construction such that a representative ambient groundwater sample is collected.

Field parameters should be collected before, during, and immediately after purging, and should stabilize prior to sampling. Minimum field parameters collected at the time of sampling include specific conductivity or electrical conductivity (EC), pH, and temperature. Additional field parameters may also be useful for meeting DQOs and assessing purge conditions (e.g., dissolved oxygen, oxidation/reduction potential, and turbidity).

Laboratory analytical methods are described in Section 2.5 of Appendix L. Samples will be accompanied by full chain of custody documentation (see Section 2.3.4 of Appendix L). Samples requiring preservation will be preserved as soon as practically possible, ideally at the time of sample collection. Samples requiring filtration, such as those to be analyzed for metals, will be filtered in the filed prior to preservation.

##### *3.5.2.2.2 Surface Water Quality*

Similar methodologies including field parameter collection will be used in sampling surface water as have been summarized above for sampling groundwater and are described in detail in Appendix L. Samples should be collected from flowing streams (not stagnate ponded water). Samples can be collected directly from the water source, so pumps and the purging process described above are not necessary for collecting surface water samples. Section 2.7.2 of Appendix L describes field equipment and instrument considerations.

Laboratory analytical methods are described in Section 2.5. Samples will be accompanied by full chain of custody documentation (see SAP subsection 2.3.4). If field conditions require filtering (e.g., such as with turbid surface water), the water samples will be mechanically filtered to remove suspended particulates prior to the samples being placed in the appropriate containers for laboratory analyses. Samples requiring filtration such as those to be analyzed for metals will be filtered in the filed prior to preservation.

### 3.5.2.3 Groundwater Extraction Measuring Protocols

Groundwater pumpers that produce groundwater from the Piru Basin pay United an extraction fee based on the number of AF they pump during a 6-month period (reporting to United 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 summarized in Section 3.5.1.4.

Groundwater pumpers are required to self-report groundwater extractions by well to United by one of three methods: domestic multiplier, electrical meter (based on SCE 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 photo 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 United or the FPBGSA.

De minimis domestic (M&I) pumping can be reported to United 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.

#### *3.5.2.4 Streamflow Monitoring Protocols*

Manual (hand) streamflow calculations are based on velocity measurements from a current meter at several intervals along a wetted cross-sectional profile of a stream channel. Established manual streamflow discharge measurement techniques include, but are not limited to, the following methods:

- In-stream wading measurements (e.g., using a top-set wading rod)
- Bridge suspended current meter
- Acoustic doppler current profiler (ADCP)

United has historically collected in-stream discharge measurements using a top-set wading rod equipped with a velocity meter. Velocity measurements were historically performed using USGS Type AA or Pygmy current meters. More recently acoustic doppler velocimeters (SonTek FlowTracker or FlowTracker2) or electromagnetic velocity meters (Hach FH950) are being used. United generally uses established USGS protocols (USGS, 2004; Turnipseed and Sauer, 2010) for wading streamflow measurements. Manual streamflow monitoring in the Piru Basin is summarized in Section 3.5.1.5.1, and additional information can be found in Appendix K. United and VCWPD maintain recording gauges (Figure 2.2-10).

Recording streamflow gauges typically measure surface water stage height (i.e., water surface level). Site-specific rating curves are established by correlating stage height with manual streamflow discharge measurements, which are periodically collected for this purpose. The rating curve is generally revised over time (e.g., as additional velocity data are collected or if the channel is significantly modified), typically using linear regression methods.

Recording gauges can be affixed to a bridge or other stationary structure that transverses a water course. These stations are equipped with a device (e.g., affixed float or sensor) that can measure stage. Stilling wells installed in stream banks are also commonly employed, and are frequently constructed adjacent to weirs that afford ideal laminar flow conditions.

Recording gauges can be equipped with telemetry systems that transmit data in near real-time. Data that are publicly accessible in real-time (e.g., via the USGS National Water Information System [NWIS]) are generally initially reported as "Provisional" and are later evaluated with a QA/QC process and revised by the monitoring entity, if necessary, before being published as "Approved."

### 3.5.3 Representative Monitoring (Reg. § 354.36)

Representative monitoring sites are designated for groundwater level monitoring to make tracking and communicating SMCs efficient and effective. Representative sites (Figure 3.5-4) are selected from the actively monitored wells (Figure 3.5-1) to target locations with relatively long water level records and provide relatively even spatial coverage of the Basin. The corresponding MT and MO are shown (in elevation relative to approximate mean sea level) at each well location on Figure 3.5-4.

### 3.5.4 Assessment and Improvement of Monitoring Network (Reg. § 354.38)

From the available data in the Piru Basin reviewed in preparing this GSP, data are generally of high quality and are of sufficient or nearly sufficient quantity and quality for use in assessing the SGMA sustainability indicators. The existing United and VCWPD monitoring programs include substantial annual data collection activities in the Piru Basin, and are an important component of the FPBGSA monitoring network. Potential data gaps ranging in sustainability evaluation significance are summarized in this subsection and are described in detail in Appendix K.

Potential data gaps are present in the historical groundwater datasets presented in Section 2 of Appendix K and in existing United and VCWPD monitoring programs described in Section 3 of Appendix K. Existing monitoring networks are the focus here, as they facilitate the gathering of new data and by their enhancement, where practicable, afford important documentation of the progression toward sustainable management in the Piru Basin. Filling data gaps will inform GSP five-year update assessments and annual reporting.

### 3.5.4.1 Groundwater Level Monitoring

Groundwater level data collected from existing monitoring networks are described in the FPBGSA Monitoring Program and Data Gap technical memorandum. This GSP subsection addresses potential spatial and temporal (and or frequency) data gaps that may exist in the FPBGSA groundwater level monitoring network. In 2020, United expanded its water level monitoring program list to include one additional well in the Fillmore Basin and two wells in Piru Basin (i.e., 04N18W27G03S and 04N18W15M01S) to fill monitoring network data gaps by using existing privately owned wells, where possible.

#### 3.5.4.1.1 Well Spatial Density by Aquifer Zone

Monitoring network wells spatial density in Piru Basin was described previously in Section 3.5.1.1.3. Potential spatial data gaps are summarized in this subsection, and Section 3.5.4.4.2 identifies potential new monitor well locations that will serve to fill groundwater level monitoring data gaps. From Table 3.5-1, approximately 70 percent (i.e., 21 of 30) of the monitored wells in the Piru Basin are screened discretely in the main or deep principal aquifers.

The majority of wells (i.e., 20 of 30 wells) currently monitored by United and VCWPD screened in a single principal aquifer are completed in Zone A and/or B (Main). These represent 117.6 wells per 100 square miles in Piru Basin. Overall, this represents a good distribution of principal aquifer wells. There is a potential monitoring point data gap in Piru Basin in the eastern portion of the Basin.

There is only one monitoring point (well) screened discretely in aquifer Zone C in the Piru Basin. There are not many wells that access groundwater from Zone C, but this is not considered a significant lack of data because little groundwater is extracted from this deep zone.

#### 3.5.4.1.2 Temporal and Frequency Assessment

Groundwater levels in California basins are often at their highest annual levels during the spring of each year following winter precipitation and groundwater recharge. They are often at their lowest in the fall preceding the start of the winter rainy season (much of the annual precipitation falls from November through February in Ventura County). Temporal coordination of groundwater level collection activities across the state is important for comparison of water level measurements collected by different monitoring entities. The DWR's BMP #2 specifies that

"Groundwater levels will be collected during the middle of October and March for comparative reporting purposes" (DWR BMP 2, 2016).

With respect to the length of the monitoring event time windows DWR offers (DWR BMP 1, 2016):

> Groundwater elevation data will form the basis of basin-wide water-table and piezometric maps, and should approximate conditions at a discrete period in time. Therefore, all groundwater levels in a basin should be collected within as short a time as possible, preferably within a 1 to 2 week period.

As subsequently mentioned, an SGMA requirement is the development of a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in the Basin. At a minimum, biannual data is needed to assess seasonal groundwater level trends for evaluation of GSP implementation. Water levels are collected by both United and VCWPD as part of their established monitoring networks in the Basin during other times of the year for various purposes, but as tight (short) a monitoring event time window as reasonably possible will be scheduled around the middle of October and March of each year. United and VCWPD coordinate their groundwater monitoring event campaigns to the extent practicable. Their respective monitoring program schedules are described in Section 3.5.1.1.1 and shown graphically in Figure 2.1-8.

Most of the pressure transducers in the Piru Basin operated by United are programed to a recording frequency of every four hours (six water level measurement per day). These high-frequency data provide a level of detail that is useful in assessing short-term trends that may be masked by biannual or monthly water level measurement programs. Potential groundwater level short-term trends that can be assessed from these data may include, but are not necessarily limited to, the following:

- Daily diurnal fluctuations
- Groundwater recharge events (e.g., in shallow wells near the Santa Clara River)
- Pumping from nearby wells
- Drawdown and recovery when installed in pumping wells

Pressure transducers and data loggers are also valuable for collecting highly reliable data for assessing seasonal high and low trends. United produces groundwater level hydrographs from the high-frequency pressure transducer data that they use to pick spring high (maximum) and fall low (minimum) water levels that are processed for import into their database and are included in Appendix K. These data are especially useful for the spring high and fall low groundwater level elevation contouring. United uses these data and manual water level measurements for groundwater level contouring for inclusion on maps in their hydrogeological conditions report series. United does not store the voluminous recording pressure transducer data directly in their database, but maintains these records in Excel files for individual wells and archives raw data logger downloaded files on their servers.

Equipping additional wells in the Piru Basin with pressure transducers and data loggers is planned (e.g., equipping the potential new monitor wells described in Section 3.5.4.4.2) for collecting highly reliable data for assessing short-term and seasonal high and low trends. A description of pressure transducers and data loggers currently deployed as a component of the FPBGSA monitoring network in the Piru Basin is included in Section 3.5.1.1.2.

### 3.5.4.2 Groundwater Quality Monitoring

Groundwater quality data collected from existing monitoring networks are described in Section 3.1 of Appendix K. The following subsections address potential spatial and temporal (and or frequency) data gaps that may exist in the FPBGSA's groundwater quality monitoring network.

#### 3.5.4.2.1 Well Spatial Density by Aquifer Zone

Groundwater monitoring network wells spatial density in Piru Basin is described previously in Section 3.5.1.2.2. Spatial data gaps are summarized in this subsection, and Section 3.5.4.4.2 identifies potential new monitor well locations that will serve to fill groundwater quality monitoring data gaps.

From Table 3.5-2, approximately 80 percent (i.e., 19 of 24) of monitored wells in the Piru Basin are screened discretely in the principal aquifer (Zone A and/or B). There are 1.1 wells per square mile in Piru Basin. Overall, this represents a good distribution of principal aquifer wells. There is a potential monitoring point data gap in the eastern portion of the Basin and south of the Santa Clara River.

There are two monitored wells screened discretely in Zone C in the Piru Basin. This is not considered a significant lack of data because little groundwater is extracted from this deep zone.

#### 3.5.4.2.2 *Temporal and Frequency Assessment*

As previously mentioned, an SGMA requirement is the development of a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in the Basin. At a minimum, semiannual data are needed to assess seasonal groundwater quality trends for evaluation of GSP implementation.

Groundwater quality samples are currently collected on varying schedules in the in the Piru Basin. United samples monitoring and production wells in the Piru Basin semiannually in the spring and fall to evaluate the quality of groundwater within their boundary (United, 2016a). These scheduled sampling runs are occasionally supplemented by targeted event-based sampling. VCWPD annually samples production wells within the Basin in the fall. VCWPD's list of groundwater sampling wells is a bit more fluid than United's, and is somewhat dependent on availability of staff's time and the Agency's annual budget. There is a core group of wells that VCWPD prioritizes to be sampled almost every year (green squares on Figure 2.1-9), and if one of these wells is unavailable for some reason, they will often sample a nearby well that is pumping (VCWPD, 2020).

Wells sampled in the Piru Basin as part of VCWPD county-wide groundwater quality monitoring program may not be sufficient for SGMA purposes. It is important to sample the same wells from year to year and to collect at least a spring and fall sample each year. Over a period of years that include both dry and wet precipitation years, if groundwater quality seasonal variability is demonstrated to be minimal in a particular well, annual sampling may be sufficient for GSP purposes.

### 3.5.4.3 Groundwater Extraction Monitoring

Groundwater extraction monitoring and measuring protocols are summarized in Sections 3.5.1.4 and 3.5.2.3, respectively. This subsection addresses potential temporal (and or frequency) data gaps that may exist in FPBGSA's groundwater extraction monitoring network.

An SGMA requirement is the annual reporting of groundwater extractions on a water year basis [23 CCR § 356.2(b)(2)]. Water years begin October 1 and end September 30 of the following year, and are intended to capture a complete annual wet period as opposed to splitting it across two years as is commonly an artifact of calendar year reporting. This is not easily accomplished under FPBGSA's current reporting mechanism, which is tied to United's accounting system (as a FPBGSA cost saving measure), and if modified would impact several additional basins within United's boundary.

Different schemes have been unofficially proposed for meeting SGMA water year groundwater production reporting requirement for Fillmore and Piru Basins. Large capacity groundwater pumpers could be requested to report quarterly (or monthly) to develop a dataset for estimating seasonal variability in water demand supplied by groundwater pumping. Another potential solution is to require all pumpers in the Basins to report groundwater production on a quarterly basis but to-date the Agency has not proposed a formal resolution. FPBGSA is working closely with United to resolve this issue in a timely and cost-effective manner that does not impose additional undue burden on Fillmore and Piru Basins pumpers or United staff..

### *3.5.4.4 Description of Steps to Fill Data Gaps*

The data gap component of Appendix K includes prioritized recommendations (Section 6 of Appendix K) on how refinement and or expansion of the existing monitoring networks in the Piru Basin might minimize or eliminate data gaps, especially in critical areas. A plan to install new monitor wells to fill data gaps in the Fillmore Basin is also summarized in this subsection.

#### *3.5.4.4.1 Data Gaps Priority Ranking*

Prioritization levels were used to rank FPBGSA monitoring program potential data gaps identified in this GSP. Table 3.5-3 was modified from the table in Section 6.1 of Appendix K to include only those recommendations that pertain to filling data gaps in the existing FPBGSA monitoring network, and does not include the recommendations for filling data gaps pertaining to historical data sets. A simple "Very High-High-Medium-Low-Very Low" priority classification ranking system is employed.

GSP preparation and implementation "value added" evaluated against cost is considered in this recommendation prioritization. For example, it would be advantageous in GSP implementation sustainability evaluation to only use groundwater data collected from properly constructed multiple-well monitoring facilities with completions in each of the aquifer zones in the Basin. Construction of 20 of these facilities equally spaced across the Basins would greatly decrease GSP analysis uncertainty and would be consistent with the DWR's data quality recommendations, but would likely be cost prohibitive for FPBGSA rate payers in the Fillmore and Piru Basins.

Table 3.5-3 summarizes the Appendix K (Section 5) monitoring network data gap analysis recommendations and ranks them by priority. They are ordered by section number in the technical memorandum.

### Table 3.5-3. Summary of Monitoring Network Data Gaps

| Appendix K Section | Priority Level | Description of Potential Monitoring Network Data Gap |
|---|---|---|
| 5.1.1, 5.1.4, 5.3.1.1, 5.4.1.1 | High | Investigate wells included in United and VCWPD's existing monitoring networks of unknown well construction (e.g., contact owner for records or perform a well video survey). If screened interval cannot be determined, they should be replaced in the monitoring networks with wells of known construction if potential substitute monitor points exist nearby. |
| 5.1.3 | High | Evaluate existing monitoring network water level data RP elevation accuracy, consistency of vertical datum reference and recording of measurement offset height above/below RP for depth to water below ground surface calculations. |
| 5.1.4, 5.3.1.1, 5.3.1.2, 5.4.1.2 | Medium | Identify additional monitoring points (for collecting groundwater quality and level) using existing wells screened discretely in each of the principal aquifers, where possible. For water quality, these might include additional groundwater sampling from existing wells surrounding known radiochemistry and selenium "hot spots". |
| 1.2.6, 5.3.1.2, 5.4.1.2, 6.2 | Medium | Construct a new multiple-well groundwater monitoring site near the Santa Paula/Fillmore Basin boundary for assessing vertical groundwater gradients and collecting aquifer zone specific water quality samples. |
| 5.1.4, 5.4.1.2 | High | Identify additional monitoring points for measuring groundwater levels using existing shallow wells screened discretely in the principal aquifer and/or construct new shallow monitor wells near the Santa Clara River and its tributaries. |
| 5.1.4, 5.4.2 | Medium | Equip additional wells in the Basin with pressure transducers and data loggers (AMI equipment can include pressure transducers for measuring water level). Wells identified in the GSPs as sustainable management criteria RMPs should be prioritized for pressure transducer and data logger deployment. |
| 5.5.1 | Medium | Consider a policy that establishes groundwater extraction reporting method requirements for all pumping wells in the Fillmore and Piru Basins. Additionally, consider commissioning a feasibility study that includes cost estimates to equip large capacity production wells in the Basins with AMI technology. |
| 5.5.1 | Very High | Gather groundwater production data sufficient for reporting to DWR by water year and for use in preparing water budgets. |
| 5.5.1 | Low | Quantification of potential unreported pumping in the Basin. |
| 5.6.3 | Very Low | Determination of interconnection between groundwater and surface water and steelhead habitat suitability for Piru Creek within Piru Canyon. |

#### *3.5.4.4.2 Potential New Monitor Wells*

A portion of FPBGSA's Proposition 1 Grant includes funds earmarked for constructing new monitor wells to fill monitoring network data gaps in the Fillmore and Piru Basins (see

Section 6.2 of Appendix K). Appendix K identifies several potential locations for installation of new shallow Zone A monitor wells and a nested (multi-depth monitoring facility) site. United staff have reviewed the potential locations for new wells suggested in Appendix K, and have identified existing wells that could be substituted for some of the shallow wells. It is proposed that these existing wells be added to the monitoring network to reduce the need for construction of new wells to address data gaps in these areas.

# 4. Projects and Management Actions to Achieve Sustainability Goal (Reg. § 354.44)

The FPBGSA has developed a list of potential projects and/or management actions that will be further considered for implementation in the post-GSP adoption time frame. As previously noted in this GSP, the FPBGSA has elected to manage the Fillmore and Piru Basins together due to their similar hydrology. The FPBGSA has not identified unmitigated significant and unreasonable impacts that would result from the implementation of the GSP. However, the FPBGSA also recognizes that there are project or management actions that could enhance the water resources of the Piru Basin and aid in keeping the basin closer to the desired future conditions as represented by the measurable objectives.

The potential projects or management actions being considered by the FPBGSA include, but are not necessarily limited to, the following:

- Supporting Cienega Springs Restoration project as drought refuge
- Monitor wells at Cienega Springs Restoration project site
- Installation of shallow monitor wells across basin
- Buying supplemental water when available
- Additional water quality sampling
- Arundo removal
- Subsidence studies: critical infrastructure, Town of Piru gravity systems (water, sewer), install continuous global positioning system (CGPS) stations

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

Technical analyses show that groundwater extractions in the Basin can exacerbate the effects of major, multi-year droughts on the rising groundwater that supports the GDE areas in the vicinity of the fish hatchery and the adjacent Cienega Restoration Project. These effects include vegetative stress when, for example, the decline of water levels below the critical water levels sooner and keeping the water levels depressed below the critical water level longer when normal or wet conditions return.

The FPBGSA desires to dampen the impacts of groundwater extraction by supporting the restoration efforts at the Cienega Restoration Project. The primary action being considered by the FPBGSA is to provide supplemental groundwater to the restoration program during multi-year droughts when the shallow groundwater levels decline to below the critical water level. The groundwater would be supplied from an existing production well (if a suitable well can be found or alternatively a newly constructed well) that is extracting water from the deeper hydrostratigraphic units (i.e., not the shallow aquifers). CDFW and the restoration management team would use the water in the manner they deem most beneficial to their restoration program.

The mitigative effects of this action include:

- Providing a refuge for vegetation and wildlife during a period of prolonged drought
- Supplying water that can be used to irrigate additional land parcels that are not served by the effluent from the fish hatchery operations
- Providing a natural seed supply that will be important for revegetation efforts in post-drought time frame
- Possible use as a seed source area for a "seed bank" that can function as a repository for native vegetation seeds for use in future restoration programs

Monitoring the depth of the shallow groundwater near this GDE area is an important component of this project. The FPBGSA recognized the lack of shallow aquifer groundwater level data in this area as a data gap and has proposed the installation of three monitor wells to serve as the reference wells for this project. The monitor wells are further described in another project.

Details of how this project would be implemented have not yet been developed. FPBGSA staff have engaged with CDFW representatives about this project, and the conversations are continuing. A detailed mitigation plan will be developed after the GSP has been adopted by the FPBGSA and the GSP has been submitted to DWR for their review (January 2022). The mitigation plan will specify critical project elements, such as source of the groundwater (i.e., which well will be used), timing (including when supplemental groundwater deliveries would start and stop), amount of water to be supplied, and the installation (capital) costs with the associated ongoing operation and maintenance costs. An implementation timeline will consider when the restoration project will be sufficiently far enough along in its development to receive the supplemental groundwater. The mitigation plan will be developed in a transparent manner with input from stakeholders, directors, and Cienega Springs Restoration Project management team considered during the development process. The FPBGSA would consider developing, adopting, and implementing the mitigation plan, likely in 2022 or 2023.

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

The FPBGSA included the construction of new monitor wells (up to three) in the current grant scope of work and budget for GSP development. Data gap analyses have identified a need for additional water level information for the shallow aquifer system near this project site where rising groundwater supports the GDE complex in the area. The grant funds will be used to install three new shallow monitor wells at locations that will be identified in consultation with CDFW and the restoration team.

The FPBGSA will need to develop a funding mechanism to support the continued monitoring of the water levels in these wells, in addition to periodic (e.g., semiannual) water quality analyses. It is likely that the wells will be equipped with pressure transducers to minimize the number of field visits.

## 4.3 Project #3: Construction of Shallow Monitor Wells

The FPBGSA included the construction of new monitor wells in the current grant scope of work and budget for GSP development. Data gap analyses have identified a need for additional water level information for the shallow aquifer system across the Basin, and the grant funds will be used to install up to two new shallow monitor wells at yet to be determined locations in the Fillmore Basin. The locations will be defined once land access agreements and easements are procured.

The FPBGSA will need to develop a funding mechanism to support the continued monitoring of the water levels in these wells, in addition to periodic (e.g., semiannual) water quality analyses. It is likely that the wells will be equipped with pressure transducers to minimize the number of field visits.

## 4.4 Project #4: Purchase Supplemental Waters

The FPBGSA will consider establishing a discretionary fund that will be used to purchase supplemental waters when they are available. The amount of these waters that become available will vary from year to year, with little or no water available most years. A likely source of supplemental water could come from United's Table A allocation and the opportunity that allocation affords United to purchase Article 21 waters. In the past, United has used their funds to purchase Article 21 waters and deliver them via the Santa Clara River to downstream users. A significant portion of the waters infiltrate in the Fillmore and Piru Basins, thus increasing the water levels and groundwater storage.

