Draft

Groundwater Sustainability Plan

for the

San Luis Obispo Valley Groundwater Basin Groundwater Sustainability Agency

Prepared by

WSC
Water Systems Consulting, Inc.
GEI Consultants
CHG
Stillwater Sciences
GSI Water Solutions, Inc.

8/30/2019

TABLE OF CONTENTS

Table of Contents i
List of Figures iii
Tables iv
Appendices v
List of Terms Used vi
Executive Summary 1
1 Introduction to the SLO Basin GSP 2
1.1 Purpose of the Groundwater Sustainability Plan 2
1.2 Description of SLO Basin 2
1.3 Basin Prioritization 3
2 Agency Information (§ 354.6) 5
2.1 Agencies Names and Mailing Addresses 5
2.2 Agencies Organization and Management Structures 7
2.2.1 County of San Luis Obispo 8
2.2.2 City of San Luis Obispo 8
2.2.3 Other Participating Parties in the MOA 8
2.2.3.1 Edna Valley Growers Mutual Water Company 8
2.2.3.2 Varian Ranch Mutual Water Company 8
2.2.3.3 Edna Ranch Mutual Water Company 8
2.2.3.4 Golden State Water Company 8
2.3 Authority of Agencies 8
2.3.1 Groundwater Sustainability Agencies 8
2.3.1.1 County of San Luis Obispo 8
2.3.1.2 City of San Luis Obispo 9
2.3.2 Memorandum of Agreement 9
2.3.3 Coordination Agreements 9
2.4 Contact information for Plan Manager 9
3 References 11
4 Appendices 11
Appendix A - City of San Luis Obispo Resolution to form GSA 11
Appendix B - County of San Luis Obispo Resolution to form GSA 15
Appendix C - Memorandum of Agreement – Preparation of GSP 20

LIST OF FIGURES

Figure 1-1: San Luis Obispo Valley Basin and Surrounding Basins. 4
Figure 2-1: San Luis Obispo Valley Basin GSAs and Participating Parties. 6
Figure 2-2: Groundwater Sustainability Commission (GSC) 7

TABLES

No table of figures entries found.

APPENDICES

A. City of San Luis Obispo Resolution to form GSA
B. County of San Luis Obispo Resolution to form GSA
C. Memorandum of Agreement – Preparation of GSP

LIST OF TERMS USED

Abbreviation	Definition
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
Basin Plan	Water Quality Control Plan for the Central Coast Basin
Cal Poly	California Polytechnic State University
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of San Luis Obispo
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CPWS-52	Cal Poly Weather Station 52
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ERMWC	Edna Ranch Mutual Water Company
ET_0	Evapotranspiration
EVGMWC	Edna Valley Growers Ranch Mutual Water Company
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet
MCL	Maximum Contaminant Level
MG	Million Gallons

Abbreviation	Definition
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCDC	National Climate Data Center
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLO Basin	San Luis Obispo Valley Groundwater Basin
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SCML	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
VRMWC	Varian Ranch Mutual Water Company
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is complete.

1 INTRODUCTION TO THE SLO BASIN GSP

1.1 PURPOSE OF THE GROUNDWATER SUSTAINABILITY PLAN

The Sustainable Groundwater Management Act (SGMA), Section 10720, et. al., of the State Water Code, requires sustainable groundwater management in all high and medium priority basins. The San Luis Obispo Valley Groundwater Basin (SLO Basin) was designated as a high priority basin. To comply with and satisfy the requirements of SGMA, the following activities are mandated:

- Forming one or more Groundwater Sustainability Agencies (GSAs) by June 30, 2017 to cover the entire SLO Basin. In May 2017, both the City of San Luis Obispo (City) and the County of San Luis Obispo (County) each formed GSAs within their jurisdictions, resulting in full coverage of the SLO Basin.
- Developing a Groundwater Sustainability Plan (GSP) by the GSAs that covers the entire SLO Basin by January 31, 2022.
- Implementing the GSP to achieve quantifiable objectives and sustainability within 20 years by 2042.
- Annual reporting of groundwater conditions in the basin to the California Department of Water Resources (DWR).
- Periodic (every five years) evaluation of the GSP implementation by the GSAs.

This document fulfills the GSP development requirement for the SLO Basin. This GSP describes and assesses the groundwater condition of the SLO Basin, develops quantifiable management objectives that account for the interests of the SLO Basin's beneficial groundwater uses and users, and identifies a group of projects and management actions that will allow the SLO Basin to achieve and maintain sustainability in the future.

1.2 DESCRIPTION OF SLO BASIN

This GSP covers the entire SLO Basin identified as Basin No. 3-009 in the DWR's Bulletin 118 (DWR, 2016). The SLO Basin lies in the southern portion of San Luis Obispo County. The SLO Basin is comprised of valleys of gentle flatlands and rolling hills ranging in elevation from approximately 100 to 500 feet above mean sea level, surrounded by larger mountain ranges. A terrain map displaying the SLO Basin boundaries is presented in Figure 1-1, which also displays the watershed areas of the San Luis Obispo Creek and Pismo Creek drainages, faults, and nearby groundwater basins symbolized by the SGMA 2019 Basin Prioritization Phase 1. Average annual precipitation ranges from approximately 18 inches throughout most of the SLO Basin to about 22 inches in relatively higher elevation areas near the City and Cal Poly. The SLO Basin is within the watershed areas of the San Luis Obispo Creek and Pismo Creek drainages, which are bounded on the northeast by the Santa Lucia Range and on the southwest by the formations of the San Luis Range and the Edna Fault. The SLO Basin is commonly referenced as being composed of two distinct valleys, with the San Luis Valley in the northwest and the Edna Valley in the southeast. The San Luis Valley lies within the San Luis Obispo Creek drainage and the Edna Valley lies within the Pismo Creek drainage.

There is a bedrock high that underlies between the San Luis Valley and Edna Valley. The watershed divide and the bedrock high divide are not coincident. The sediments of the Edna Valley have significantly greater thickness than those of the San Luis Valley. Precipitation that falls west of the watershed divide ultimately flows to Davenport and San Luis Obispo Creeks, and precipitation that falls

east of that divide flows to Corral de Piedras Creek or the other small tributaries, which ultimately flow to Pismo Creek south of the SLO Basin.

San Luis Obispo and Pismo Creeks are the primary surface water features within the SLO Basin. Significant tributaries to the San Luis Obispo Creek within Basin include Prefumo Creek, Stenner Creek, and Davenport Creek. Significant tributaries to Pismo Creek include both East and West branches of the Corral de Piedras Creek. Urban areas within the SLO Basin include the City of San Luis Obispo, Cal Poly, Edna, and Verde. Highway 101 is the most significant north-south highway in the Basin.

1.3 BASIN PRIORITIZATION

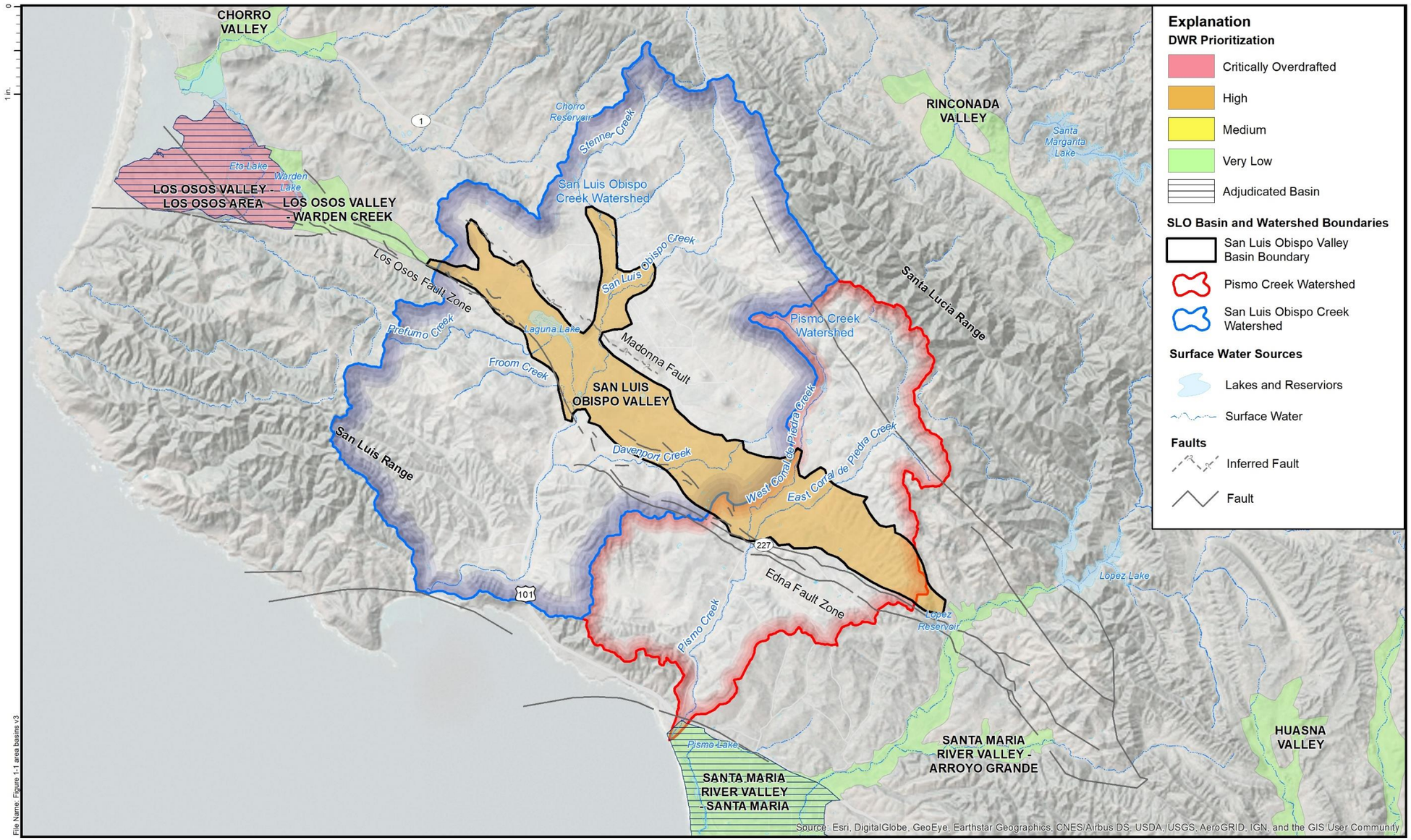
The DWR prioritized California's groundwater basins through the California Statewide Groundwater Elevation Monitoring (CASGEM) program and released the results in 2014. With the passage of SGMA, DWR redefined 54 groundwater basins based on requests for basin boundary modifications and classified the basins into four categories; high, medium, low, or very low priority. The SLO Basin was classified as a medium priority basin.

The DWR reassessed the priority of the groundwater basins following the 2016 basin boundary modification, as required by the Water Code and documented the results in the SGMA 2019 Basin Prioritization (DWR, 2019). DWR followed the process and methods developed for the CASGEM 2014 Basin Prioritization and incorporated new data, to the extent data was available, and the amended the language of Water Code Section 10933(b)(8) (component 8) included an analysis of adverse impacts on local habitat and local streamflow. DWR prioritized the basins based on the following components specified in Water Code Section 10933(b):

1. The population overlying the basin or sub-basin.
2. The rate of current and projected growth of the population overlying the basin or sub-basin.
3. The number of public supply wells that draw from the basin or sub-basin.
4. The total number of wells that draw from the basin or sub-basin.
5. The irrigated acreage overlying the basin or sub-basin.
6. The degree to which persons overlying the basin or sub-basin rely on groundwater as their primary source of water.
7. Any documented impacts on the groundwater within the basin or sub-basin, including overdraft, subsidence, saline intrusion, and other water quality degradation.
8. Any other information determined to be relevant by the department, including adverse impacts on local habitat and local streamflow.

With the addition of component 8, the SLO Basin moved from a medium priority basin to a high priority basin not in critical overdraft and is required to submit a GSP to DWR by January 31, 2022. The change in priority is inconsequential, as medium priority basins are also required to submit a GSP to DWR by January 31, 2022.

Additional information about how each of these components were analyzed can be found in the 2019 SGMA Basin Prioritization Process and Results Document (DWR, 2019). DWR is required to provide updates on basin boundaries, basin priority and critically overdrafted basins every 5 years beginning in 2020 as part of the Bulletin 118 updates.



File Name: Figure 1-1 area basins v3

Prepared for:

Author: EC
Date: 8/28/2019

SAN LUIS OBISPO VALLEY BASIN GSP

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References:

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

1.
2.
3.

San Luis Obispo Valley Basin and Surrounding Basins

Figure 1-1

2 AGENCY INFORMATION (§ 354.6)

On May 16, 2017, the City formed the City of San Luis Obispo Groundwater Sustainability Agency (City GSA) for the portion of the SLO Basin that lies within its city boundary. On May 23, 2017, the County formed the San Luis Obispo Valley Basin – County of San Luis Obispo Groundwater Sustainability Agency (County GSA) to cover all otherwise unrepresented areas within the SLO Basin. The County, City, the Edna Valley Growers Mutual Water Company (EVGMWC), the Varian Ranch Mutual Water Company (VRMWC), the Edna Ranch Mutual Water Company (ERMWC) and the Golden State Water Company (GSWC) (each referred to individually as a " Party" and collectively as the "Parties") entered into a Memorandum of Agreement Regarding Preparation of a GSP for the SLO Basin (MOA) effective as of January 25, 2018. The MOA's purpose is for the City and County, with input from the Participating Parties, to coordinate preparation of a single GSP for the entire SLO Basin pursuant to SGMA and other applicable provisions of law. Figure 2-1 shows the service area boundaries of each of the MOA Parties and the GSA areas.

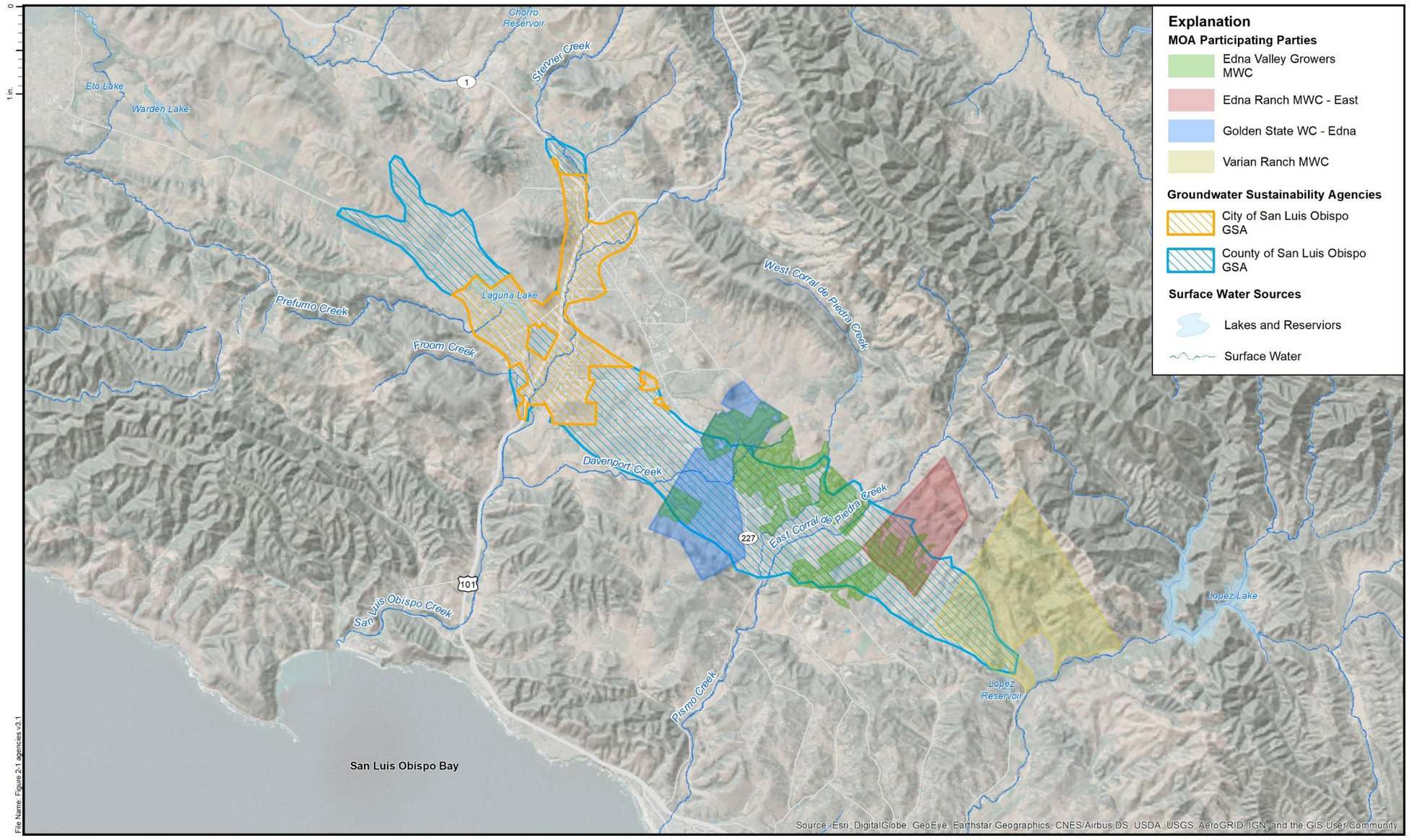
On October 16, 2018, the County GSA gave notice to DWR that it intends to develop a GSP in collaboration with the City GSA for the SLO Basin in accordance with California Water Code (CWC) Section 10727.8 and the Title 23, Section 353.6 of the California Code of Regulations (CCR).

2.1 AGENCIES NAMES AND MAILING ADDRESSES

The following contact information is provided for each groundwater sustainability agency for the SLO Basin pursuant to California Water Code
§10723.8.

County of San Luis Obispo
County Government Center, Room 206
San Luis Obispo, CA 93408
Attention: John Diodati , Public Works Interim Director

City of San Luis Obispo
Utilities Department
879 Morro Street
San Luis Obispo, CA 93401-2710
Attention: Aaron Floyd, Utilities Director



File Name: Figure 2-1 agencies v3.1

Prepared for:

COUNTY OF SAN LUIS OBISPO

Author: EC
Date: 8/28/2019

SAN LUIS OBISPO VALLEY BASIN GSP

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0 0.75 1.5 3 Km

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Notes:

1.
2.
3.

San Luis Obispo Valley Basin GSA And Participating Parties

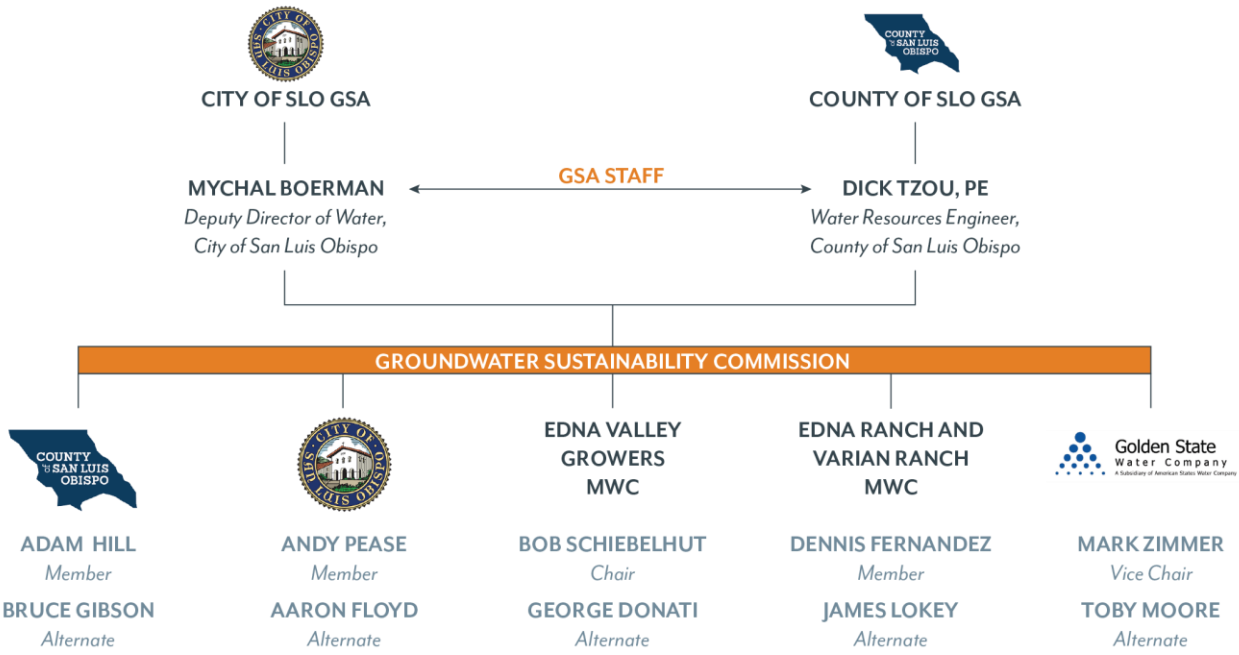
Figure 2-1

2.2 AGENCIES ORGANIZATION AND MANAGEMENT STRUCTURES

The MOA establishes the Groundwater Sustainability Commission (GSC) as an advisory body to the GSAs and the terms under which the City GSA and County GSA will jointly develop a single GSP, in coordination with the GSC. The GSC consists of representatives of the GSAs and the Participating Parties (i.e., EVGMWC, VRMWC, ERMWC, and GSWC). Each member of the GSC shall be entitled to one vote on any matter under consideration by the GSC. All recommendations submitted by the GSC to the City Council and the County Board of Supervisors shall be supported by a majority of the members, except for the recommendation to adopt the GSP or any amendments which shall be supported by at least four of the members.

City and County staff will collaboratively participate in developing a GSP through, among other things, providing guidance to consultant, coordinating with the GSC, and engaging SLO Basin users and stakeholders. Once the GSP is developed, it will be considered for adoption by the GSAs (i.e., City Council and County Board of Supervisors) and subsequently submitted to DWR for approval. The MOA automatically terminates upon approval of the GSP by DWR. The organization and management structures of each of the Parties are described in the following sections. The MOA does not specify the appointment of officer positions. However, Figure 2-2 shows the names of the appointed representative members and alternates and depicts the relationship of the GSAs and the Participating Parties and the overall governance structure for developing the GSP:

Figure 2-2: Groundwater Sustainability Commission (GSC)



2.2.1 County of San Luis Obispo

The County is a GSA and Party of the MOA. Members of the County Board of Supervisors sit on the GSC as a member and alternate member. The County is governed by a five-member Board of Supervisors representing five districts in the County. Board of Supervisor members are elected to staggered four-year terms.

2.2.2 City of San Luis Obispo

The City is a GSA and Party of the MOA. A member of the City Council and the Director of Utilities sit on the GSC as a member and alternate member, respectively. The City is an incorporated charter city and operates under the "Council-Mayor-City Manager" form of municipal government. The five-member City Council consists of the directly-elected Mayor and four City Council Members. The Mayor is elected to a two-year term and Council Members are elected to four-year terms.

2.2.3 Other Participating Parties in the MOA

2.2.3.1 Edna Valley Growers Mutual Water Company

EVGMWC is a Party of the MOA and its representative is designated as Chair of the GSC. EVGMWC provides water to the residents of unincorporated San Luis Obispo County within the SLO Basin.

2.2.3.2 Varian Ranch Mutual Water Company

VRMWC is a Party of the MOA and a member of the GSC. VRMWC provides water to the residents of unincorporated San Luis Obispo County and serves an area within the SLO Basin as shown in Figure 2-1.

2.2.3.3 Edna Ranch Mutual Water Company

ERMWC is a Party of the MOA and a member of the GSC. ERMWC provides water to the residents of unincorporated San Luis Obispo County and serves an area within the SLO Basin as shown in Figure 2-1.

2.2.3.4 Golden State Water Company

GSWC is a Party of the MOA and its representative is designated as a Vice Chair of the GSC. GSWC is an Investor Owned Utility regulated by the California Public Utilities Commission (CPUC) and subject to federal Sarbanes-Oxley requirements that hold companies to the highest levels of transparency. CPUC's authority to regulate water, electric, natural gas, and other public utilities subject to its jurisdiction derives from the California state constitution.

2.3 AUTHORITY OF AGENCIES

The GSAs developing this coordinated GSP were formed in accordance with the requirements of California Water Code §10723 et seq. The resolutions of formation for the GSAs and the Memorandum of Understanding (MOA) are included in Appendices A - C. The specific legal authorities for GSA formation and GSP implementation are summarized below.

2.3.1 Groundwater Sustainability Agencies

"Local agency" is defined pursuant to CWC§ 10721 as a local public agency that has water supply, water management, or land use responsibilities within a groundwater basin.

2.3.1.1 County of San Luis Obispo

The County was created as described in Government Code Section 460
which states that the state is divided into counties, the names, boundaries and territorial subdivisions of

which are declared in Title 3 of the Government Code. The County has land use authority over the unincorporated areas of the county, including areas overlying the SLO Basin. The County is therefore a local agency under CWC§ 10721(n) with the authority to establish itself as a GSA. Upon establishing itself as a GSA, the County retains all the rights and authorities provided to GSAs under CWC§ 10725 et seq. The City and the County shall each be responsible for adopting the GSP and implementing the GSP within their respective service areas.

2.3.1.2 City of San Luis Obispo
The City is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents. The City is therefore a local agency under CWC§ 10721(n) with the authority to establish itself as a GSA. Upon establishing itself as a party of the GSA, San Luis Obispo retains all the rights and authorities provided to GSAs under CWC§ 10725 et seq. The City and the County shall each be responsible for adopting the GSP and implementing the GSP within their respective service areas.

2.3.2 Memorandum of Agreement
The MOA Parties entered into the MOA effective as of January 25, 2018. The MOA establishes the GSC as an advisory body to the GSAs and the terms under which the City GSA and County GSA will jointly develop a single GSP, in coordination with the GSC pursuant to SGMA and other applicable provisions of law. The GSC members consists of representatives of the GSAs and the Participating Parties (i.e., EVGMWC, VRMWC, ERMWC, and GSWC). City and County staff will collaboratively participate in developing a GSP through, among other things, providing guidance to the consultant, coordinating with the GSC, and engaging SLO Basin users and stakeholders. Each GSC member has one vote on the GSC. The County Board of Supervisors and the City Council may approve or reject any advisory opinion submitted by the GSC provided that in every case that the County Board of Supervisors or City Council rejects an advisory opinion of the GSC related to the contents or adoption of the GSP it shall do so only after holding a public hearing, at which time the members of the GSC shall have the right to appear and address the City Council and the County Board of Supervisors. The MOA automatically terminates upon approval of the GSP by DWR. A copy of the MOA is included in Appendix B.

2.3.3 Coordination Agreements
Only a single GSP is developed by the City and County GSAs to cover the entire SLO Basin. Therefore, no coordination agreements with other GSAs are necessary because there is no multiple GSPs.

2.4 CONTACT INFORMATION FOR PLAN MANAGER
The plan manager is to be determined.

3 REFERENCES

Carollo. 2012. *San Luis Obispo County Master Water Report.* 2012.
City of San Luis Obispo. 2016. *2015 Urban Water Management Plan.* 2016.
County of San Luis Obispo. 2014. *San Luis Obispo County Integrated Regional Water Management Plan (IRWMP).* 2014.
Cuesta Engineering Corporation. 2007. *San Luis Obispo Creek Watershed Calibration Study.* 2007.
DWR. 2016. *California's Groundwater: Bulletin 118 - Interim Update 2016, Working Towards Sustainability.* 2016.
—. 2003. *California's Groundwater: Bulletin 118 - Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization - Process and Results Document.* 2019.
GSI Water Solutions. 2018. *San Luis Obispo Valley Basin Characterization and Monitoring Well Installation.* 2018.
WSC. 2018. *Salinas and Whale Rock Reserviors Safe Annual Yield TM.* 2018.