It has been suggested by stakeholders that the FPBGSA should consider establishing a discretionary fund that would be used solely for the purchase of supplemental water. Conceptually, when United is informed that Article 21 waters are available, the FPBGSA could elect to supplement the United funds for the purchase of a larger quantity of water. The FPBGSA would work with United on the delivery of those waters so that the appropriate portion of the Article 21 waters would percolate in the Piru Basin.

The FPBGSA will also consider exploring relationships with other entities that may, on occasion, have supplemental water that could be purchased or are in a position to sell some of their water entitlements to raise capital. There are several existing water banks in California that could be explored to identify which member entities might be amenable to selling water when the conditions and pricing are appropriate. This a long-lead time effort that will require outreach to water bank operators and their member entities to craft buy-sell agreements in advance of a possible transaction. The purchase of water currently stored in an existing water bank affords the FPBGSA flexibility in how and when the water is delivered. If it is not needed immediately, the water can remain in the water bank. If those waters cannot be physically delivered to the Fillmore and Piru basins due the lack of suitable conveyance infrastructure, the water entitlement can be traded to others with access to water conveyance infrastructures (e.g., Santa Clarita Valley Water Agency that enable delivery of the water to the basin via Castaic Lake or Lake Piru.

It is anticipated that the FPBGSA will evaluate the pros and cons of implementing a program to purchase supplemental waters and, if deemed appropriate, will develop and implement such a program prior to the submittal of the five-year update to the GSP.

## 4.5 Project #5: Additional Water Quality Sampling

The FPBGSA will consider augmenting the water quality network in the vicinity of Pole Creek Fan (just west of the Fillmore-Piru Basin boundary). Data gaps suggesting the need for additional water quality sampling were not identified for the Piru Basin. The Pole Creek Fan area was identified (Appendix K) as having limited water quality information on analytes that are near a regulatory threshold. If additional water quality sampling is deemed appropriate by the FPBGSA, a detailed monitoring program outlining which wells would be sampled, the sampling frequency, and the suite of analytes will be prepared and implemented by the FPBGSA prior to the five year update to the GSP.

The FPBGSA would need to identify who is going to collect these additional samples (e.g., FPBGSA staff, consultant) and develop a funding source for these activities. Water quality regulatory authorities do not fall into the purview of FPBGSA, but the Agency is committed to monitoring the water quality and working with the appropriate entity that does have regulatory authority to address any concerns identified in the future.

## 4.6 Project #6: Non-Native Vegetation Removal

The FPBGSA will consider developing a program to assist other entities in the removal of non-native vegetation (e.g., arundo, tamarisk). The program would likely focus on providing financial or in-kind services to assist other entities engaged in the removal of non-native vegetation species that are intensive water users. Periods of vegetation die-off in the GDE areas associated with a prolonged series of drought years creates opportunities for plants such as arundo and tamarisk to aggressively colonize areas impacted by the die-off. The FPBGSA will evaluate the cost-benefit relationship of a non-native vegetation removal program as integrated into other entities vegetation removal activities. Prior high-level cost estimates of arundo removal (Bell et al., 2016) vary depending on the density of arundo per acre (e.g., from as low as $5,500 per acre for high density areas that can be efficiently removed with heavy machinery up to the range of $24,500 to $44,250 per acre for moderate and low density areas, respectively, which require more manual labor to treat localized occurrences). Effective (i.e., long-lasting) removal of arundo for the Basin would likely require coordination with upper Watershed (i.e., Santa Clarita) to remove all sources of the arundo that would otherwise likely transport and recolonize downriver in the Basin. The non-native vegetation removal program, if deemed appropriate by the FPBGSA, will be include the preparation of an implementation and funding plan by the FPBGSA prior to the five-year update to the GSP.

## 4.7 Project #7: Subsidence Infrastructure Vulnerability Evaluation

The FPBGSA will consider developing an infrastructure vulnerability evaluation of civil infrastructure that may be susceptible to differential, inelastic ground subsidence. The Piru Basin Pumpers Association (PBPA) (letter dated March 9, 2021) expressed a desire for the FPBGSA to study the major infrastructure in the Basin (e.g., bridges, pipelines, gravity sewage, gravity water lines, roads). The focus of the study would be to identify the sensitivity of these structures to differential subsidence and to establish thresholds (e.g., how much inelastic subsidence is too much) that could be used to refine the definition of significant and unreasonable and the related minimum threshold. Additionally, the PBPA recommended installing permanent CGPS stations (at least one in the Fillmore basin) to help distinguish between subsidence and tectonic movement.

If deemed appropriate by the FPBGSA, a subsidence infrastructure vulnerability evaluation plan will be prepared and implemented (with a funding plan) by the FPBGSA prior to the five-year update to the GSP. The Piru Basin is classified as having a low potential for subsidence by DWR (2014), and Appendix F reaffirms this low potential.

## 4.8 Project # 8: Drought Vulnerability Assessment

Droughts can have a significant impact on the ability of groundwater resources to be accessed by the existing water supply well network in a basin. As water levels decline in response to drought conditions, domestic wells can be the most susceptible due to their commonly shallower depths than irrigation or municipal water supply wells. Well owners in the Fillmore basin have not reported their wells going dry during past droughts (or the most recent multi-year drought), and initial forward modeling of future groundwater conditions for preparation of the GSP did not predict dry wells. Additionally, a preliminary estimate of the number and types of wells that might be impacted by hypothetical water level declines of 50, 75, and 100 feet (see section on Chronic Lowering of Groundwater Levels) was performed, with MTs set accordingly to minimize significant and unreasonable impacts to production wells (including domestic wells).

In an abundance of caution the FPBGSA desires to perform a drought vulnerability assessment as a precautionary measure to further define the magnitude, potential severity, and likelihood of occurrence of dry wells or impaired well performance due to declining water levels under future conditions.

This drought vulnerability assessment will be informed by an updated, more refined groundwater and surface water flow model developed by UWCD. This assessment will incorporate data on the spatial variability of water level declines anticipated from future climate scenarios that were not able to be included in the hypothetical water level decline scenarios used to develop MTs during the 180-day resubmission period.

The FPBGSA will conduct a drought vulnerability assessment for all existing wells in the Basin. The assessment is expected to extend over a two-year period with the initial activities to include:

- *Outreach to existing well owners*, in particular domestic well owners, but also to irrigation well owners to collect well construction data. An estimated 39 percent of the wells in the Piru Basin have unreported information on the depths of well screens, for example. Well construction information is a fundamental data set needed to determine which wells could potentially be impacted (e.g., go dry or have decreased production capacity) during future, multi-year droughts. This outreach is anticipated to leverage connections with local well owners available through the Piru Basin Pumpers Association and its representative to the FPBGSA Board of Directors, in addition to local community groups.
- A *revision of the existing regional groundwater flow model* designed to improve its representation of past hydrogeologic conditions and predictive capabilities with respect to groundwater levels and surface water flows. This revised model will be used to estimate various groundwater pumping conditions (e.g., no groundwater extractions, basin-wide increases in groundwater extractions, spatially targeted adjustments to groundwater extractions such as near GDEs) and the number and type of wells potentially impacted by future pumping and climate scenarios, in addition to the severity of the impact to groundwater resources, in general, and individual wells, specifically.
- The revised groundwater flow *model results will be summarized and incorporated into the FPBGSA Online Database* to allow existing well owners to see what effects a future, multi-year drought might have on water levels in their well. Additionally, this information will be provided to applicants for new well permits as guidance on their well design. This information will help new well owners avoid constructing new wells that could be impaired by future, multi-year drought induced water level declines.
- As the assessment advances and the number and type of wells that potentially could be impacted and the severity of the impact identified, the FPBGSA will consider the need for the *development of a mitigation program*. The details of the program will be dependent on findings from the outreach program and results from the revised groundwater flow model. This mitigation program is envisioned to consider management actions, well modification projects, and possibly alternative water supply options.
- The drought mitigation plan (DMP) would likely consider the establishment of a “mitigation fund” that could be used to assist impacted well owners. The FPBGSA would develop

policies for who, how, what and when the mitigation fund could be accessed.  The DMP may include, for example, elements such as:

- Updating well permitting requirements to include recommended minimum screen depths based on MTs and future modeled GW conditions resulting from a multi-year drought for new domestic, municipal, industrial, and irrigation wells.
- Creation of a mitigation fund that would be built up over time (e.g., 10 years)
- Development of policies for:
  - Who can access the mitigation fund (e.g., domestic only?  Any potable water supply well owner [domestic and municipal]?  Should irrigation wells be included?)
  - How the mitigation fund would be implemented (e.g, percentage cost share based on age of well, no-interest loan program, grant)
  - What the mitigation fund could be used for (e.g., drilling a new well, lowering a pump, construction costs to connect to a nearby water system
  - When can the mitigation fund be accessed (e.g., only when significant and unreasonable impacts occur?  Anytime a well goes dry?)

Once the DMP is adopted, the FPBGSA would conduct an outreach effort to well owners in the basin informing them of the DMP, its eligibility requirements, and how to access the mitigation fund.

# 5. Plan Implementation

Implementation of the GSP requires the identification of funding sources and development of an implementation schedule, including how and when annual reports and periodic GSP reevaluations will be performed.

## 5.1 Estimate of GSP Implementation Costs (Reg. § 354.6)

The ongoing FPBGSA administrative costs are covered by a current groundwater extraction fee of $12.00/acre-foot that generates an estimated income of about $540,000.00. This fee is sufficient to cover routine legal counsel support of agency operations, as well as reimbursement of expenses from United for the executive director and accounting services.

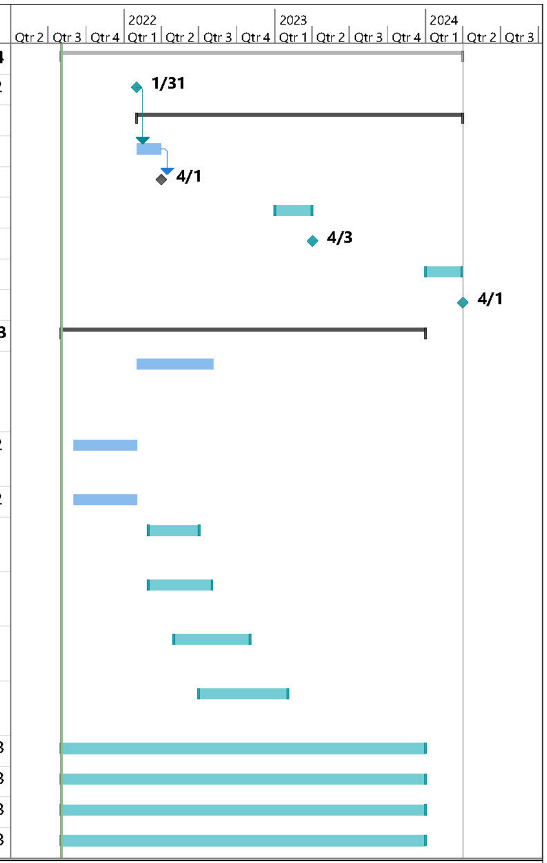
The GSP development grant awarded to FPBGSA from DWR includes funds to cover the installation of monitor wells to reduce data gaps identified during GSP creation (Projects 2 and 3 in Section 4). As identified in Section 4, there are other projects that the FPBGSA will consider implementing in the near-term future (Section 5.2). The project consideration process includes the identification of likely funding sources (e.g., supplemental groundwater extraction fees, ad valorem taxes, grants). The FPBGSA will consider the technical viability and water resource management impact of a project, the cost-benefit relationship, as well as the availability of funding.

## 5.2 Schedule for Implementation

The schedule for implementation of the GSP has the following major milestones through the first quarter of 2024:

# GSP Preliminary Implementation Schedule

| Task Name | Duration | Start | Finish |
|---|---|---|---|
| **GSP Implementation Schedule2** | **695 days** | **Sun 8/1/21** | **Mon 4/1/24** |
| GSP submitted to DWR | 0 days | Mon 1/31/22 | Mon 1/31/22 |
| **Annual Reports** | **564 days** | **Tue 2/1/22** | **Mon 4/1/24** |
| Prepare 2021 Anual Report | 43 days | Tue 2/1/22 | Thu 3/31/22 |
| Submit 2021 Annual Report to DWR | 0 days | Fri 4/1/22 | Fri 4/1/22 |
| Prepare 2022 Anual Report | 66 days | Sun 1/1/23 | Fri 3/31/23 |
| Submit 2022 Annual Report to DWR | 0 days | Mon 4/3/23 | Mon 4/3/23 |
| Prepare 2023 Anual Report | 65 days | Mon 1/1/24 | Fri 3/29/24 |
| Submit 2023 Annual Report to DWR | 0 days | Mon 4/1/24 | Mon 4/1/24 |
| **Project and Management Actions** | **630 days** | **Sun 8/1/21** | **Sun 12/31/23** |
| 1- Develop Mitigation Plan for vegetative GDEs - Supplemental groundwaer to Cienga Springs restoration program | 133 days | Tue 2/1/22 | Thu 8/4/22 |
| 2 - Construct Shallow Monitoring Wells at Cienega Springs restoration project site | 109 days | Wed 9/1/21 | Mon 1/31/22 |
| 3 - Construction of Shallow Montioring Wells | 109 days | Wed 9/1/21 | Mon 1/31/22 |
| 4 - Consider creating discretionary fund to Purchase Supplemental Waters | 89 days | Tue 3/1/22 | Fri 7/1/22 |
| 5 - Consider augmenting Water Quality Monitoring Network | 110 days | Tue 3/1/22 | Mon 8/1/22 |
| 6 - Consider creating Non-Native Vegetation Removal Program | 132 days | Mon 5/2/22 | Tue 11/1/22 |
| 7 - Consider performing Subsidence Infrastructure Vulnerability Evaluation | 154 days | Fri 7/1/22 | Wed 2/1/23 |
| **FPBGSA Administration** | 632 days | Sun 8/1/21 | Sun 12/31/23 |
| **Groundwater Monitoring - WLs & WQ** | 632 days | Sun 8/1/21 | Sun 12/31/23 |
| **Surface Water Monitoring - Flow & WQ** | 632 days | Sun 8/1/21 | Sun 12/31/23 |
| **Data Management & Online DMS Updates** | 632 days | Sun 8/1/21 | Sun 12/31/23 |




The project and management actions consist of activities that have been funded by the Proposition 1 GSP Development Grant, and will be completed prior to the submittal of the GSP to DWR (Projects 2 and 3), as well as projects the FPBGSA board of directors will consider for implementation after GSP submittal. The vegetative GDE mitigation plan would be developed in the first half of 2023 after consultation with the Cienega Springs restoration project management team and basin stakeholders. Projects 4 through 7 will be considered for potential implementation by the board of directors once further details are developed (e.g., project scope, costs, implementation timeline, cost-benefit ratio for water resources). These projects are not specifically required for the basin to remain in a sustainable condition, but could provide water resource benefits if the cost-benefit relationship is acceptable to the stakeholders.

## 5.3 Annual Reporting

The FPBGSA will prepare the required annual report for submittal to DWR by the April 1 deadline. Groundwater extractions in the Piru Basin are required to be reported to United every six months on a calendar year basis. The extraction reports for the second half of the year include information from July 1 through December 31, and are due to United shortly after the first of the subsequent year. Data tabulation for the annual report can proceed for several of the report items; however, the pumping totals will be dependent on the timing of those submittals to United.

## 5.4 Periodic Evaluations

The FPBGSA has an extensive groundwater level and water quality monitoring program for the Piru Basin. United monitors key wells on a monthly basis, with others on a quarterly or semiannual basis. If anomalous conditions are observed, United personnel will report those conditions to the FPBGSA board of directors. It is expected that, unless otherwise directed by the FPBGSA board of directors, a quarterly groundwater conditions summary will be delivered to the directors.

SGMA regulations require the FPBGSA evaluate, and update as needed, this GSP at least every five years (or whenever the GSP is updated). The types of information to be considered in the five year update include, but are not necessarily limited to, the following:

- Current groundwater conditions for each applicable sustainability indicator relative to measurable objectives, interim milestones, and minimum thresholds.
- A description of the implementation of any projects or management actions, and their effects or expected effects on groundwater conditions.
- Foundational components such as Basin setting based on new information or changes in water use, or the identification of undesirable results and the setting of minimum thresholds and measurable objectives, shall be reconsidered and revisions proposed, if necessary.
- A reevaluation of the monitoring network within the Basin, including whether data gaps persist, or if new data gaps have been identified. The evaluation shall include the following:
    - An assessment of monitoring network function with an analysis of data collected to date, identification of data gaps, and the actions necessary to improve the monitoring network, consistent with the requirements of Section 354.38.

  - If the FPBGSA identifies data gaps, the GSP shall describe a program for the acquisition of additional data sources, including an estimate of the timing of that acquisition, and for incorporation of newly obtained information into the GSP.

- A description of material new information that has been made available since GSP adoption or amendment, or the last five-year assessment.
- A description of actions taken by the FPBGSA, including a summary of regulations or ordinances related to the Plan.
- Information describing any enforcement or legal actions taken by the FPBGSA to achieve the sustainability goal for the Basin.
- A description of completed or proposed Plan amendments.
- Other information the FPBGSA deems appropriate, along with any information required by the DWR to conduct a periodic review as required by Water Code Section 10733.

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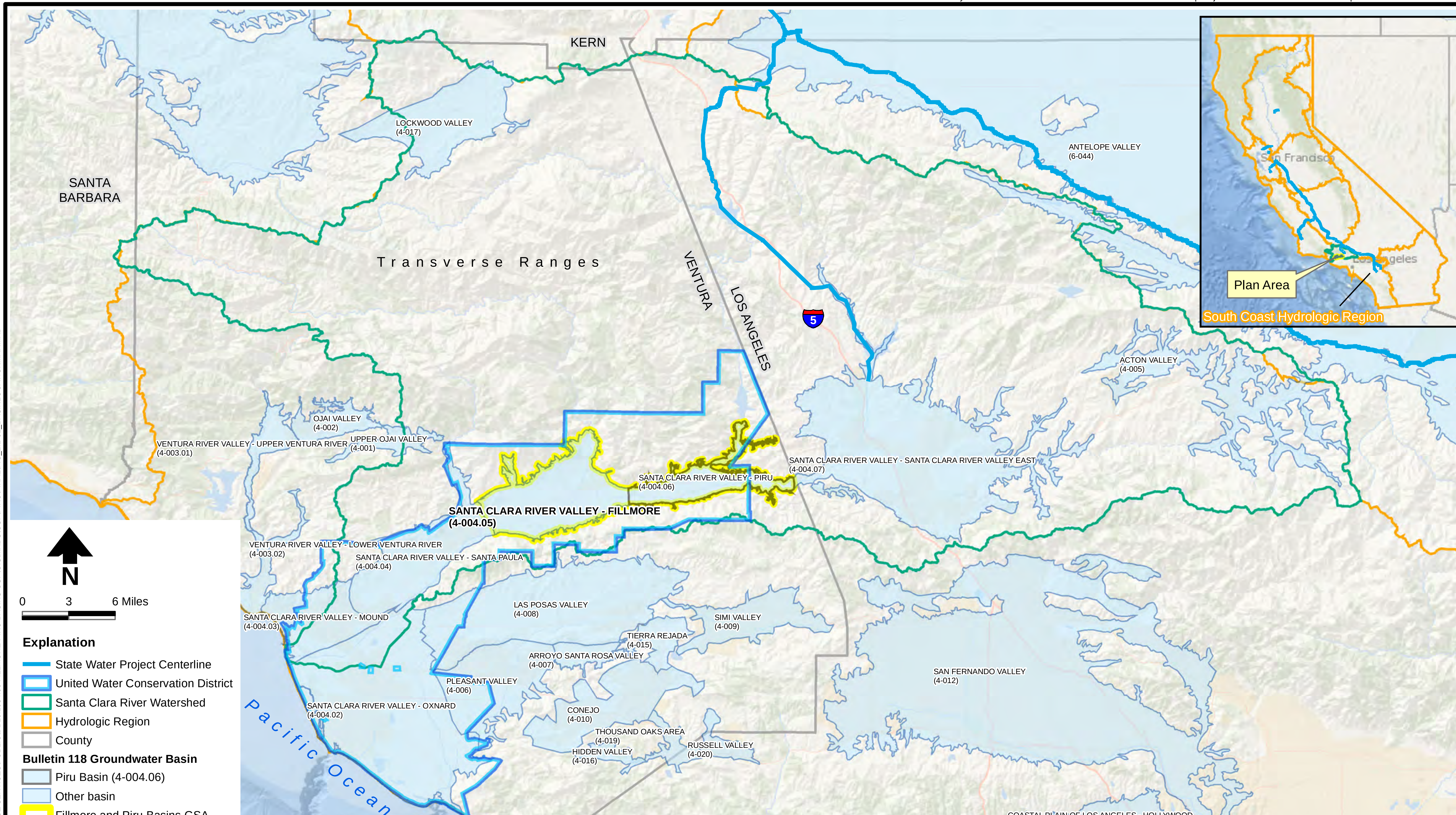
# Figures

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983




Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors | Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Notes:
1. The term "basin" refers to a groundwater basin or sub-basin of a basin (e.g., Fillmore sub-basin of the Santa Clara River Valley basin), as defined by California Department of Water Resources (DWR) Bulletin 118.
2. The version of Bulletin 118 basins depicted on this figure is recent as of the 2019 basin boundary modifications.
3. Hydrologic region boundaries are from DWR Detailed Analysis Unit (DAU) dataset.
4. Watershed boundary is from the United States Geological Survey (USGS) Watershed Boundary Dataset (WBD).