4 APPENDICES

APPENDIX A - CITY OF SAN LUIS OBISPO RESOLUTION TO FORM GSA

RESOLUTION NO. 10796 (2017 SERIES)

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SAN LUIS OBISPO, CALIFORNIA, AUTHORIZING THE CITY TO BECOME A GROUNDWATER SUSTAINABILITY AGENCY FOR THE SAN LUIS OBISPO VALLEY GROUNDWATER BASIN FOR THE AREA THAT LIES BENEATH AND WITHIN THE JURISDICTIONAL BOUNDARIES OF THE CITY OF SAN LUIS OBISPO

WHEREAS, in 2014 the California Legislature and the Governor passed into law the Sustainable Groundwater Management Act (SGMA) for local management of groundwater resources in California through the formation of Groundwater Sustainability Agencies (GSAs) and through preparation and implementation of Groundwater Sustainability Plans (GSPs); and

WHEREAS, the City overlies a portion of the San Luis Obispo Valley Groundwater Basin (SLOVGB), which is subject to SGMA, and thus one or more GSAs must be formed for the SLOVGB by June 30, 2017, or the SLOVGB may be subject to regulation by the State Water Resources Control Board; and

WHEREAS, the City is a "local agency" as that term is defined by SGMA, and as such is authorized to form a GSA to manage groundwater resources in the SLOVGB and within the City's jurisdictional boundaries in accordance with SGMA and other applicable laws and authorities; and

WHEREAS, the City desires to form a GSA to manage groundwater resources in the SLOVGB beneath and within the City's jurisdictional boundaries; and

WHEREAS, the City intends that its GSA will work cooperatively with the other GSAs that have formed or will be formed in the SLOVGB to prepare one or more GSPs by January 31, 2022, so that groundwater resources in the SLOVGB will be properly managed and sustainable in accordance with the provisions of SGMA; and

WHEREAS, it is essential that the City form this GSA because SGMA grants GSAs substantial additional powers and authorities to ensure sustainable groundwater management. Acting as the GSA within the City's jurisdictional boundaries will, among other things, confirm the City's role as the local groundwater management agency, ensure access to SGMA authorities, and preserve access to grant funding and other opportunities that may be available to GSAs; and

WHEREAS, pursuant to the requirements of SGMA, the City held a public hearing on this date after publication of notice pursuant to California Government Code section 6066 to consider adoption of this Resolution.

R 10796

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of San Luis Obispo as follows:

SECTION 1. All of the above recitals are true and correct and incorporated herein by reference.

SECTION 2. The City of San Luis Obispo hereby elects to become the Groundwater Sustainability Agency in accordance with the Sustainable Groundwater Management Act over the portion of the San Luis Obispo Valley Groundwater Basin which lies under and within the jurisdictional boundaries of the City of San Luis Obispo.

SECTION 3. The City Manager is authorized and directed to submit a notice of this Resolution along with all other required information to the California Department of Water Resources in accordance with the Sustainable Groundwater Management Act.

SECTION 4. The City Groundwater Sustainability Agency shall consider the interests of all beneficial uses and users of the groundwater within the jurisdictional boundaries of the City and will develop an outreach program for all such stakeholders. The City Groundwater Sustainability Agency will continue to coordinate with other local agencies and stakeholders that overlie the San Luis Obispo Valley Groundwater Basin in order to manage groundwater resources.

SECTION 5. The City Groundwater Sustainability Agency shall establish and maintain a list of persons interested in receiving notices regarding the City's involvement in the preparation of one or more Groundwater Sustainability Plans in the San Luis Obispo Valley Groundwater Basin, where any person may request in writing to be placed on the City's list of interested persons.

SECTION 6. Resolution Number 10777 (2017 Series) is hereby repealed.

Resolution No. 10796 (2017 Series) Page 3

Upon motion of Council Member Pease, seconded by Council Member Christianson, and on the following roll call vote:

AYES:	Council Members Christianson, Gomez, and Pease Vice Mayor Rivoire and Mayor Harmon
NOES:	None
ABSENT:	None

The foregoing resolution was adopted this 16th day of May, 2017.

Mayor Heidi Harmon

ATTEST:

Carrie Gallagher
City Clerk

APPROVED AS TO FORM:

J. Christine Dietrick
City Attorney

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of the City of San Luis Obispo, California, this 24th day of May, 2017.

Carrie Gallagher
City Clerk

APPENDIX B - COUNTY OF SAN LUIS OBISPO RESOLUTION TO FORM GSA

GSA Formation — **Exhibit C - Resolution forming the San Luis Obispo Valley Basin - County of SLO GSA**

IN THE BOARD OF SUPERVISORS

County of San Luis Obispo, State of California

Tuesday, May 23, 2017

PRESENT: Supervisors Bruce S. Gibson, Adam Hill, Lynn Compton, Debbie Arnold, and Chairperson John Peschong

ABSENT: None

RESOLUTION NO. 2017-146

RESOLUTION FORMING THE SAN LUIS OBISPO VALLEY BASIN – COUNTY OF SAN LUIS OBISPO GROUNDWATER SUSTAINABILITY AGENCY AND FINDING THAT THE PROJECT IS EXEMPT FROM SECTION 21000 ET SEQ. OF THE CALIFORNIA PUBLIC RESOURCES CODE (CEQA)

The following Resolution is hereby offered and read:

WHEREAS, in 2014, the California Legislature adopted, and the Governor signed into law, three bills (SB 1168, AB 1739, and SB 1319) collectively referred to as the Sustainable Groundwater Management Act (SGMA) (Water Code §§ 10720 *et seq.*), that became effective on January 1, 2015, and that have been subsequently amended; and

WHEREAS, the intent of SGMA, as set forth in Water Code Section 10720.1, is to provide for the sustainable management of groundwater basins at a local level by providing local groundwater agencies with the authority, and technical and financial assistance necessary, to sustainably manage groundwater; and

WHEREAS, SGMA requires the formation of Groundwater Sustainability Agencies (GSAs) for the purpose of achieving groundwater sustainability through the adoption and implementation of Groundwater Sustainability Plans (GSPs) for all medium and high priority basins as designated by the California Department of Water Resources (DWR); and

WHEREAS, SGMA requires that a local agency or collection of agencies decide to become a GSA for all medium and high priority basins on or before June 30, 2017 and that the GSA or GSAs for basins DWR has not designated as "subject to critical conditions of overdraft" develop a GSP or coordinated GSPs on or before January 31, 2022; and

WHEREAS, the San Luis Obispo Valley Groundwater Basin (Basin) has been designated by DWR as a medium priority basin, but not subject to critical conditions of overdraft; and

WHEREAS, the County of San Luis Obispo and the City of San Luis Obispo are each a "local agency" within the Basin as defined in Water Code Section 10721(n) and thus are eligible to form GSAs; and

WHEREAS, it is anticipated that the City of San Luis Obispo will form a GSA for the portion of the Basin within the City boundary; and

WHEREAS, the County of San Luis Obispo intends to form a GSA to cover all other portions of the Basin; and

WHEREAS, SGMA authorizes certain entities, specifically water corporations regulated by the Public Utilities Commission and mutual water companies, to participate in a GSA through a memorandum of agreement or other legal agreement; and

WHEREAS, a number of such entities overlie the Basin, including the Edna Valley Growers Mutual Water Company, the Edna Ranch Mutual Water Company, the Varian Ranch Mutual Water Company and the Golden State Water Company, and it is anticipated that such entities will desire to enter into a memorandum of agreement with the County and City of San Luis Obispo establishing a process by which such entities will participate in the preparation of the GSP for the Basin; and

WHEREAS, the County of San Luis Obispo published a notice of public hearing consistent with the requirements contained within Water Code Section 10723(b); and

WHEREAS, the Board of Supervisors conducted such a public hearing on May 23, 2017; and

WHEREAS, the County of San Luis Obispo is committed to the sustainable management of groundwater within the Basin and intends to consider the interests of all beneficial users and uses of groundwater within the Basin through, among other things, coordination with the City of San Luis Obispo and the entities eligible to participate in SGMA as described above.

NOW, THEREFORE, BE IT RESOLVED AND ORDERED by the Board of Supervisors of the County of San Luis Obispo, State of California, that:

Section 1: The foregoing recitals are true and correct and are incorporated herein by reference.

Section 2: The County of San Luis Obispo hereby decides to become the GSA for, and undertake sustainable groundwater management within, the Basin, with the exception of the portions of the Basin located within the City of San Luis Obispo ("GSA Boundary"). The GSA shall be known as the San Luis Obispo Valley Basin – County of San Luis Obispo Groundwater Sustainability Agency, and a map of the GSA Boundary is attached hereto as Exhibit A and incorporated herein.

Section 3: The Director of Public Works of the County of San Luis Obispo, or designee, is hereby authorized and directed to submit notice of adoption of this Resolution in addition to all other information required by SGMA, including but not limited to, all

information required by Water Code Section 10723.8, to DWR, and to develop and maintain an interested persons list as described in Water Code Section 10723.4 and a list of interested parties as described in Water Code Section 10723.8(a)(4).

Section 4: The Director of Public Works of the County of San Luis Obispo, or designee, is hereby authorized and directed to take such other and further actions as may be necessary or appropriate to implement the intent and purposes of this Resolution.

Section 5: The Board of Supervisors finds that the adoption of this Resolution is exempt from the requirements of the California Environmental Quality Act (Public Resources Code §§ 21000 et seq.) (CEQA) pursuant to Section 15061(b)(3) of the CEQA Guidelines.

Section 6: The Environmental Coordinator of the County of San Luis Obispo is hereby directed to file a Notice of Exemption in accordance with the provisions of CEQA.

Upon motion of Supervisor Hill, seconded by Supervisor Gibson, and on the following roll call vote, to wit:

AYES: Supervisors Hill, Gibson, Compton, Arnold and Chairperson Peschong

NOES: None

ABSENT: None

ABSTAINING: None

the foregoing resolution is hereby adopted on the 23rd day of May, 2017.

John Peschong
Chairperson of the Board of Supervisors

ATTEST:

TOMMY GONG
Clerk of the Board of Supervisors

By: Annette Ramirez
Deputy Clerk
[SEAL]

APPROVED AS TO FORM AND LEGAL EFFECT:

RITA L. NEAL
County Counsel

By: /s/ Erica Stuckey
Deputy County Counsel

Dated: May 1, 2017

L:\Water Resources\2017\May\BOS\San Luis Obispo Valley Basin GSA\SLO Valley Basin rsl.docx CB:jb

STATE OF CALIFORNIA,)
) **ss.**
COUNTY OF SAN LUIS OBISPO)

I, Tommy Gong, County Clerk and ex-officio Clerk of the Board of Supervisors, in and for the County of San Luis Obispo, State of California, do hereby certify the foregoing to be a full, true and correct copy of an order made by the Board of Supervisors, as the same appears spread upon their minute book.

WITNESS my hand and the seal of said Board of Supervisors, affixed this 23rd day of May, 2017.

Tommy Gong
County Clerk and Ex-Officio Clerk
of the Board of Supervisors

(SEAL)

By: _____
Deputy Clerk

APPENDIX C - MEMORANDUM OF AGREEMENT – PREPARATION OF GSP

DICK T.

MEMORANDUM OF AGREEMENT REGARDING PREPARATION OF A GROUNDWATER SUSTAINABILITY PLAN FOR THE SAN LUIS OBISPO VALLEY GROUNDWATER BASIN

This Memorandum of Agreement ("MOA") is entered into by and between the City of San Luis Obispo ("City"), the County of San Luis Obispo ("County"), the Edna Valley Growers Mutual Water Company ("EVGMWC"), the Varian Ranch Mutual Water Company ("VRMWC"), the Edna Ranch Mutual Water Company ("ERMWC") and the Golden State Water Company ("GSWC") (each referred to individually as a "Party" and collectively as the "Parties") for purposes of coordinating preparation of a single groundwater sustainability plan for the San Luis Obispo Valley Groundwater Basin.

Recitals

WHEREAS, on September 16, 2014, Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act ("SGMA"), which became effective on January 1, 2015 and which have been and may continue to be amended from time to time; and

WHEREAS, SGMA requires the establishment of a groundwater sustainability agency ("GSA") or agencies for all basins designated as medium- or high-priority by the Department of Water Resources ("DWR") on or before June 30, 2017; and

WHEREAS, SGMA further requires the adoption of a groundwater sustainability plan ("GSP") or coordinated GSPs for all basins designated by DWR as medium- or high-priority and not subject to critical conditions of overdraft on or before January 31, 2022; and

WHEREAS, DWR has designated the San Luis Obispo Valley Groundwater Basin (Basin No. 3-9) ("Basin") as a medium-priority basin not subject to critical conditions of overdraft; and

WHEREAS, the County and the City have each decided to become the GSA within their respective service areas overlying the Basin and have informed DWR of their decision and intent to undertake sustainable groundwater management therein; and

WHEREAS, the County and the City desire to collectively develop a single GSP to sustainably manage the Basin; and

WHEREAS, the County and the City further desire to include the other Parties to this MOA who each constitute entities eligible to participate in a GSA (sometimes referred to individually as a "Participating Party" or collectively as the "Participating Parties") in the development of the GSP through the creation of the Groundwater Sustainability Commission.

NOW, THEREFORE, it is mutually understood and agreed as follows:

Section 1
Purpose

This MOA is entered into by the Parties for the purpose of establishing the manner in which the City and the County, with input from the Participating Parties, will coordinate in the development of a single GSP for the Basin that will be considered for adoption by the City Council and the County Board of Supervisors and subsequently submitted to DWR for approval. This MOA may also serve as the basis for continued cooperation among the City and the County in the management of the Basin during the period between adoption of the GSP by the City Council and the County Board of Supervisors and approval of the GSP by DWR. As more specifically set forth in Section 10.3 below, this MOA shall automatically terminate upon DWR's approval of the GSP for the Basin.

Section 2
Term

This MOA shall become effective on the date that the last of the six (6) Parties signs ("Effective Date") and shall remain in effect until terminated in accordance with Section 9.2 or Section 10.3 below.

Section 3
City and County Roles and Responsibilities

3.1 The City and the County shall work jointly to meet the objectives of this MOA.

3.2 The City and the County shall retain the services of a consultant(s) to meet the objectives of this MOA, including, but not limited to, preparation of a GSP for the Basin in accordance with the provisions set forth in Section 7 below.

3.3 The City and the County shall each designate a staff person(s) to participate in the development of the GSP and related technical studies through, without limitation, the provision of guidance and available data, in coordination with the consultant(s), and to administer the Groundwater Sustainability Commission (e.g. to, among other things, timely publish all agendas and take minutes).

3.4 The City and the County shall each be responsible for adopting the GSP and implementing the GSP within their respective service areas. Notwithstanding the foregoing, nothing contained in this MOA shall be construed as obligating either the City Council or the County Board of Supervisors to adopt the GSP developed pursuant to this MOA or as preventing either the City Council or the County Board of Supervisors from adopting the GSP developed under this MOA in the event that the other elects not to adopt it or in the event that the Groundwater Sustainability Commission fails to recommend approval.

3.5 The City and the County may lead certain Basin-wide public outreach and stakeholder involvement to improve development of the GSP.

3.6 The City shall be responsible for taking all legally required actions associated with its appointment of the member and alternate member to the Groundwater Sustainability Commission representing the City as set forth in Section 4.5, including, without limitation, all applicable requirements under the Maddy Act (Government Code §§ 54970 et seq.) and the County shall be responsible for taking all such actions associated with its appointment of the member and alternate member to the Groundwater Sustainability Commission representing the County and its confirmation of the members and alternate members to the Groundwater Sustainability Commission representing the Participating Parties as set forth in Section 4.4 and Section 4.3, respectively.

Section 4
Establishment of the Groundwater Sustainability Commission

4.1 The City and the County hereby establish the Groundwater Sustainability Commission to serve as an advisory committee to the City Council and the County Board of Supervisors in connection with preparation of the GSP and interim Basin management actions subject to each Participating Party making its required contributions under Section 6(B).

4.2 The Groundwater Sustainability Commission shall be composed of five (5) members: one (1) member representing the City, one (1) member representing the County, one (1) member representing EVGMWC, one (1) member collectively representing VRMWC and ERMWC and one (1) member representing GSWC.

4.3 Each of the Participating Parties shall nominate a member and an alternate member to represent it on the Groundwater Sustainability Commission subject to confirmation by the County Board of Supervisors with the exception that VRMWC and ERMWC shall jointly nominate a member and an alternate member to represent them subject to confirmation by the County Board of Supervisors. Said members shall serve at the pleasure of the County Board of Supervisors and may be removed at any time provided that the County Board of Supervisors shall have no authority to replace a removed member with an individual who has not been nominated by the relevant Participating Party or collection of Participating Parties.

4.4 The County Board of Supervisors shall appoint the member and alternate member representing the County and said members shall serve at the pleasure of the County Board of Supervisors.

4.5 The City Council shall appoint the member and alternate member representing the City and said members shall serve at the pleasure of the City Council.

4.6 All meetings of the Groundwater Sustainability Commission shall be conducted in accordance with the Ralph M. Brown Act (Government Code §§ 54950 et seq.).

4.7 A majority of the members of the Groundwater Sustainability Commission shall constitute a quorum for purposes of transacting business, except that less than a quorum may vote to adjourn the meeting.

4.8 Each member of the Groundwater Sustainability Commission shall be entitled to one (1) vote on any matter under consideration by the Groundwater Sustainability Commission.

4.9 All advisory opinions submitted by the Groundwater Sustainability Commission to the City Council and the County Board of Supervisors shall be supported by a majority of the members, except for the recommendation to adopt the GSP or any amendments thereto which shall be supported by at least four (4) of the members.

4.10 The County Board of Supervisors and the City Council may approve or reject any advisory opinion submitted by the Groundwater Sustainability Commission provided that in every case that the County Board of Supervisors or City Council rejects an advisory opinion of the Groundwater Sustainability Commission related to the contents or adoption of the GSP it shall do so only after holding a public hearing, at which time the members of the Groundwater Sustainability Commission shall have the right to appear and address the City Council and the County Board of Supervisors.

4.11 None of the members or alternate members shall be entitled to any compensation from the County or the City for their service on the Groundwater Sustainability Commission.

Section 5
Establishment of Additional Advisory Committees

The City Council and the County Board of Supervisors may from time to time jointly establish one or more additional advisory committees or establish standing or ad hoc committees to assist in carrying out the purposes and objectives of this MOA. Without limiting the foregoing, it is anticipated that the City Council and the County Board of Supervisors will establish a stakeholder advisory committee to the Groundwater Sustainability Commission to consider the interests of beneficial uses and users not already represented on the Groundwater Sustainability Commission consistent with Water Code Section 10723.2.

Section 6
Funding

The City and the County agree to jointly fund the costs associated with implementation of this MOA in accordance with and subject to the following:

A. Within sixty (60) days of the Effective Date and prior to each anniversary of the Effective Date, City and County staff shall prepare an annual budget for the GSAs to implement this MOA for approval by the City Council and the County Board of Supervisors.

B. Each of the Participating Parties shall be responsible for contributing the following funds to help defray the costs of the Groundwater Sustainability Commission and in consideration for their participation thereon within thirty (30) days of the Effective Date and within thirty (30) days of each anniversary of the Effective Date:

EVGMWC	$28,200
VRMWC	$4,550
ERMWC	$4,550
GSWC	$12,700

C. Subject to City Council and County Board of Supervisor approval of the annual budget, the City and County agree to fund the annual budget (less the contributions set forth in Section 6(B)) in accordance with the percentage allocations set forth below. Notwithstanding the foregoing and Section 10.1, the City Council and the County Board of Supervisors may amend said percentage allocations without the agreement of the Participating Parties.

County	70%
City	30%

D. It is anticipated that the vast majority of budgeted costs to be paid by the City and the County will involve costs for consultant services. Consequently, most City and County contributions will be paid in the manner described in Section 7 below.

Section 7
Retention of Consultants

7.1 The County agrees to act as the contracting agent to retain the services of a consultant(s) as described in Section 3.2 above.

7.2 Notwithstanding the foregoing, the County agrees that the City and one (1) member of the Groundwater Sustainability Commission not representing the City or the County designated by the Groundwater Sustainability Commission shall be included in the selection of any consultant retained by the County pursuant to this MOA. More specifically,

a staff representative from the City and the designated member of the Groundwater Sustainability Commission shall be given an opportunity to review and approve all requests for proposals prior to their release and to participate in the various stages of the selection process, including, but not limited to, review of proposals and participation on interview panels.

7.3 All consultant contracts entered into by the County pursuant to this MOA shall include the following: (1) a provision requiring that the consultant name the City as an additional insured, (2) an expected spend plan estimating the amount of the not to exceed contract amount that the consultant expects to invoice each month, and (3) a provision requiring that the consultant calculate both the County and City's share of each invoice consistent with Section 6(C) and send monthly invoices to both the County and the City showing the foregoing calculation.

7.4 Both the City and the County shall be responsible for remitting payment of their share of each monthly invoice directly to the consultant within thirty (30) days of receipt or within the time frame otherwise set forth in the consultant contract.

Section 8
Notice

8.1 To provide for consistent and effective communication among the Parties, each Party shall designate a representative as its central point of contact on matters relating to this MOA.

8.2 All notices, statements, or payments related to this MOA shall be deemed to have been duly given if in writing and delivered electronically, personally or mailed by first-class, registered or certified mail to the Parties at the addresses set forth in Exhibit A. The Parties may update Exhibit A from time to time without formal amendment to this MOA.

Section 9
Withdrawal and Termination

9.1 Any Participating Party may unilaterally withdrawal from this MOA without causing or requiring termination of this MOA. Withdrawal shall become effective upon thirty (30) days written notice to the remaining Parties' designated addresses as listed in Exhibit A. A Participating Party that has withdrawn from this MOA shall remain obligated to pay its allocation of the current annual budget. If a Participating Party withdraws, the Groundwater Sustainability Commission shall automatically be reconstituted to no longer include a member or alternate member representing the withdrawing Participating Party. In addition, the withdrawing Participating Party's annual contribution as set forth in Section 6(B) for all subsequent years shall be allocated among the remaining Participating Parties on a pro rata basis.

9.2 This MOA may be terminated by either the City or the County upon thirty (30) days written notice to all Parties' designated addresses as listed in Exhibit A. Upon termination, any unused portion of the cost contributions described in Section 6(B) and Section 6(C) as of the effective date of termination shall be returned to each Party on a pro rata basis. If the City terminates this MOA, it shall remain obligated to pay its cost share obligation under any existing consultant contract entered into by the County pursuant to this MOA.

Section 10
Miscellaneous

10.1 Subject to the exception set forth in Section 6(C), this MOA may be amended only by unanimous written consent of all current Parties.

10.2 This MOA may be executed in counterparts.

10.3 This MOA shall automatically terminate upon DWR's approval of the adopted GSP. Depending on the content of the GSP, the Parties may decide to enter into a new agreement to coordinate GSP implementation.

10.4 This MOA is made in the State of California, under the Constitution and laws of said State and is to be so construed.

10.5 If any provision of this MOA is determined to be invalid or unenforceable, the remaining provisions shall remain in full force and unaffected to the fullest extent permitted by law and regulation.

10.6 This MOA constitutes the sole, entire, integrated and exclusive agreement between the Parties regarding the contents herein. Any other contracts, agreements, terms, understandings, promises or representations not expressly set forth or referenced in this writing are null and void and of no force and effect.

10.7 The Parties agree and acknowledge that this MOA has been developed through negotiation, and that each Party has had a full and fair opportunity to revise the terms of this MOA. Consequently, the normal rule of construction that any ambiguities are to be resolved against the drafting party shall not apply in construing or interpreting this MOA.

[signatures to follow on next page]

IN WITNESS WHEREOF, the Parties have executed this MOA by authorized officials thereof on the dates indicated below.

CITY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

COUNTY OF SAN LUIS OBISPO

By:

Its:

Date

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: Deputy County Counsel

Date: Nov. 6, 2017

EDNA VALLEY GROWERS MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

VARIAN RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

EDNA RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

GOLDEN STATE WATER COMPANY

By: _____

Its: _____

Date: _____

IN WITNESS WHEREOF, the Parties have executed this MOA by authorized officials thereof on the dates indicated below.

CITY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

COUNTY OF SAN LUIS OBISPO

By: JOHN PESCHONG

Its: Chairperson, Board of Supervisors, County of San Luis Obispo, State of California

Date: January 9, 2018

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

ATTEST:

Tommy Gong, County Clerk-Recorder and Ex-Officio Clerk of the Board of Supervisors

By, SANDY CURRENS
Deputy Clerk

EDNA VALLEY GROWERS MUTUAL WATER COMPANY

By: _____

Its: President

Date: 11/2/17

VARIAN RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

EDNA RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

GOLDEN STATE WATER COMPANY

By: _____

Its: _____

Date: _____

IN WITNESS WHEREOF, the Parties have executed this MOA by authorized officials thereof on the dates indicated below.

CITY OF SAN LUIS OBISPO

By: _____

Its: Mayor

Date: 1/26/18

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: Asst. City Attorney

Date: 1/25/18

COUNTY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: deputy county counsel

Date: NOV. 6, 2017

EDNA VALLEY GROWERS MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

VARIAN RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

EDNA RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

GOLDEN STATE WATER COMPANY

By: _____

Its: _____

Date: _____

EXHIBIT A
PARTY ADDRESS LIST

County of San Luis Obispo
County Government Center, Room 206
San Luis Obispo, CA 93408
Attention: Wade Horton, Public Works Director

City of San Luis Obispo
Utilities Department
879 Morro Street
San Luis Obispo, CA 93401-2710
Attention: Carrie Mattingly, Utilities Director

Edna Valley Growers Mutual Water Company
4910 Edna Road
San Luis Obispo, CA 93401
Attention: Bob Schiebelhut, President

Varian Ranch Mutual Water Company
2060 Varian Circle
Arroyo Grande, CA 93420
Attention: James Lokey

Edna Ranch Mutual Water Company
5665 Edna Ranch Circle
San Luis Obispo, CA 93401
Attention: Andy Mangano

Golden State Water Company
2330 A Street, Suite A
Santa Maria, CA 93455
Attention: General Manager, Coastal District

EXHIBIT A
PARTY ADDRESS LIST

County of San Luis Obispo
County Government Center, Room 206
San Luis Obispo, CA 93408
Attention: Wade Horton, Public Works Director

City of San Luis Obispo
Utilities Department
879 Morro Street
San Luis Obispo, CA 93401-2710
Attention: Carrie Mattingly, Utilities Director

Edna Valley Growers Mutual Water Company
4910 Edna Road
San Luis Obispo, CA 93401
Attention: Bob Schiebelhut, President

Varian Ranch Mutual Water Company
2060 Varian Circle
Arroyo Grande, CA 93420
Attention: James Lokey

Edna Ranch Mutual Water Company
5665 Edna Ranch Circle
San Luis Obispo, CA 93401
Attention: Andy Mangano

Golden State Water Company
2330 A Street, Suite A
Santa Maria, CA 93455
Attention: General Manager, Coastal District

IN WITNESS WHEREOF, the Parties have executed this MOA by authorized officials thereof on the dates indicated below.

CITY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

COUNTY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

EDNA VALLEY GROWERS MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

EDNA RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

VARIAN RANCH MUTUAL WATER COMPANY

By: [signature]

Its: President

Date: 12/31/2017

GOLDEN STATE WATER COMPANY

By: _____

Its: _____

Date: _____

IN WITNESS WHEREOF, the Parties have executed this MOA by authorized officials thereof on the dates indicated below.

CITY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

COUNTY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

EDNA VALLEY GROWERS MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

VARIAN RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

EDNA RANCH MUTUAL WATER COMPANY

By: _____

Its: PRESIDENT

Date: 11/14/17

GOLDEN STATE WATER COMPANY

By: _____

Its: _____

Date: _____

IN WITNESS WHEREOF, the Parties have executed this MOA by authorized officials thereof on the dates indicated below.

CITY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

COUNTY OF SAN LUIS OBISPO

By: _____

Its: _____

Date: _____

APPROVED AS TO FORM AND LEGAL EFFECT:

By: _____

Its: _____

Date: _____

EDNA VALLEY GROWERS MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

EDNA RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

VARIAN RANCH MUTUAL WATER COMPANY

By: _____

Its: _____

Date: _____

GOLDEN STATE WATER COMPANY

By: Denise Kuy

Its: Sr. Vice President

Date: November 3, 2017

Draft

Groundwater Sustainability Plan Chapter 3 – Description of Plan Area and Chapter 4 - Basin Setting

for the

San Luis Obispo Valley Groundwater Basin Groundwater Sustainability Agencies

Prepared by

12/2/2019

TABLE OF CONTENTS

Table of Contents i
List of Figures vii
Tables viii
Appendices ix
List of Terms Used x
Executive Summary 1
3 Description of Plan Area (§ 354.8) 2
3.1 SLO Basin Introduction 2
3.2 Adjudicated Areas 5
3.3 Jurisdictional Areas 5
3.3.1 Federal Jurisdictions 5
3.3.2 Tribal Jurisdiction 5
3.3.3 State Jurisdictions 5
3.3.4 County Jurisdictions 5
3.3.5 City and Local Jurisdictions 5
3.3.6 Special Districts 5
3.4 Land Use 5
3.4.1 Water Source Types 9
3.4.2 Water Use Sectors 11
3.5 Density of Wells 13
3.6 Existing Monitoring and Management Programs 18
3.6.1 Groundwater Monitoring 18
3.6.1.1 Groundwater Level Monitoring 18
3.6.1.2 Groundwater Quality Monitoring 18
3.6.1.3 Surface Water Monitoring 20
3.6.1.4 Climate Monitoring 20
3.6.2 Existing Management Plans 24
3.6.2.1 SLO Basin Characterization and Monitoring Well Installation 24
3.6.2.2 San Luis Obispo County Master Water Report (2012) 24
3.6.2.3 San Luis Obispo County Integrated Regional Water Management Plan (2014) 25
3.6.2.4 City of San Luis Obispo 2015 Urban Water Management Plan (2016) 25
3.6.3 Existing Groundwater Regulatory Programs 25
3.6.3.1 Groundwater Export Ordinance (2015) 25

3.6.3.2 Well Ordinances, County and City 25
3.6.3.3 Countywide Water Conservation Program Resolution 2015-288 (2015) 26
3.6.3.4 Agricultural Order R3-2017-002 (2017) 26
3.6.3.5 Water Quality Control Plan for the Central Coast Basins (2017) 26
3.6.3.6 California DWR Well Standards (1991) 26
3.6.3.7 Requirements for New Wells (2017) 27
3.6.3.8 Title 22 Drinking Water Program (2018) 27
3.6.3.9 Waterway Management Plan – San Luis Obispo Creek Watershed (2003) 27
3.6.3.10 Incorporation Into GSP 27
3.6.3.11 Limits to Operational Flexibility 27
3.7 Conjunctive Use Programs 28
3.8 Land Use Plans 28
3.8.1 City of San Luis Obispo General Plan 28
3.8.2 County of San Luis Obispo General Plan 29
3.8.3 Los Ranchos/Edna Village Plan 30
3.8.4 Plan Implementation Effects on Existing Land Use 31
3.8.5 Plan Implementation Effects on Water Supply 32
3.8.6 Well Permitting 32
3.8.7 Land Use Plans Outside of Basin 32
3.9 Management Areas 32
3.9.1 Reason for Creation 32
3.10 Additional GSP Elements, if Applicable 32
4 Basin Setting (§ 354.14) 33
4.1 Basin Topography and Boundaries 33
4.2 Primary Users of Groundwater 40
4.3 Soils Infiltration Potential 40
4.4 Regional Geology 42
4.4.1 Regional Geologic Structures 42
4.4.2 Geologic Formations within the Basin 42
4.4.2.1 Alluvium 46
4.4.2.2 Paso Robles Formation 46
4.4.2.3 Pismo Formation 46
4.4.3 Geologic Formations Surrounding the Basin 47
4.4.3.1 Monterey Formation 47
4.4.3.2 Obispo Formation 47

4.4.3.3 Franciscan Assemblage 47
4.5 Principal Aquifers and Aquitards 48
4.5.1 Cross Sections 48
4.5.2 Aquifer Characteristics 65
4.5.3 Aquitards 70
4.6 Surface Water Bodies 70
4.7 Subsidence Potential 71
5 Groundwater Conditions (§ 354.16) .....
5.1 Groundwater Elevations and Interpretation .....
5.1.1 Groundwater Levels .....
5.1.2 Groundwater Level Trends .....
5.1.3 Vertical Groundwater Gradients .....
5.1.4 Groundwater Contours .....
5.2 Change in Storage .....
5.3 Seawater Intrusion .....
5.4 Groundwater Quality Distribution and Trends .....
5.4.1 Anthropogenic Constituents: Diffuse Sources .....
5.4.2 Anthropogenic Constituents: Point Sources .....
5.4.3 Natural Constituents: Diffuse Sources .....
5.4.4 Natural Constituents: Point Sources .....
5.5 Subsidence .....
5.6 Interconnected Surface Water .....
5.6.1 Streams and Lakes .....
5.6.2 Groundwater-Dependent Ecosystems .....
6 Water Budget (§ 354.18) .....
6.1 Climate .....
6.1.1 Historical Climate .....
6.1.2 Projected Climate .....
6.2 Water Budget Data Sources and Groundwater Model .....
6.3 Historical Water Budget .....
6.3.1 Historical Time Period .....
6.3.2 Inflows .....
6.3.3 Outflows .....
6.3.4 Change in Storage .....
6.3.5 Sustainable Yield .....

6.3.6 Quantification of Overdraft .....
6.4 Current Water Budget.....
6.4.1 Inflows.....
6.4.2 Outflows.....
6.4.3 Change In Storage .....
6.4.4 Sustainable Yield .....
6.4.5 Quantification of Overdraft .....
6.5 Projected Water Budget .....
6.5.1 Assumptions.....
6.5.2 Inflows.....
6.5.3 Outflows.....
6.5.4 Change In Storage .....
7 Sustainable Management Criteria (§ 354.22-30).....
7.1 Sustainability Goal.....
7.2 Process for Establishing Sustainable Management Criteria .....
7.2.1 Minimum Thresholds .....
7.2.2 Measurable Objectives .....
7.2.3 Undesirable Results.....
7.3 Chronic Lowering of Groundwater Levels Sustainability Indicator.....
7.3.1 Locally Defined Undesirable Results .....
7.3.2 Minimum Thresholds and Measurable Objectives .....
7.3.3 Relation to Other Sustainability Indicators.....
7.4 Change in Storage Sustainability Indicator .....
7.4.1 Locally Defined Undesirable Results .....
7.4.2 Minimum Thresholds .....
7.4.3 Measurable Objectives .....
7.4.4 Relation to Other Sustainability Indicators.....
7.5 Seawater Intrusion Sustainability Indicator.....
7.5.1 Locally Defined Undesirable Results .....
7.5.2 Minimum Thresholds .....
7.5.3 Measurable Objectives .....
7.5.4 Relation to Other Sustainability Indicators.....
7.6 Degraded Water Quality Sustainability Indicator .....
7.6.1 Locally Defined Undesirable Results .....
7.6.2 Minimum Thresholds .....

7.6.3 Measurable Objectives .....
7.6.4 Relation to Other Sustainability Indicators .....
7.7 Subsidence Sustainability Indicator .....
7.7.1 Locally Defined Undesirable Results .....
7.7.2 Minimum Thresholds .....
7.7.3 Measurable Objectives .....
7.7.4 Relation to Other Sustainability Indicators .....
7.8 Depletion of Interconnected Surface Water Sustainability Indicator .....
7.8.1 Locally Defined Undesirable Results .....
7.8.2 Minimum Thresholds .....
7.8.3 Measurable Objectives .....
7.8.4 Relation to Other Sustainability Indicators .....
7.9 Management Areas .....
7.9.1 Minimum Thresholds and Measurable Objectives .....
7.9.2 Monitoring and Analysis .....
7.9.3 Explanation of How Operation of Management Area Will Avoid Undesirable Results .....
8 Monitoring Networks (§ 354.34) .....
8.1 Monitoring Objectives .....
8.2 Monitoring Network .....
8.2.1 Chronic Lowering of Groundwater Levels .....
8.2.2 Reduction of Groundwater Storage .....
8.2.3 Seawater Intrusion .....
8.2.4 Groundwater Quality .....
8.2.5 Land Subsidence .....
8.2.6 Depletion of Interconnected Surface Water .....
8.3 Groundwater Monitoring Protocol .....
8.4 Data Management System .....
8.5 Assessment and Improvement of Monitoring Network .....
8.6 Annual Reports .....
8.7 Periodic Evaluation by Agency .....
9 Projects and Management Actions (§ 354.44) .....
9.1 Projects .....
9.1.1 Project A .....
9.2 Management Actions .....
9.2.1 Management Action A .....

9.3 Projects Needed to Mitigate Overdraft .....
10 Implementation Plan .....
10.1 Cost of Implementation .....
10.2 Funding Alternatives .....
10.3 Implementation Schedule .....
10.4 GSP Annual Reporting .....
10.5 Periodic Evaluations of GSP .....
11 Notice and Communications (§ 354.10) .....
11.1 Communications and Engagement Plan .....
11.2 Nature of Consultations .....
11.3 Public Meetings .....
11.4 Incorporation of Feedback in Decision-Making Process .....
11.5 Comments Received .....
11.6 Responses to Comments .....
12 Interagency Agreements (§ 357.2-4) .....
12.1 Coordination Agreements .....
13 References .....
14 Appendices .....

LIST OF FIGURES

Figure 1-1: San Luis Obispo Valley Basin and Surround 1
Figure 3-1: San Luis Obispo Historical Annual Precipitation. 4
Figure 3-2: San Luis Obispo Valley Basin Existing Land Use Designations. 8
Figure 3-3: San Luis Obispo Valley Basin Water Supply Sources. 10
Figure 3-4: San Luis Obispo Valley Basin Water Use Sectors. 12
Figure 3-5: San Luis Obispo Valley Basin Domestic Well Density. 14
Figure 3-6: San Luis Obispo Valley Basin Production Well Density. 15
Figure 3-7: San Luis Obispo Valley Basin Public Supply Well Density. 16
Figure 3-8: San Luis Obispo Valley Basin Public Supply Well Density. 17
Figure 3-9: Monitored Wells in the San Luis Obispo Valley Basin 19
Figure 3-10: San Luis Obispo Valley Basin Surface Water Features, Weather Stations, and Stream Gauges. 22
Figure 3-11: San Luis Obispo Valley Basin Historical Annual Precipitation and CDFM. 23
Figure 3-12. City Land Use Map 28
Figure 3-13. County Land Use Map (San Luis Obispo Planning Area) 29
Figure 3-14. County Land Use Map (South County Planning Area) 30
Figure 3-15. Los Ranchos/Edna Land Use Map 31
Figure 4-1: Topographic map. 35
Figure 4-2: Aerial Photograph. 36
Figure 4-3: Annual Precipitation. 37
Figure 4-4: Bottom Elevation of Basin. 38
Figure 4-5: Thickness of Basin Sediments. 39
Figure 4-6: Soil Hydrologic Groups. 41
Figure 4-7: Stratigraphic Column. 43
Figure 4-8: Geologic Map. 44
Figure 4-9: Lithologic Data Points and Cross Section Lines. 51
Figure 4-10: Cross Section A1-A2. 52
Figure 4-11: Cross Section A2-A3. 53
Figure 4-12: Cross Section A3-A4. 54
Figure 4-13: Cross Section B-B'. 55
Figure 4-14: Cross Section C1-C1'. 56
Figure 4-15: Cross Section C2-C2'. 57
Figure 4-16: Cross Section D-D'. 58
Figure 4-17: Cross Section E-E'. 59
Figure 4-18: Cross Section F-F'. 60
Figure 4-19: Cross Section G-G'. 61
Figure 4-20: Cross Section H-H'. 62
Figure 4-21: Cross Section I-I'. 63
Figure 4-22: Hydraulic Parameter Data Locations. 66
Figure 4-23: Subsidence Potential. 74

TABLES

Table 3-1: Land use categories defined for the SLO Basin by DWR (2014). 7
Table 3-2: Summary of surface water supply sources available to the SLO Basin..... 9
Table 3-3: DWR and County Wells 13
Table 3-4: Stream gauges and summary of records available. 20
Table 3-5: Weather station Information and summary of records available. 21
Table 3-6. Average Monthly Climate Summary 1987 – 2018 at Cal Poly Weather Station 52. 24
Table 3-7. Los Ranchos/Edna Land Use Acreage 31
Table 4-1: SLO Basin Well Aquifer Test Data Summary. 68
Table 4-2: SLO Basin Well Specific Capacity Data Summary. 69

APPENDICES

LIST OF TERMS USED

Abbreviation	Definition
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
AMSL	Above Mean Sea Level
Basin Plan	Water Quality Control Plan for the Central Coast Basin
Cal Poly	California Polytechnic State University
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of San Luis Obispo
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CPWS-52	Cal Poly Weather Station 52
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ERMWC	Edna Ranch Mutual Water Company
ET_0	Evapotranspiration
EVGMWC	Edna Valley Growers Ranch Mutual Water Company
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet
MCL	Maximum Contaminant Level

Abbreviation	Definition
MG	Million Gallons
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCDC	National Climate Data Center
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLO Basin	San Luis Obispo Valley Groundwater Basin
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SCML	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
VRMWC	Varian Ranch Mutual Water Company
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is complete.

3 DESCRIPTION OF PLAN AREA (§ 354.8)

3.1 SLO BASIN INTRODUCTION

The SLO Basin is oriented in a northwest-southeast direction and is composed of unconsolidated or loosely consolidated sedimentary deposits. It is approximately 14 miles long and 1.5 miles wide. It covers a surface area of about 12,700 acres (19.9 square miles). The SLO Basin is bounded on the northeast by the relatively impermeable bedrock formations of the Santa Lucia Range, and on the southwest by the formations of the San Luis Range and the Edna fault system. The bottom of the SLO Basin is defined by the contact of permeable sediments with the impermeable bedrock Miocene-aged and Franciscan Assemblage rocks. The SLO Basin is commonly referenced as being composed of two distinct valleys, with the San Luis Valley in the northwest and the Edna Valley in the southeast.

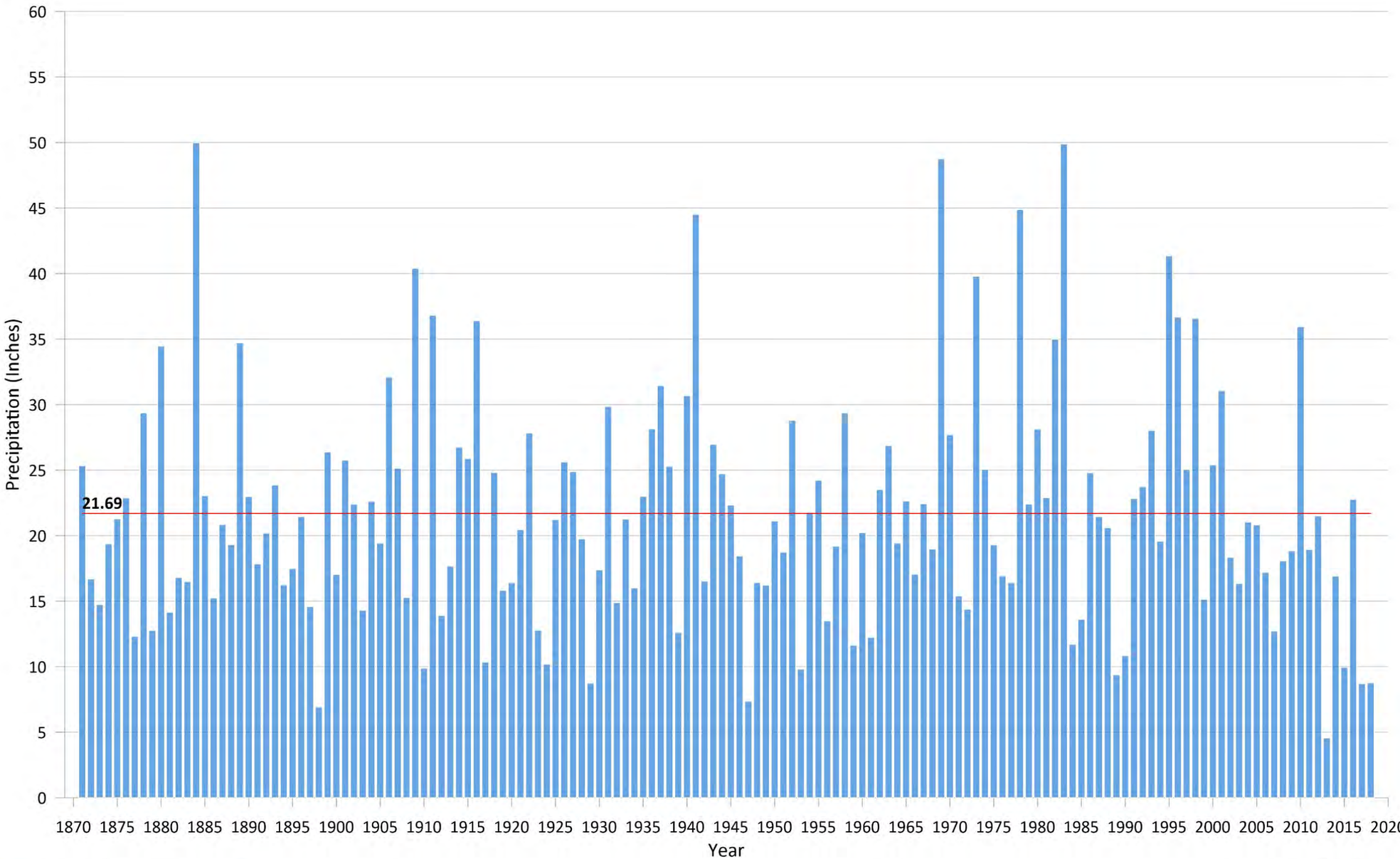
The San Luis Valley comprises approximately the northwestern half of the SLO Basin. It is the area of the SLO Basin drained by San Luis Obispo Creek and its tributaries (Prefumo Creek and Stenner Creek west of Highway 101, Davenport Creek and smaller tributaries east of Highway 101). Surface drainage in San Luis Valley drains out of the SLO Basin, flowing to the south along the course of San Luis Obispo Creek, toward the coast in the Avila Beach area, approximately along the course of Highway 101. The San Luis Valley includes part of the City and California Polytechnic State University (Cal Poly) jurisdictional boundaries, while the remainder of the San Luis Valley is unincorporated land. Land use in the City is primarily single- and multi-family residential, commercial, industrial, and a small amount of land in agricultural uses. The area in the northwest part of the SLO Basin, along Los Osos Valley Road, has significant areas of irrigated agriculture, primarily row crops.

The Edna Valley comprises approximately the southeastern half of the SLO Basin. The primary creeks that drain the SLO Basin are the east and west branches of Corral de Piedras Creek, which join to form Pismo Creek, draining south out of the Edna Valley into Price Canyon. Smaller unnamed tributaries drain south from the SLO Basin in the extreme southeastern part of Edna Valley, ultimately joining Pismo Creek. Some of the unincorporated lands in Edna Valley are served by various private water purveyors. The primary land use in the Edna Valley is agriculture. During the past two decades wine grapes have become the most significant crop type in the Edna Valley.

The physical definition of the SLO Basin boundary is the contact between the unconsolidated or loosely consolidated sediments and the basement rock of the Miocene-aged formations and Franciscan Assemblage. There is a topographic high point in the underlying bedrock elevation between the San Luis and Edna sub-basins. The watershed divide and the bedrock divide are not coincident. The sediments of the Edna Valley have significantly greater thickness than those of the San Luis Valley. Precipitation that falls west of that divide ultimately flows to Davenport and San Luis Obispo Creeks, and precipitation that falls east of that divide flows to Corral de Piedras Creek or the other small tributaries, ultimately flowing to Pismo Creek south of the SLO Basin.

The primary weather patterns for the SLO Basin derive from seasonal patterns of atmospheric conditions that originate over the Pacific Ocean and move inland. As storm fronts move in from the coast, rainfall in the area falls more heavily in the mountains, and the SLO Basin itself receives less rainfall because of a muted rain shadow effect. Average annual precipitation ranges from approximately 18 inches throughout most of the SLO Basin to about 22 inches in relatively higher elevation areas near the City and Cal Poly. Figure 3-1 presents the time series of annual precipitation for the period of record from 1870 to 2018 at the Cal Poly weather station No. 52. The average historical rainfall at this location to date is 21.69 inches, with a

standard deviation of 8.75 inches. The historical maximum is 49.99 inches, which occurred in 1884. The historical minimum is 4.56 inches, which occurred in 2013.



Prepared for:
SAN LUIS OBISPO VALLEY BASIN GSP
Author: EC
11/26/2019

Legend
Precipitation (Annual)
Historical Average Precipitation

Notes:
1. Data Source: Cal Poly State University, Cal Poly/NOAA Station

San Luis Obispo Historical Annual Precipitation

Figure 3-1

3.2 ADJUDICATED AREAS

The SLO Basin is not an adjudicated basin.

3.3 JURISDICTIONAL AREAS

In addition to MOA Parties, there are several entities that have some degree of water management authority in the SLO Basin. Each entity is discussed below.

3.3.1 Federal Jurisdictions

There are no federal agencies with land holdings in the SLO Basin.

3.3.2 Tribal Jurisdiction

The two prominent Native American tribes in the County are the Obispeño Chumash and Salinan Indian Tribes. The Chumash occupied the coast between San Luis Obispo and northwestern Los Angeles County, inland to the San Joaquin Valley. They were divided into two broad groups, of which the Obispeño were the northern group. The Salinan were northern neighbors of the Chumash, and although the presence of a firm boundary between the Chumash and the Salinan is uncertain, ethnographic accounts have placed Salinan territories in the northern portion of the County. However, these two tribes do not have any recognized tribal land in the SLO Basin.

3.3.3 State Jurisdictions

The State of California University system owns and operates land that is associated with California Polytechnic State University, San Luis Obispo (Cal Poly) located in the northern edge of the SLO Basin off Hwy 1. Cal Poly is a significant user of local water sources and manages their water supply in conjunction with the City. The City treats the wastewater generated from Cal Poly. There are no California State Parks or other State-owned lands or entities located within the SLO Basin.

3.3.4 County Jurisdictions

The County of San Luis Obispo and the associated San Luis Obispo County Flood Control and Water Conservation District (SLOFCWCD) (see section under Special Districts below) have jurisdiction over the entire County including the SLO Basin. The County owns approximately 300 acres of land in the SLO Basin and is primarily located in the vicinity of the SLO County Airport which makes up the majority of the land owned by the County.

3.3.5 City and Local Jurisdictions

The City is centrally located in the SLO Basin and has land and water management authority over its incorporated area. The City has four primary water supply sources including Whale Rock Reservoir, Salinas Reservoir, Nacimiento Reservoir, and recycled water (for irrigation), with groundwater serving as a fifth supplemental source. Three major mutual water companies exist in the SLO Basin: Edna Valley Growers, Varian Ranch, and Edna Ranch Mutual Water Companies. One investor owned utility exists within the SLO Basin: Golden State Water Company (GSWC). GSWC provides groundwater that is pumped from the Edna Valley Basin to residential and agriculture customers.

3.3.6 Special Districts

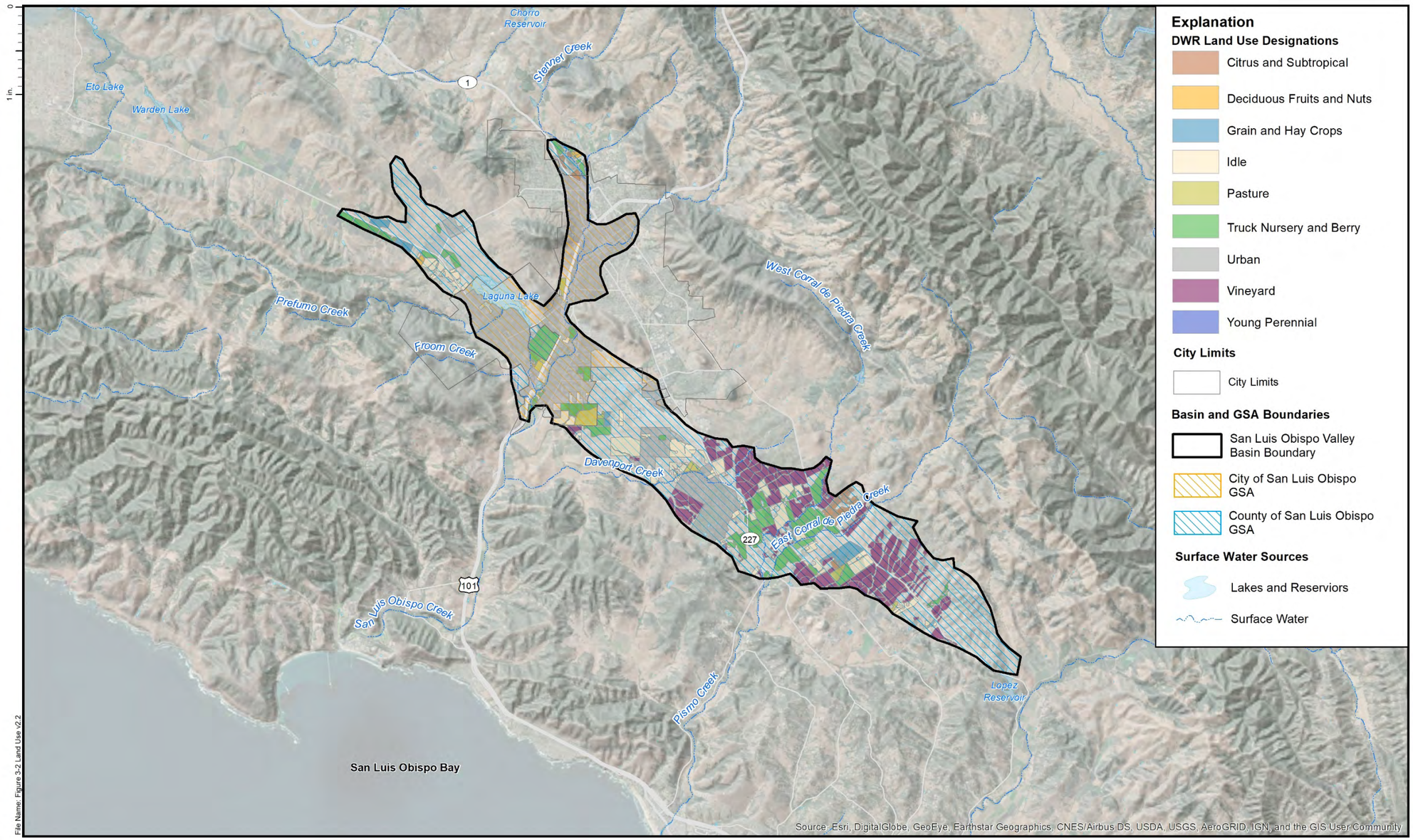
The San Luis Obispo Flood Control and Water Conservation District (SLOFCWCD) is a dependent Special District governed by the County Board of Supervisors. It has jurisdiction over all of the County including the SLO Basin and was established as a resource to help individuals and communities in San Luis Obispo County identify and address flooding problems with the purpose "to provide for control, disposition and distribution of the flood and storm waters of the district and of streams flowing into the district...".

3.4 LAND USE

The County, City and State have land use authority in the SLO basin within their respective jurisdictions. Land use information for the SLO Basin was based on DWR's land use database (DWR, 2014). The 2014 land use in the SLO Basin is shown on Figure 3-2 and is summarized by group in . All land use categories except native vegetation listed in Table 3-1 are provided by DWR (DWR, 2014). The areas of the basin that did not have a land use designation were assumed to be native vegetation.

Table 3-1: Agricultural Land use categories defined for the SLO Basin by DWR (2014).