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Basin Location Map**

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K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXD\GSP\PIRU\FINAL\FIG_2.1-01_BASINLOCATIONMAP.MXD

Figure 2.1-1

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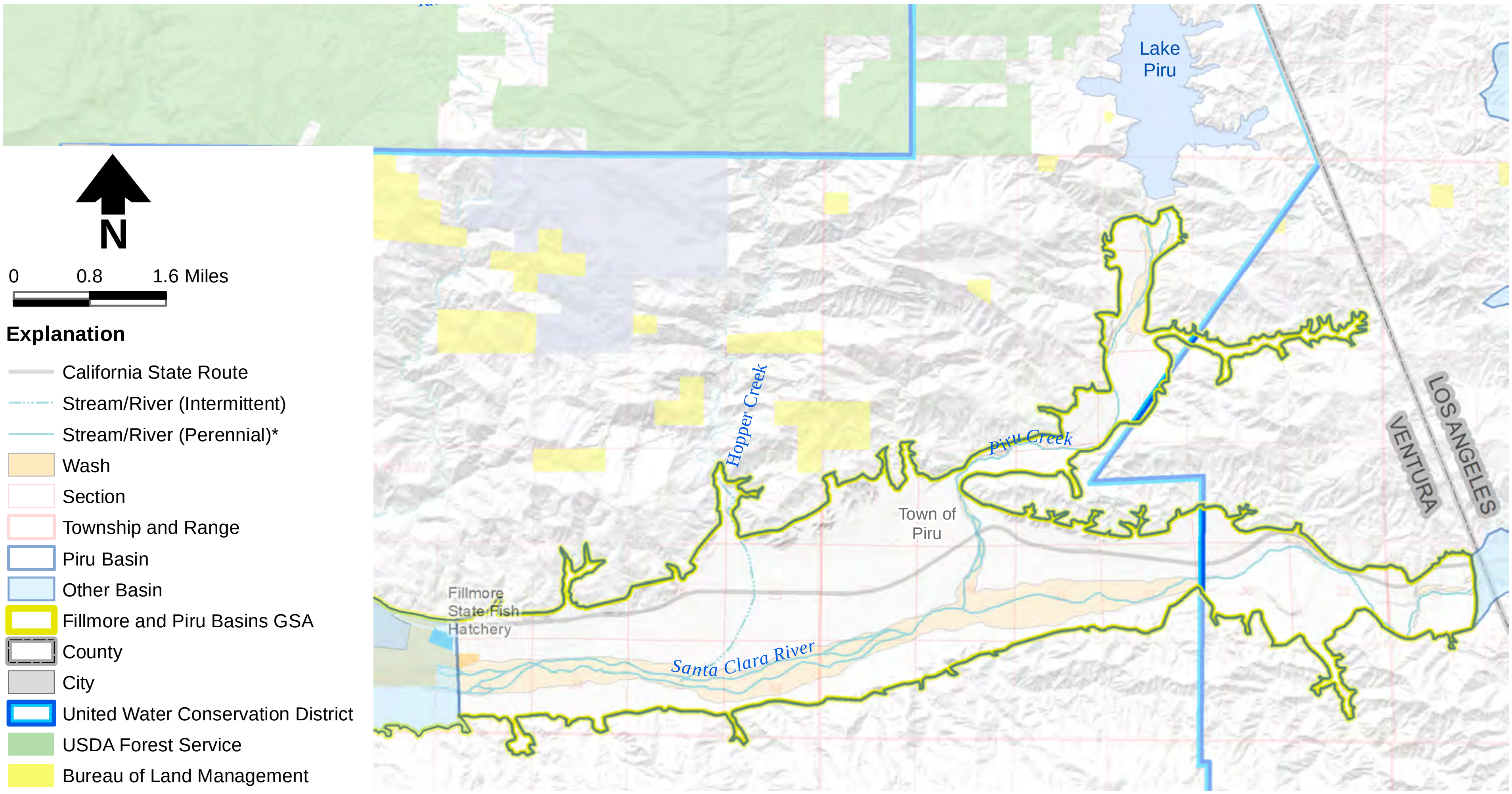


Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. CDFW: California Department of Fish and Wildlife
2. USDA: United States Department of Agriculture

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Jurisdictions Map**

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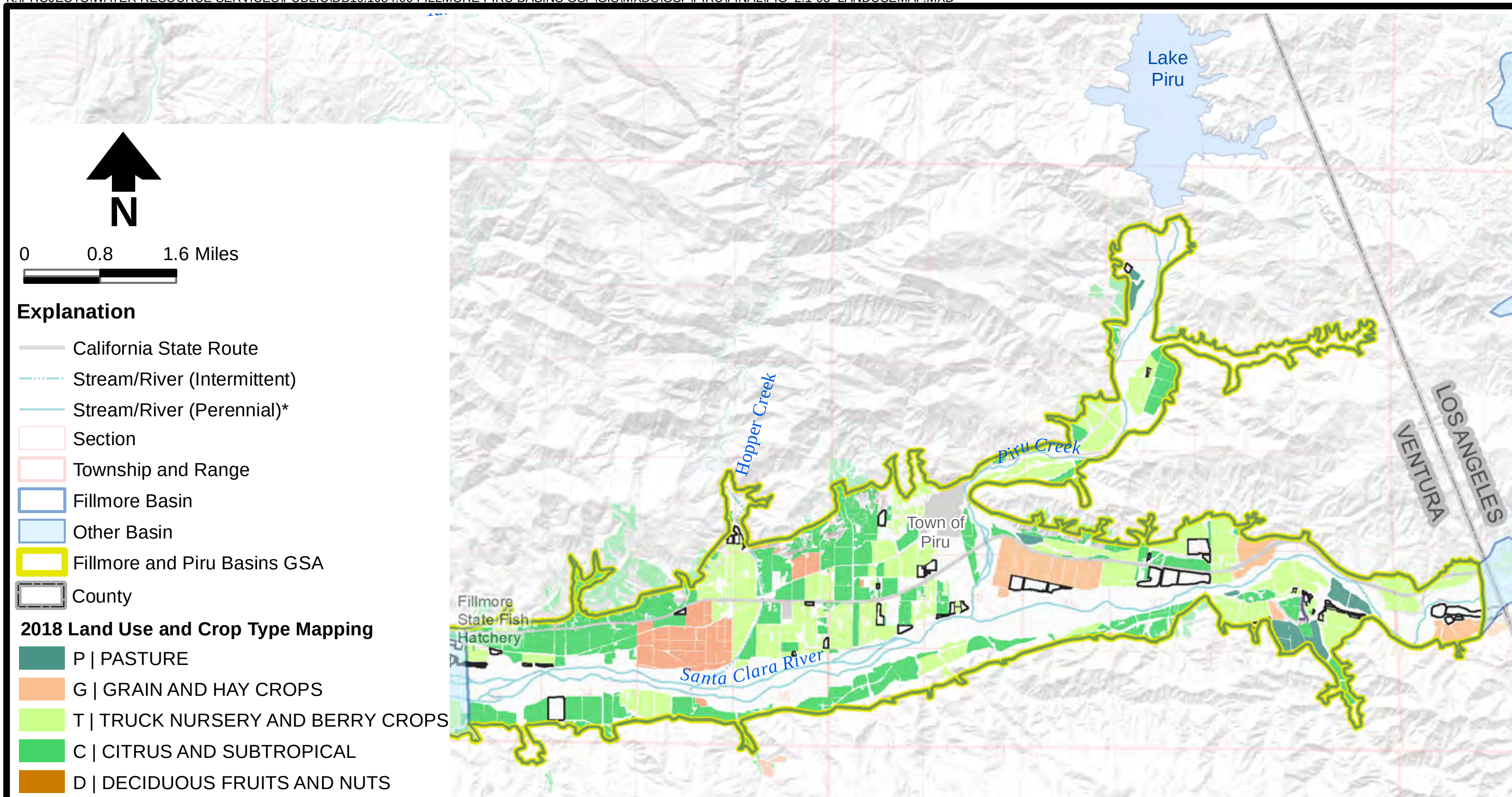
Figure 2.1-2

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.1-03_LANDUSEMAP.MXD




Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land use information is from the 2018 Crop Mapping dataset provided by Land IQ (2021) and DWR.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Land Use Map**

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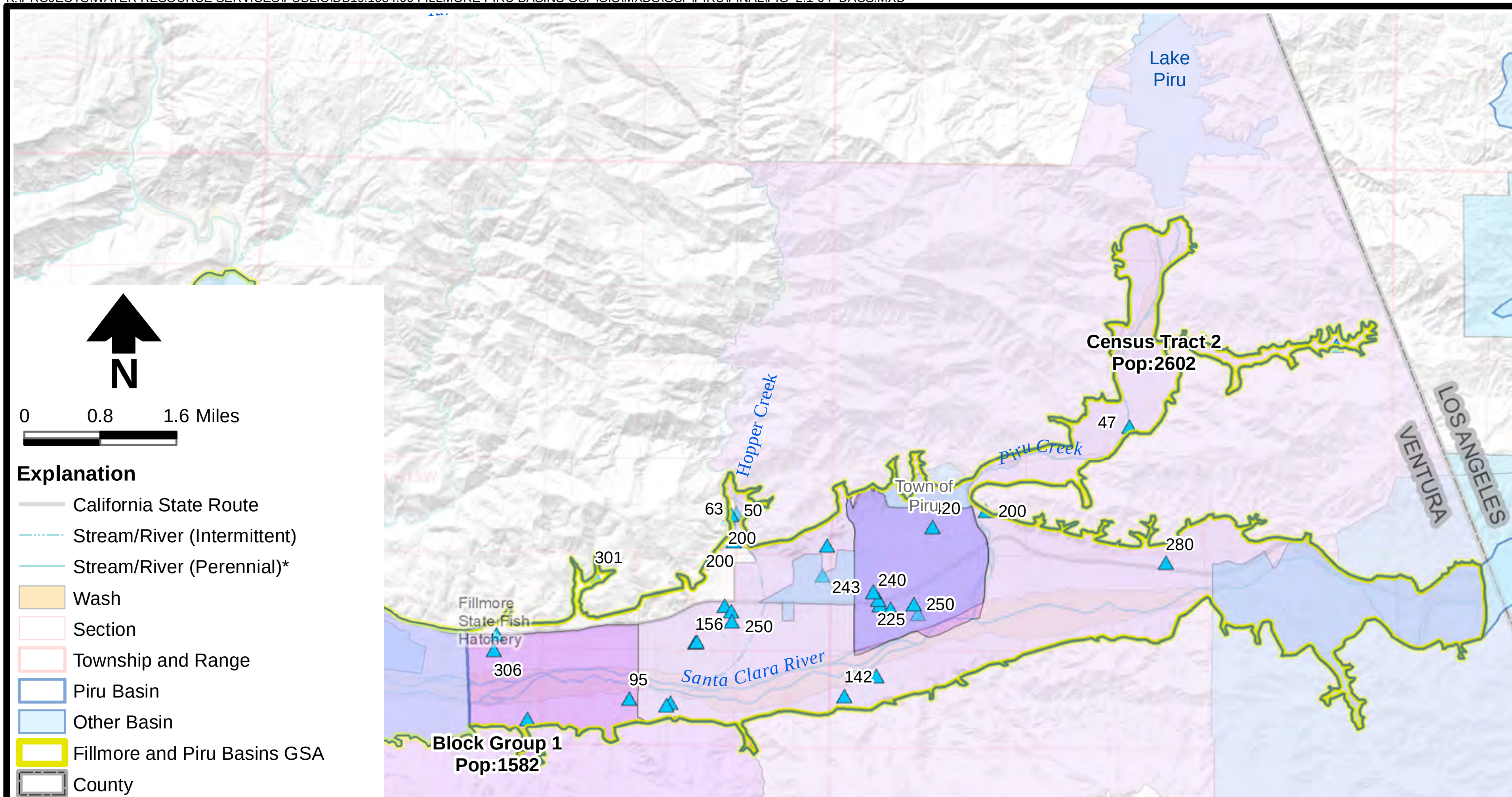
Figure 2.1-3

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.1-04_DACS.MXD




Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Disadvantaged Community (DAC) information is from DWR DAC Mapping Tool (https://gis.water.ca.gov/app/dacs/).
2. Drinking water system boundaries are from SWRCB's System Area Boundary Layer dataset (as of Oct. 25, 2021).
3. Existing domestic wells are shown:
   a. active wells have solid symbology
   b. inactive or unknown status wells have transparent symbology
   c. perforation depth corresponds to the bottom of well screen/perforation

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Disadvantaged Communities (DAC)s Map**

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Figure 2.1-4

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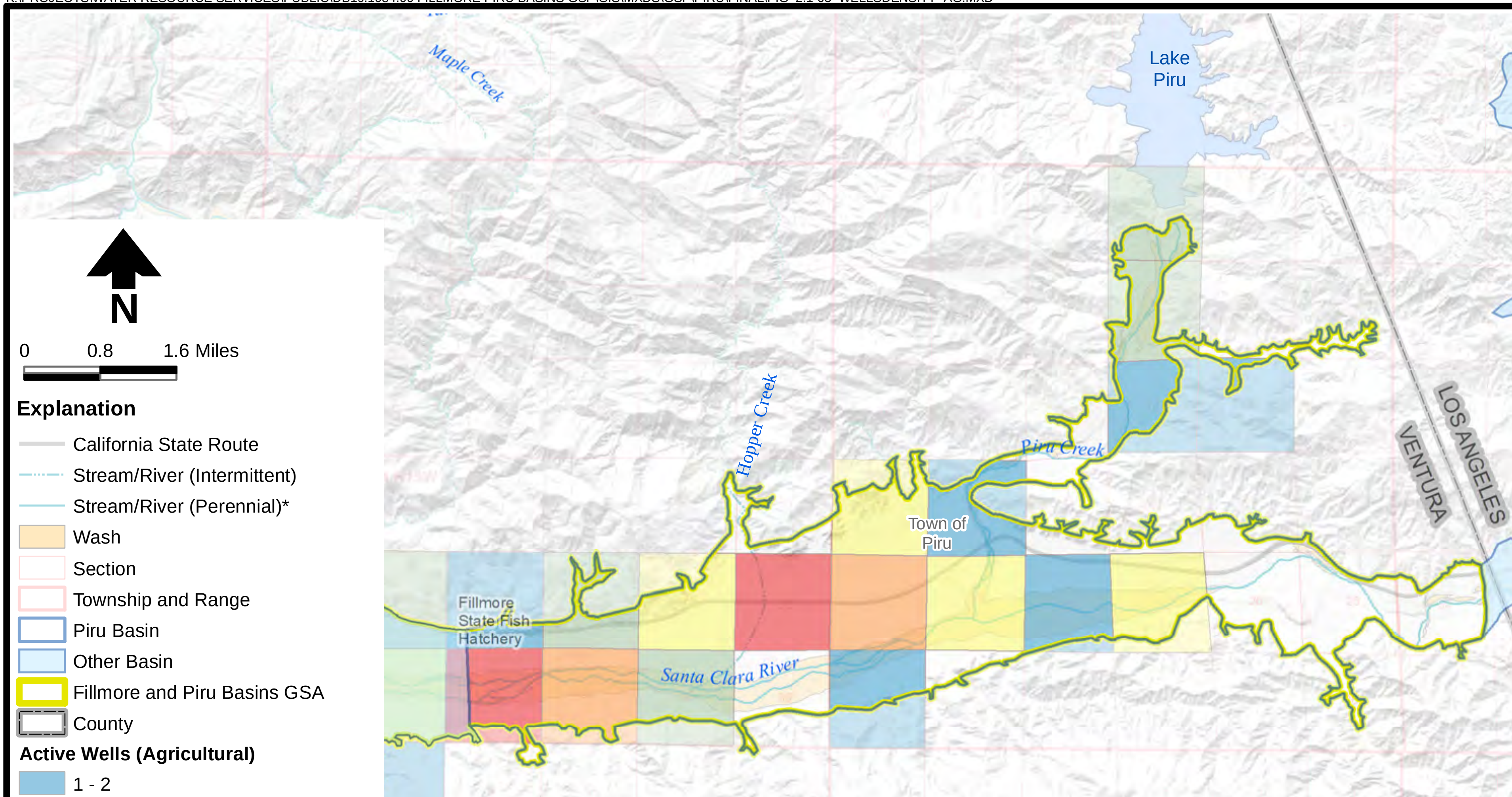


Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Well density is calculated by count of wells per section (i.e., about 1 square mile) of the Public Land Survey System.
2. Wells from outside the Basin are included in the wells density calculation.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Density of Agricultural Wells Map**

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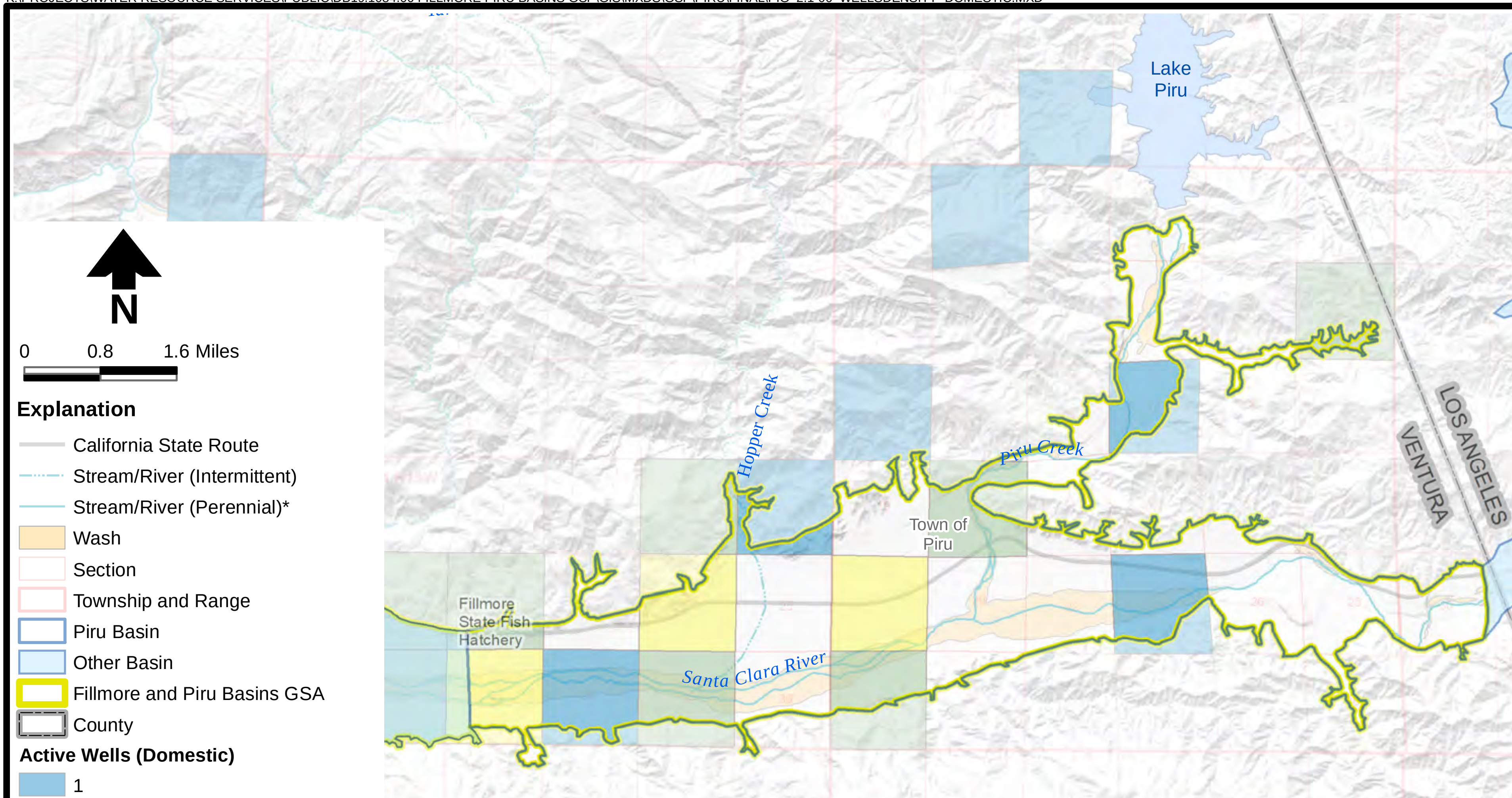
Figure 2.1-5




Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Well density is calculated by count of wells per section (i.e., about 1 square mile) of the Public Land Survey System.
2. Wells from outside the Basin are included in the wells density calculation.

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Density of Domestic Wells Map**

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Figure 2.1-6

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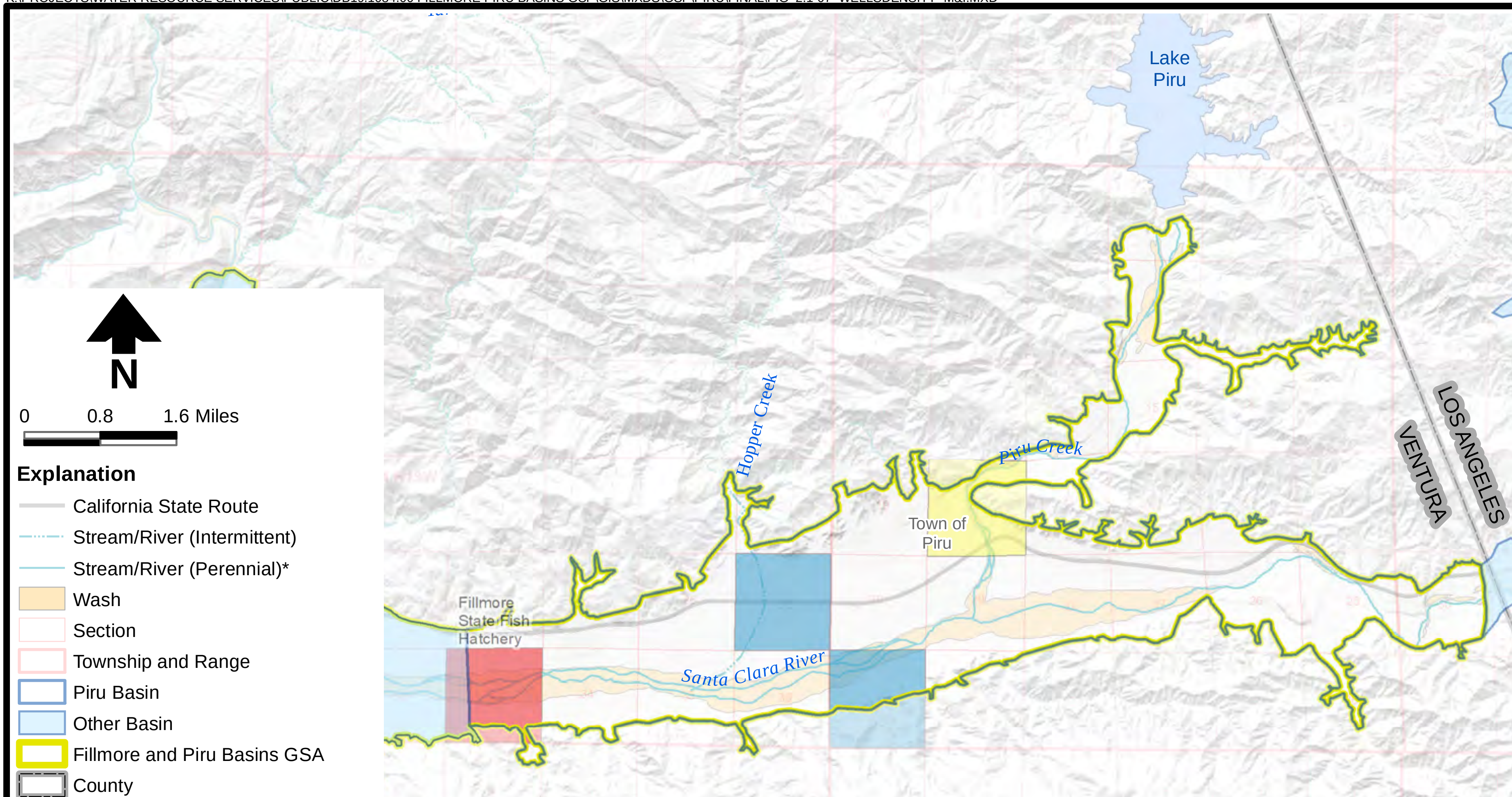


Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Well density is calculated by count of wells per section (i.e., about 1 square mile) of the Public Land Survey System.
2. Wells from outside the Basin are included in the wells density calculation.