Land Use Category	**Acres**
Citrus and subtropical	136
Deciduous fruits and nuts	21
Grain and hay crops	183
Idle	713
Pasture	179
Truck nursery and berry crops	1079
Urban	6,412
Vineyard	1,929
Young perennial	2
Native vegetation	<1
Total	**10,656**



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COUNTY OF SAN LUIS OBISPO
Author: EC
Date: 11/22/2019
SAN LUIS OBISPO VALLEY BASIN GSP

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
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Notes:
1. Land Use Designations from DWR (2014); data obtained from gis.water.ca.gov
2.
3.

San Luis Obispo Valley Basin Land Use Designations

Figure 3-2

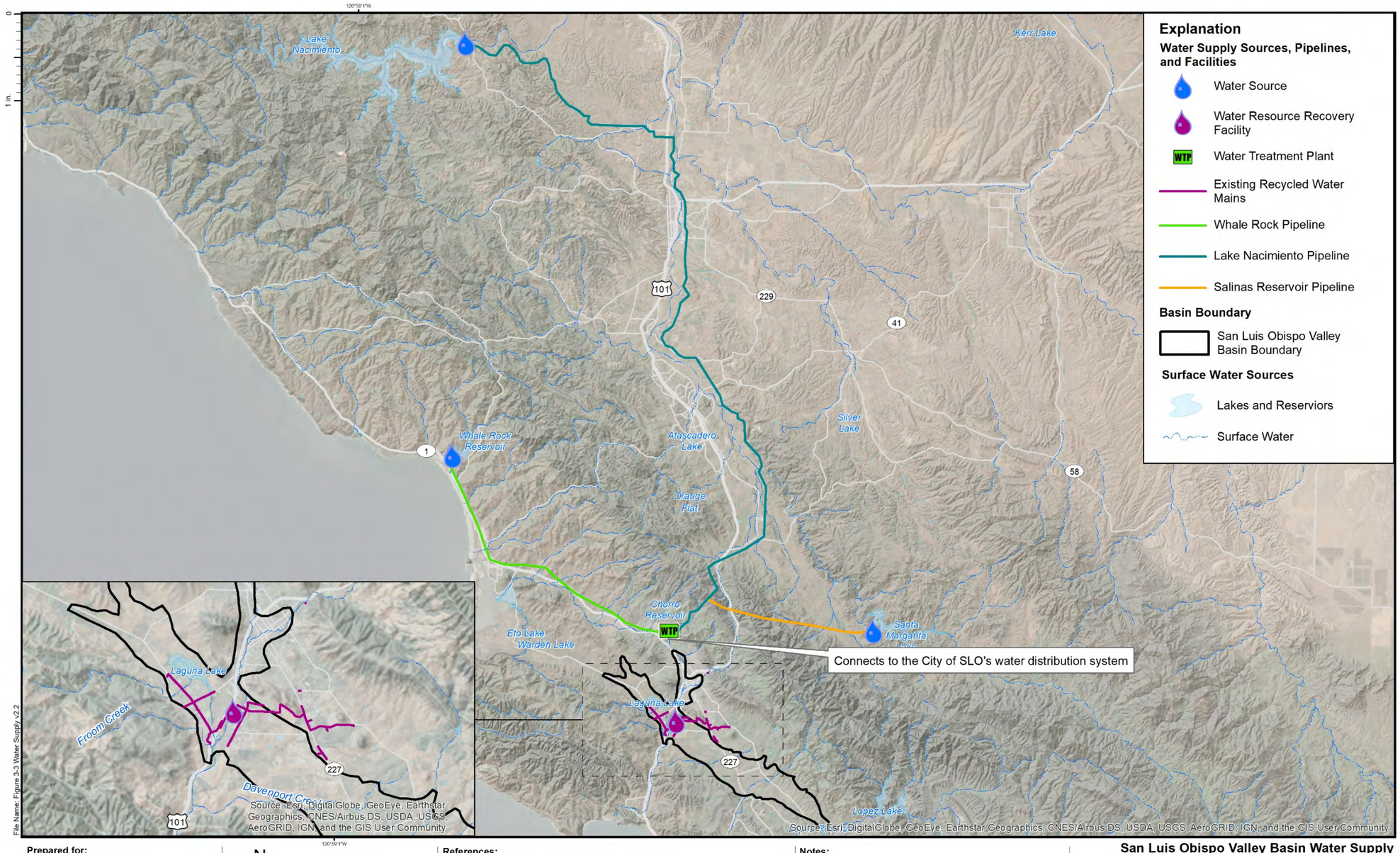
3.4.1 Water Source Types

Entities in the SLO Basin utilize three types of water sources to meet the demands: groundwater, surface water, and recycled water. Excluding the City, Cal Poly, and Edna Valley Golf Course, all water demand in the SLO Basin are met with groundwater. Cal Poly has rights to 33.71% of water from Whale Rock Reservoir and the rest of their water supply comes from local groundwater. The City has an entitlement to water from the Nacimiento Water Project, rights to Salinas Reservoir (Santa Margarita Lake), rights to 55.05% of water in Whale Rock Reservoir, SLO Basin groundwater, and recycled water from the City's Water Resource Recovery Facility (WRRF). The City has imported supplies from Salinas Reservoir, located near the community of Santa Margarita, since 1944, Whale Rock Reservoir, located near the community of Cayucos, since 1961, and Lake Nacimiento since 2011. Table 3-2 summarizes the surface water supply available from each source and Table 3-3 shows the location of water supply source types within the SLO Basin.

Table 3-2: Summary of surface water supply sources available to the SLO Basin.

Supply Sources	Amount Available (AFY)
Nacimiento Reservoir- City	5,482[1]
Salinas Reservoir - City	4,910[1]
Whale Rock Reservoir - City	
Recycled Water - City	~1,000[1]
Total	**11,392**

[1] City of San Luis Obispo, General Plan, Water and Wastewater Management Element, 2018..



San Luis Obispo Valley Basin Water Supply Sources

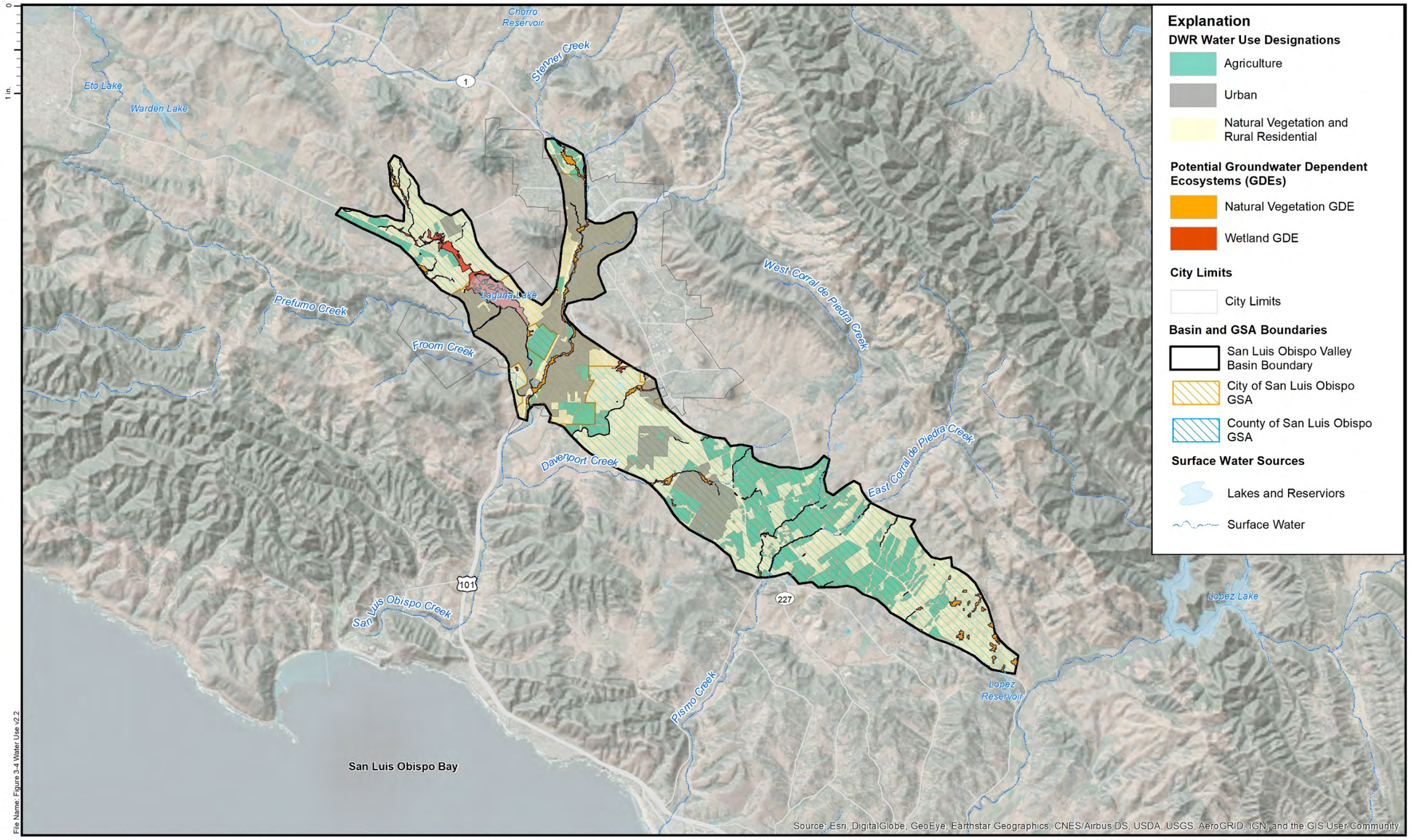
Figure 3-3

3.4.2 Water Use Sectors

Water demand in the SLO Basin is organized into the six water use sectors identified in the GSP Emergency Regulations. These include:

- **Urban-** Urban water use is assigned to non-agricultural water uses in the City and census-designated places. Domestic use outside of census-designated places is not considered urban use.
- **Industrial-** There is limited industrial use in the SLO Basin. The DWR land use designations in the SLO Basin does not include industrial uses.
- **Agricultural-** This is the largest groundwater use sector in the SLO Basin by water demand.
- **Managed wetlands-** There are several managed wetlands in the SLO Basin that are managed by both federal, state, and local agencies. In general, wetlands in the area are managed by either of the following agencies: (1) City of San Luis Obispo, (2) California Department of Fish and Wildlife, (3) California State Water Resources Control Board, (4) U.S. Fish and Wildlife Service, and (5) U.S. Army Corps of Engineers. The wetlands and natural vegetation areas that are potentially dependent ecosystems include Laguna Lake and reaches of the San Luis Obispo Creek, Prefumo Creek, Stenner Creek, Davenport Creek, East and West Corral De Piedra Creeks, and Pismo Creek. Water use for these ecologically sensitive areas will be addressed in the water budget and modeling scope of this GSP in order to designate appropriate management actions and proposed projects to provide adequate water supply for natural water use of these areas.
- **Managed recharge-** There is no managed recharge in the SLO Basin. Recycled water discharge to creeks and applied irrigation is included in the urban water use sector.
- **Native vegetation-** This is the largest water use sector in the SLO Basin by land area. This sector includes rural residential areas.

Figure 3-4 shows the distribution of the water use sectors and potential groundwater dependent ecosystems in the SLO Basin.



File Name: Figure 3-4 Water Use v2.2

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SAN LUIS OBISPO VALLEY BASIN GSP

Author: EC
Date: 11/22/2019

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Notes:
1. Land Use Designations from DWR (2014); data obtained from gis.water.ca.gov
2. GDE data obtained from gis.water.ca.gov
3.

San Luis Obispo Valley Basin Water Use Sectors and Potential Groundwater Dependent Ecosystems (GDEs)

Figure 3-4

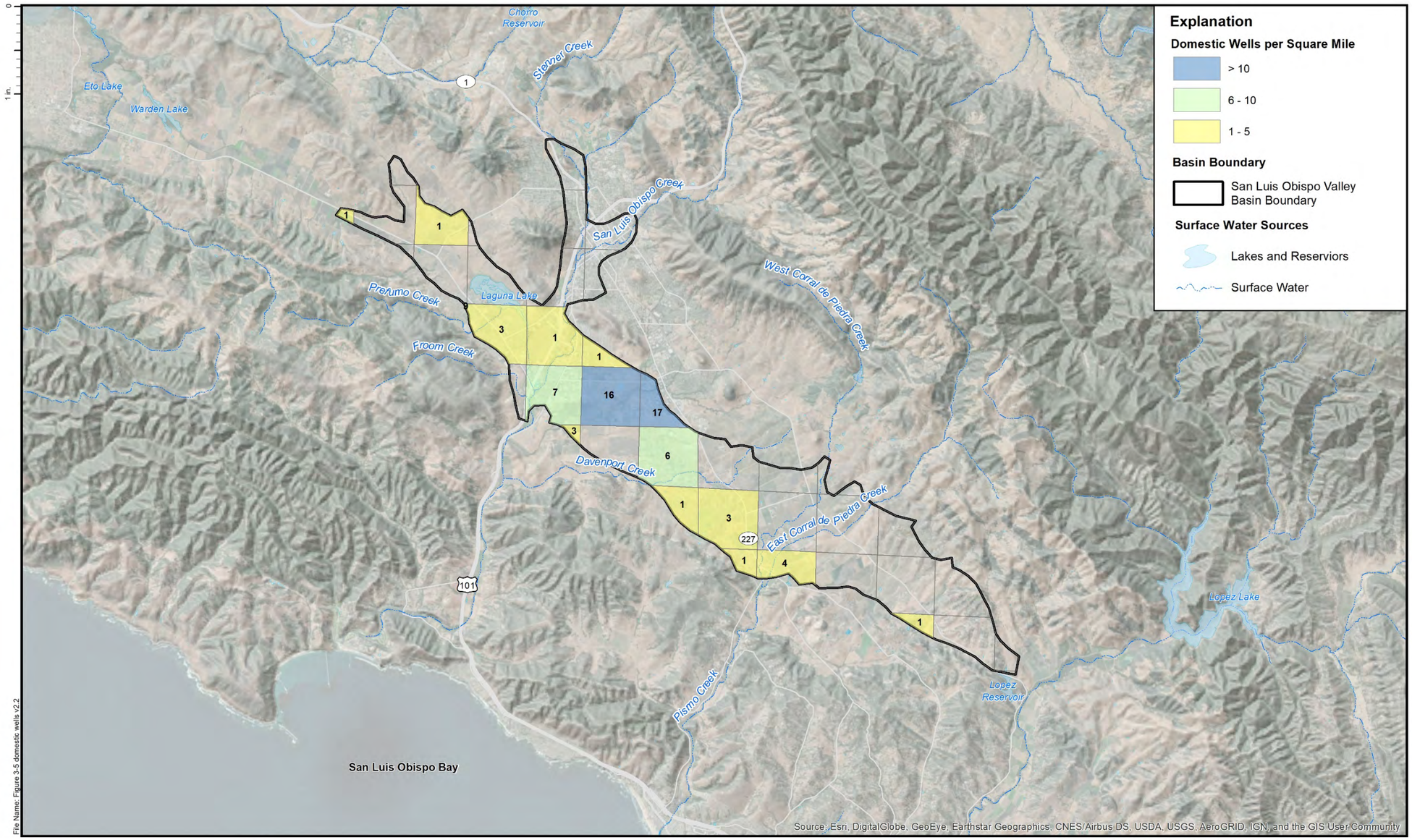
3.5 DENSITY OF WELLS

Well types, well depth data, and well distribution data were downloaded from DWR's well completion report map application (DWR, 2018). DWR categorizes wells in this mapping application as either domestic, production, or public supply. These categories are based on the well use information submitted with the well logs to DWR. Well information was also collected from County of San Luis Obispo Environmental Health Services (EHS). The EHS dataset was compiled from information gained from the well construction permit application process. Table 3-3 summarizes the types of wells by use for all well logs submitted to DWR and EHS.

Table 3-3: DWR and County Wells

Well Data Source	Type of Well	Total No. of Wells
DWR	Domestic	75
	Production	71
	Public Supply	24
	Total	*170*
County EHS	Domestic Private	355
	Domestic Public	43
	Irrigation	231
	Total	*629*

Figure 3-5, Figure 3-6, and Figure 3-7 show the density of wells in the SLO Basin by their types of use. The DWR data used to develop these maps is not necessarily the same set of well data held EHS as shown in Figure 3-8. DWR data was used to develop maps of well densities because they are organized for easy mapping of well density per square mile. These maps should be considered representative of well distributions, but are not definitive. It is also important to note that both the DWR and EHS well databases are not updated with information regarding well status and the well locations are not verified in the field. Therefore, it is uncertain whether the wells in these databases are currently active or have been abandoned or destroyed.



File Name: Figure 3-5 domestic wells v2.2

Prepared for:

Author: EC
Date: 11/24/2019

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
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Notes:
1. Well data provided by DWR (2018); data obtained from gis.water.ca.gov
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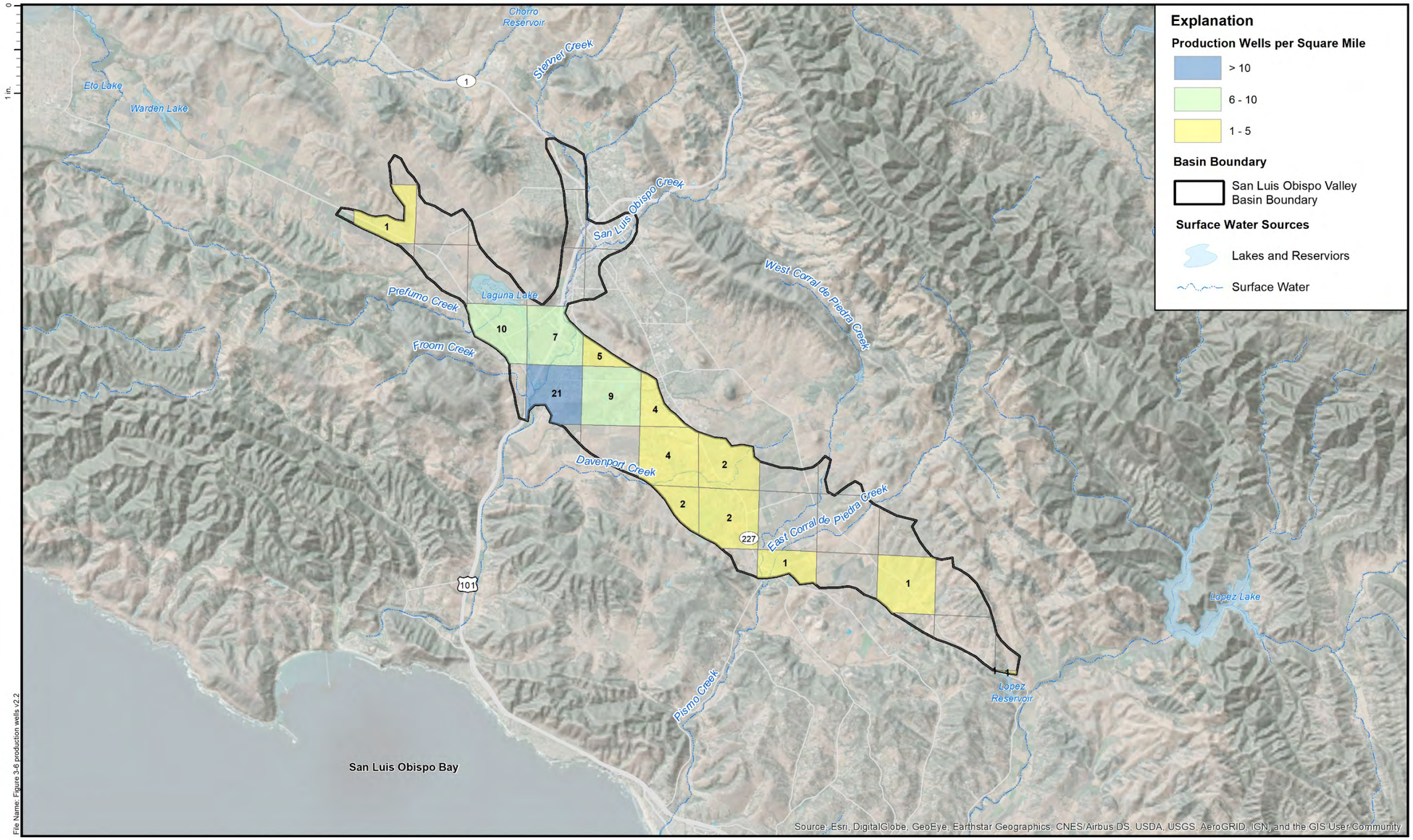
San Luis Obispo Valley Basin Domestic Well Density

Figure 3-5



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Author: EC
Date: 11/24/2019

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
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Notes:
1. Well data provided by DWR (2018); data obtained from gis.water.ca.gov
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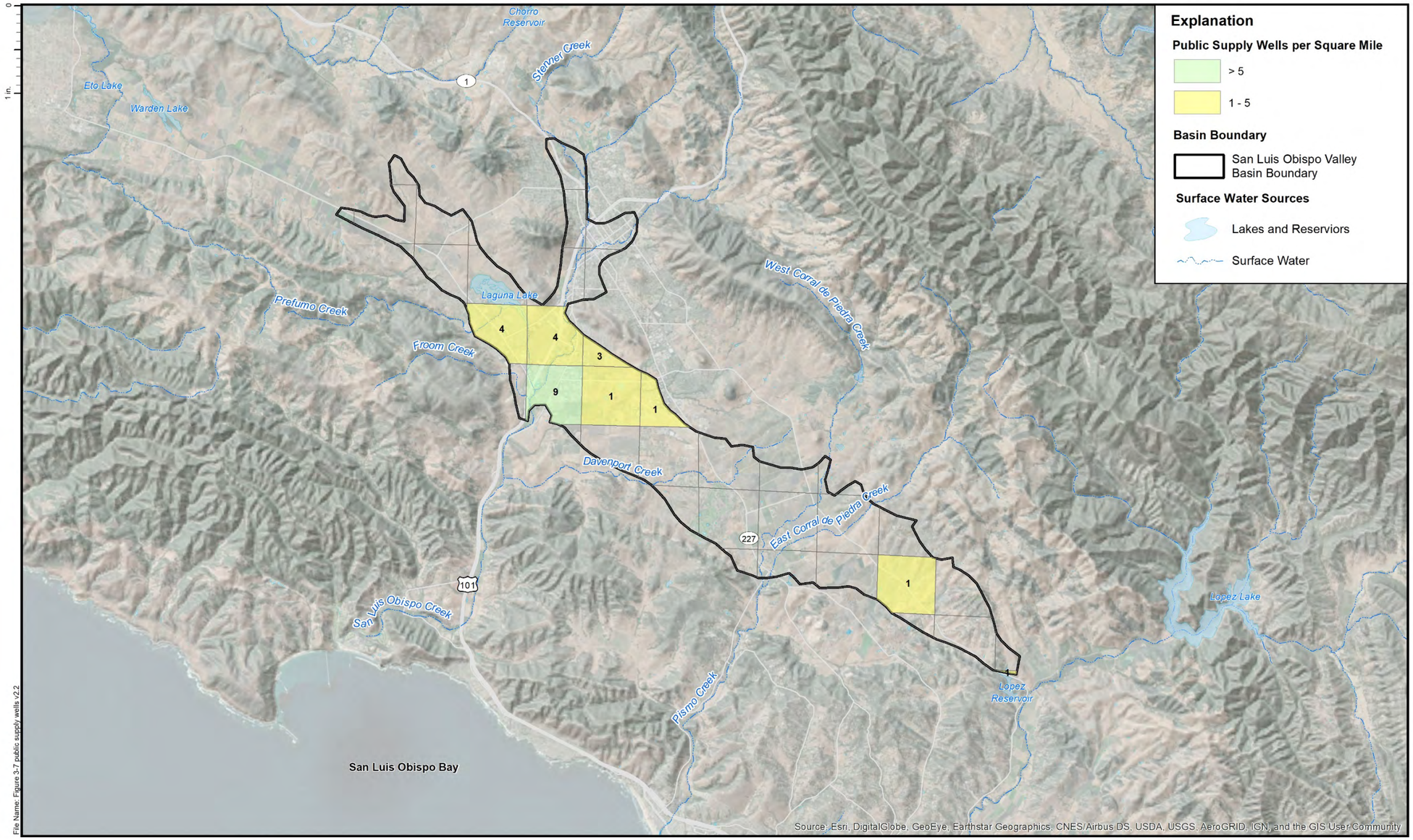
3.

San Luis Obispo Valley Basin Production Well Density

Figure 3-6



File Name: Figure 3-7 public supply wells v2.2

Prepared for:
SAN LUIS OBISPO VALLEY BASIN GSP

Author: EC
Date: 11/24/2019

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
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Notes:
1. Well data provided by DWR (2018); data obtained from gis.water.ca.gov
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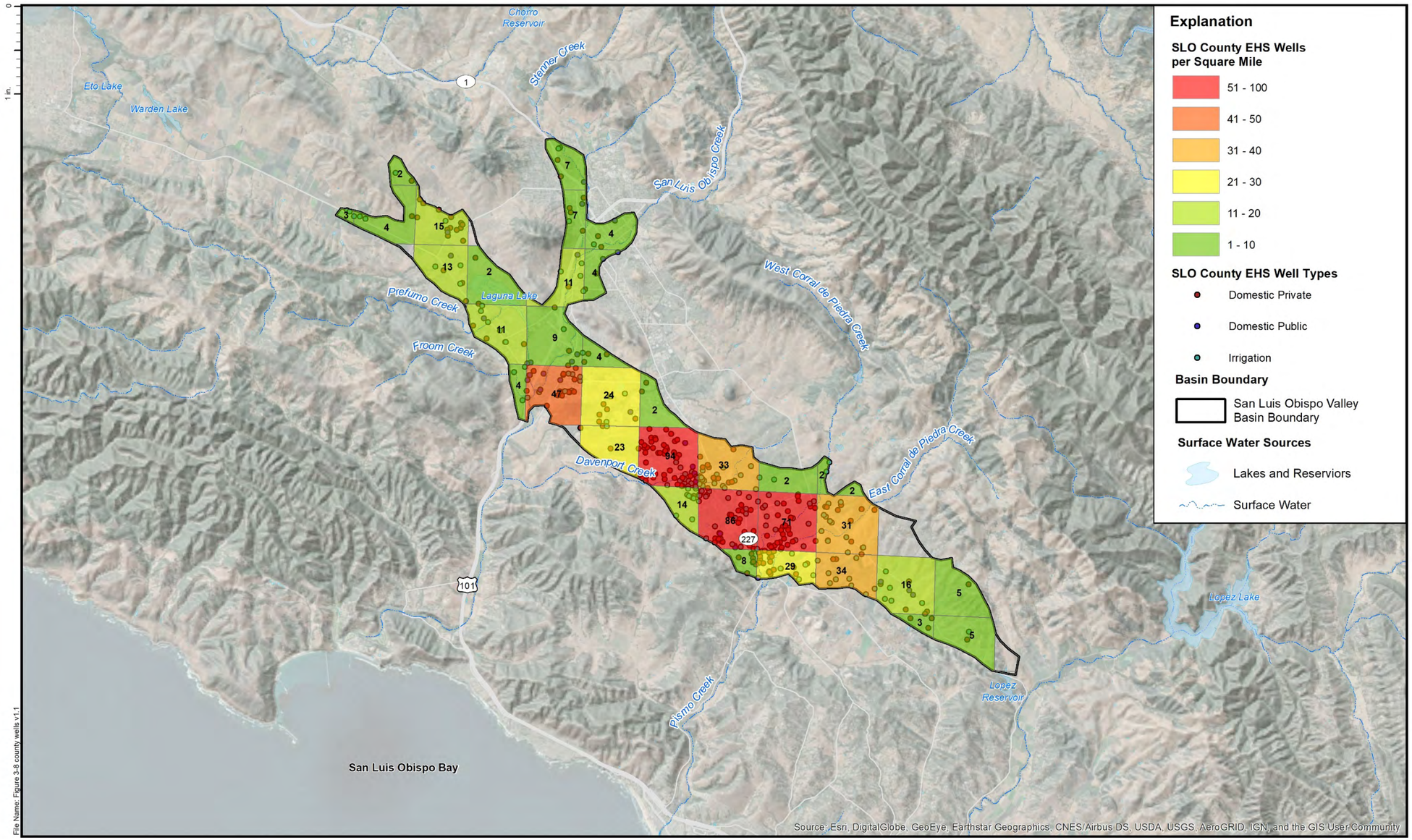
San Luis Obispo Valley Basin Public Supply Well Density

Figure 3-7



File Name: Figure 3-8 county wells v1.1

Prepared for:

Author: EC
Date: 11/25/2019

SAN LUIS OBISPO VALLEY BASIN GSP

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
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San Luis Obispo Valley Basin County Environmental Health Services Well Density

Figure 3-8

3.6 EXISTING MONITORING AND MANAGEMENT PROGRAMS

3.6.1 Groundwater Monitoring

Groundwater levels and quality are currently measured in the SLO Basin by the SLOFCWCD and a variety of other agencies as described below. Figure 3-9 shows the locations of monitored wells identified in the Groundwater Ambient Monitoring and Assessment (GAMA) program (i.e. publicly available data) that are monitored by several public agencies, the SLOFCWCD, and the Central Coast Regional Water Quality Control Board (CCRWQCB) Irrigated Lands Program. The monitoring network also includes other wells in the area designated as private that are not shown on this map (Figure 3-8). Additional evaluation of the current monitoring program will be conducted for the GSP to establish a representative monitoring network of public and private wells that will be used during plan implementation to track groundwater elevations and ensure that minimum thresholds have not been exceeded.

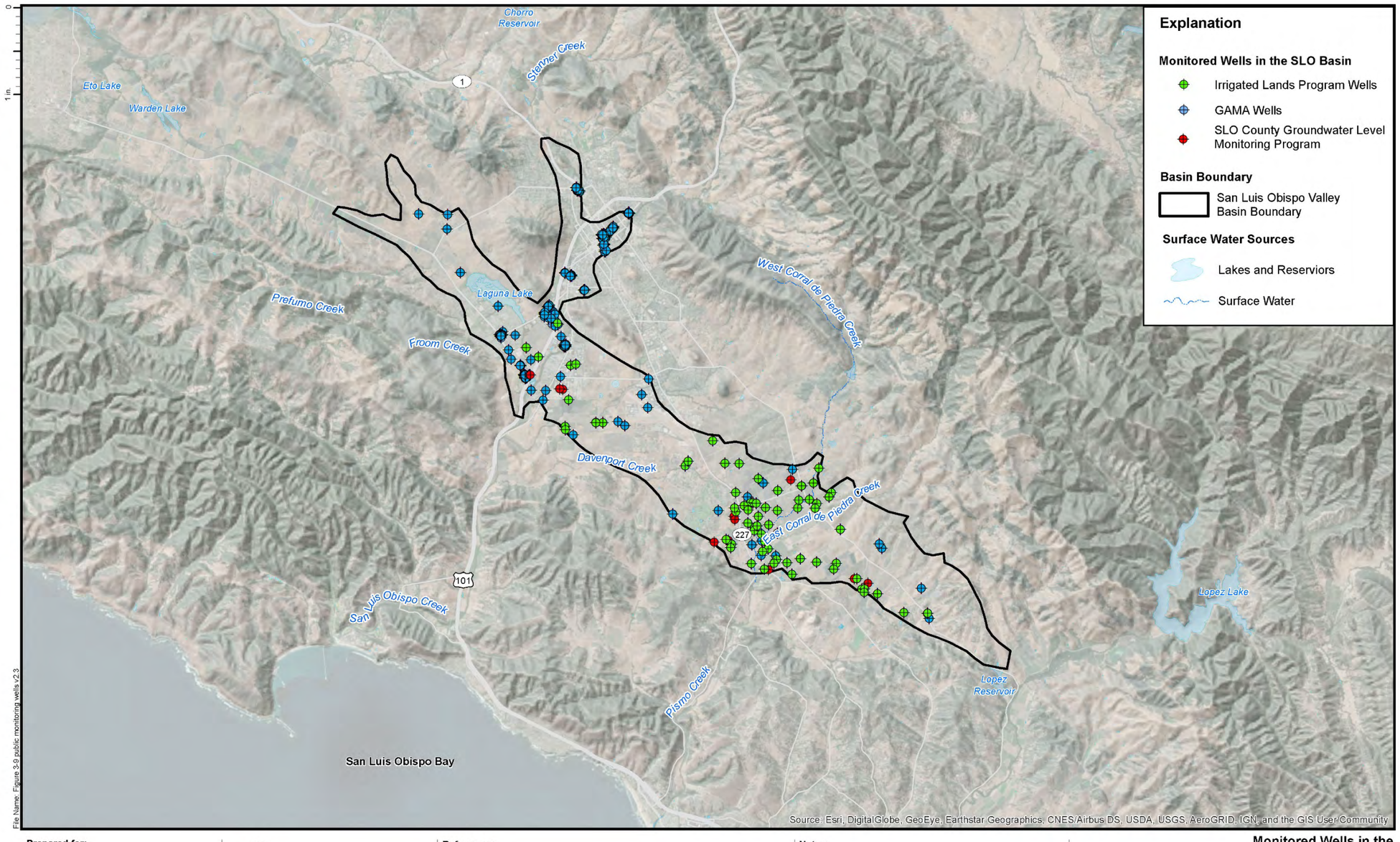
3.6.1.1 Groundwater Level Monitoring

The SLOFCWCD has been monitoring groundwater levels county-wide on a semi-annual basis for more than 50 years to support general planning and for engineering purposes. Groundwater level measurements are taken once in the spring and once in the fall. The monitoring takes place from a voluntary network of wells. In the SLO Basin, there are 16 active wells in this program (Figure 3-9). The voluntary monitoring network has changed over time as access to wells has been lost or new wells have been added to the network.

3.6.1.2 Groundwater Quality Monitoring

Groundwater quality is monitored/reported under several different programs and by different agencies including:

- Municipal and community water purveyors must collect water quality samples on a routine basis for compliance monitoring and reporting to the California State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW).
- The USGS collects water quality data on a routine basis under the GAMA program. These data are stored in the State's Geotracker GAMA system.
- There are multiple sites that are monitoring groundwater quality as part of investigation or compliance monitoring programs through the CCRWQCB. See Figure 3-9 for CCRWQCB well monitoring locations through the GEotracker GAMA system.
- The CCRWQCB under Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands, requires all growers to implement groundwater monitoring, either individually or as part of a cooperative regional monitoring program. Growers electing to implement individual monitoring (i.e., not participating in the regional monitoring program implemented by the Central Coast Groundwater Coalition [CCGC] within the SLO Basin) are required to test all on-farm domestic wells and the primary irrigation supply wells for nitrate or nitrate plus nitrite, and general minerals (including, but not limited to, TDS, sodium, chloride, and sulfate).
- California Water Data Library contains groundwater level and water quality monitoring stations. The data available from this resource has been used above.



Monitored Wells in the San Luis Obispo Valley Basin

Figure 3-9

3.6.1.3 Surface Water Monitoring

The Water Resources Division of the SLO County Public Works maintains six (6) real-time data monitoring stream gauges within the San Luis Obispo Creek watershed and all except Andrews St. Bridge is located within the SLO Basin. As summarized in Table 3-4, each stream gauge measures stage at 15-minute intervals. Stage-discharge relationships, or rating curves, for each of the five stream gauge stations were generated by Questa Engineering Corps in 2007 as part of the San Luis Obispo Creek Watershed Hydrology and Hydraulic Model Calibration Study. More recently (2018/2019), Central Coast Salmon Enhancement has approximated rating curves for the Andrews St., Elks Lane, and Stenner Creek gauge stations based on recorded stage data and measured flows. The location of the five County gauges are presented in Figure 3-10.

In addition to the County gauges, the City of San Luis Obispo routinely estimates flow at four locations (RW-4, RW-5, RW-7, RW-8) along San Luis Obispo Creek in the vicinity of the City's WRRF outfall as part of its National Pollutant Discharge Elimination System permitting program. RW-8 at South Higuera Bridge is located outside of the SLO Basin. Flow at the four locations (RW-4, RW-5, RW-7, and RW-8) is calculated weekly from April through the end of October based on the depth measurements recorded along the creek cross-section and are located within the Basin.

Table 3-4: Stream gauges and summary of records available.

Stream Gage	Source	Data Recorded	Data Interval	Year Data Begins	Datum[1]
Andrews St Bridge	SLO County	Stage	15 Minutes	2006	NAVD 88
Stenner Creek at Nipomo	SLO County	Stage	15 Minutes	2005	NAVD 88
Elks Ln	SLO County	Stage	15 Minutes	2005	NAVD 88
Madonna Rd	SLO County	Stage	15 Minutes	2005	NAVD 88
E. Fork at Jespersen Rd	SLO County	Stage	15 Minutes	2005	NAVD 88
Marsh Street Bridge	SLO County	Stage	15 Minutes	2019	NAVD 88
RW-4	City of SLO	Depth, Flow	Weekly	2005	-
RW-5	City of SLO	Depth, Flow	Weekly	2005	-
RW-7	City of SLO	Depth, Flow	Weekly	2005	-
RW-8	City of SLO	Depth, Flow	Weekly	2005	-

[1]Prior to 5/23/2017 County data was recorded on NGVD 29 datum. Conversion is 2.86 feet.

3.6.1.4 Climate Monitoring

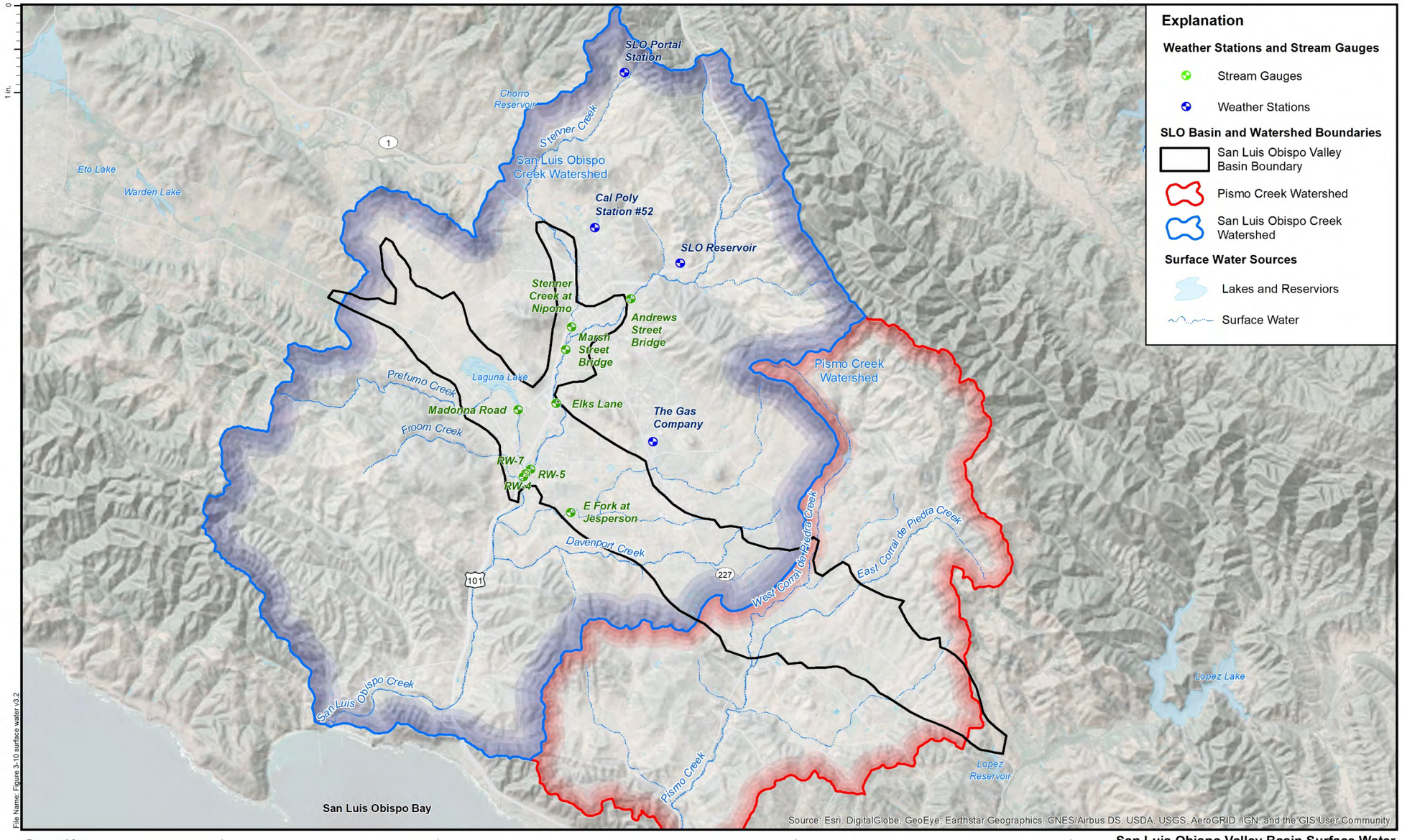
Climate monitoring in the SLO Basin includes stations that collect data related to temperature, evapotranspiration, relative humidity, atmospheric pressure, precipitation, and other climate parameters. Four stations monitored by San Luis Obispo County Public Works collect one or more climate parameters in the SLO Basin. The locations of these stations are shown on Figure 3-10.

The National Climatic Data Center has three stations within the County of San Luis Obispo and one station within the SLO Basin that collect climate data. These stations do not have extensive historic data. The station with the most precipitation data not associated with the National Climatic Data Center, Cal Poly Weather Station 52 (CPWS-52), began recording data in 1870. The Cal Poly Weather Station 52 measures daily temperatures and other climate parameters in addition to precipitation. Daily records are available from April 1986 to present. Table 3-5 lists the climate stations and summary of records available.

The long-term precipitation and cumulative departure from the mean (CDFM) measurements at CPWS-52 are shown in Figure 3-11 from 1870 - 2018. Average annual precipitation at this station varies from approximately 7 to 55 inches with a mean annual average precipitation of 21.95 inches. The longest dry period on record occurred from 1943 – 1965 and the longest wet period on record occurred from 1899 – 1916. Table 3-6 provides a summary of average monthly rainfall, temperature, and evapotranspiration (ET_0) for the SLO Basin from CPWS-52.

Table 3-5: Weather station Information and summary of records available.

Station	Source	Data Recorded	Data Interval	Year Data Begins
Cal Poly Weather Station 52	CIMIS	Precipitation, Temperature, Evapotranspiration	Daily	1986
SLO Reservoir	SLO County	Precipitation	12-Hour	2005
The Gas Company	SLO County	Precipitation	12-Hour	2005
South Portal	SLO County	Precipitation	12-Hour	2005
SLO County Farm Bureau	Weather Element	Precipitation, Temperature	Daily	2015



File Name: Figure 3-10 surface water v3.2

Prepared for:
SAN LUIS OBISPO VALLEY BASIN GSP

Author: EC
Date: 11/24/2019

N

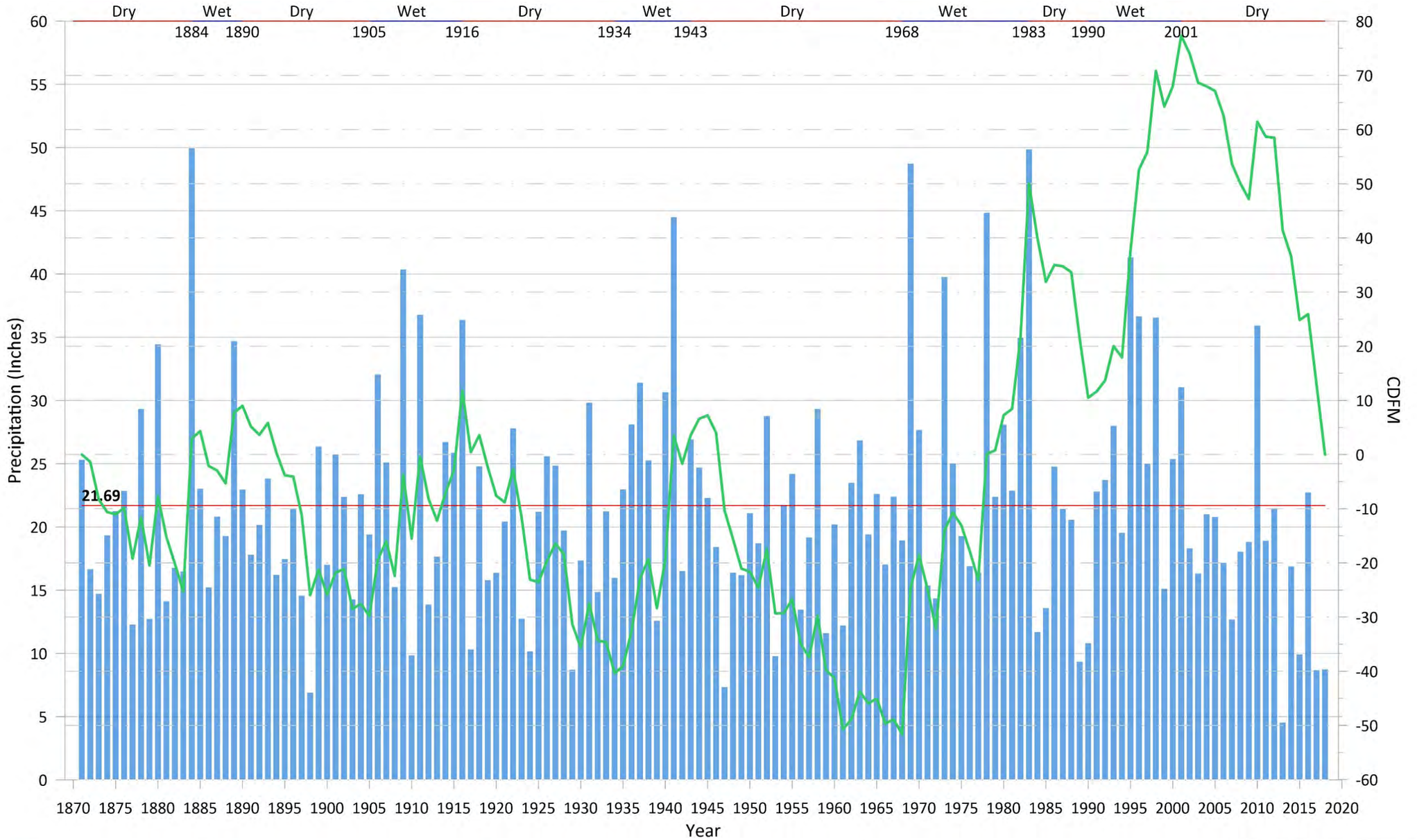
1 in : 1.5 mi
0 0.5 1 2 Mi
0 0.75 1.5 3 Km

References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.
3.

Notes:
1. Stream gauge and weather station locations provided by the County and Natioanl Climatic Data Center
2. Pismo Creek watershed and the combined upper and lower San Luis Obispo Creek watersheds are based on USGS Hydrologic Units (HUC-12)
3.

San Luis Obispo Valley Basin Surface Water Features, Weather Stations, and Stream Gauges

Figure 3-10



Prepared for:
Author: EC
11/26/2019
SAN LUIS OBISPO VALLEY BASIN GSP

Legend
Precipitation (Annual)
Historical Average Precipitation
CDFM

Notes:
1. Data Source: Cal Poly State University, Cal Poly/NOAA Station

San Luis Obispo Historical Annual Precipitation and CDFM

Figure 3-11

Table 3-6. Average Monthly Climate Summary 1987 – 2018 at Cal Poly Weather Station 52.

Month	Average Precipitation (inches)[a]	Average ET_0 (inches)[a]	Average Temperature (°F)[a]
January	0.14	0.07	54
February	0.15	0.09	54
March	0.11	0.12	56
April	0.03	0.16	57
May	0.02	0.18	59
June	0.01	0.2	62
July	0	0.2	64
August	0.13	0.19	64
September	0.2	0.16	64
October	0.04	0.13	63
November	0.05	0.09	58
December	0.11	0.07	53
Monthly Average	0.08	0.14	59
Average Calendar Year	21.69[b]	0.14	59

Notes:
[a] Average of monthly data at Cal Poly SLO Weather Station 52 1987 – 2018.
[b] Average Calendar Year is not the sum of the monthly average, but rather a historical annual average over the period of record from 1871 – 2018.

3.6.2 Existing Management Plans

There are numerous groundwater and water management plans and study reports that cover either the whole or portion of the SLO Basin. These plans and reports are described in the following subsections, along with brief descriptions of how they relate to the management of current water supply, projected water supplies, and land use.

3.6.2.1 SLO Basin Characterization and Monitoring Well Installation

The SLO Basin Characterization and Monitoring Well Installation documents the available published reports, private well reports, well completion reports, geologic logs, and other data that were reviewed to generate a comprehensive compilation of the current understanding of the hydrogeologic setting of the SLO Basin. This information is intended to provide the basis of knowledge for future planning and management activities performed under the requirements of GMA, including the development of a hydrogeologic conceptual model, construction of a numerical groundwater model, and development of a GSP.

3.6.2.2 San Luis Obispo County Master Water Report (2012)

The County's Master Water Report (MWR) is a compilation of the current and future water resource management activities being undertaken by various entities within the County and is organized by Water Planning Areas (WPA). The MWR explores how these activities interrelate, analyzes current and future supplies and demands, identifies future water management strategies and ways to optimize existing strategies, and documents the role of the MWR in supporting other water resource planning efforts. The MWR evaluates and compares the available water supplies to the water demands for the different water planning areas. This was accomplished by reviewing or developing the following:

- Current water supplies and demands based on available information

- Forecast water demands and water supplies available in the future under current land use policies and designations
- Criteria under which there is a shortfall when looking at supplies versus demands
- Criteria for analyzing potential water resource management strategies, projects, programs, or policies
- Potential water resource management strategies, projects, programs, or policies to resolve potential supply deficiencies

3.6.2.3 San Luis Obispo County Integrated Regional Water Management Plan (2014)

The San Luis Obispo County Integrated Regional Water Management Plan (IRWMP) was initially developed and adopted by the SLOFCWCD in 2005 (GEI Consultants, 2005), and has been updated several times. The SLOFCWCD, in cooperation with the SLOFCWCD's Water Resources Advisory Committee (WRAC), prepared the 2014 IRWMP (San Luis Obispo County, 2014) to align the region's water resources management planning efforts with the State's planning efforts. The IRWMP is used to support the region's water resource management planning and submittal of grant applications to fund these efforts.

The IRWMP includes goals and objectives that provide the basis for decision-making and are used to evaluate project benefits. The goals and objectives reflect input from interested stakeholders on the region's major water resources issues. These goals and objectives help secure and enhance the water supply reliability, water quality, ecosystems, groundwater, flood management and water-related communication efforts across the entire region. In addition, the IRWMP identifies resource management strategies, recognizes other funding opportunities and includes a list of action items (projects, programs, and studies) that agencies around the region are undertaking to achieve and further these goals and objectives.

The IRWMP is currently being updated with a DWR submittal target date of December 2019 and adoption by local agencies scheduled for Summer 2020.

3.6.2.4 City of San Luis Obispo 2015 Urban Water Management Plan (2016)

The City's Urban Water Management Plan (UWMP) describes the City's current and future water demands, identifies current water supply sources, and assesses supply reliability for the City. The UWMP describes the City's use of groundwater and its support for efforts to avoid overdraft by developing additional sources. The UWMP provides a forecast of future growth, water demand, and water sources for the City through 2035. These sources include water conservation, Nacimiento Water Project, Salinas Reservoir (Santa Margarita Lake), Whale Rock Reservoir, SLO Basin groundwater, and recycled water from the WRRF. The UWMP identifies beneficial impacts to groundwater quality through the use of these sources.

3.6.3 Existing Groundwater Regulatory Programs

3.6.3.1 Groundwater Export Ordinance (2015)

In 2015, County of San Luis Obispo adopted an Exportation of Groundwater ordinance (County Code Chapter 8.95) that requires a permit for the export of groundwater out of a groundwater basin or out of the County. An export permit is only approved if the Department of Public Works Director or his/her designee finds that moving the water would not have any adverse impacts to groundwater resources, such as causing aquifer levels to drop, disrupting the flow of neighboring wells, or resulting in seawater intrusion. Export permits are only valid for one year.

3.6.3.2 Countywide Water Conservation Program Resolution 2015-288 (2015)

The ordinance also identified areas of severe decline in groundwater elevation and properties overlying these areas would be further restricted from planting new or expanding irrigated agriculture except for those converting irrigated agriculture on the same property into a different crop type. This resolution applies to the Nipomo Mesa Water Conservation Area which is part of the Santa Maria Groundwater Basin,

the Los Osos Groundwater Basin, and the Paso Robles Groundwater Basin. Therefore, it is not applicable to the SLO Basin.

3.6.3.3 Agricultural Order R3-2017-002 (2017)

In 2017 the CCRWQCB issued Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve surface receiving water quality. Specific requirements for individual growers are structured into three tiers based on the relative risk their operations pose to water quality.

Growers must enroll, pay fees, and meet various monitoring and reporting requirements according to the tier to which they are assigned. All growers are required to implement groundwater monitoring, either individually or as part of a cooperative regional monitoring program. Growers electing to implement individual monitoring (i.e., not participating in the regional monitoring program implanted by the Central Coast Groundwater Coalition [CCGC]) are required to test all on-farm domestic wells and the primary irrigation supply wells for nitrate or nitrate plus nitrite, and general minerals (including, but not limited to, TDS, sodium, chloride, and sulfate).

3.6.3.4 Water Quality Control Plan for the Central Coast Basins (2017)

The Water Quality Control Plan for the Central Coastal Basin (Basin Plan) was most recently updated in September 2017 by the SWRCB. The objective of the Basin Plan is to outline how the quality of the surface water and groundwater in the Central Coast Region should be managed to provide the highest water quality reasonably possible.

The Basin Plan lists beneficial users, describes the water quality that must be maintained to allow those uses, provides an implementation plan, details SWRCB and CCRWQCB plans and policies to protect water quality, and a statewide surveillance and monitoring program as well as regional surveillance and monitoring programs.

Present and potential future beneficial uses for inland waters in the SLO Basin are: surface water and groundwater as municipal supply (water for community, military or individual water supplies); agricultural; groundwater recharge; recreational water contact and non-contact; sport fishing; warm fresh water habitat; wildlife habitat; rare threatened or endangered species; and spawning, reproduction, and/or early development of fish.

Water Quality Objectives for both groundwater (drinking water and irrigation) and surface water are provided in the Basin Plan.

3.6.3.5 California DWR Well Standards (1991)

Under the CWC Sections 13700 to 13806, DWR has the responsibility for developing well standards. DWR maintains these standards to protect groundwater quality. California Well Standards, published as DWR Bulletin 74, represent minimum standards for well construction, alteration, and destruction to protect groundwater. Cities, counties, and water agencies in California have regulatory authority over wells and can adopt local well ordinances that meet or exceed the statewide Well Standards. When a well is constructed, modified or destroyed a well completion report is required to be submitted to DWR.

3.6.3.6 Requirements for New Wells (2017)

Senate Bill 252 effective on January 1, 2018. SB 252 requires well permit applicants in critically overdrafted basins to include information about the proposed well, such as location, depth, and pumping capacity. The bill also requires the permitting agency to make the information easily accessible to the public and the GSA. As of 2019, these requirements are under review by DWR. This bill is not applicable because the SLO Basin is not a critically overdrafted basin.