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Density of Municipal and Industrial (M&I) Wells Map**

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Figure 2.1-7

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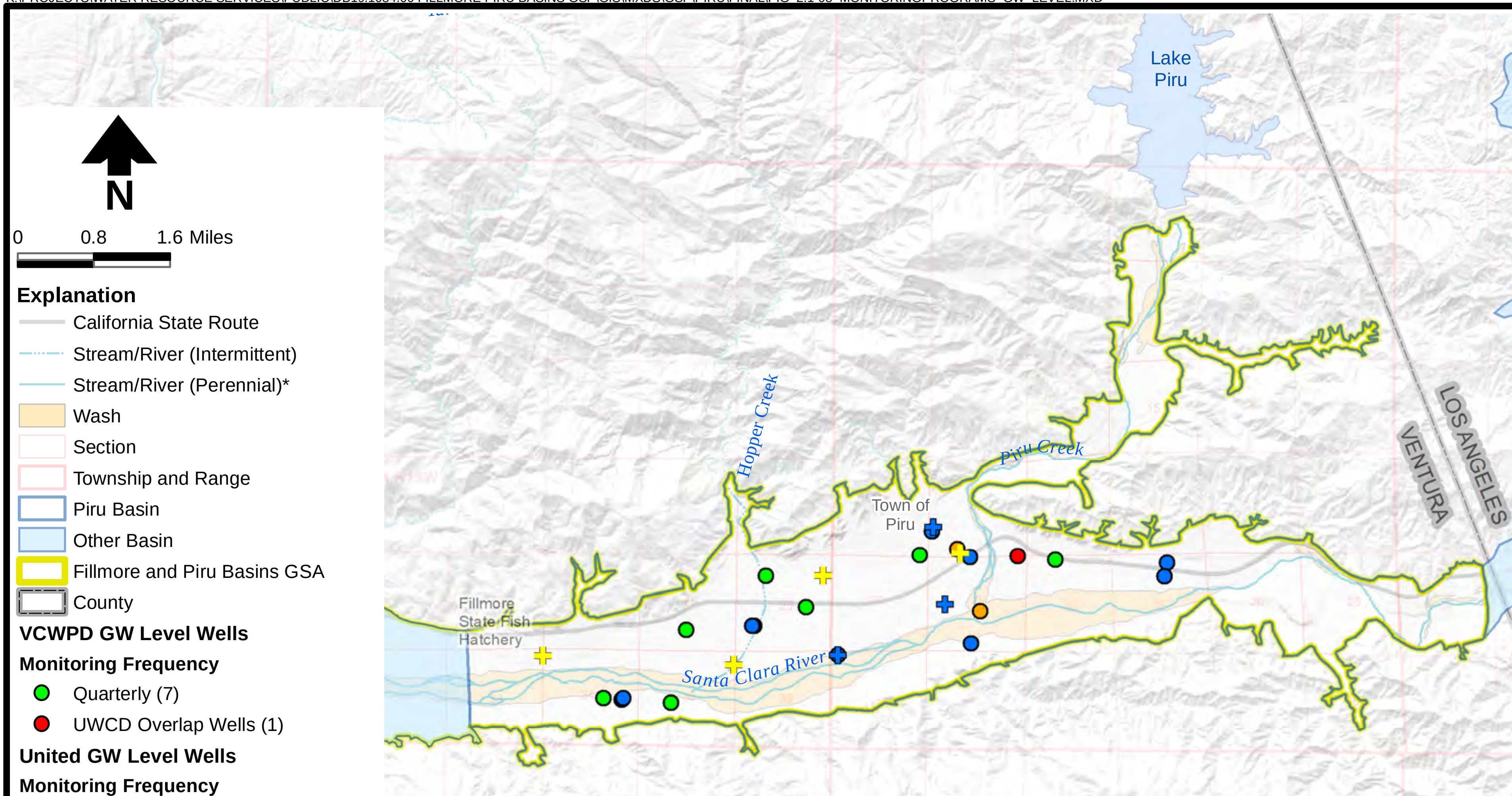


Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. GW: groundwater
2. VCWPD: Ventura County Watershed Protection District
3. United: United Water Conservation District

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Existing Groundwater Level Monitoring Programs Map**

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Figure 2.1-8

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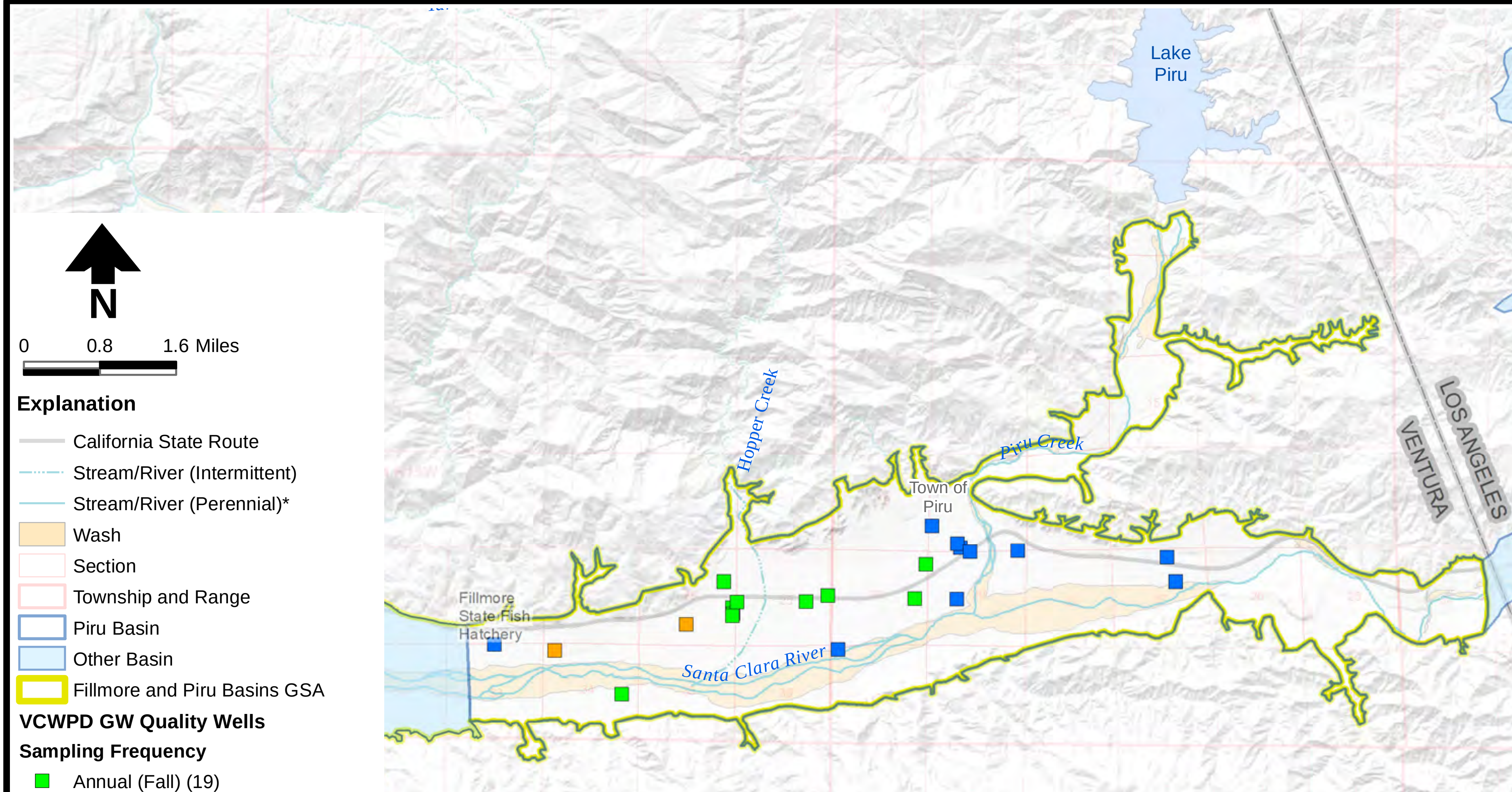


N

0 0.8 1.6 Miles

**Explanation**

- California State Route
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Section
- Township and Range
- Piru Basin
- Other Basin
- Fillmore and Piru Basins GSA

**VCWPD GW Quality Wells**

**Sampling Frequency**

- Annual (Fall) (19)
- Alternate (2)

**United GW Quality Wells**

**Sampling Frequency**

- Semi-Annual (Fall and Spring) (14)

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. GW: groundwater
2. Alternate sampling frequency means this well is sampled if the other nearby well is not accessible.
3. VCWPD: Ventura County Watershed Protection District
4. United: United Water Conservation District

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Existing Groundwater Quality Monitoring Programs Map**

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Figure 2.1-9

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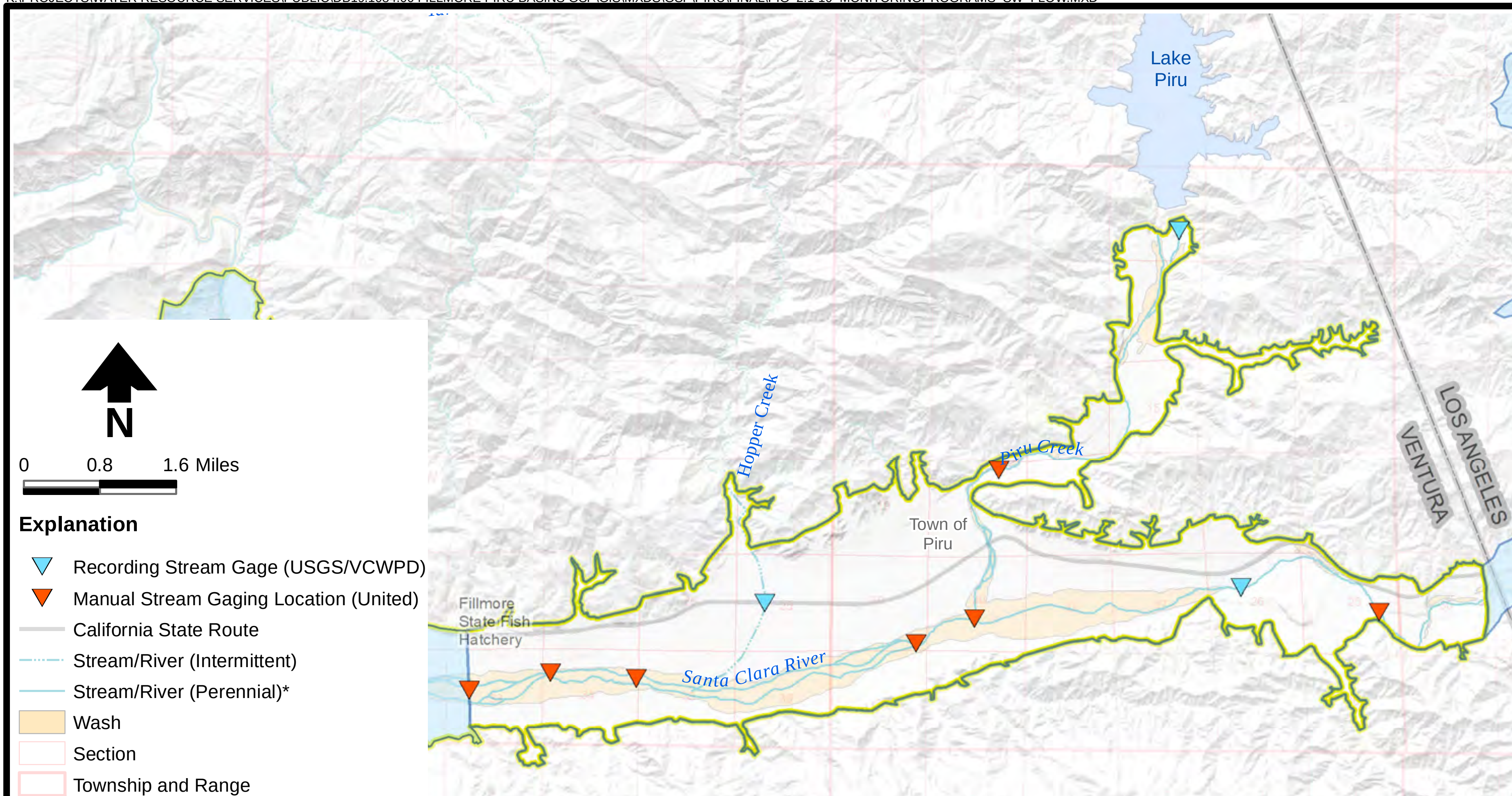


Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. VCWPD: Ventura County Watershed Protection District
2. United: United Water Conservation District

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Existing Surface Water Flow Monitoring Programs Map**

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Figure 2.1-10

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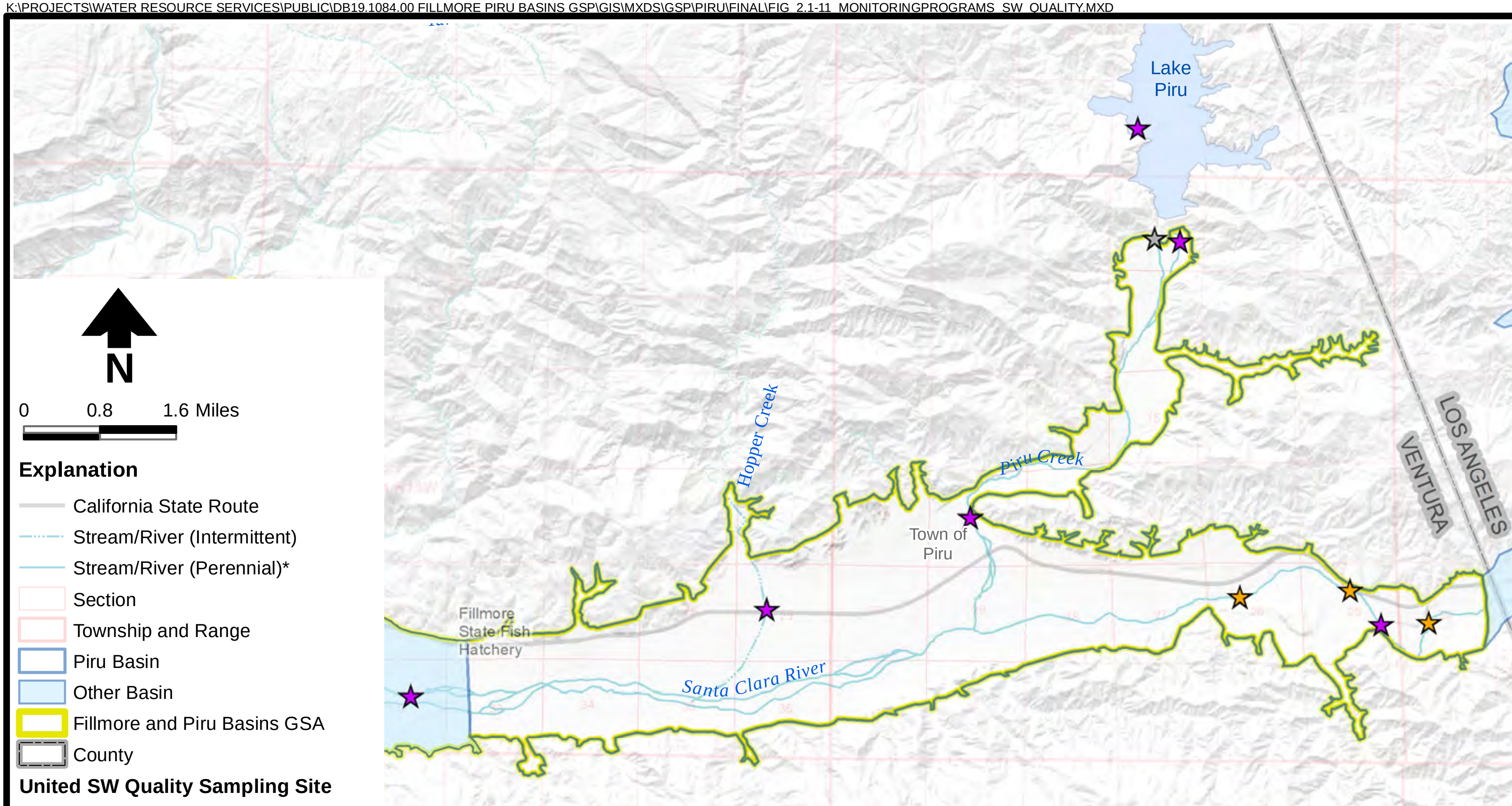


Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. SW: surface water
2. United: United Water Conservation District

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Existing Surface Water Quality Monitoring Programs Map**

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Figure 2.1-11

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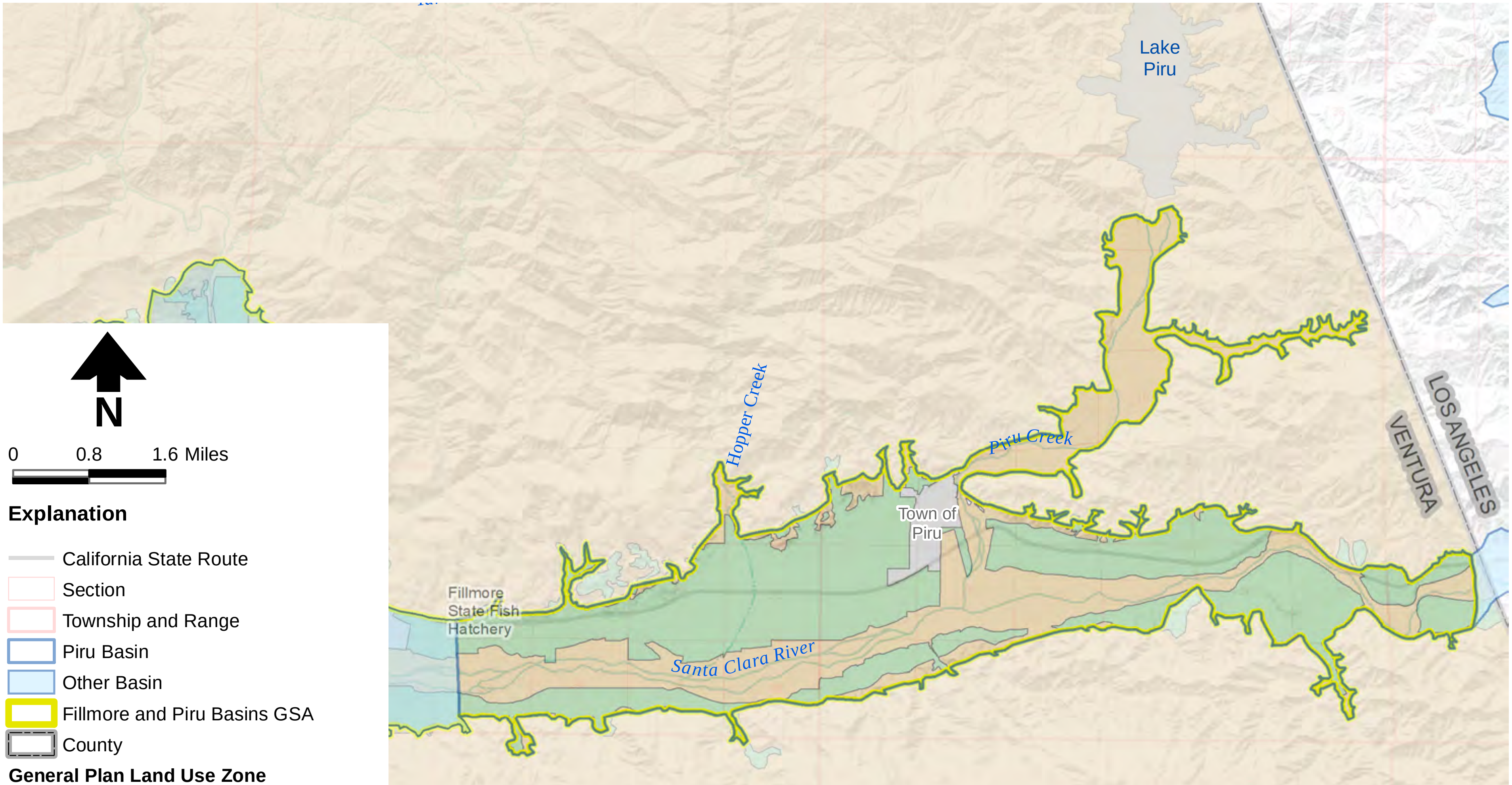


**Explanation**

- California State Route
- Section
- Township and Range
- Piru Basin
- Other Basin
- Fillmore and Piru Basins GSA
- County

**General Plan Land Use Zone**

- Agricultural
- Agricultural - Urban Reserve
- Open Space
- Urban

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land use zoning information is from the 2040 Ventura County General Plan.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Land Zoning Map**

Figure 2.1-12

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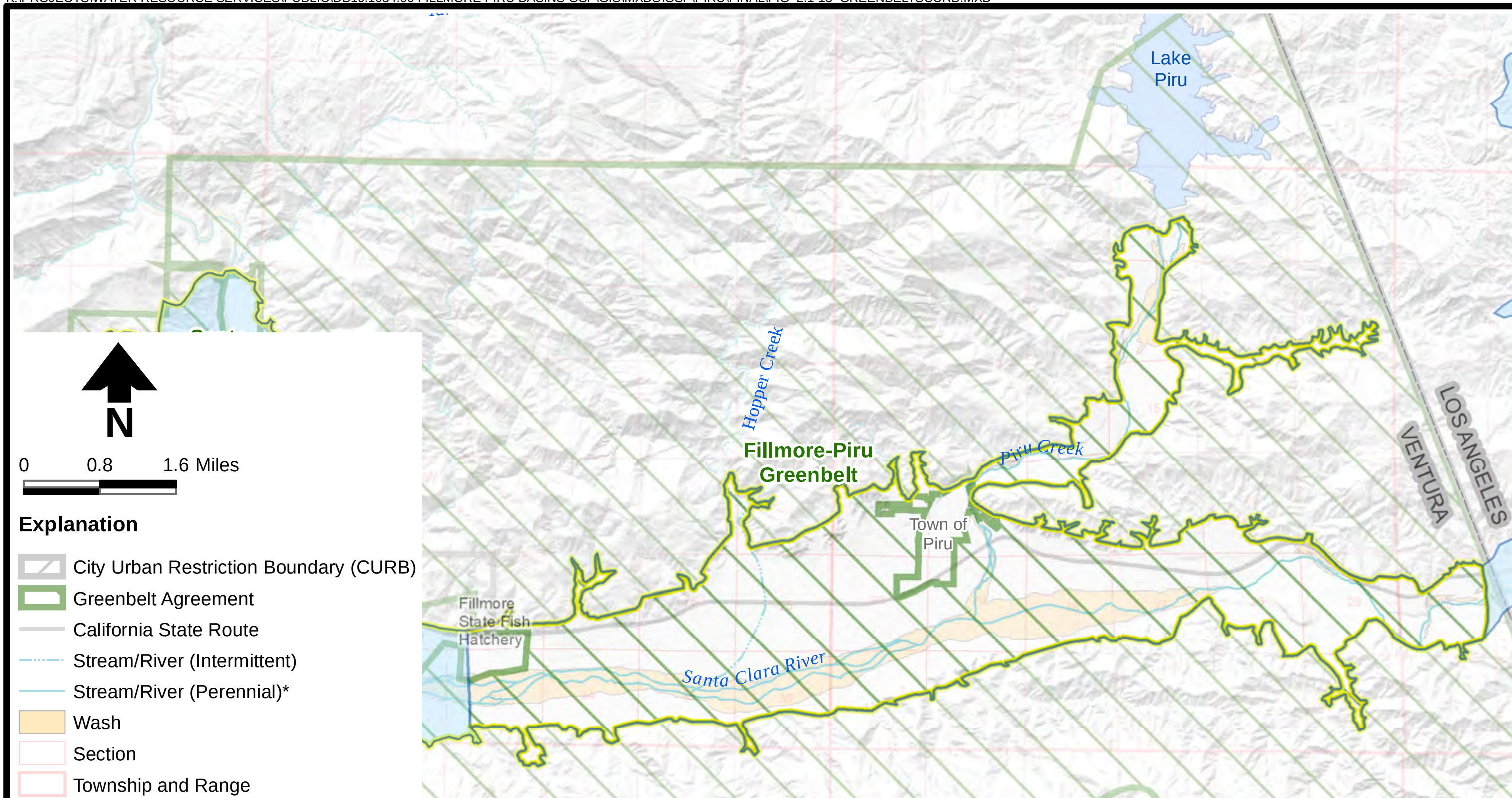


Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land use zoning information is from the 2040 Ventura County General Plan.