3.6.3.7 Title 22 Drinking Water Program (2018)

The 2018 SWRCB DDW regulates public water systems in the State to ensure the delivery of safe drinking water to the public. A public water system is defined as a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells, wells associated with drinking water systems with less than 15 residential service connections, and industrial and irrigation wells are not regulated by the DDW. Additional information regarding the public water systems can be found using the following link: https://sdwis.waterboards.ca.gov/PDWW/JSP/WaterSystems.jsp?PointOfContactType=none&number=&name=&county=San%20Luis%20Obispo

The SWRCB DDW enforces the monitoring requirements established in Title 22 of CCR for public water system wells, and all the data collected must be reported to the DDW. Title 22 also designates the regulatory limits (e.g., maximum contaminant levels [MCLs]) for various waterborne contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

3.6.3.8 Waterway Management Plan – San Luis Obispo Creek Watershed (2003)

The San Luis Obispo Creek Watershed Waterway Management Plan was created in response to several damaging floods that occurred in 1969, 1973, and 1995 that caused widespread damage throughout the watershed that includes out-of-bank flooding and extensive bank erosion. This plan identifies management problems and needs of the waterways, detailed hydrologic analyses of the watershed and its main tributaries. The plan also presents a Stream Management and Maintenance Program for the waterways of the watershed that outlines the planning, design, and permitting required to fully implement the program and a Drainage Design Manual that contains revised policies for floodplain and stream corridor management and redesigned flows for stream channels within the City boundary.

3.6.3.9 Incorporation Into GSP

Information in these various plans mentioned above has been incorporated into this GSP for consideration in the development of Sustainability Goals, when setting Minimum Thresholds and Measurable Objectives, and was considered during development of Projects and Management Actions to provide consistency among the above listed plans to achieve groundwater sustainability in the SLO Basin.

3.6.3.10 Limits to Operational Flexibility

Some of the existing management plans and ordinances will limit operational flexibility. These limits to operational flexibility have already been incorporated into the sustainability projects and programs included in this GSP. Examples of limits on operational flexibility include:

- The Groundwater Export Ordinance requires county approval to export of water out of the SLO Basin. This is likely not a significant limitation because exporting water out of the SLO Basin hinders sustainability.
- Title 22 Drinking Water Program regulates the quality of water that can be recharged into the SLO Basin.

3.7 CONJUNCTIVE USE PROGRAMS

There are no active conjunctive use programs currently operating within SLO Basin.

3.8 LAND USE PLANS

The County and City have land use authority in the SLO Basin and the other MOA Parties do not. However, SGMA requires the GSAs to consider land use documents by the overlying governing agencies when making decisions. Government Code Section 65350.5 and 65352 require review and consideration of groundwater requirements before the adoption or any substantial amendment of a city's or county's general plan. The planning agency shall review and consider GSPs and any proposed action should refer to the GSA and GSP. Land use is an important factor in water management as described below. The following sections provide a general description of these land use plans and how implementation may affect groundwater supply.

3.8.1 City of San Luis Obispo General Plan

The General Plan is the principal tool the City uses when evaluating municipal service improvements and land use proposals. Every service the City provides to its citizens can trace its roots back to goals and policies found in the General Plan. General Plan goals, policies, and implementation measures are based on an assessment of current and future needs and available resources. The land use element designates the general distribution and intensity of land uses, including the location and type of housing, businesses, industry, open space, and education, public buildings, and parks. Figure 3-12 shows the City's Land Use Map.

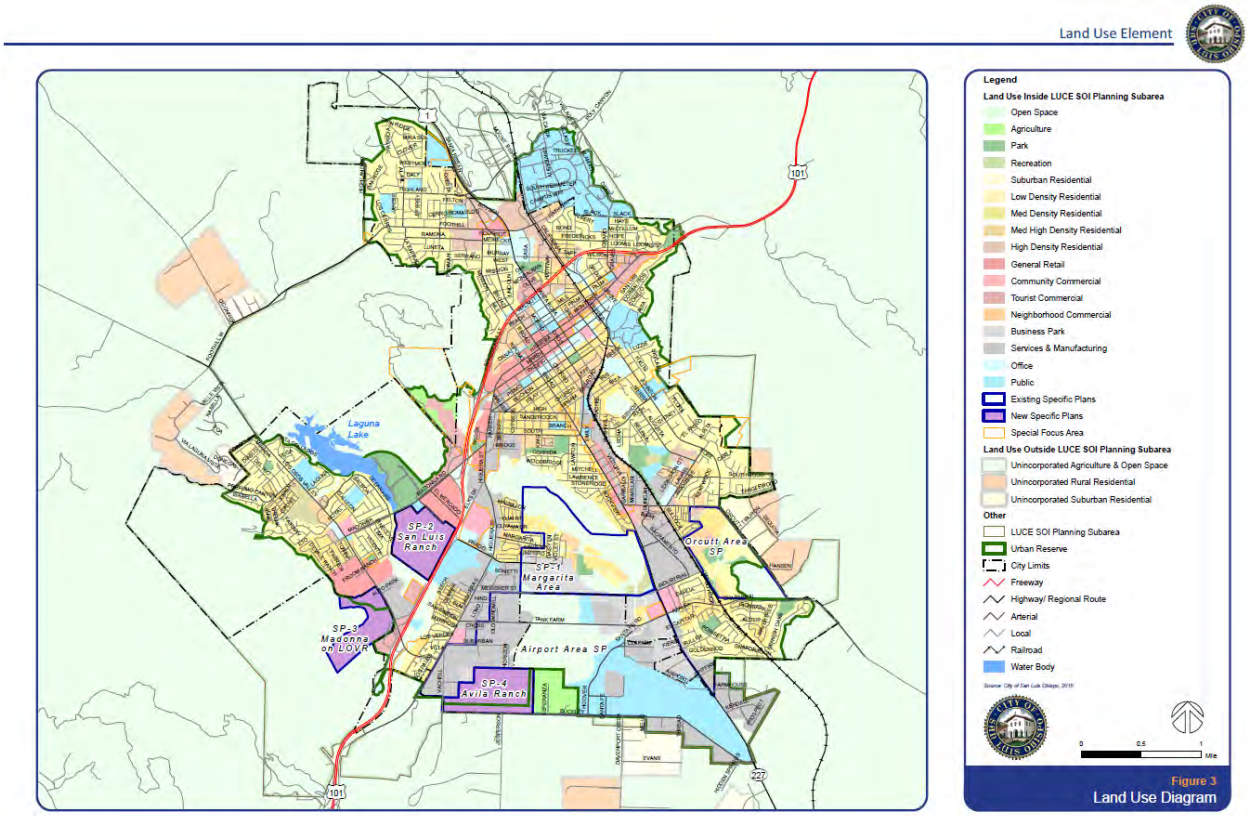


Figure 3-12. City Land Use Map

The City manages its housing supply growth so that it does not exceed one percent per year on average, excluding dwellings affordable to residents with extremely low, very low or low incomes as defined by the Housing Element. The City decided to adopt a Water and Wastewater Element addressing water resources and wastewater services because of the vital role of these resources and the far-reaching impacts of water policies on community growth and character. This element translates the Land Use Element's capacity for development into potential demand for water supply and wastewater services. This element outlines how the City plans to provide adequate water and wastewater services for its citizens, consistent with the goals

and policies of other General Plan elements. As stated in the General Plan, the City has an adequate water supply to serve the community's existing and future water needs. The City envisions groundwater playing an important role in ensuring continued resiliency in its water supply portfolio.

3.8.2 County of San Luis Obispo General Plan

The 2014 County General Plan contains three pertinent elements that are related to land use and water supply. Pertinent sections include the Land Use, Agricultural, and Inland Area Plans elements.
The County's General Plan also contains programs that are specific, non-mandatory actions or policies recommended by the Land Use and Circulation Element (LUCE) to achieve community or area wide objectives. Implementing each LUCE program is the responsibility of the County or other public agency that is identified in the program. Programs are recommended actions rather than mandatory requirements. Implementation of any program by the County should be based on consideration of community needs and substantial community support for the program and its related cost.

The SLO Basin is within the San Luis Obispo Planning Area and South County Planning Area. The planning areas do not conform to the SLO Basin boundaries but do provide a general representation of the land use in the areas. Figure 3-13 and Figure 3-14 shows the planning areas and land uses.

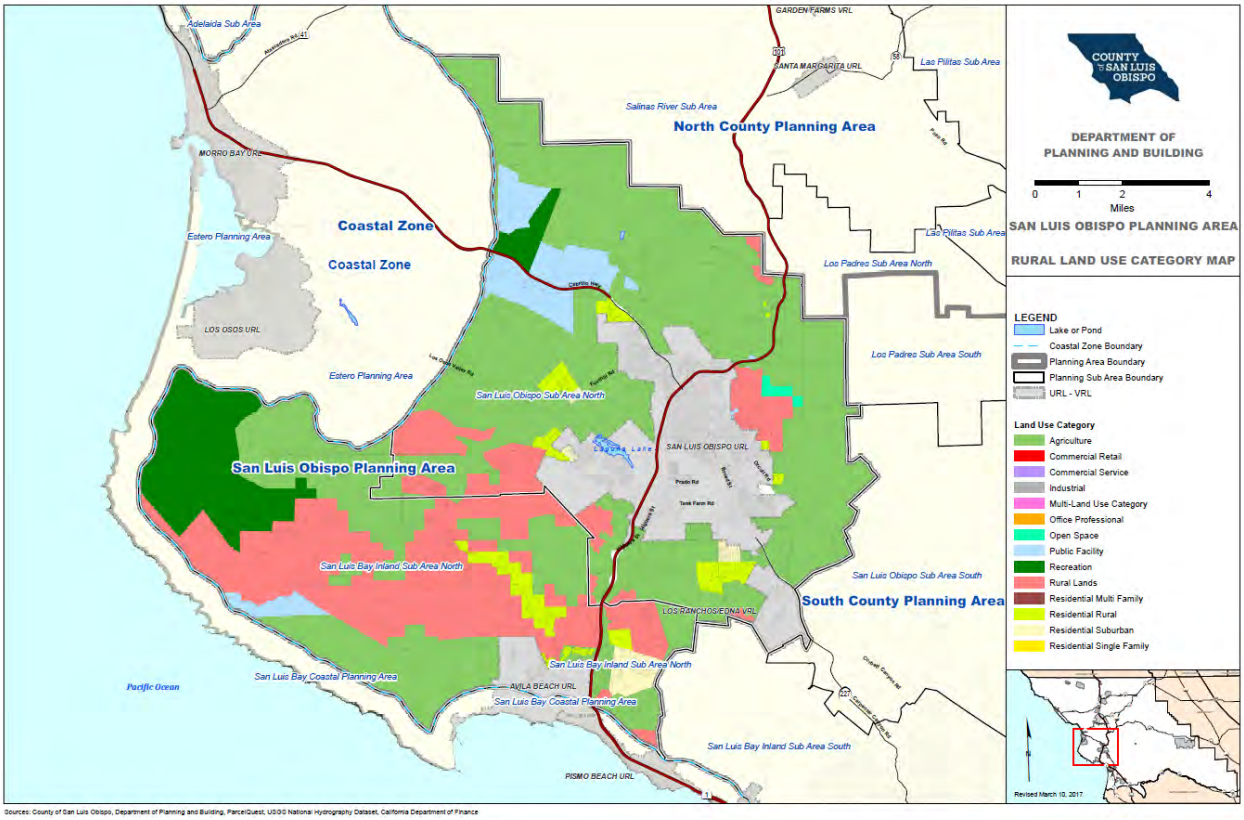


Figure 3-13. County Land Use Map (San Luis Obispo Planning Area)

The General Plan Framework for Planning does not provide tabular assessment of land use types and acres, or population projection estimates within the San Luis Obispo Planning Area and South County Planning Area. Therefore, projected demands and supplies based on land use aren't identified for the SLO Basin in the Land Use element.

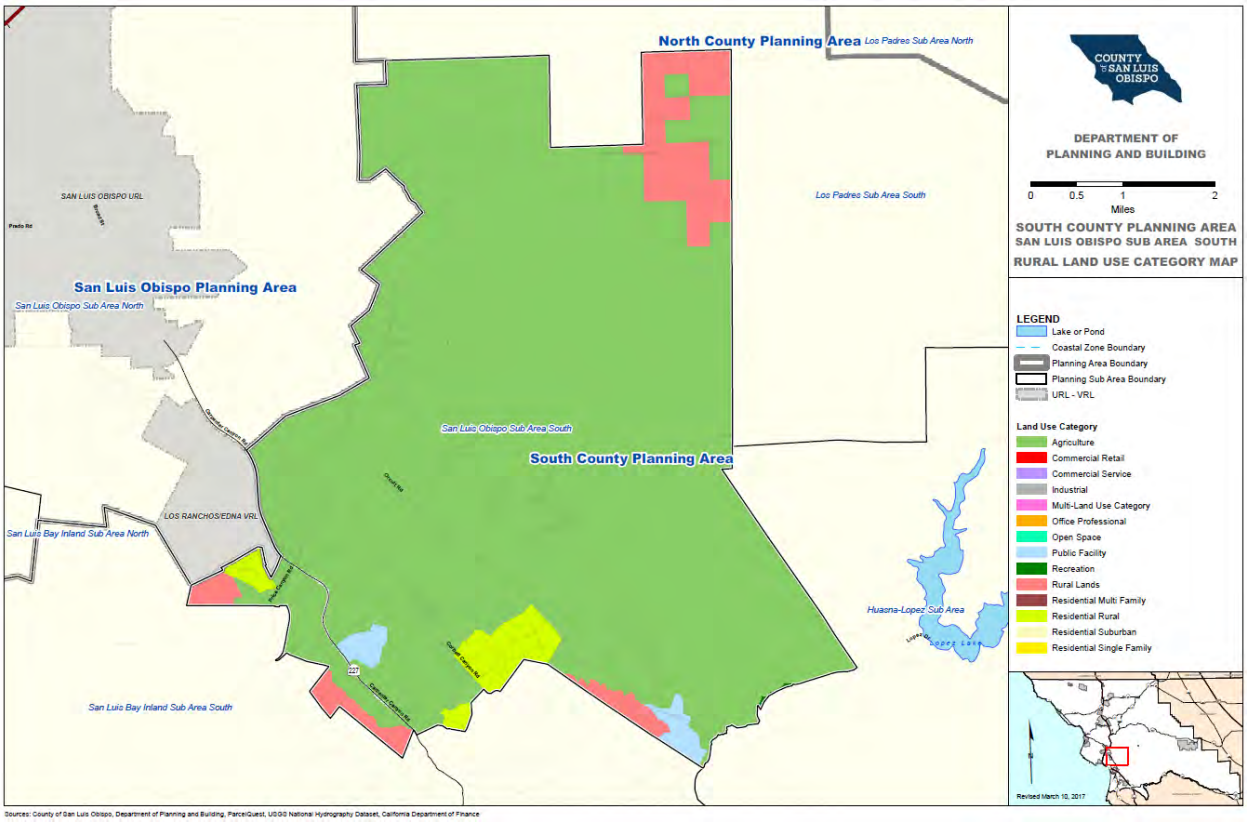


Figure 3-14. County Land Use Map (South County Planning Area)

3.8.3 Los Ranchos/Edna Village Plan

More specifically, the Los Ranchos/Edna Village Plan establishes a vision for the future that will guide land use and transportation over the next 20 years. This village plan is part of Part III of the LUCE of the County General Plan within the San Luis Obispo Planning Area. The Framework for Planning (LUCE Part I) is the central policy document, while this plan contains programs more specifically applicable to the Los Ranchos/Edna village area. In accordance with the Framework for Planning, allowable densities (intensity of land use) are established (Figure 3-15). The San Luis Obispo Area Plan contains regional land use and circulation goals, policies, and programs that also apply to Los Ranchos/Edna. Table 3-7 and summarize the acreage and distribution of each land use category in Los Ranchos/Edna village. Rural land use acreage is summarized in the Framework for Planning.

Table 3-7. Los Ranchos/Edna Land Use Acreage

Land Use Categories	Acreage
Agriculture	0
Rural Lands	0
Recreation	235
Open Space	0
Residential Rural	394
Residential Suburban	259
Residential Single Family	59
Residential Multi-Family	0
Office and Professional	0
Commercial Retail	0
Commercial Service	0
Industrial	0
Public Facilities	10
Dalidio Ranch	0
Total	957

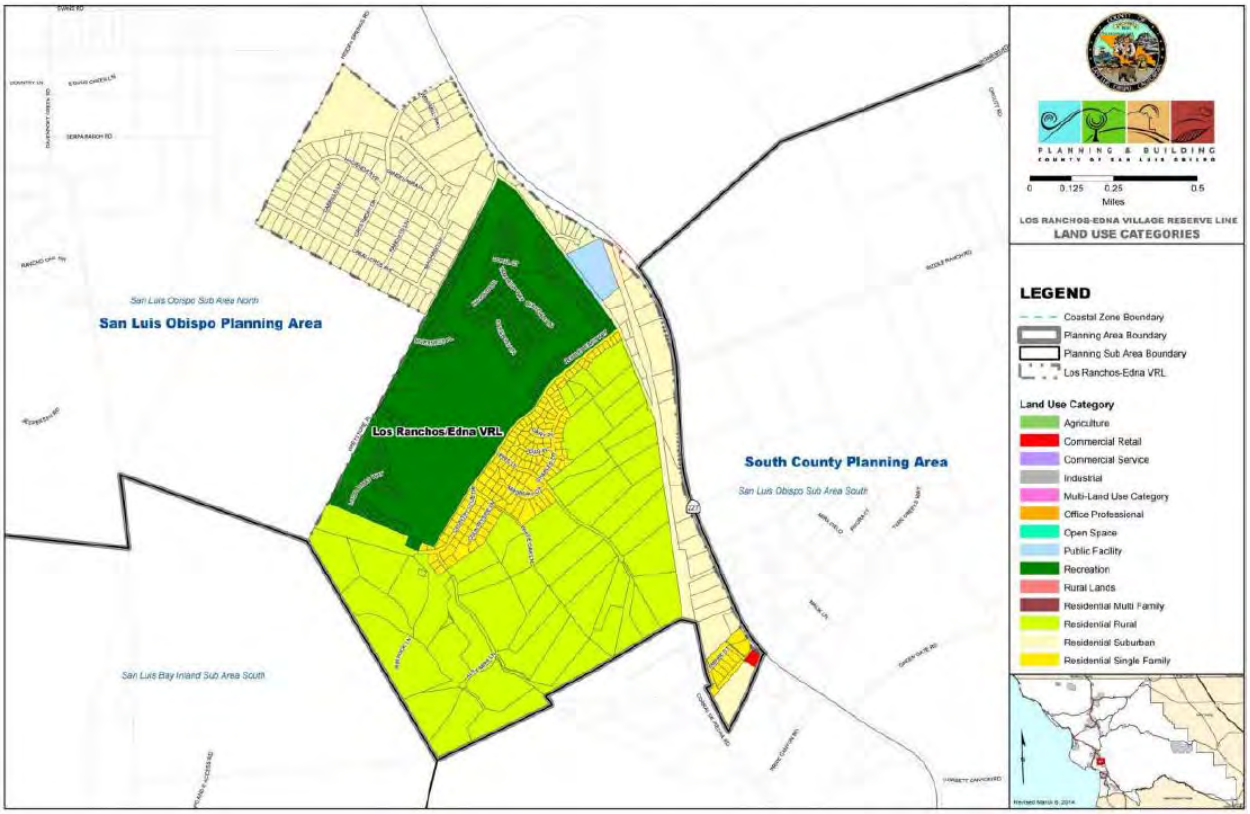


Figure 3-15. Los Ranchos/Edna Land Use Map

3.8.4 Plan Implementation Effects on Existing Land Use

This section to be completed after GSP is complete.

3.8.5 Plan Implementation Effects on Water Supply

This section to be completed after GSP is complete.

3.8.6 Well Permitting/Ordinance

This section to be completed after GSP is complete.

3.8.7 Land Use Plans Outside of Basin

The Parties submitting this GSP have not included information regarding the implementation of land use plans outside of the SLO Basin as adjacent basins are also required to implement SGMA and their GSPs will require them to achieve sustainable groundwater management.

3.9 MANAGEMENT AREAS

This section to be completed after GSP is complete.

3.9.1 Reason for Creation

3.10 ADDITIONAL GSP ELEMENTS, IF APPLICABLE

4 BASIN SETTING (§ 354.14)

This section describes the geologic setting of the San Luis Obispo Valley Groundwater Basin (Basin), including the Basin boundaries, geologic formations and structures, principal aquifer units, geologic cross sections, and hydraulic parameter data. The information presented in this chapter, when considered with the information presented in Chapter 5 (Groundwater Conditions) and Chapter 6 (Water Budget), comprises the basis of the Hydrogeologic Conceptual Model (HCM) of the Basin. This section draws upon previously published studies, primarily a hydrogeologic and geologic investigation prepared by GSI for the San Luis Obispo County Flood Control and Water Conservation District (SLOCFCWCD) in 2018, as well as a 1997 draft report, "San Luis-Edna Groundwater Basin Study, Draft Report" (DWR, 1997), which was prepared but never finalized for official publication, and a 1991 report by Boyle Engineering (Ground Water Basin Evaluation) that was prepared for the City. The data and information presented in this section is not intended to be exhaustive but is a summary of the relevant and important aspects of the Basin geology that influence groundwater sustainability. More detailed information can be found in the original reports discussed above. This section presents the framework for subsequent sections on groundwater conditions and water budgets.

As part of the GSP process, a numerical groundwater model is being developed for the Basin to use as a tool in the planning process (Appendix ZZ). Much of the information comprising the HCM presented in Chapters 4, 5, and 6 of the GSP is applied directly to the development of the groundwater model. Physical data on the geology and hydrogeologic parameters of the Basin presented in Chapter 4 are used to develop the model structure and parameterization. Data on groundwater conditions and water budget presented in Chapters 5 and 6 are used in model calibration.

Multiple sources and types of data are presented in Chapters 4, 5, and 6. Some of this data, such as rainfall amounts, depth to groundwater, and depth to bedrock, is directly measurable and involves a low degree of uncertainty. Other data, such as aquifer transmissivity, is based on calculations and interpretations of observed data, but is not directly measurable, and so involves a greater amount of uncertainty than direct measurements. And finally, values presented in the water budget are primarily derived from analysis of related data; almost none of the water budget components are directly measurable, and so involve more uncertainty than the previously discussed data types.

4.1 BASIN TOPOGRAPHY AND BOUNDARIES

The Basin is oriented in a northwest-southeast direction and is composed of unconsolidated or loosely consolidated sedimentary deposits. It is approximately 14 miles long and 1.5 miles wide. It covers a surface area of about 12,700 acres (19.9 square miles). The Basin is bounded on the northeast by the relatively impermeable bedrock formations of the Santa Lucia Range, and on the southwest by the formations of the San Luis Range and the Edna fault system. The bottom of the Basin is defined by the contact of permeable sediments with the impermeable bedrock Miocene-aged and Franciscan Assemblage rocks (DWR, 2003). A topographic map displaying the Basin boundaries is presented in Figure 4-1, which also displays the watershed areas of the San Luis Obispo Creek and Pismo Creek drainages. An aerial photo of the Basin area is presented in Figure 4-2. Elevations within the Basin range from over 500 feet above mean seal level in the southeastern extent of Edna Valley, to under 100 feet above mean sea level where San Luis Obispo Creek flows out of the Basin.

The Basin is commonly referenced as being composed of two distinct valleys, with the San Luis Valley in the northwest and the Edna Valley in the southeast. The San Luis Valley comprises approximately the northwestern half of the Basin. It is the area of the Basin drained by San Luis Obispo Creek and its

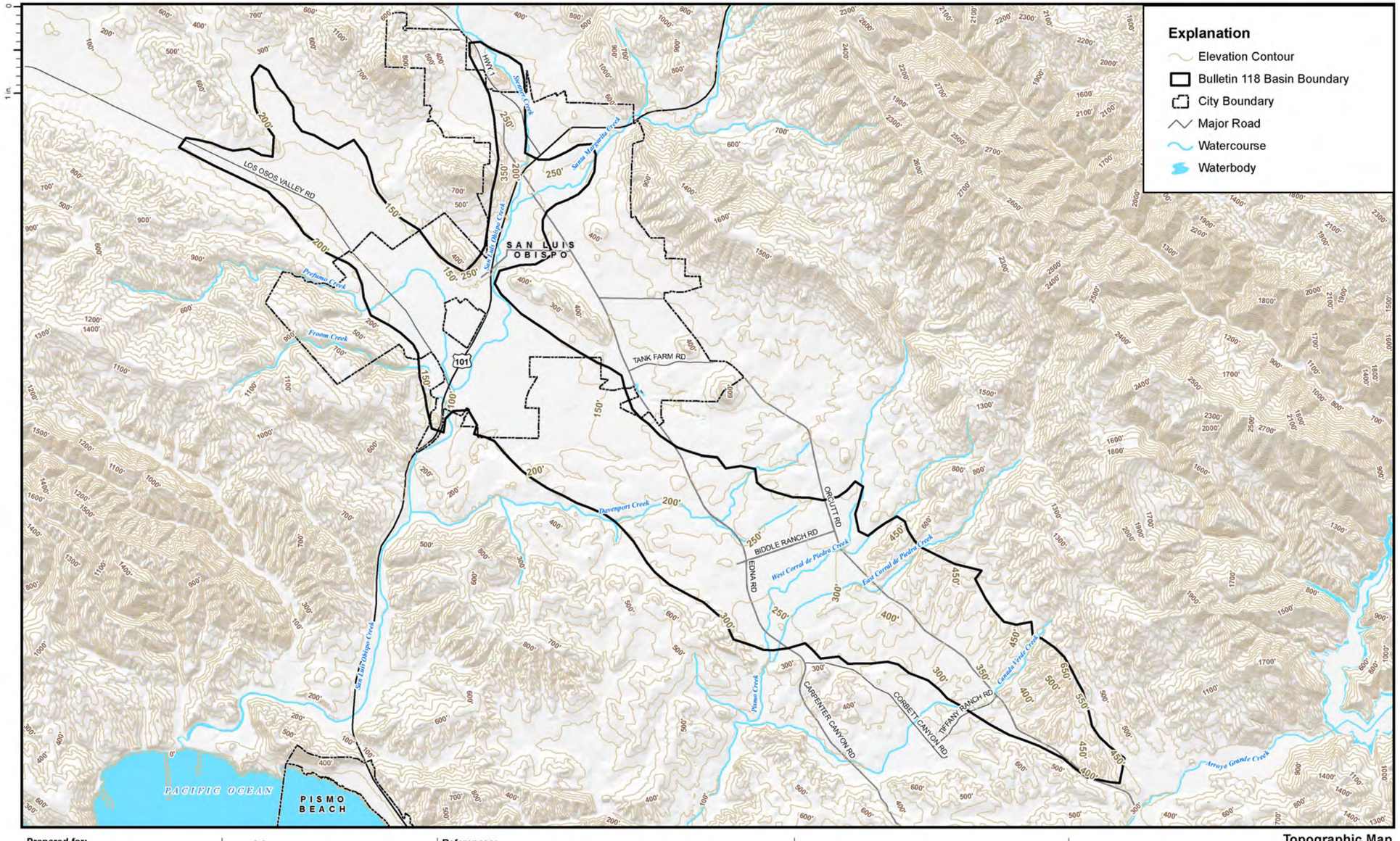
tributaries (Prefumo Creek and Stenner Creek west of Highway 101, Davenport Creek and smaller tributaries east of Highway 101). Surface drainage in San Luis Valley drains out of the Basin flowing to the south along the course of San Luis Obispo Creek toward the coast in the Avila Beach area, approximately along the course of Highway 101. The San Luis Valley includes part of the City and California Polytechnic University (Cal Poly) jurisdictional boundaries, while the remainder of the valley is unincorporated land. Land use in the City is primarily municipal, residential, and industrial. The area in the northwest part of the Basin, along Los Osos Valley Road, has significant areas of irrigated agriculture, primarily row crops.

The Edna Valley comprises approximately the southeastern half of the Basin. The primary creeks that drain the Basin are the east and west branches of Corral de Piedras Creek; the Corral de Piedras Creek tributaries join to form Pismo Creek, draining south out of the Edna Valley into Price Canyon. Canada de Verde Creek is also a significant tributary that flows south out of the Basin in the extreme southeastern part of Edna Valley, ultimately joining Pismo Creek (Figures 4-1 and 4-2). The Edna Valley includes unincorporated lands, including lands associated with various private water purveyors. The primary land use in the Edna Valley is agriculture. During the past two decades, wine grapes have become the most significant crop type in the Edna Valley.