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Ventura County Greenbelts and City Urban Restriction Boundary (CURB) Map**

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Figure 2.1-13

K:\Projects\Water Resource Services\Public\DB19.1084.00 Fillmore Piru Basins GSP\Background\USGS\Hanson_etal_2003_SimulationGW_SWflowSantaClaraCalleguasBasin\GSP_Piru_Figure_2.2-1_GeneralizedRegionalStratigraphicColumn.afdesign

| Geologic era | Geologic system | Geologic series (epoch) | Weber and others (1976) | Dibblee[1] | Turner (1975) Green and others (1978)[2] | RASA[3] | Hanson et al. (2003) Aquifer system, model layer | United (2021a) Aquifer zone, model layer(s) |
|---|---|---|---|---|---|---|---|---|
| | | | Lithologic units and Formations | | Aquifers | | | |
| Cenozoic | Quaternary | Holocene | **Recent Alluvium** (Lagoonal, beach, river and flood plain deposits, artificial fill, and alluvial fan deposits) | | Recent alluvial and semiperched | Shallow | Upper-aquifer system[4], layer 1 | **Aquifer zone A, layer 1** |
| | | | ***Recent Alluvium*** (Lagoonal, beach, river and flood plain deposits and alluvial fan deposits) | | Oxnard[5] | | | **layer 3** |
| | | Late (Upper) Pleistocene[6] | ***Older Alluvium*** (Lagoonal, beach, river and flood plain, alluvial fan, terrace, and marine terrace deposits) | | Mugu[2] | | | **Aquifer zone B, layer 5** |
| | | | ***Saugus Formation***[7] (Terrestrial fluvial sediments) | Saugus Formation | Hueneme | Upper Hueneme | Lower-aquifer system, layer 2 | **layer 7** |
| | | | ***San Pedro Formation***[8] (Marine clays and sands and terrestrial fluvial sediments) | | | Lower Hueneme | | **Aquifer zone C** |
| | | | | Las Posas Sand (Marine shallow regressive sands) | Fox Canyon | Fox Canyon | | |
| | | Early (Lower) Pleistocene[6] | ***Santa Barbara Formation***[8] (Marine shallow regressive sands) | | Grimes Canyon[9,10] | Grimes Canyon | | |
| | | | ***Pico Formation*** [11] (Marine siltstones, sandstones, and conglomerates) | | Formation not included in regional flow model | | Formation not included in regional flow model | |
| | Tertiary | Pliocene[6] | ***Repetto formation*** (Terrestrial conglomerates, sandstones, and shales) | | Formation not included in regional flow model | | Formation not included in regional flow model | |
| | | Miocene | ***Santa Margarita Formation, Monterey Shale, Rincon Mudstone, Towsley Formation*** (Terrestrial fluvial sandstones and fine-grained lake deposits) | | Not Included | Santa Margarita sandstones included in northeastern Santa Rosa Valley | Lower-aquifer system, layer 2 | |
| | | | ***Conejo Volcanics*** (Terrestrial and marine extrusive and intrusive, felsic-andesites to basalts) | | Formation not included in regional flow model | | | |
| | | | ***Lower Topanga Formation, Topanga-Vaqueros Sandstones, Modelo Formation, Sisquoc Formation*** (Marine transgressive sands and siltstones) | | | | | |
| | | Oligocene | ***Sespe Formation*** (Terrestrial fluvial claystones and sandstones) | | | | | |
| | | Eocene | ***Llajas Formation, Coldwater Sandstone, Cozy Dell Shale, Matilija Sandstone, Juncal Formation, Santa Susana Formation*** (Marine sandstones, mudstones, and claystones) | | | | | |
| | | Paleocene | ***Martinez Formation*** (Terrestrial conglomerate, sandstones, and marine shales) | | | | | |
| Mesozoic | **Upper Cretaceous** | | Chico Formation (Sandstones with shales) | | | | | |

**FIGURE MODIFIED FROM: Figure 7B from Hanson et al. (2003). Simulation of Ground-Water/Surface-Water Flow in the Santa Clara–Calleguas Ground-Water Basin, Ventura County, CA**

1 Formations from Dibblee (1988; 1990a,b; 1991; 1992a,b,c,d) and Dibblee and Ehrenspeck (1990).
2 Perched aquifer designated in parts of the Oxnard Plain only.
3 From the Southern California Regional Aquifer-System Analysis Program of the U.S. Geological Survey.
4 Shallow aquifer included in the Oxnard Plain Forebay and inland subbasins. Semiperched part of Shallow aquifer not included in remainder of Oxnard Plain.
5 Restricted to the Oxnard Plain and Forebay by Turner (1975).
6 Modified on the basis of ash-deposit age dates (Yerkes and others, 1987, fig.11.2).
7 Mapped in eastern Ventura County subbasins of Santa Paula, Fillmore, Piru, and Las Posas Valley and may be time equivalent to parts of the San Pedro and Santa Barbara Formations (Weber and others, 1976, fig. 3).
8 Mapped in western Ventura County subbasins.
9 San Pedro Formation everywhere except in Pleasant Valley where the Santa Barbara Formation was assigned to the Grimes Aquifer.
10 Las Posas and Pleasant Valley subbasins only.
11 Includes Mud Pit and Claystone Members.

**- Fillmore and Piru Basins**

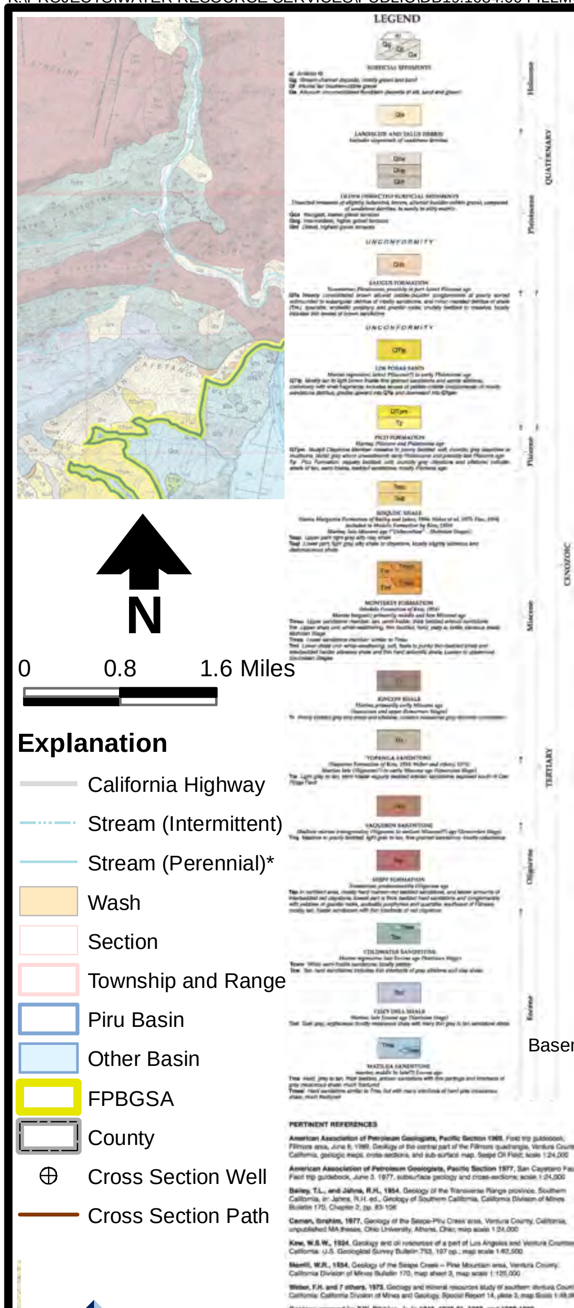
Fillmore and Piru Basins Groundwater Sustainability Agency

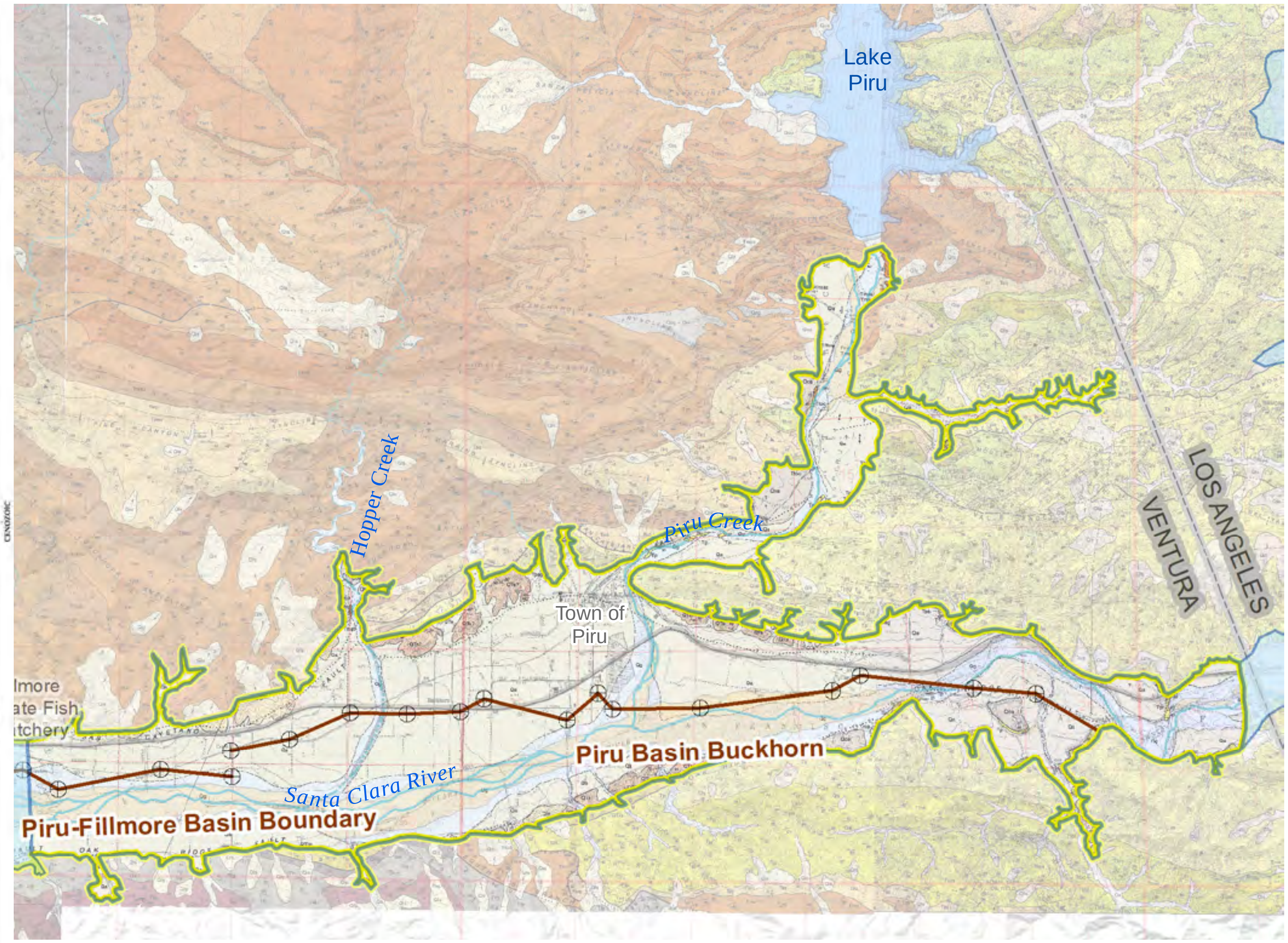
PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Regional Stratigraphic Column with Aquifer Designations**

Figure 2.2-1

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-02_GEOLOGICMAP_DIBBLEE.MXD




N

0 0.8 1.6 Miles

**Explanation**

- California Highway
- Stream (Intermittent)
- Stream (Perennial)*
- Wash
- Section
- Township and Range
- Piru Basin
- Other Basin
- FPBGSA
- County
- Cross Section Well
- Cross Section Path

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. USGS: United States Geological Survey
2. Geologic map source: Dibblee, T.W., and Ehrenspeck, H.E., ed. Quadrangle Geologic Maps.
3. FPBGSA: Fillmore and Piru Basins Groundwater Sustainability Agency (FPBGSA)
4. Cross section paths are from United Water Conservation District (2021a).

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Detailed (Dibblee) Geologic Map**

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Figure 2.2-2

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-03_GEOLOGICMAP_RASA.MXD

N

0 0.8 1.6 Miles

**Explanation**

- Index Contours
- Intermediate Contours
- California State Route
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Section
- Township and Range
- Piru Basin
- Other Basin
- Fillmore and Piru Basins GSA
- County
- ⊕ Cross Section Well
- Cross Section Path (UWCD, 2021)
- Fault (Ventura County, 2021)

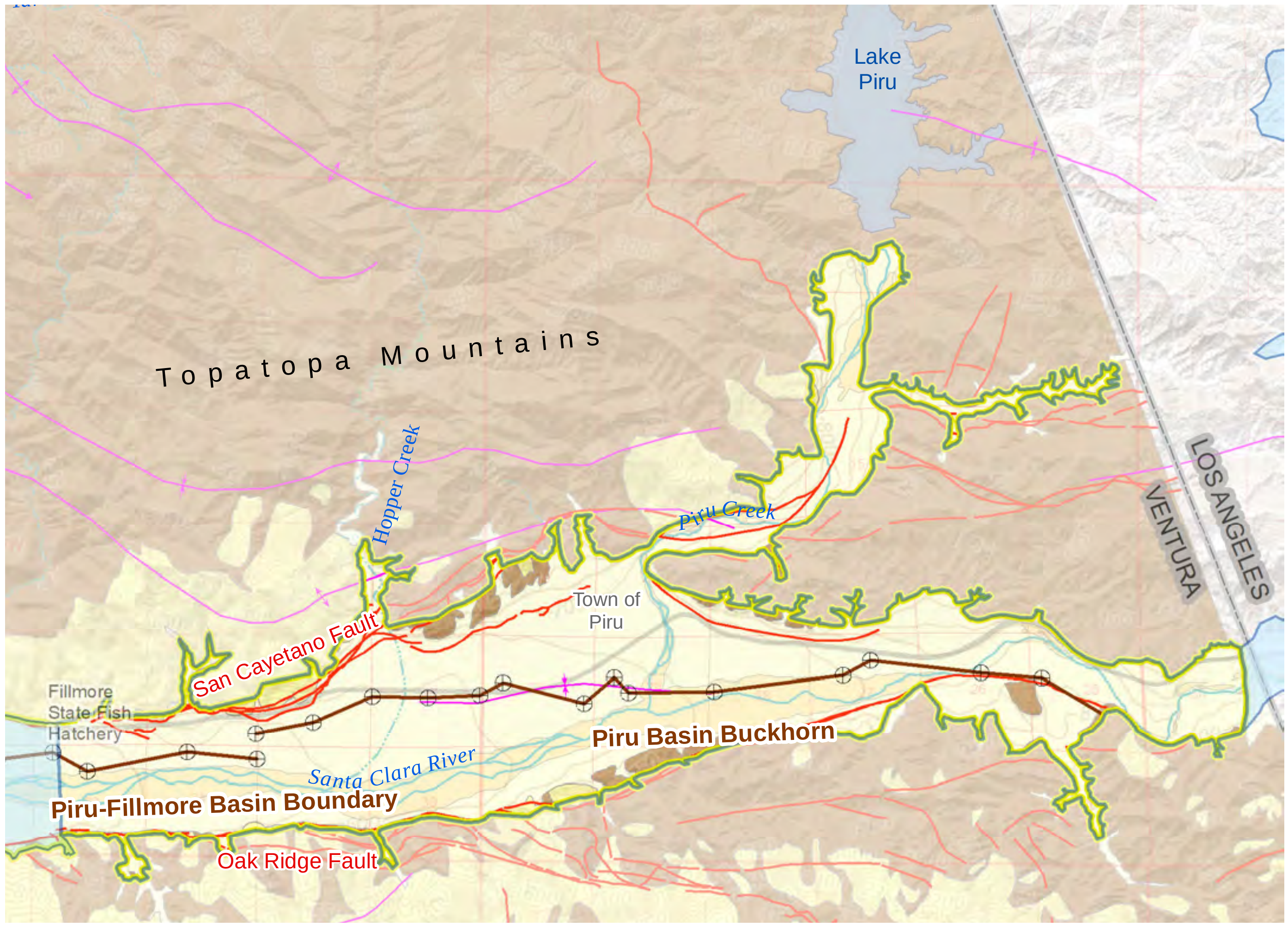
**Structure (CGS GMC, 2010)**

- anticline, certain
- plunging anticline, certain
- syncline, certain
- plunging syncline, certain
- syncline, concealed (multisym)

**RASA Geologic Map (USGS, 1996)**

**Geologic Formation**

- Alluvium
- Landslide
- San Pedro Formation
- Pico Formation & Older




Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021. USGS The National Map: 3D Elevation Program. Data Refreshed October, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. Ventura County, 2021: a compilation of faults identified in:
   a. U.S. Geological Survey. Seismic Hazards and Land Use Planning. Geological Survey Circular 690, 1974, and
   b. Dibblee, T.W., and Ehrenspeck, H.E., ed. Quadrangle Geologic Maps,
3. USGS: United States Geological Survey
4. RASA: Regional Aquifer-System Analysis Program
5. CGS: California Geological Survey
6. GMC: Geologic Map of California

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Generalized Geologic Map**

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Figure 2.2-3

| Aquifer System[1] | Hydrostratigraphic Unit[1] | Model Layer[1] | Basin Aquifer or Aquitard[2] |
|---|---|---|---|
| A | Surficial Deposits and Colluvium | 1 | Principal Aquifer |
| | Aquitard (discontinuous) | 2 | |
| | Recent (younger) Alluvium | 3 | |
| B | Aquitard (insignificant) | 4 | |
| | Older Alluvium | 5 | |
| | Aquitard (insignificant) | 6 | |
| | Upper Saugus/San Pedro | 7 | |
| C | Aquitard (continuous) | 8 | Aquitard |
| | Lower Saugus/San Pedro | 9 | Non-Principal Aquifer |
| | Undifferentiated Sedimentary Deposits | 10 | |

Notes:

1. Figure is modified from United (2021a).
2. Principal aquifer and aquitard designations for Plan purposes.

Fillmore and Piru Basins
Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Conceptual Basin Hydrostratigraphy with Principal Aquifer and Aquitards**

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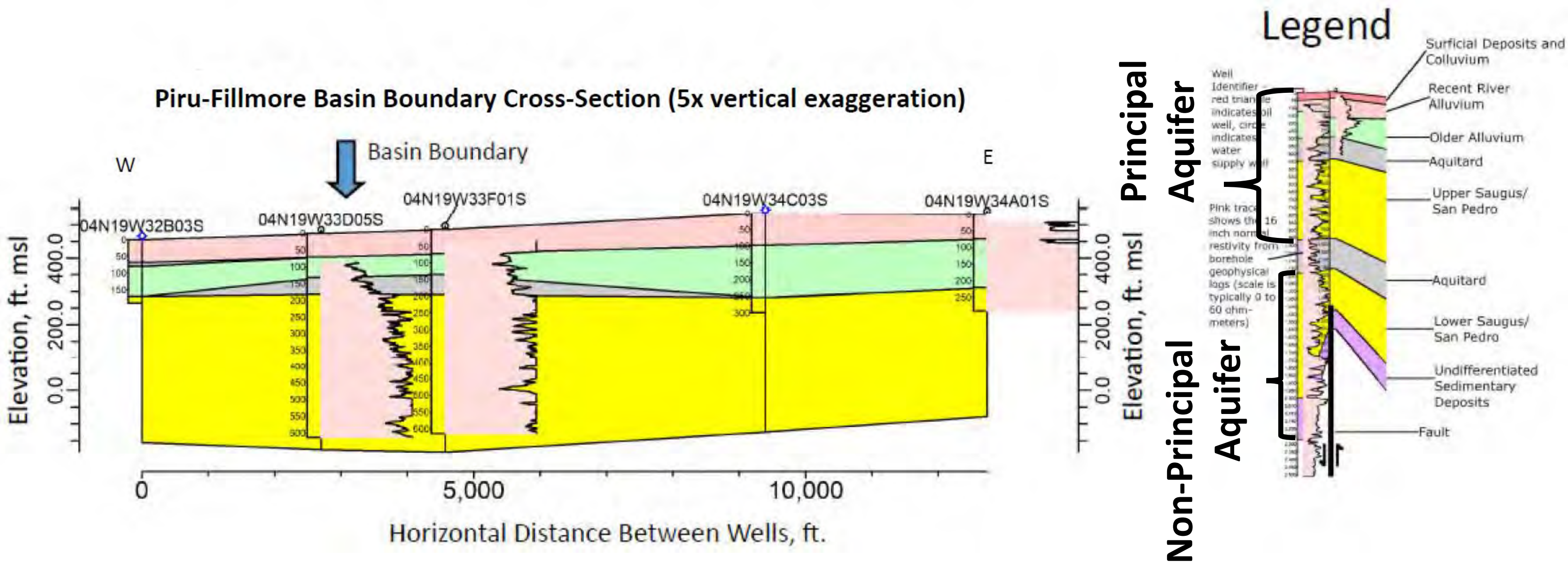
Figure 2.2-4




Notes:
Figure modified from Figure 2-21 from United (2021a).