The primary weather patterns for the Basin are derived from seasonal patterns of atmospheric conditions that originate over the Pacific Ocean and move inland. As storm fronts move in from the coast, rainfall in the area falls more heavily in the mountains, and the Basin itself receives less rainfall because of a muted rain shadow effect. Average annual precipitation ranges from approximately 18 inches throughout most of the Basin to about 22 inches in relatively higher elevation areas near the City and Cal Poly (Figure 4-3). The time series of annual precipitation for the period of record from 1871 to 2018 at the Cal Poly weather station is presented in Figure 3-11. The average rainfall at this location is 21.69 inches, with a standard deviation of 8.71 inches. The historical maximum is 49.99 inches, which occurred in 1884. The historical minimum is 4.56 inches, which occurred in 2013.

The physical definition of the Basin boundary is the occurrence of unconsolidated or loosely consolidated saturated sediments down to the contact with the basement rock of the Miocene-aged formations and Franciscan Assemblage. (The geologic units will be described in more detail Section 4-4.) Figure 4-4presents a surface defining the bottom boundary of the Basin, based on the elevation of bedrock surface below the Basin sediments. There is a topographic high point in the underlying bedrock elevation between the San Luis Valley and Edna Valley sub-areas. As shown, the watershed divide and the bedrock divide are not coincident.

Figure 4-5 presents contours of total thickness of the Basin sediments; the inset figure displays the thickness of sediments in a longitudinal cross section. It is apparent from Figure 4-6 that the sediments of the Edna Valley have significantly greater thickness than those of the San Luis Valley. The longitudinal profile of the Basin from the northwest on the left of the figure to the southeast on the right indicates the watershed divide present in the vicinity of Biddle Ranch Road, indicated on Figure 4-4 and Figure 4-5. Precipitation that falls west of that divide ultimately flows to Davenport and San Luis Obispo Creeks, and precipitation that falls east of that divide flows to Corral de Piedras Creek or the other small tributaries, ultimately flowing to Pismo Creek south of the Basin.



Prepared for:

Author: AB
Date: 11/25/2019

SAN LUIS OBISPO VALLEY BASIN GSP

N

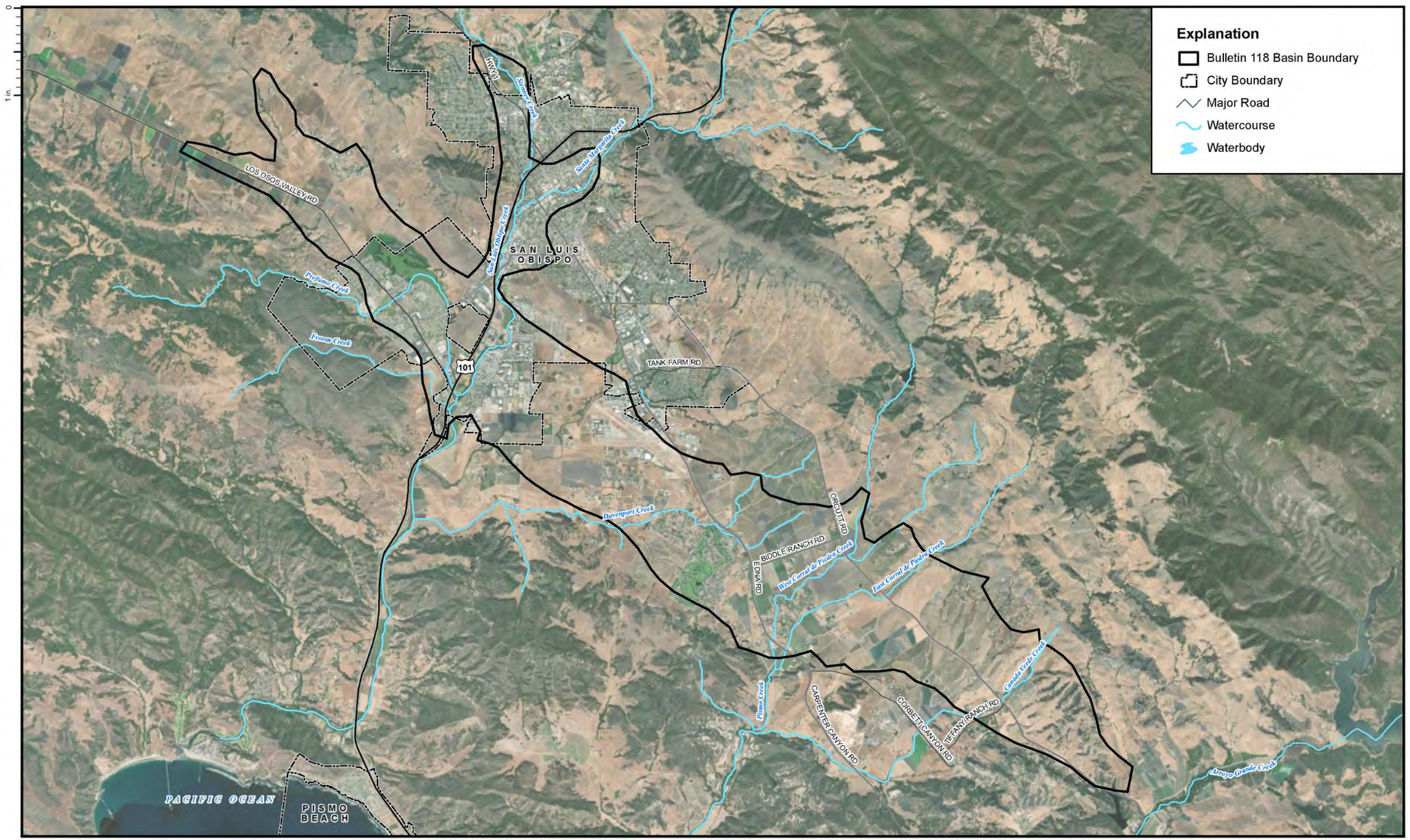
0 0.25 0.5 1 Miles
0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.San Luis Obispo County
3. USGS

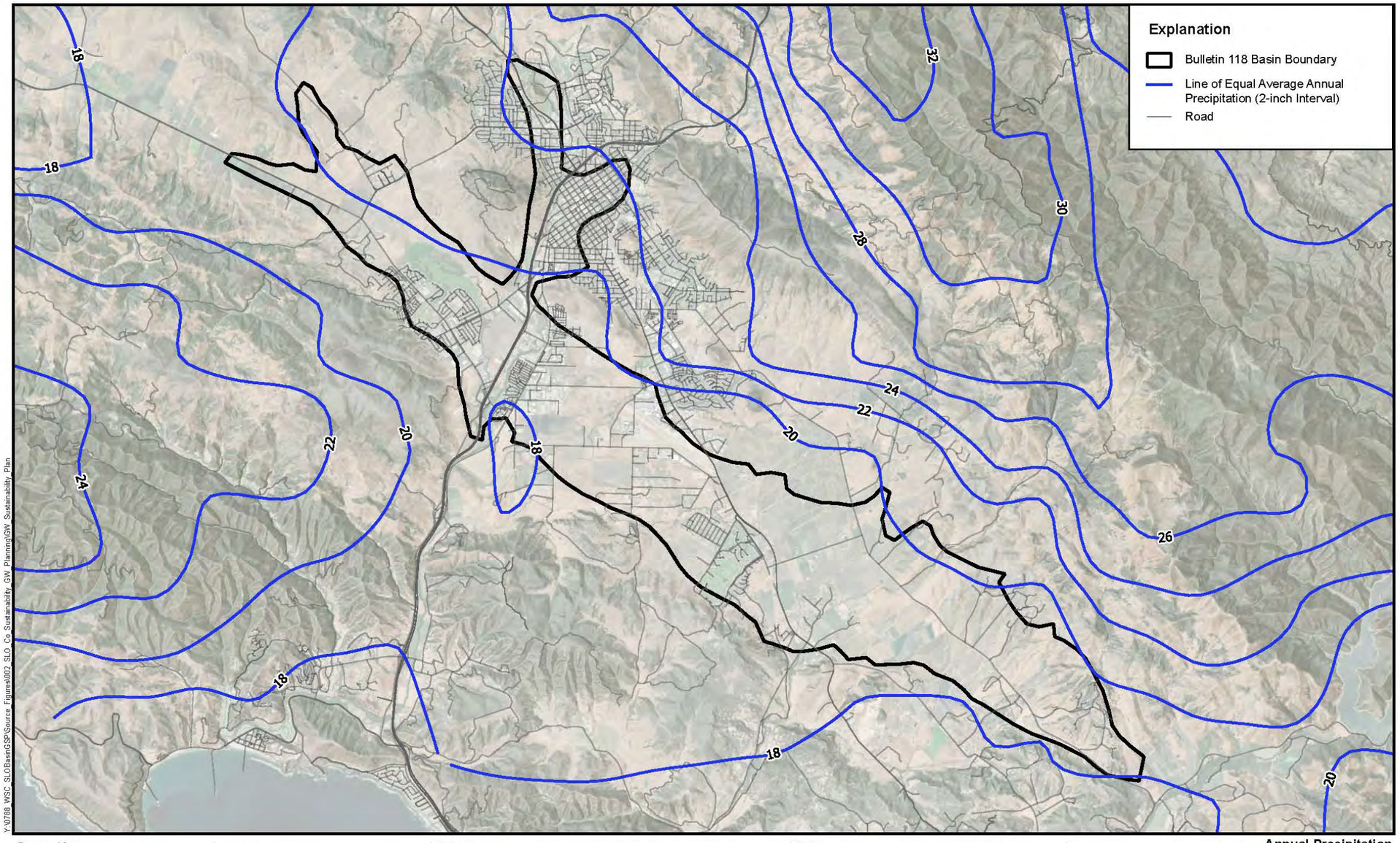
Topographic Map

Figure 4-1



Aerial Photograph

Figure 4-2



Prepared for:

COUNTY OF SAN LUIS OBISPO

Author: NP
Date: 10/31/2019

SAN LUIS OBISPO VALLEY BASIN GSP

N

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0 0.425 0.85 1.7 Kilometers

References:

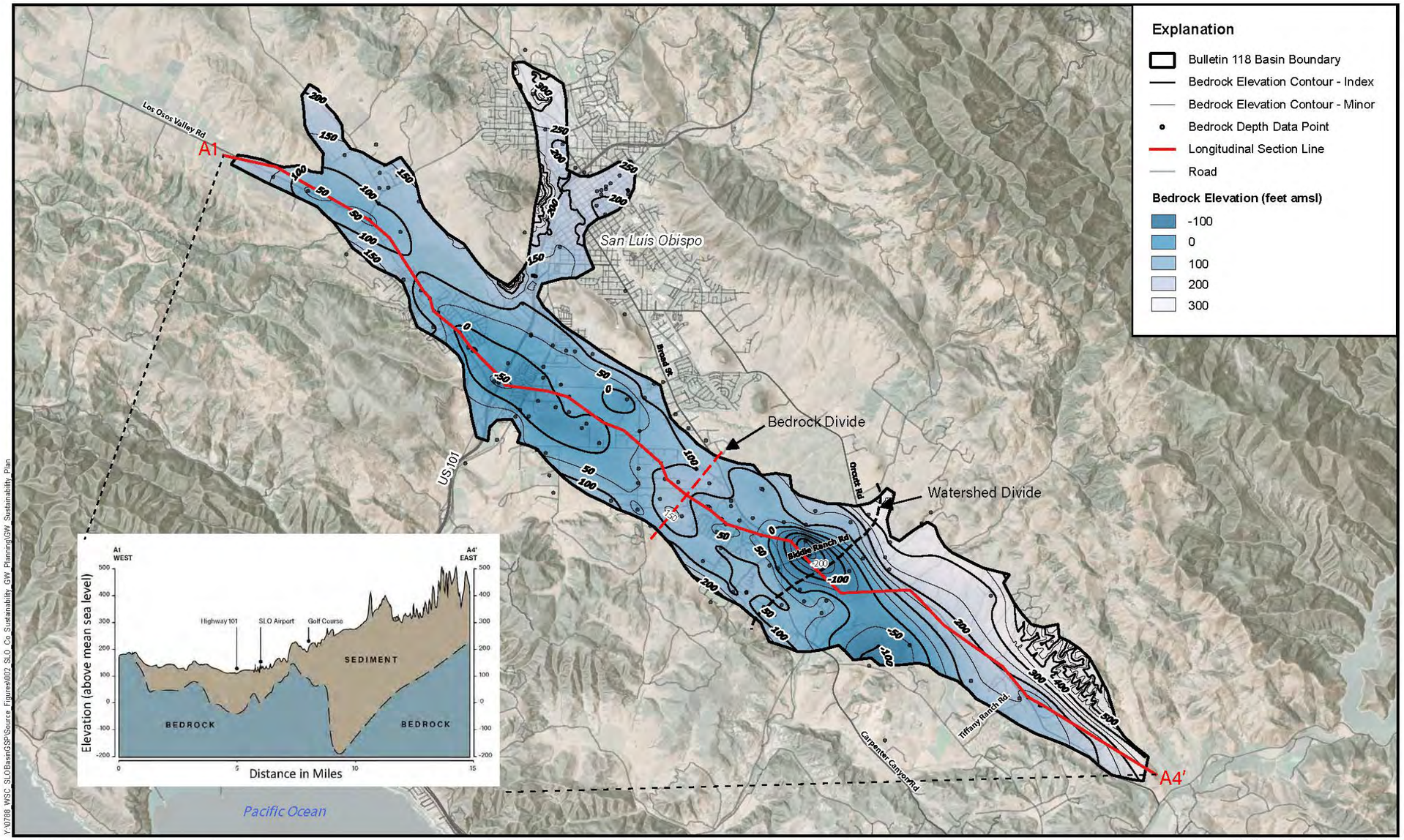
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. PRISM Climate Group (Oregon State University)

Notes:

1. Precipitation data from: PRISM 30 yr Normal sataset (1981-2010)

Annual Precipitation

Figure 4-3



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: NP
Date: 10/31/2019

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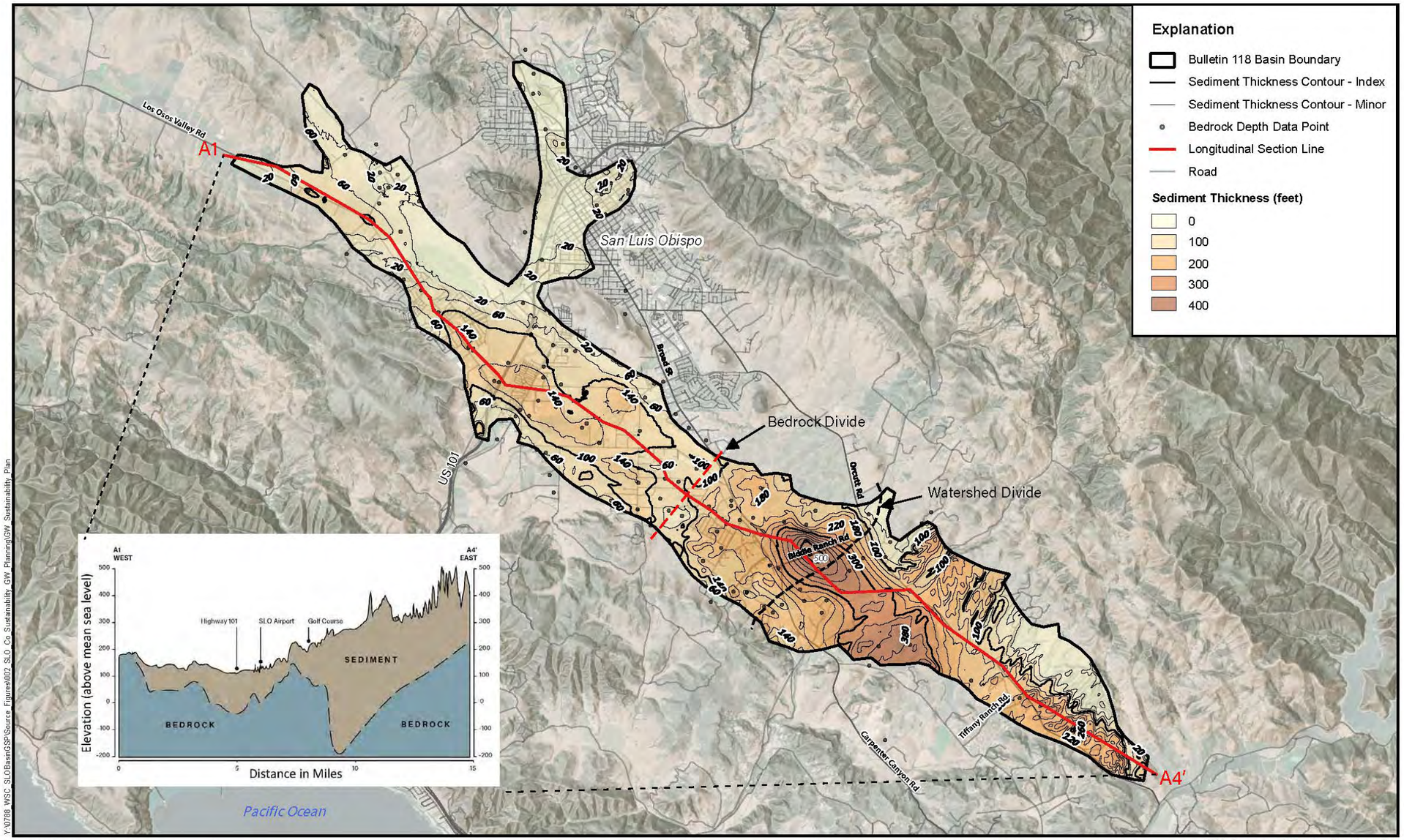
References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS

Bottom Elevation of Basin

Figure 4-4



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: NP
Date: 10/31/2019

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS

Notes:
1. Contour Interval = 40 feet

Thickness of Basin Sediments

Figure 4-5

4.2 PRIMARY USERS OF GROUNDWATER

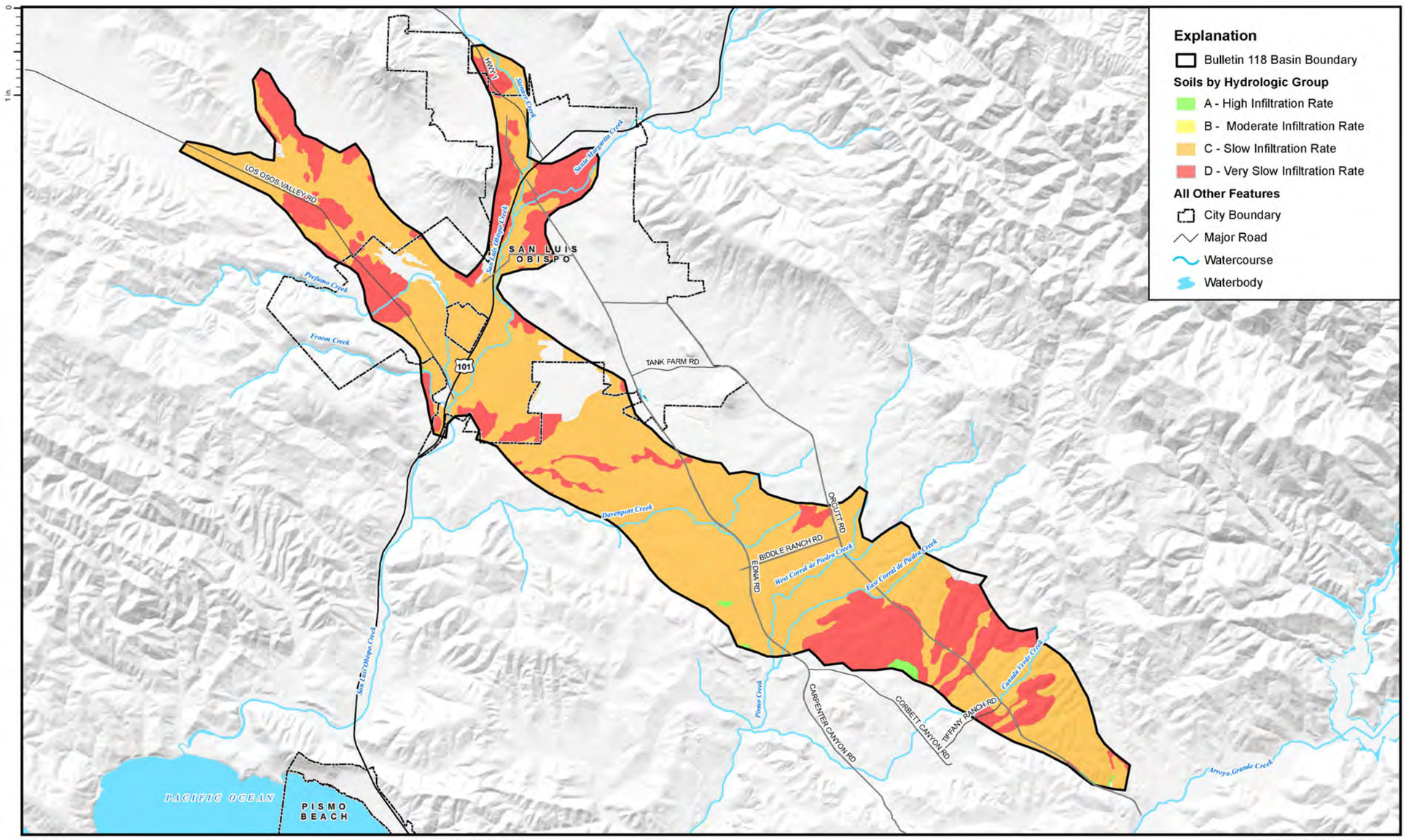
The primary groundwater users in the Basin include municipal, agricultural, and domestic (i.e., rural residential, small community water systems, and small commercial entities). These entities are discussed in more detail in Chapter 2 of this report. The City currently receives most or all of its supply from surface water sources including Whale Rock Reservoir, Santa Margarita Reservoir, Nacimiento Reservoir, and recycled water (Figure 3-3). However, it maintains its network of production wells in standby mode for emergency supply and intends to utilize groundwater as a resource to meet future water demand. The mutual and private water companies, domestic and agricultural users in the Edna Valley rely almost exclusively on groundwater, although some have water rights along East and West Corral de Piedras Creeks. No surface water points of diversion along San Luis Obispo Creek are present in the Basin.

4.3 SOILS INFILTRATION POTENTIAL

Saturated hydraulic conductivity of surficial soils is a good indicator of the soil's infiltration potential. Soil data from the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (USDA NRCS, 2007) is shown by the four hydrologic groups on Figure 4-6. The soil hydrologic group is an assessment of soil infiltration rates that is determined by the water transmitting properties of the soil, which includes hydraulic conductivity and percentage of clays in the soil relative to sands and gravels. The groups are defined as:

- Group A – High Infiltration Rate: water is transmitted freely through the soil; soils typically less than 10 percent clay and more than 90 percent sand or gravel.
- Group B – Moderate Infiltration Rate: water transmission through the soil is unimpeded; soils typically have between 10 and 20 percent clay and 50 to 90 percent sand
- Group C – Slow Infiltration Rate: water transmission through the soil is somewhat restricted; soils typically have between 20 and 40 percent clay and less than 50 percent sand
- Group D – Very Slow Infiltration Rate: water movement through the soil is restricted or very restricted; soils typically have greater than 40 percent clay, less than 50 percent sand

A higher soil infiltration capacity does not necessarily correlate to higher transmissivity in the underlying aquifer, but it may correlate to greater recharge potential in localized areas. This will be discussed in more detail in Chapter 5.



Prepared for:

Author: EC
Date: 11/25/2019

SAN LUIS OBISPO VALLEY BASIN GSP

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References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS

Soil Hydrologic Groups

Figure 4-6

4.4 REGIONAL GEOLOGY

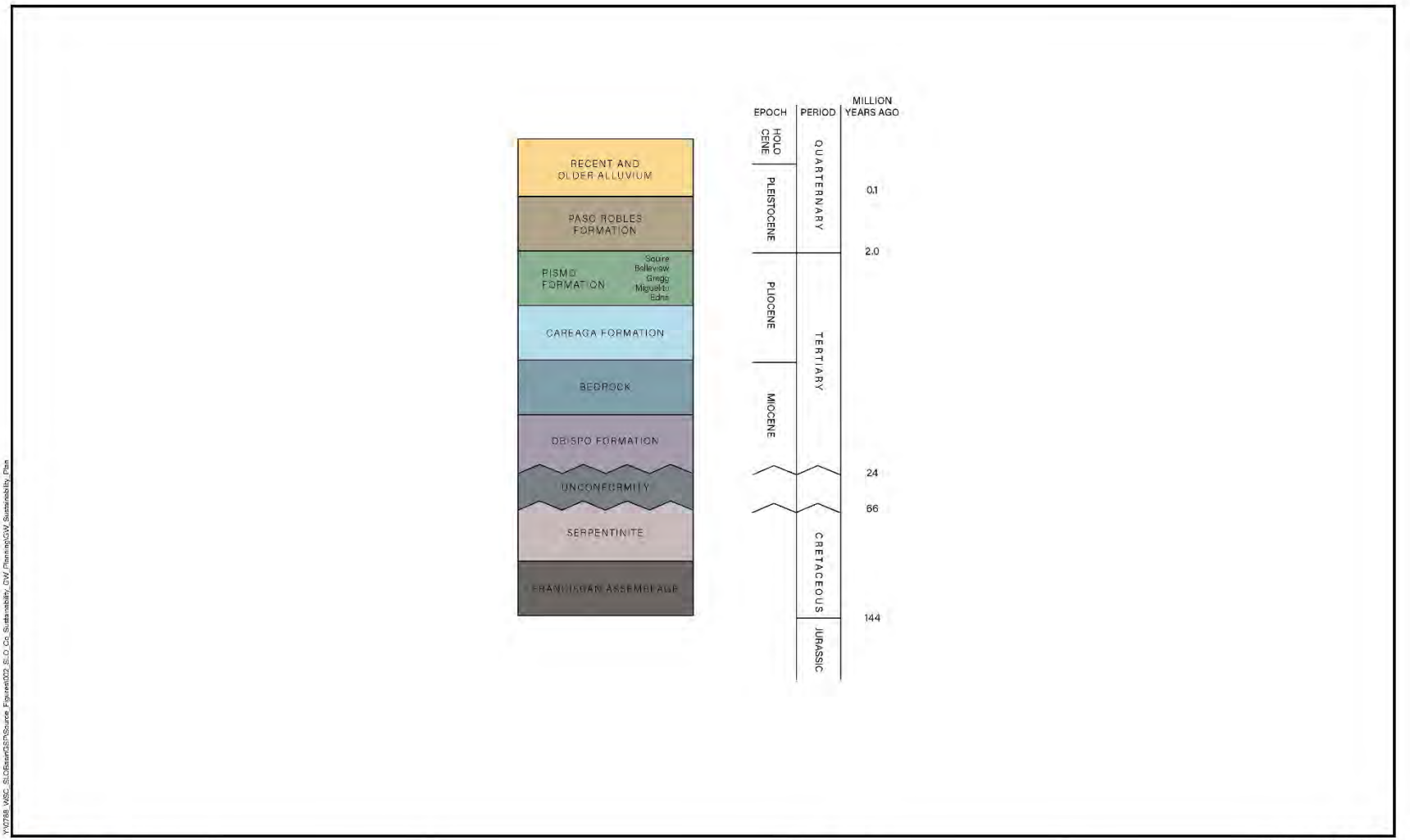
This section provides a description of the geologic formations and structures in the Basin. These descriptions are summarized from previously published reports. Figure 4-7 displays a stratigraphic column presenting the significant geologic formations within the Basin. Figure 4-8 presents a surficial geologic map of the Basin and surrounding area. Figure 4-9 displays the locations of lithologic data used for this plan, and the section lines corresponding to cross sections in the following figures. Geologic cross sections are presented in Figure 4-10 through 4-22. The selected geologic cross sections illustrate the relationship of the geologic formations that comprise the Basin and the geologic formations that underlie and bound the Basin. The cross sections displayed on Figure 4-10 through Figure 4-21were directly adopted from the SLO Basin Characterization Report (GSI, 2018).