United Water Conservation District, 2021a. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. Open-File Report 2021-01. June.

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN
**Piru-Fillmore Basin Boundary Cross-Section**

Figure 2.2-5

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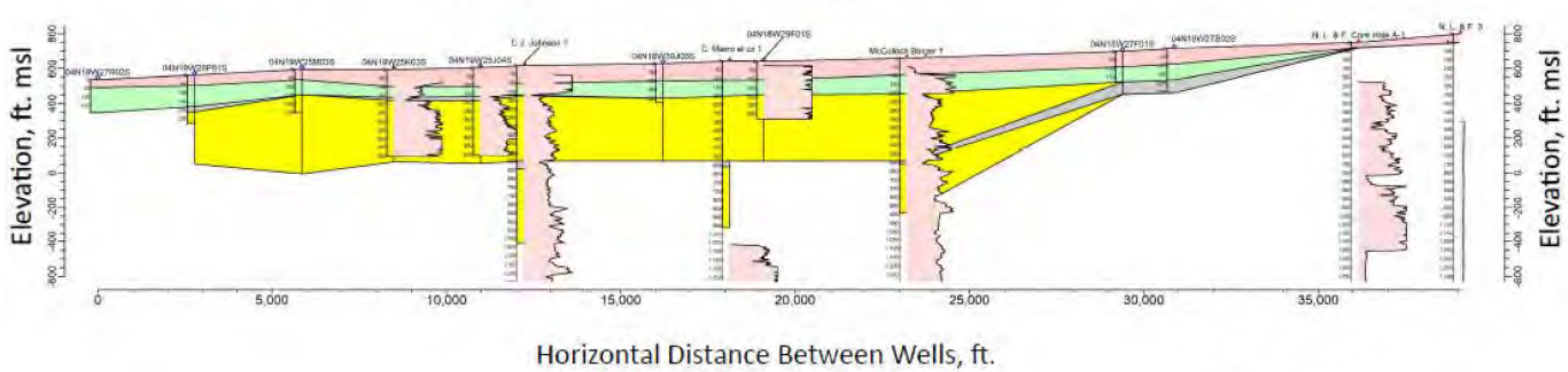
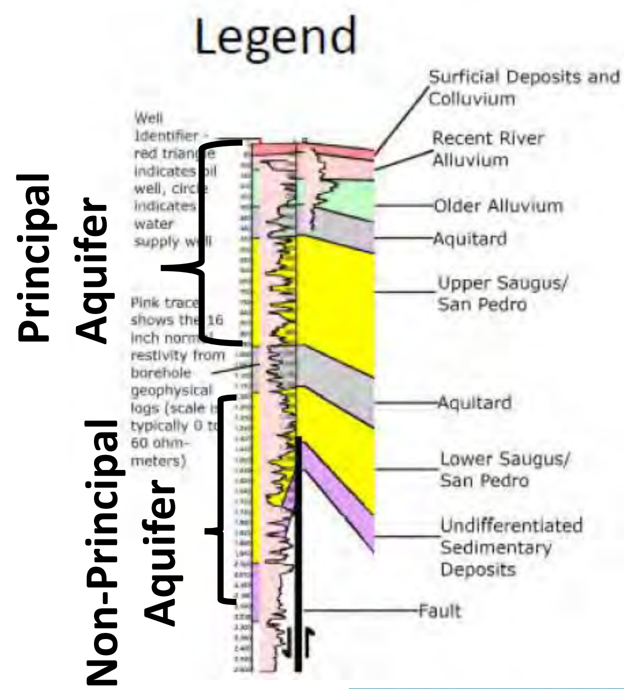
## Piru Basin Buckhorn Cross Section (5x vertical exaggeration)




Notes:
Figure modified from Figure 2-18 from United (2021a).
United Water Conservation District, 2021a. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. Open-File Report 2021-01. June.

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN
**Fillmore Basin Highway 126 Cross-Section**

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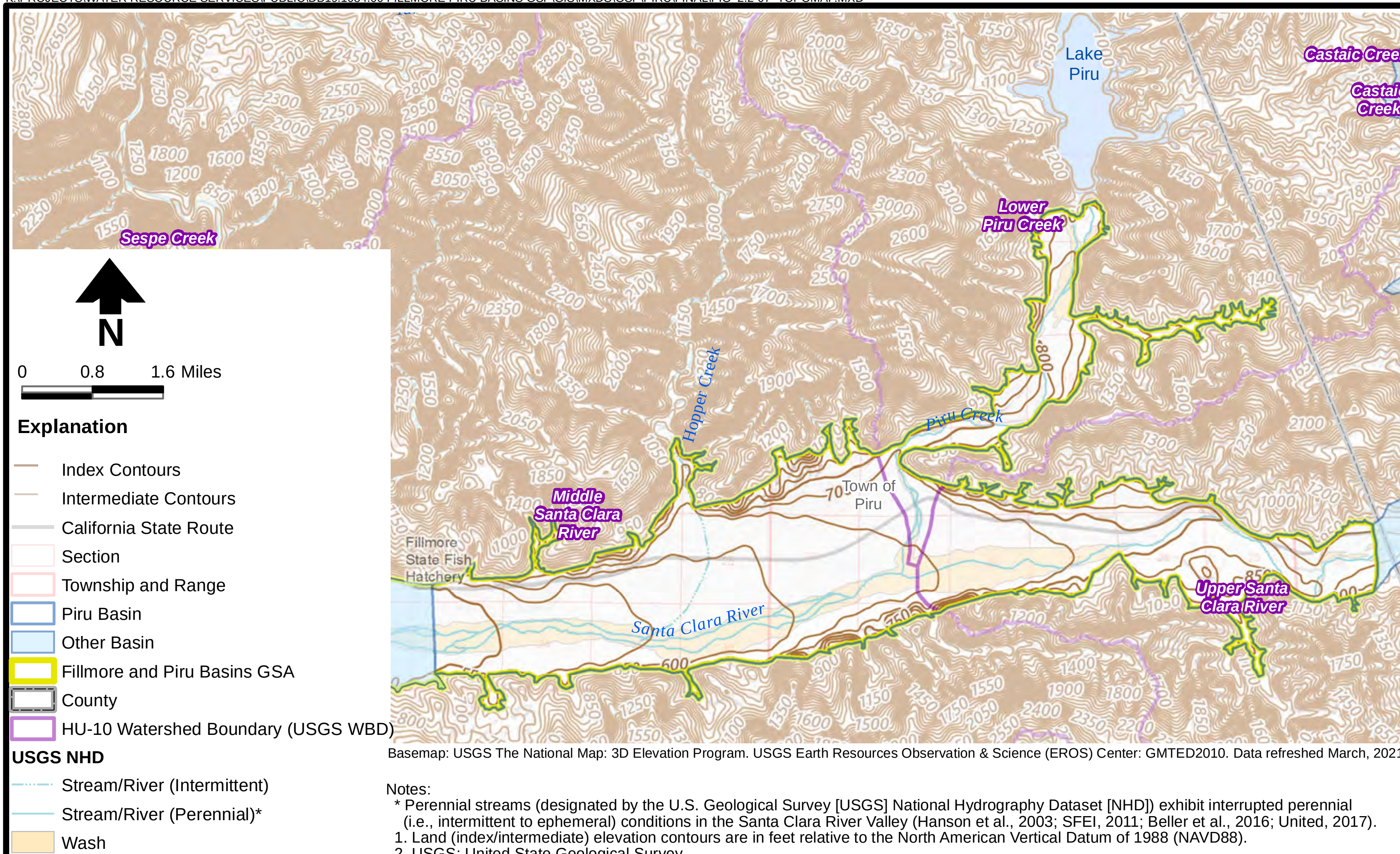
K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-07_TOPOMAP.MXD




Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. USGS: United State Geological Survey
3. WBD: Watershed Boundary Dataset
4. HU: Hydrologic Unit
5. NHD: National Hydrologic Dataset

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Topographic Map**

Figure 2.2-7

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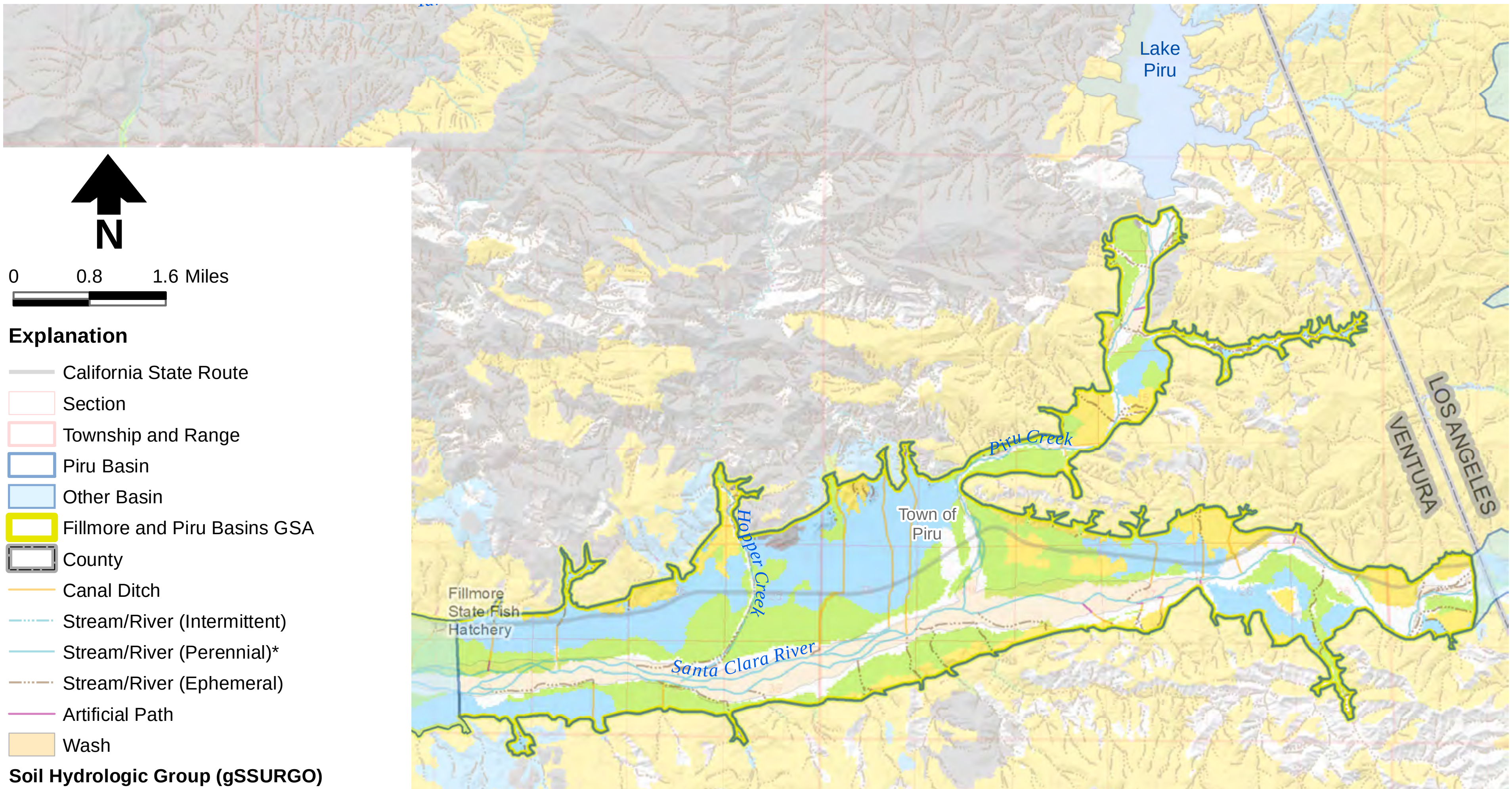
K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-08_SOILSMAP.MXD




**Explanation**

- California State Route
- Section
- Township and Range
- Piru Basin
- Other Basin
- Fillmore and Piru Basins GSA
- County
- Canal Ditch
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Stream/River (Ephemeral)
- Artificial Path
- Wash

**Soil Hydrologic Group (gSSURGO)**

- Group A
- Group B
- Group C
- Group D

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. USDA: United States Deparment of Agriculture
2. NRCS: National Resources Conservation Service
3. Soil hydrologic group data from USDA NRCS gSSURGO database (July 2020).

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Group A soils consist of deep, well drained sands or gravelly sands with high infiltration and low runoff rates.
Group B soils consist of deep well drained soils with a moderately fine to moderately coarse texture and a moderate rate of infiltration and runoff.
Group C consists of soils with a layer that impedes the downward movement of water or fine textured soils and a slow rate of infiltration.
Group D consists of soils with a very slow infiltration rate and high runoff potential. This group is composed of clays that have a high shrink-swell potential, soils with a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material.

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Soil Hydrologic Characteristics Map**

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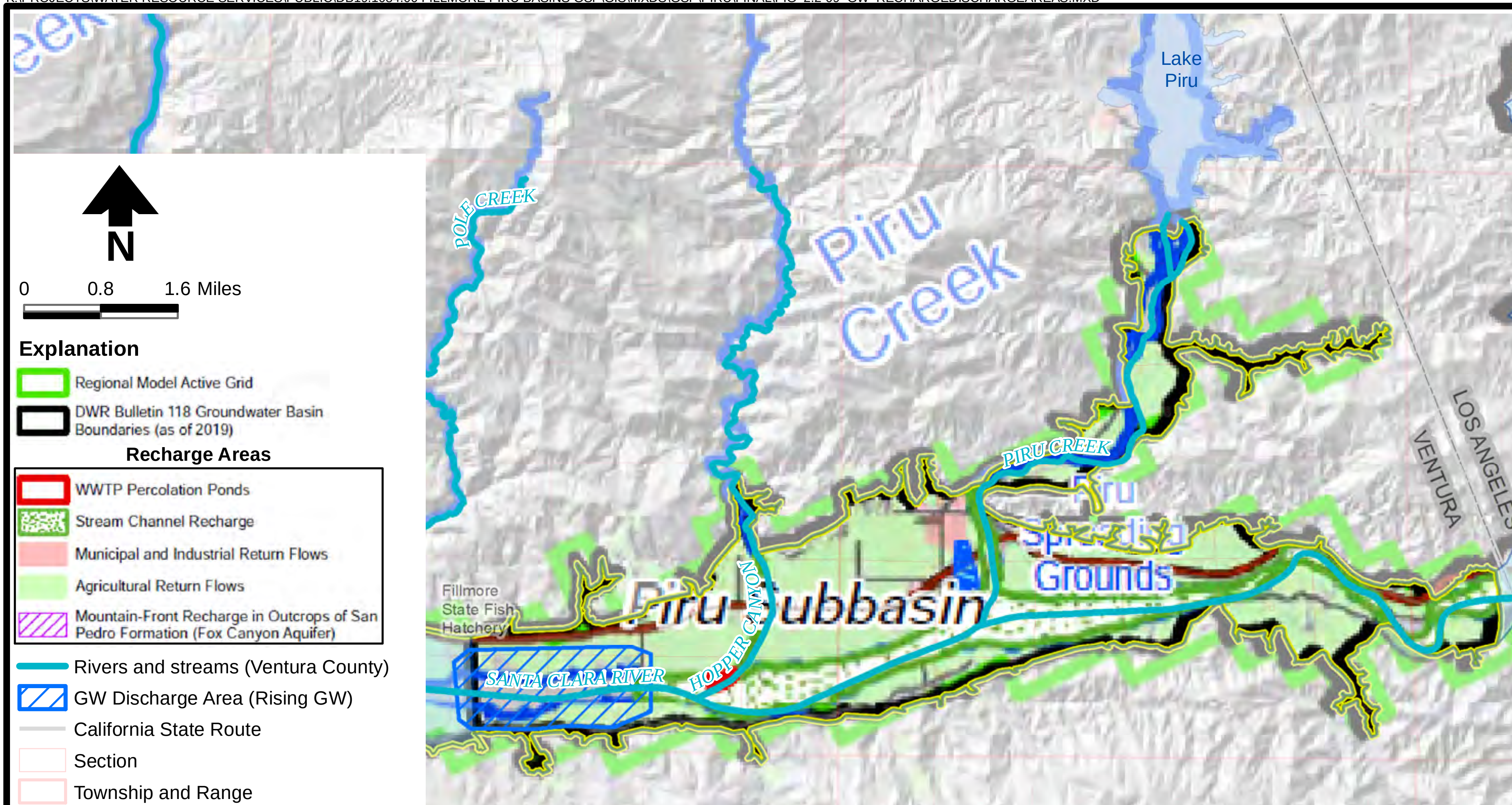
Figure 2.2-8




Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
1. Map is modified from Figure 2-25 from United Water Conservation District (2021a).
2. GW: groundwater

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Groundwater Recharge and Discharge Areas Map**

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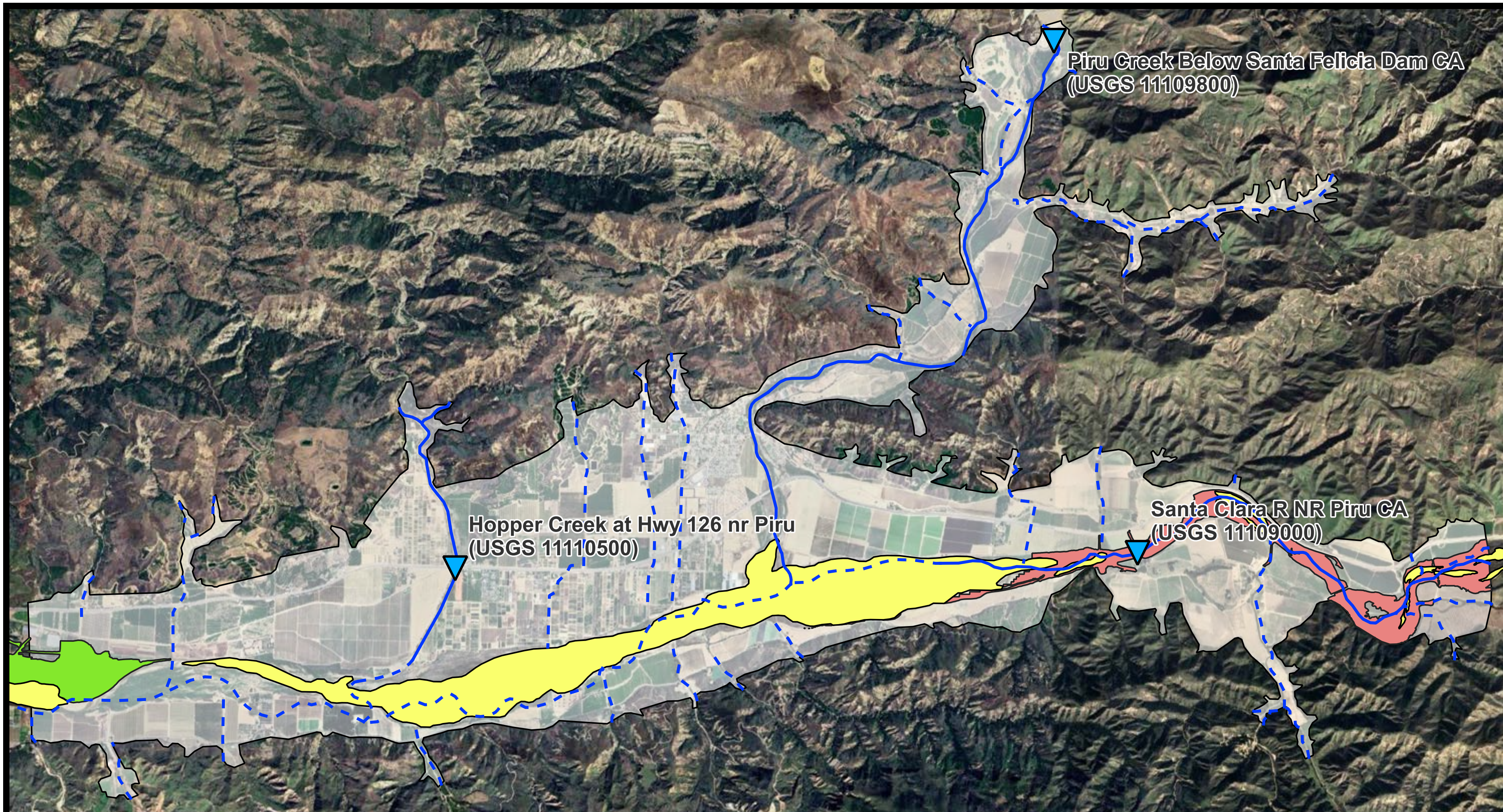
Figure 2.2-9




Sources: https://fillmore-piru.gladata.com; https://waterdata.usgs.gov/nwis/rt; https://apps.nationalmap.gov/services/

**Explanation**

Streams
- Perennial
- Intermittent

Stream Gages
- Recording

Critical Groundwater Dependent Ecosystems
- Cienega Riparian Complex
- Del Valle Riparian Complex

- Wash
- Groundwater Basin Boundary

0 0.5 1 mi

N

Fillmore and Piru Basins
Groundwater Sustainability Agency

FILLMORE BASIN GROUNDWATER SUSTAINABILITY PLAN

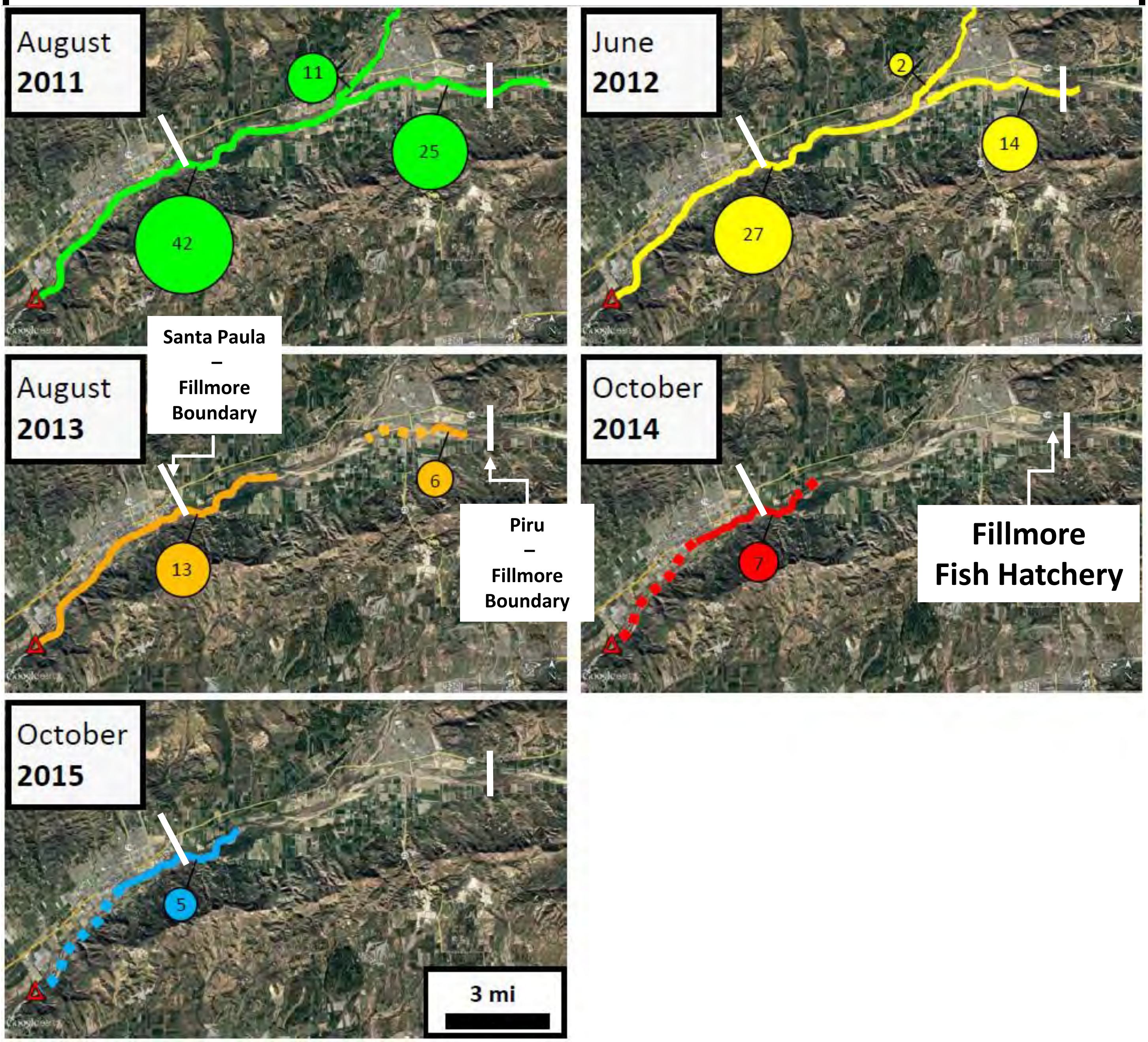
**Surface Water Features**

DBS&A
a Geo-Logic Company

06/14/2024 DB23.1279

Figure 2.2-10

C:\Users\500\OneDrive - Geo-Logic Associates Inc\Documents\Local Project Files\Fillmore-Piru\GIS\QGZs\Piru GSP.qgz




Notes:
- Figure is modified from United (2017) Figure 5.2-2.
- Solid lines are observed wetted stream reaches; dotted lines indicate uncertain wetted intervals.
- Circles and values represent surface water flow in cubic-feet per second (cfs) at manual streamflow monitoring sites conducted by United.
- Aerial imagery is static (does not represent the changes observed over time).

Fillmore and Piru Basins Groundwater Sustainability Agency

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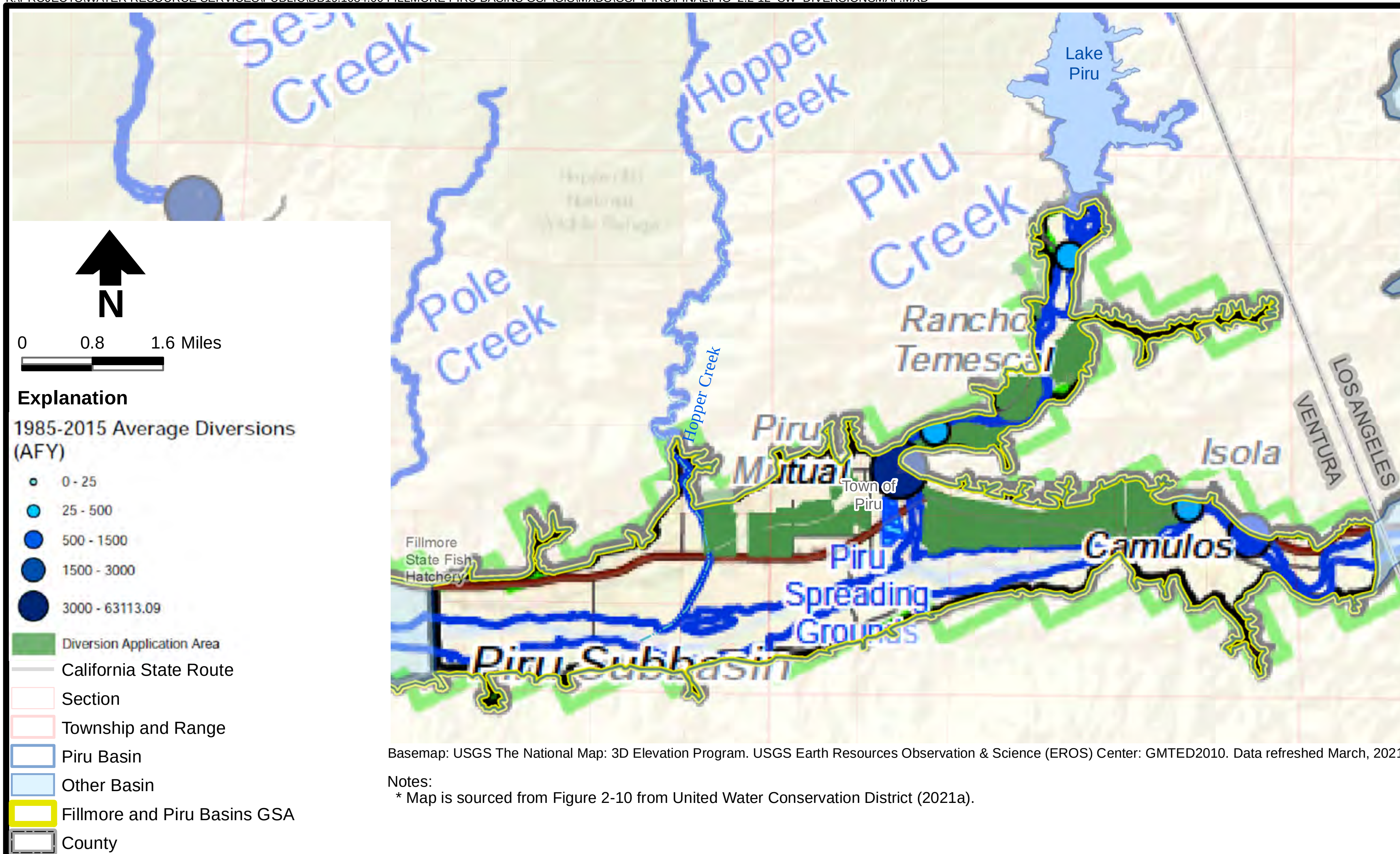
PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN
**Change in Wetted Extent of Streams Between 2011 and 2015**

Figure 2.2-11

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-12_SW_DIVERSIONSMAP.MXD




Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Map is sourced from Figure 2-10 from United Water Conservation District (2021a).

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Surface Water Diversions and Application Areas Map**

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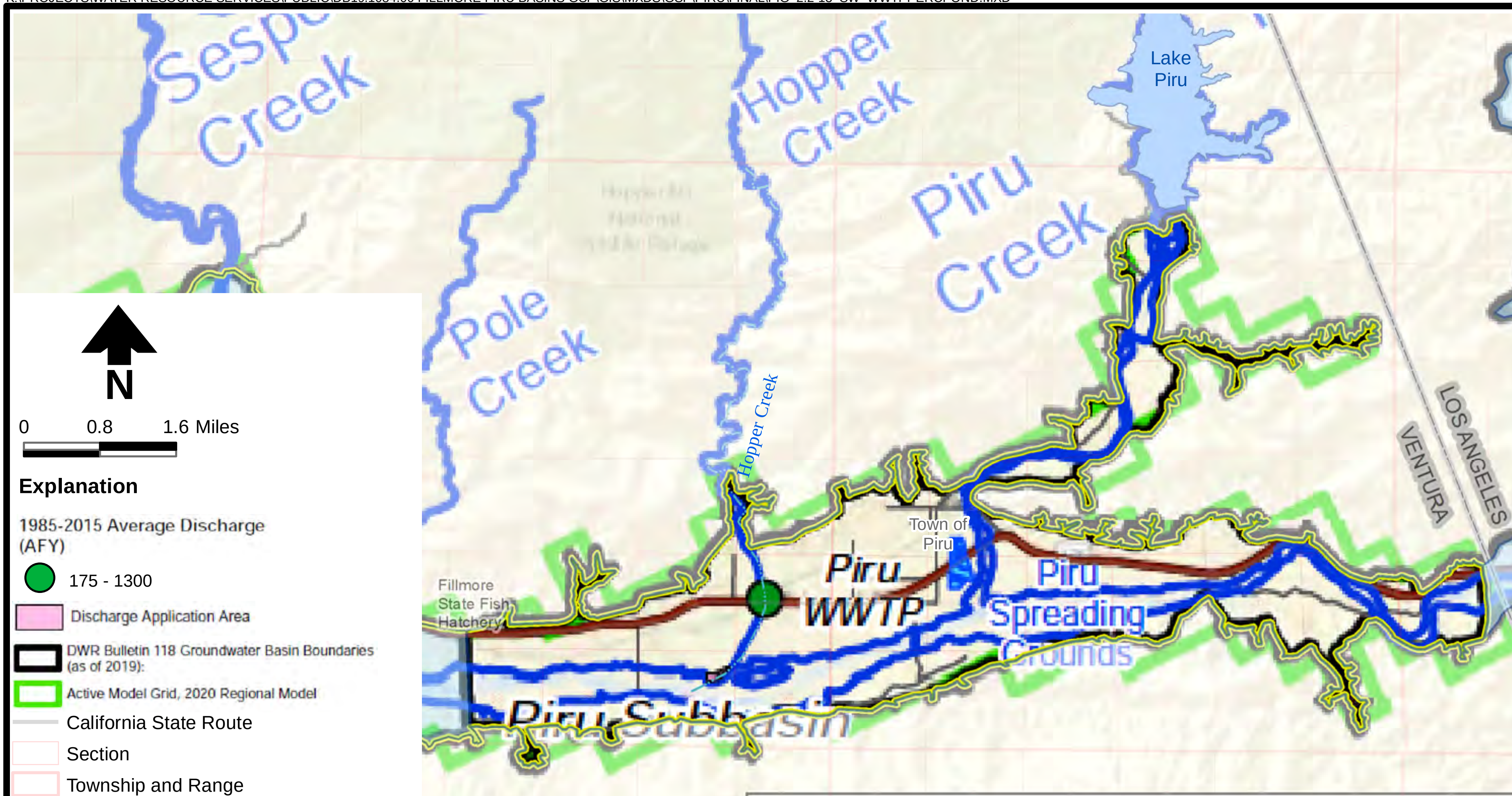
Figure 2.2-12

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-13_SW_WWTPPERCPOND.MXD




Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Map is sourced from Figure 2-12 from United Water Conservation District (2021a).
1. WRP: water reclamation plant

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Wastewater Treatment Plant (WWTP) and Percolation Pond Map**

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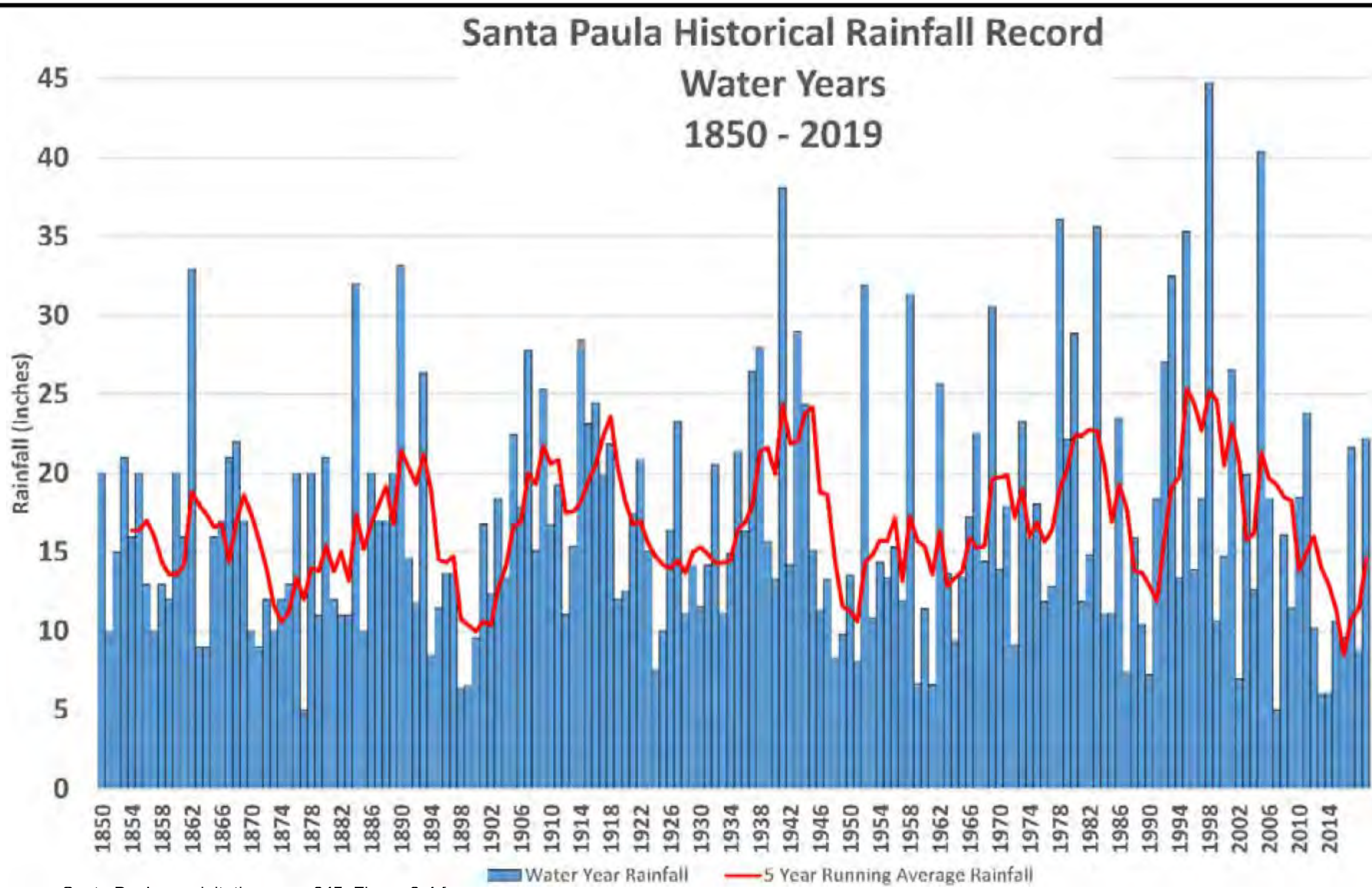
Figure 2.2-13




Source: Santa Paula precipitation gage 245, Figure 2-4 from:
United Water Conservation District, 2021a. Ventura Regional Groundwater Flow Model Expansion and Updated Hydrogeologic Conceptual Model for the Piru, Fillmore, and Santa Paula Groundwater Basins. Open-File Report 2021-01. June.

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Long-Term Precipitation Record for Santa Clara River Valley**

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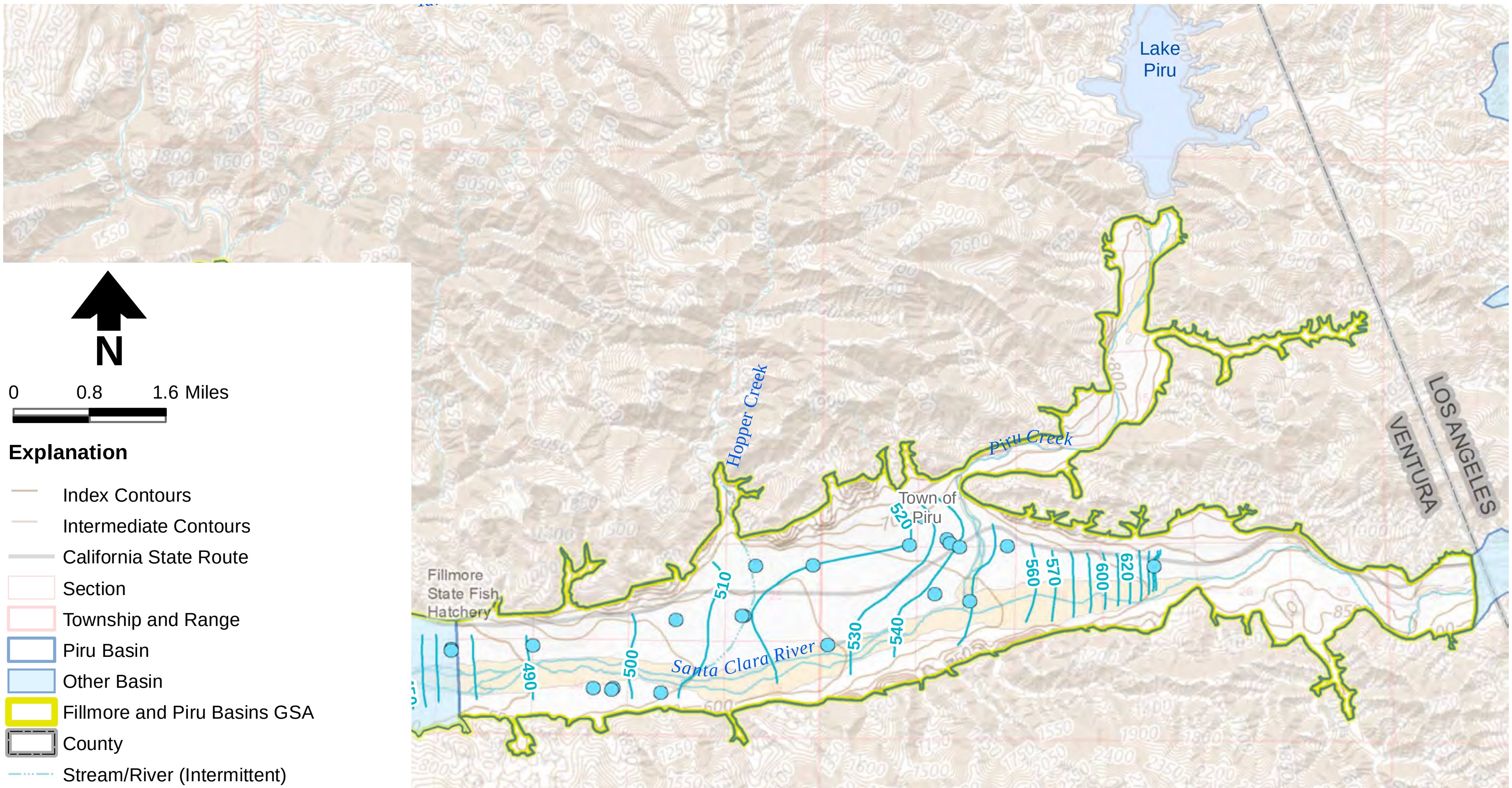
Figure 2.2-14

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-15_GWECONTOUR_PRINCIPAL_2019_SPRING.MXD




Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. GW elevation contours are provided at 10-foot intervals by United Water Conservation District, based on GWL data measured 3/1-3/31/2019, in feet relative to approximate mean sea level (ft-msl), the National Geodetic Vertical Datum of 1929 (NGVD29).
3. GWL: groundwater level

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Groundwater Elevation Contours in the Principal Aquifer, Spring 2019**

Figure 2.2-15

DBS&A
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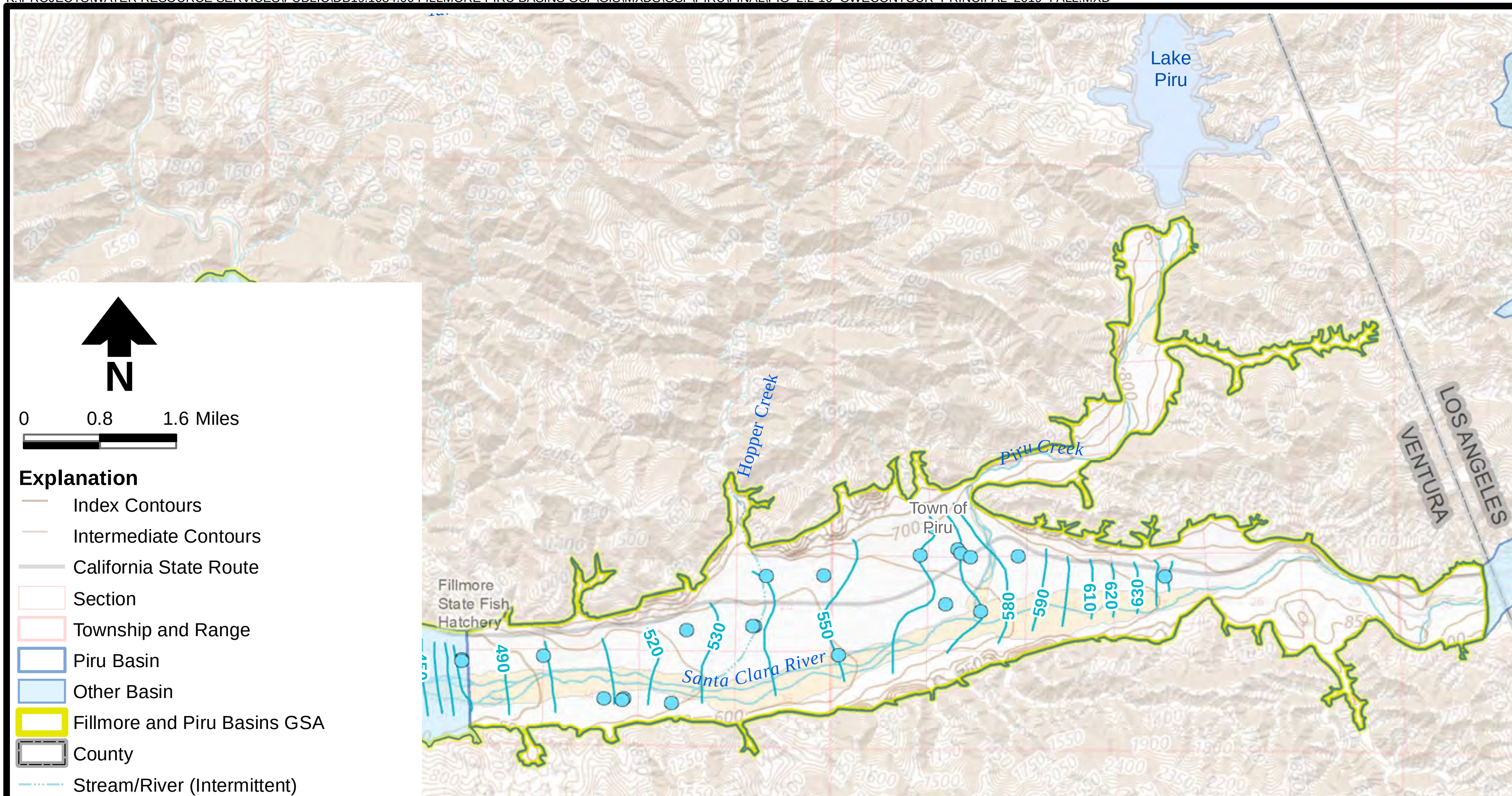
12/16/2021 DB19.1084

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-16_GWECONTOUR_PRINCIPAL_2019_FALL.MXD




N

0 0.8 1.6 Miles

**Explanation**

- Index Contours
- Intermediate Contours
- California State Route
- Section
- Township and Range
- Piru Basin
- Other Basin
- Fillmore and Piru Basins GSA
- County
- Stream/River (Intermittent)
- Stream/River (Perennial)*
- Wash
- Well used for GWL contouring
- 520 GW Elevation Contour (Fall 2019)

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:

* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Land (index/intermediate) elevation contours are in feet relative to the North American Vertical Datum of 1988 (NAVD88).
2. GW elevation contours are provided at 10-foot intervals by United Water Conservation District, based on GWL data measured 9/9-11/14/2019, in feet relative to approximate mean sea level (ft-msl), the National Geodetic Vertical Datum of 1929 (NGVD29).
3. GWL: groundwater level

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Groundwater Elevation Contours in the Principal Aquifer, Fall 2019**

Figure 2.2-16

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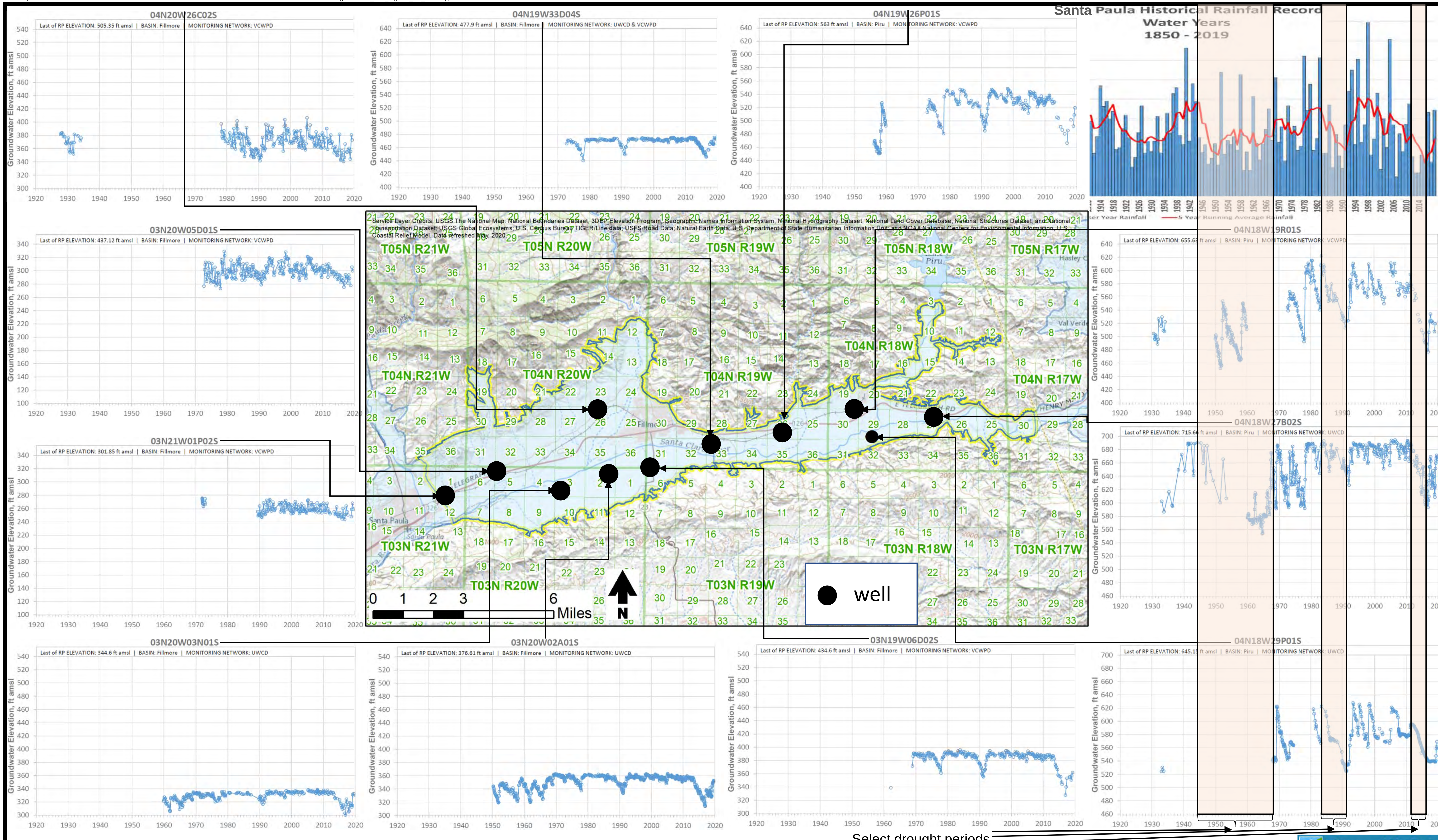


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**Long-Term Groundwater Level Hydrographs in Map View**

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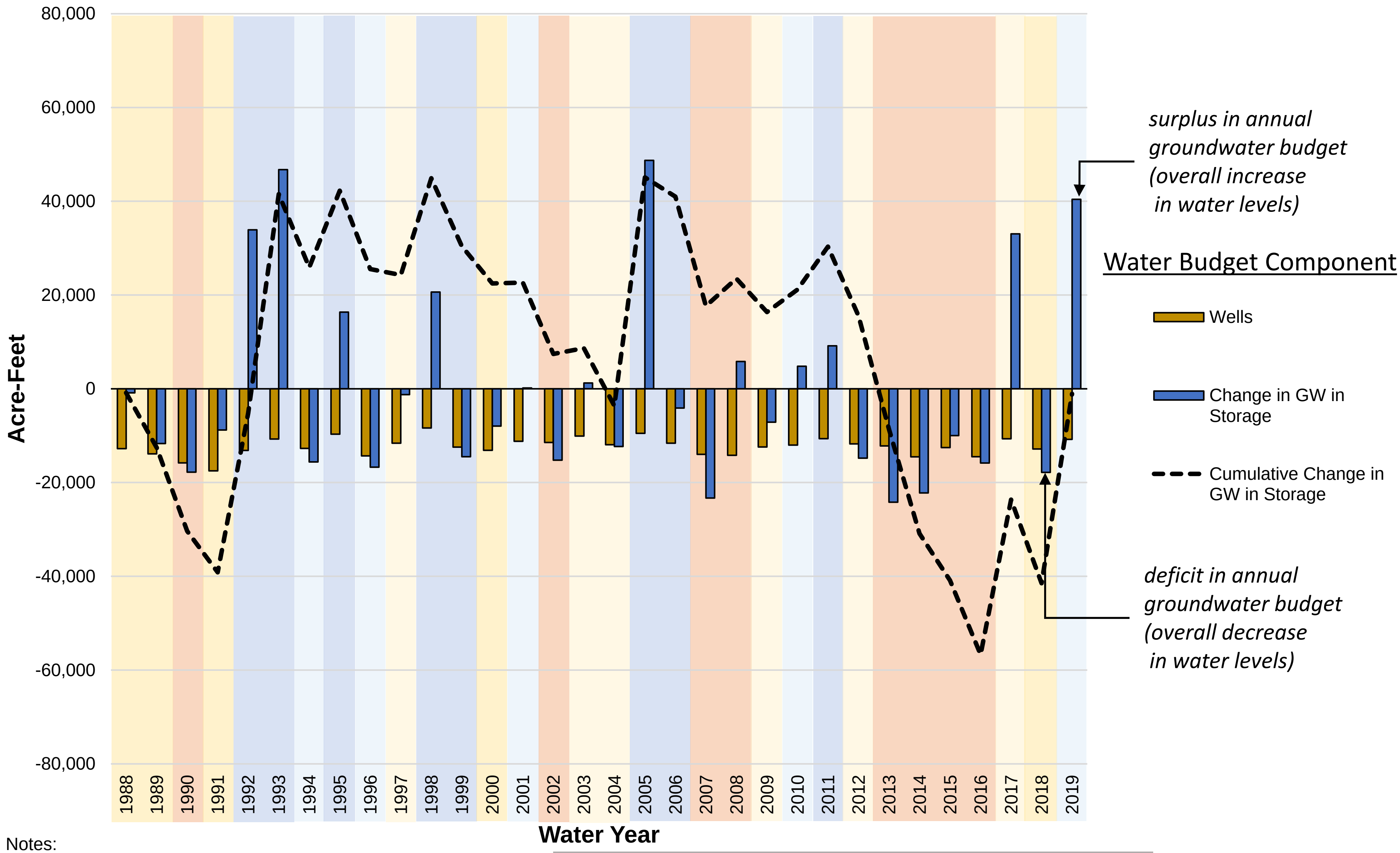
Figure 2.2-17




Notes:
- Information is from United (2021a,e)
- GW: groundwater

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**Estimates of the Change in Groundwater in Storage**

DB&A Daniel B. Stephens & Associates, Inc.

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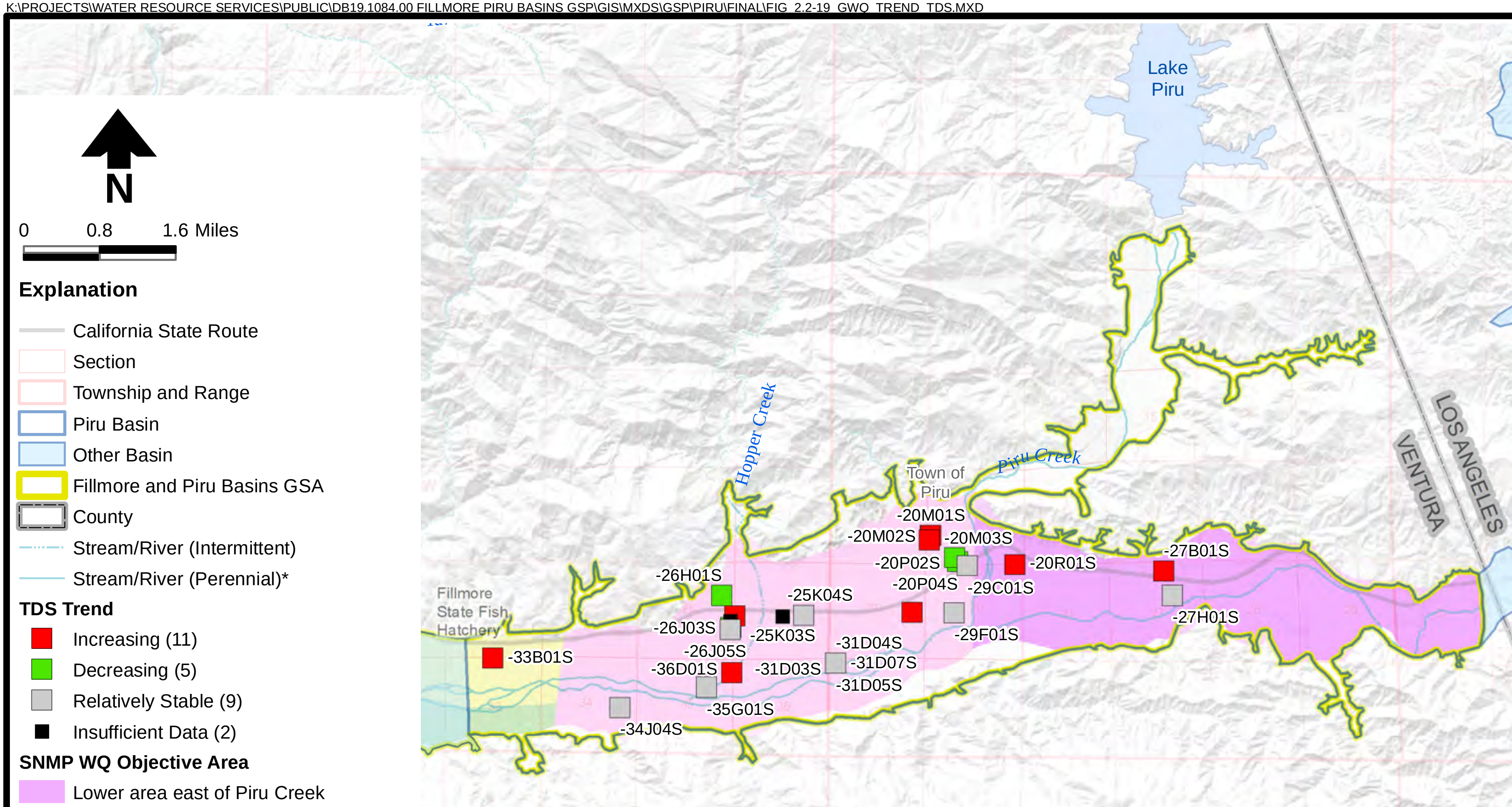
Figure 2.2-18

K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-19_GWQ_TREND_TDS.MXD




Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).

1. Trends are quantified at wells with water quality (WQ) data available since 2000.
2. LARWQCB: Los Angeles Regional Water Quality Control Board
3. SNMP: Salt and Nutrient Management Plan, a component of the LARWQCB Basin Plan for Coastal Watersheds of Los Angeles and Ventura County
4. WQ Objective Area boundaries represent the original Department of Water Resources (DWR) Bulletin 118 basin boundaries.

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Map of Groundwater Quality Trends, Total Dissolved Solids (TDS)**

Figure 2.2-19

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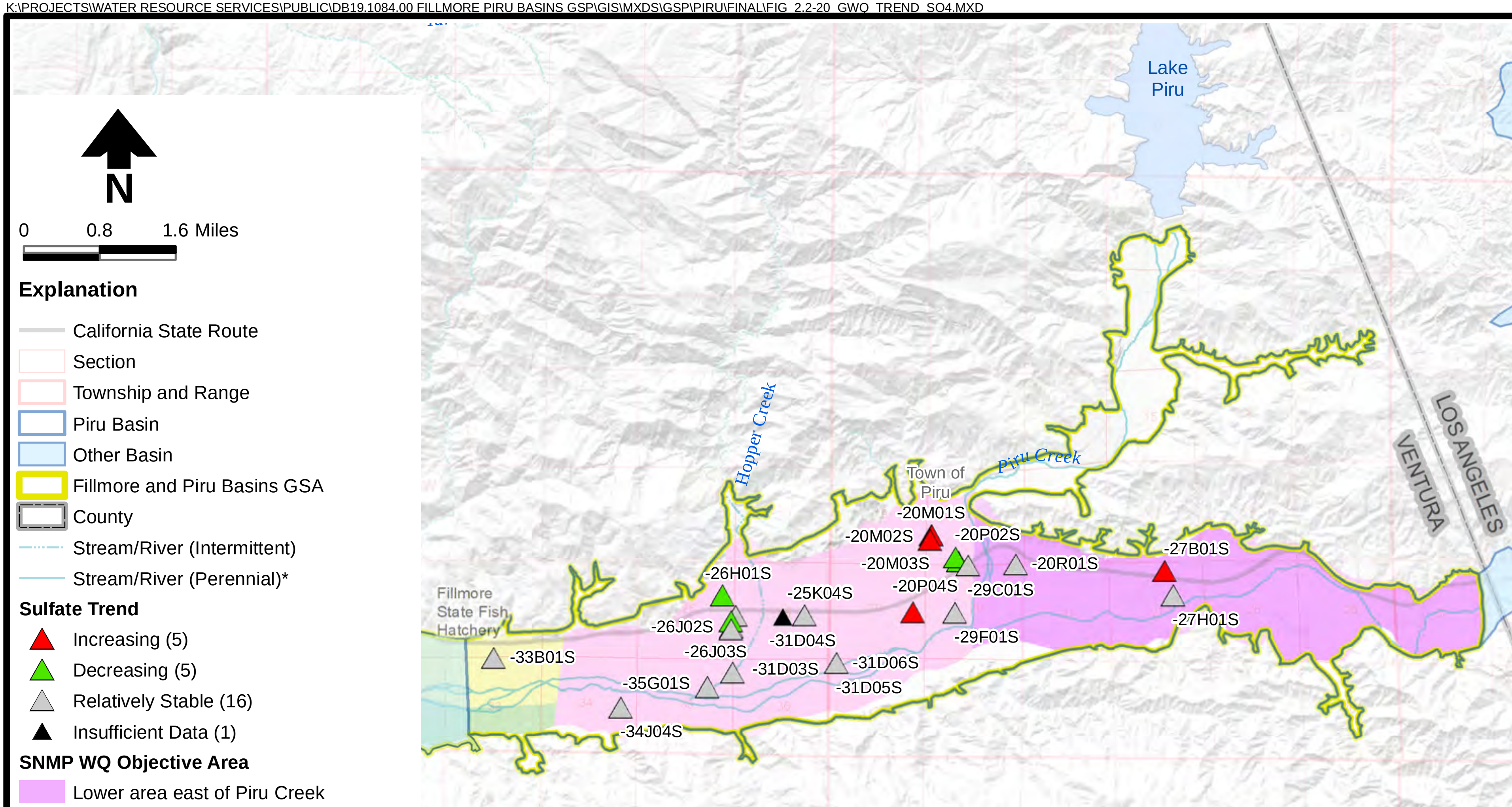


Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
* Perennial streams (designated by the U.S. Geological Survey [USGS] National Hydrography Dataset [NHD]) exhibit interrupted perennial (i.e., intermittent to ephemeral) conditions in the Santa Clara River Valley (Hanson et al., 2003; SFEI, 2011; Beller et al., 2016; United, 2017).
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Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

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PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Map of Groundwater Quality Trends, Sulfate (SO4)**

Figure 2.2-20

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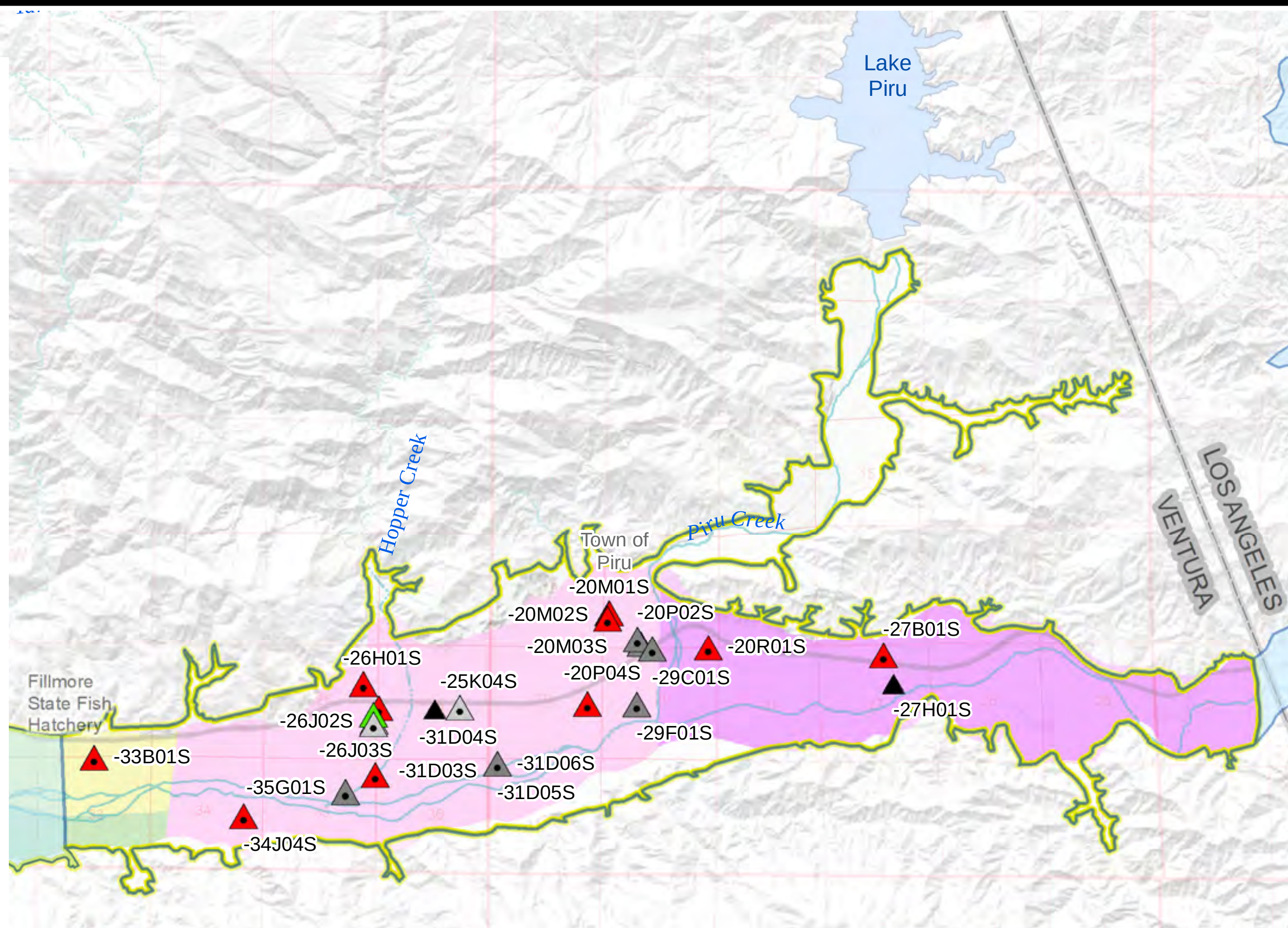
K:\PROJECTS\WATER RESOURCE SERVICES\PUBLIC\DB19.1084.00 FILLMORE PIRU BASINS GSP\GIS\MXDS\GSP\PIRU\FINAL\FIG_2.2-21_GWQ_TREND_CL.MXD




**Explanation**

- California State Route
- Section
- Township and Range
- Piru Basin
- Other Basin
- Fillmore and Piru Basins GSA
- County
- Stream/River (Intermittent)
- Stream/River (Perennial)*

**Chloride Trend**

- Increasing (14)
- Decreasing (1)
- Relatively Stable (4)
- No Clear Trend (6)
- Insufficient Data (2)

**SNMP WQ Objective Area**

- Lower area east of Piru Creek
- Lower area west of Piru Creek
- Pole Creek Fan area
- Remaining Fillmore area
- South side of Santa Clara River

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet | Projection: Lambert Conformal Conic | Datum: North American 1983

Basemap: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed March, 2021.

Notes:
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4. WQ Objective Area boundaries represent the original Department of Water Resources (DWR) Bulletin 118 basin boundaries.

Fillmore and Piru Basins Groundwater Sustainability Agency

PIRU BASIN GROUNDWATER SUSTAINABILITY PLAN

**Map of Groundwater Quality Trends, Chloride (Cl)**

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DB19.1084

Figure 2.2-21