4.4.1 Regional Geologic Structures

The primary geologic structures of significance to the hydrogeology of the Basin are the Edna Fault Zone and the adjacent Los Osos Fault Zone, which together form the southwestern boundary of the Basin through the uplift of the Franciscan and Monterey Formation strata in the San Luis Range southwest of the faults. The Edna and Los Osos Faults are normal faults, indicating primary displacement motion is vertical rather than lateral (Figure 4-8). There are some disconnected and unnamed fault splays mapped in the area south of the airport.

4.4.2 Geologic Formations within the Basin

For the purpose of this plan, the geologic units in the Basin and vicinity may be considered as two basic groups; the Basin sediments and the consolidated bedrock formations surrounding and underlying the Basin. The consolidated bedrock formations range in age and composition from (1) Jurassic-aged serpentine and marine sediments to (2) Tertiary-aged marine and volcanic depositions. Compared to the saturated sediments that comprise the Basin aquifers, the consolidated bedrock formations are not considered to be significantly water-bearing. Although bedding plane and/or structural fractures in these rocks may yield small amounts of water to wells, they do not represent a significant portion of the pumping in the area. The delineation of the Basin boundaries is defined both laterally and vertically by the contacts of the Basin sedimentary formations with the consolidated bedrock formations. From a hydrogeologic standpoint, the most important strata in the Basin are the sedimentary basin fill deposits that define the vertical and lateral extents of the Basin. These include recent and older deposits of terrestrial sourced sediments, underlain in the Edna Valley by older marine sedimentary units. Figure 4-7 presents a stratigraphic column of the significant local geologic units. Figure 4-8 presents a map of the Basin vicinity (assembled from a mosaic of the Dibblee maps from the San Luis Obispo, Pismo Beach, Lopez Mountain, and Arroyo Grande NE quadrangles) showing where the various formations crop out at the surface. Fault data displayed in Figure 4-8 were acquired via the USGS Earthquake Hazards Program. The Quaternary fault and fold database from which the shapefiles are derived was published in 2006 and cites a wide variety of published sources. Fault traces within the shapefile represent surficial deformation caused by earthquakes during the Quaternary Period (the last 1.6 million years). Figure 4-8 also displays the Basin boundaries defined in DWR Bulletin 118. Inspection of Figure 4-8 indicates that the Bulletin 118 Boundary lines for the Basin boundary do not match up precisely with the most recently mapped extent of the water-bearing formations based on GSI (2018). This is likely an artifact of previous mapping being performed at a larger (statewide) scale. The water-bearing sedimentary formations and the non-water-bearing bedrock formations are briefly described below.



Prepared for:

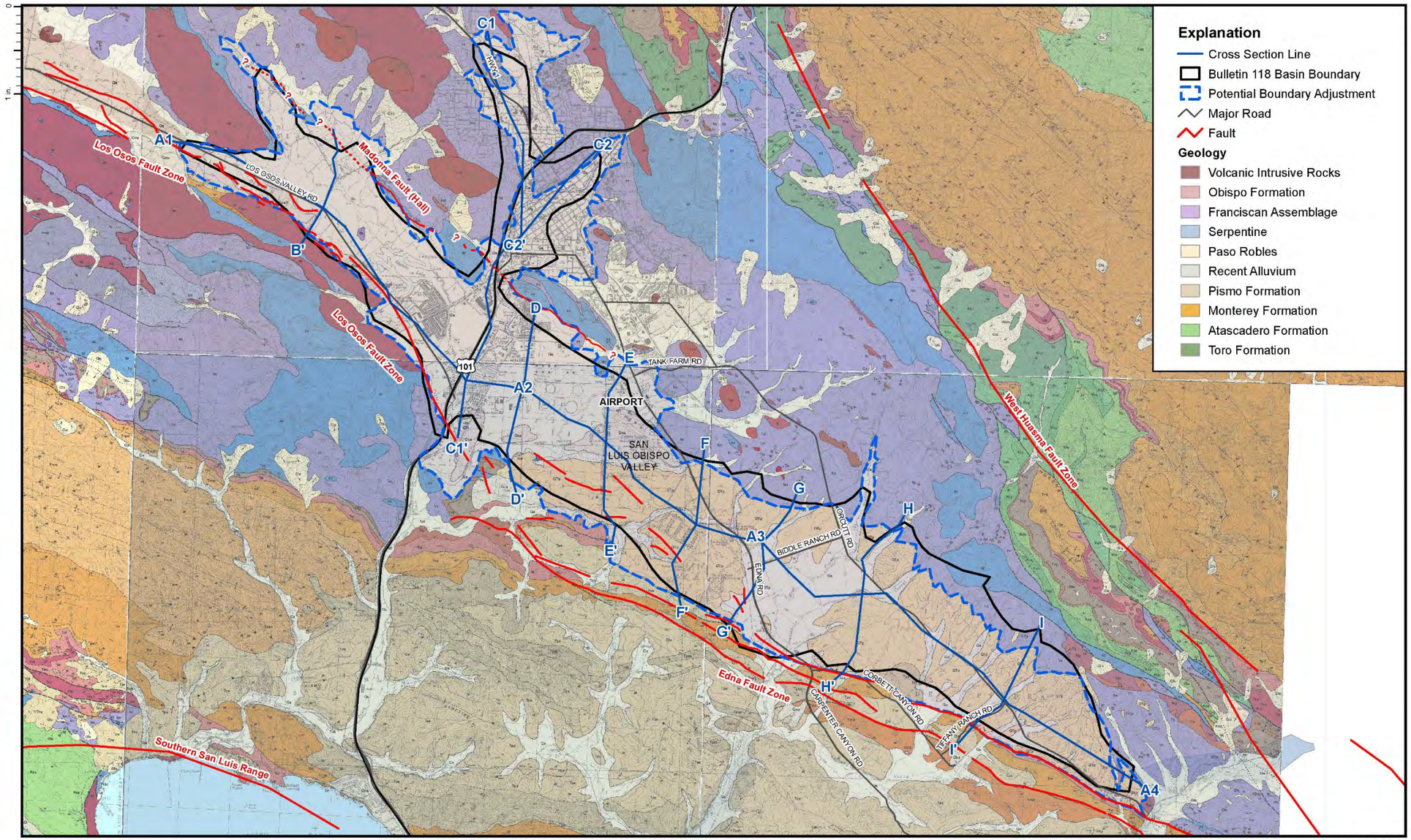
SAN LUIS OBISPO VALLEY BASIN GSP

Author: NP
Date: 10/31/2019

Notes:
1. Adapted from Chioping, 1987.

Stratigraphic Column

Figure 4-7



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: AB
Date: 11/25/2019

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0 0.25 0.5 1 Miles
0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. GeoMap

Geologic Map

Figure 4-8

4.4.2.1 Alluvium

The Recent Alluvium is the mapped geologic unit composed of unconsolidated sediments of gravel, sand, silt, and clay, deposited by fluvial processes along the courses of San Luis Obispo Creek, Davenport Creek, East and West Corral de Piedras Creeks, and their tributaries. Lenses of sand and gravel are the productive strata within the Recent Alluvium. These strata have no significant lateral continuity across large areas of subsurface within the Basin. Thickness of Recent Alluvium may range from just a few feet to more than 50 feet. Well pumping rates may range from less than 10 gallons per minute (gpm) to more than 100 gpm. However, wells screened exclusively in Recent Alluvium are generally less productive than wells that screen significant thicknesses of the Paso Robles and/or Pismo Formations.

4.4.2.2 Paso Robles Formation

The Paso Robles Formation underlies the Recent Alluvium throughout most of the Basin, and overlies the Pismo Formation where present. It is composed of poorly sorted, unconsolidated to mildly consolidated sandstone, siltstone, and claystone, with thin beds of volcanic tuff in some areas. The Paso Robles Formation was deposited in a terrestrial setting on a mildly sloping floodplain that has been faulted, uplifted, and eroded since deposition. The Paso Robles Formation is exposed at the surface throughout much of the Edna Valley, except in areas where existing streams have deposited Recent Alluvium on top of it. It is not readily distinguishable from alluvium in geophysical well logs. Locally, the Paso Robles Formation is sometimes distinguished as being yellow in color, with sticky clay. DWR Well Completion Reports with these types of descriptions generally were identified as Paso Robles Formation for the purpose of interpreting the geology in the cross sections. However, it was sometimes difficult to distinguish between Recent Alluvium and Paso Robles Formation in driller's descriptions, and professional judgment and broader context within the Basin were often used when defining the contact between these two units. Wells that screen both the Recent Alluvium and Paso Robles Formation have reported yields from less than 100 to over 500 gpm.

4.4.2.3 Pismo Formation

The oldest geologic water-bearing unit with significance to the hydrogeology of the Basin is the Pismo Formation. The Pismo Formation is a Pliocene-aged sequence of marine deposited sedimentary units composed of claystone, siltstone, sandstone, and conglomerate. There are five recognized members of the Pismo Formation (Figure 4-7). While all members are part of the Pismo Formation, each member reflects different depositional environments, and the variations in geology may affect the hydrogeologic characteristics of the strata. From the oldest to youngest, the members are:

- The Edna Member, which lies unconformably atop the Monterey Formation, and is locally bituminous (hydrocarbon-bearing)
- The Miguelito Member, primarily composed of thinly bedded grey or brown siltstones and claystones
- The Gragg Member, usually described as a medium-grained sandstone
- The Bellview Member, composed of interbedded fine-grained sandstones and claystones
- The Squire Member, generally described as a medium- to coarse-grained fossiliferous sandstone of white to grey sands

Previous reports have identified the significant thicknesses of sand at depth beneath the Paso Robles Formation in the Edna Valley as the Squire Member of the Pismo Formation. However, it is not clear

whether these are accurately assigned as Squire. Other members of the Pismo Formation may be part of the sequence, and there is some ambiguity as to the actual member assignment. Even in the adjacent Pismo Beach and Arroyo Grande NE quadrangle geologic (Dibblee 2006a, 2006b), there is ambiguity in the geologic nomenclature. In the adjacent geologic maps these quadrangles, a continuous exposure of this unit across the boundary between the two maps is referred to as Pismo Formation in one map (Dibblee 2006b), and Squire Sandstone in the other (Dibblee 2006a). Therefore, it is probably more accurate to generally refer to these units as the Pismo Formation, and not to specifically identify the member designations. This convention will be followed for the remainder of this report.

The Pismo Formation is extensive below the Paso Robles Formation in the Edna Valley. Thicknesses of Pismo Formation up to 400 feet are reported or observed in well completion reports and in the cross sections (Figure 4-5). The presence of sea shells in the lithologic descriptions of well completion reports is clearly diagnostic of the Pismo Formation because of its marine origin. Many of the well completion reports in the Edna Valley document the presence of water-bearing blue and green sands beneath the Paso Robles Formation, and these are considered to be largely diagnostic of the Pismo Formation as well. Wells that are completed in both the Paso Robles and Pismo Formations are reported to yield from less than 100 gpm to approximately 700 gpm.

4.4.3 Geologic Formations Surrounding the Basin

Older geologic formations that underlie the Basin sediments typically have lower permeability and/or porosity and are generally considered non-water-bearing. In some cases, these older beds may occasionally yield flow adequate for local or domestic needs, but wells drilled into these units are also often dry or produce groundwater less than 10 gpm. Generally, the water quality from the bedrock units is poor in comparison to the Basin sediments. In general, the geologic units underlying the basin include Tertiary-age consolidated sedimentary and volcanic beds (Monterey and Obispo Formations), and Cretaceous-age sedimentary and metamorphic rocks (Franciscan Assemblage).

4.4.3.1 Monterey Formation
The Monterey Formation is a thinly bedded siliceous shale, with layers of chert in some locations. In other areas of the County outside of the Basin, the Monterey Formation is the source of significant oil production. While fractures in consolidated rock may yield small quantities of water to wells, the Monterey Formation is not considered to be an aquifer for the purposes of this GSP. Regionally, the unit thickness is as great as 2,000 feet, and the unit is often highly deformed. Water wells completed in the Monterey Formation are occasionally productive if a sufficient thickness of highly deformed and fractured shale is encountered. More often, however, the Monterey shale produces groundwater to wells in very low quantities. Groundwater produced from the Monterey Formation often has high concentrations of Total Dissolved Solids (TDS), hydrogen sulfide, total organic carbon, and manganese.

4.4.3.2 Obispo Formation
The Obispo Formation and associated Tertiary volcanics are composed of materials associated with volcanic activity along tectonic plate margins approximately 20 to 25 million years ago. The Obispo Formation is composed of ash and other material expelled during volcanic eruptions. Although fractures in consolidated volcanic rock may yield small quantities of water to wells, the Obispo Formation is not considered to be an aquifer for the purposes of this GSP.

4.4.3.3 Franciscan Assemblage
The Franciscan Assemblage contains the oldest rocks in the Basin area, ranging in age from late Jurassic through Cretaceous (150 to 66 million years ago). The rocks include a heterogeneous collection of basalts, which have been altered through high-pressure metamorphosis associated with subduction of the oceanic

crust beneath the North American Plate before the creation of the San Andreas Fault. The current assemblage includes ophiolites, which weather to serpentinites and are common in the San Luis and Santa Lucia Ranges. Although fractures may yield small quantities of water to wells, the Franciscan Assemblage is not considered to be an aquifer for the purposes of this GSP.

4.5 PRINCIPAL AQUIFERS AND AQUITARDS

Water-bearing sand and gravel beds that may be laterally and vertically discontinuous are generally grouped together into zones that are referred to as aquifers. The aquifers can be vertically separated by fine-grained zones that can impede movement of groundwater between aquifers, referred to as aquitards. Three aquifers exist in the Basin:

- Alluvial Aquifer – A relatively continuous aquifer comprising alluvial sediments that underlie the San Luis Obispo Creek and tributary streams, as well as East and West Corral de Piedras Creeks and tributary streams;
- Paso Robles Formation Aquifer – An interbedded aquifer comprised of terrestrially-derived sand and gravel lenses in the Paso Robles Formation.
- Pismo Formation Aquifer - An interbedded aquifer comprised of marine sand and gravel lenses in the Pismo Formation.

There are no significant aquitards that vertically separate the three aquifers in the Basin over large areas. There may be deposits of clay and silt that are not laterally extensive that locally separate two aquifers, but there is no recognized aquitard in the Basin that separates the aquifers over significant areas.

4.5.1 Cross Sections

Eleven cross sections were prepared for this report; three (A1-A2, A2-A3, A3-A4) are oriented along the longitudinal axis of the Basin and eight (B-B' through I-I') are oriented across the Basin, perpendicular to the longitudinal axis (Figure 4-9). All lithologic data was reviewed during the selection of the section line locations. The cross sections display lithology, interpretations of geologic contacts based on available data, well screen intervals, and interpreted and mapped faults. If the geologic interpretation was not clear from the points on the cross section lines, nearby data from other locations was reviewed to provide broader geologic context. Each geologic cross section is discussed in the following paragraphs. The longitudinal axis of the Basin is much longer than the cross basin section lines, the longitudinal axis was divided into three separate cross sections for the sake of clarity and presentation of detail.
As part of the work performed for the GSP, CHG performed a passive seismic geophysical plan in the area along Buckley Road south of the airport (Appendix ZZ). Data from this plan resulted in slight adjustments in three of the previously developed cross sections. These data have been incorporated into the cross sections.

- Cross Section A1-A2 (Figure 4-10) extends approximately 6.5 miles from the northwest extent of the Basin at its boundary with the Los Osos Basin to about 1 mile east of Highway 101. Land surface elevation is about 200 feet AMSL at the northwest extent, and slopes gently downward to about 120 feet AMSL at the southeast extent. Recent Alluvium is exposed at the surface for the entire length of this cross section, ranging in thickness from less than 50 feet near the Los Osos Valley Basin boundary to about 80 feet near the center of the section. The Paso Robles Formation is relatively thin in the northeast where it has been significantly eroded by the alluvium, but thickens to approximately 70 feet in the southeastern part of the section. Marine sands of the Pismo

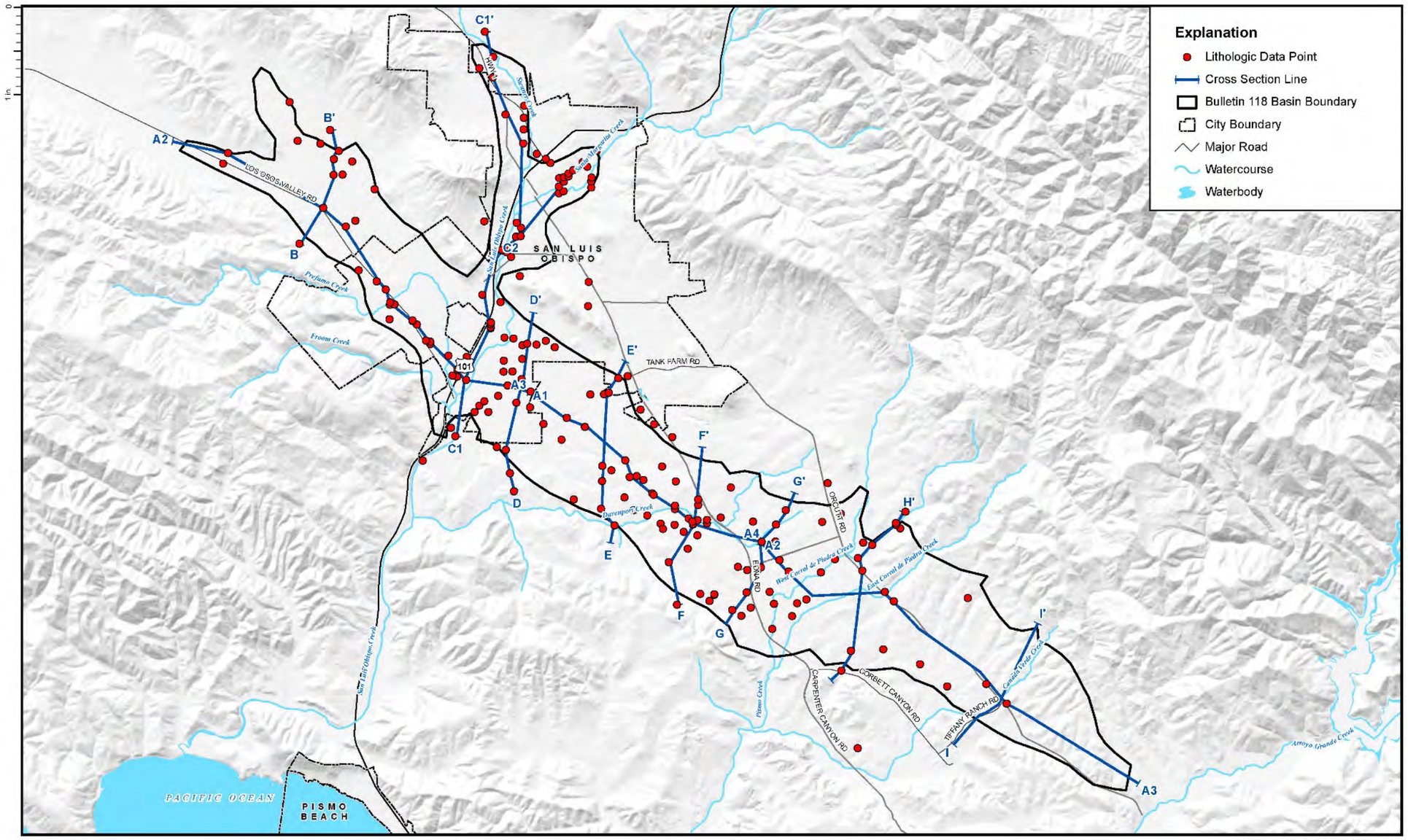
Formation occur below the Paso Robles Formation in the southeastern part of the section, with a maximum thickness of about 50 feet.

- Cross Section A2-A3 (Figure 4-11) extends approximately 4 miles along the longitudinal Basin axis, starting near Tank Farm Road and cutting obliquely across Buckley Road to just past Edna Road in the southeast. Land surface elevation ranges from approximately 120 feet AMSL in the northwest to more than 270 feet AMSL in the southwest. Along the northwest half of the section line, alluvium is exposed at the surface, with an approximate thickness of 40 to 50 feet. The alluvium is primarily underlain by the Paso Robles Formation with thicknesses ranging from approximately 40 to 80 feet. Just southeast of the airport, the Paso Robles Formation is exposed at the surface, beginning at the point where there is a noticeable rise in land surface elevation. This is approximately coincident with the maximum elevation of the underlying bedrock formations (the bedrock divide that approximates the dividing line between the Edna Valley and the San Luis Valley). A recent geophysical investigation by Cleath-Harris Geologists in the area of the high bedrock elevation has provided greater detail on the Basin geometry in this area. The thickness of the Paso Robles Formation in this area is up to 120 feet. Pismo Formation sediments underlie the Paso Robles Formation in this area, with thickness of about 50 feet in the area of Davenport Creek. The Pismo Formation thickness starts to increase significantly along this section line to the southeast, with about 250 feet of Pismo sediments evident at the southeastern extent of the section line. Several of the borings in this section indicate wells are partially or completely screened in bedrock formations, indicating that the relatively thin saturated portions of the water-bearing sediments did not yield enough water for the purposes of the wells.
- Cross section A3-A4 (Figure 4-12) extends about 6.5 miles along the Basin axis from approximately Biddle Ranch Road to the southeast extent of the Basin. Land surface elevation rises from about 250 feet AMSL on the northwest end of the section to over 500 feet AMSL in the southeast. Relatively thin occurrences (40 feet or less) of Recent Alluvium associated with Corral de Piedras Creek and its tributaries are evident in some areas on the western half of this section. In the southeastern extent of the section, the Paso Robles Formation crops out at the surface where the land is beginning to rise to the northern mountains, and is dissected by small streams and valleys in this area. The Pismo Formation sediments reach their maximum thickness of more than 400 feet along the northwestern extent of this section; the thickness of the Pismo gradually thins to about 90 feet at the southwestern extent of the section.
- Cross section B-B' (Figure 4-13) extends about 1.5 miles across the Basin perpendicular to the Basin axis in the vicinity of Foothill Boulevard and Los Osos Valley Road. The section line has a land surface elevation of about 180 feet AMSL on the northern end, sloping downward to about 130 feet AMSL along the Basin's long axis, and rising again to about 230 feet AMSL on the southern end. Recent Alluvium is exposed at the surface along this entire section, with thicknesses of about 20 to 30 feet. In the northern half of the section, alluvium is deposited directly on underlying basement rock. In the southern half of the section, the Paso Robles Formation underlies the alluvium with a maximum thickness of about 45 feet. The southern extent of the section crosses the Los Osos Fault Zone.
- Cross Section C1-C1' (Figure 4-14) extends from the northern lobes of the Basin boundary, which are formed from alluvium from Stenner and San Luis Obispo Creeks, and trends southward approximately 5.5 miles across the Basin from Cal Poly through the City, approximately along the path of Highway 101. Land surface elevation is about 350 feet at the northern end of the section line on some noticeable hilltops along the line, and slopes downward to an approximate altitude of 80 feet on the southern end. Most of the northern extent of this section has alluvium of about 20 to 40 feet of thickness deposited directly on underlying bedrock. Only in the southernmost 1½ miles of the section line, where it crosses the main body of the Basin, do Paso Robles Formation sediments underlie the alluvium. The Paso Robles Formation is about 90 feet thick here, and it is in turn underlain by about 60 feet of Pismo Formation sediments.

- Cross Section C2-C2' (Figure 4-15) extends about 1½ miles southward through the eastern lobe of the northern part of San Luis Valley. Alluvium is deposited directly on top of basement rock along this section. Alluvium is thin here, ranging from less than 10 feet to about 40 feet.
- Cross Section D-D' (Figure 4-16) extends about 2.5 miles southward from a prominent serpentine ridge in the north to the southern Basin boundary. Land surface elevation is about 160 feet on the northern end of the section, sloping down to about 110 feet in the Basin center, and rising to about 180 feet on the southern end. Recent Alluvium is exposed at the surface along most of this section, reaching a maximum thickness of about 80 feet. The alluvium is deposited directly on basement rock through the northern half of the section. In the southern half of the section, approximately 20 to 30 feet of Paso Robles Formation underlies the alluvium. Near the southern extent of the Basin, the section line crosses into the combined Edna-Los Osos Fault Zone, at which point the land surface elevation rises steeply and the Paso Robles Formation crops out at the surface due to the upthrown formations south of the faults.
- Cross Section E-E' (Figure 4-17) extends about 2½ miles across the Basin in the vicinity of the airport and the area south of Buckley Road. Land surface elevation ranges from about 170 feet on the northern end to 230 feet in the southern end. In the northern half of this section, Recent Alluvium are exposed at the surface. In the southern half, the Paso Robles Formation is exposed. Alluvial thickness in the northern half of the section ranges from about 20 to 70 feet, and is underlain by about 30 to 35 feet of Paso Robles Formation. In the southern half of the section, it crosses into the Edna-Los Osos Fault Zone, and the Paso Robles Formation is upthrown to the point that it is exposed at the surface. Paso Robles Formation thickness ranges from 50 feet to about 100 feet. Sediments of the Pismo Formation underlie the Paso Robles Formation in this area, and are about 25 to 70 feet thick.
- Cross Section F-F' (Figure 4-18) extends about 2 miles north to south in the western extent of the Edna Valley area. The Paso Robles Formation is exposed at the surface along most of this section. One small pod of alluvium associated with Davenport Creek is evident in the center of the section. The Paso Robles Formation has a maximum thickness of about 175 feet in this section. It is underlain by about 50 to 60 feet of Pismo Formation sediments in the area north of the Edna Fault Zone. To the south, the section line extends into the Edna Fault Zone. South of the fault, the formations are upthrown, resulting in a small area of Pismo Formation sediments exposed at the surface.
- Cross Section G-G' (Figure 4-19) extends about 2 miles through the heart of the Edna Valley area. Land surface elevation ranges from about 300 feet on the north end to more than 350 feet on the south end. A thin veneer of alluvium, about 20 feet thick, that is associated with Corral de Piedras Creek and tributaries is exposed at the surface along much of this section. The Paso Robles Formation crops out in the north of the section, and underlies the alluvium with an average thickness of about 50 to 60 feet. The Pismo Formation displays its largest thickness along this section, with a maximum thickness of about 450 feet near where this section intersects with cross section A3-A4. The southern end of the section line crosses into the Edna Fault zone, and sediments are displaced such that the Pismo Formation sediments are exposed at the surface on the southern slopes of the Basin in this area.
- Cross Section H-H' (Figure 4-20) extends approximately 2½ miles through the Edna Valley. Land surface is approximately 350 feet on the northern end, sloping downward to about 230 feet near Corbett Canyon Road, then quickly rising to nearly 400 feet on the south end of the section on the upthrown side of the Edna Fault. The Paso Robles Formation is exposed at the surface for nearly the entire section. The section line crosses a small exposure of Recent Alluvium associated with Corral de Piedras Creek. In the northern half of the section, the Paso Robles Formation sediments are deposited directly on the basement rock formations, with a maximum thickness of about 80 feet. In the southern half of the section, the basement rock elevation plunges and the thickness of the Paso Robles Formation is about 150 to 230 feet. The Pismo Formation underlies the Paso

Robles Formation sediments in the southern half of the section, with a maximum thickness of about 200 feet. In the Corbett Canyon area, the section crosses the Edna Fault; south of the fault the basement rock formations are thrust up to the surface, and represent the boundary of the Basin.

- Cross Section I-I' (Figure 4-21) crosses the southern extent of the Edna Valley. The northern part of the section lies along the lower slopes of the Santa Lucia Range, and displays Paso Robles Formation sediments deposited on top of bedrock formations. A small pod of Recent Alluvium associated with Corral de Piedras Creek is displayed. Along the center of the Edna Valley, the Paso Robles Formation thickness is about 200 feet, and is underlain by about 100 feet of Pismo Formation sediments. The section crosses the Edna Fault Zone, which shows Pismo Formation sediments upthrown to land surface on the south side of one fault splay, and bedrock of the Monterey Formation upthrown to land surface elevation south of a second fault splay.



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: EC
Date: 11/25/2019

N

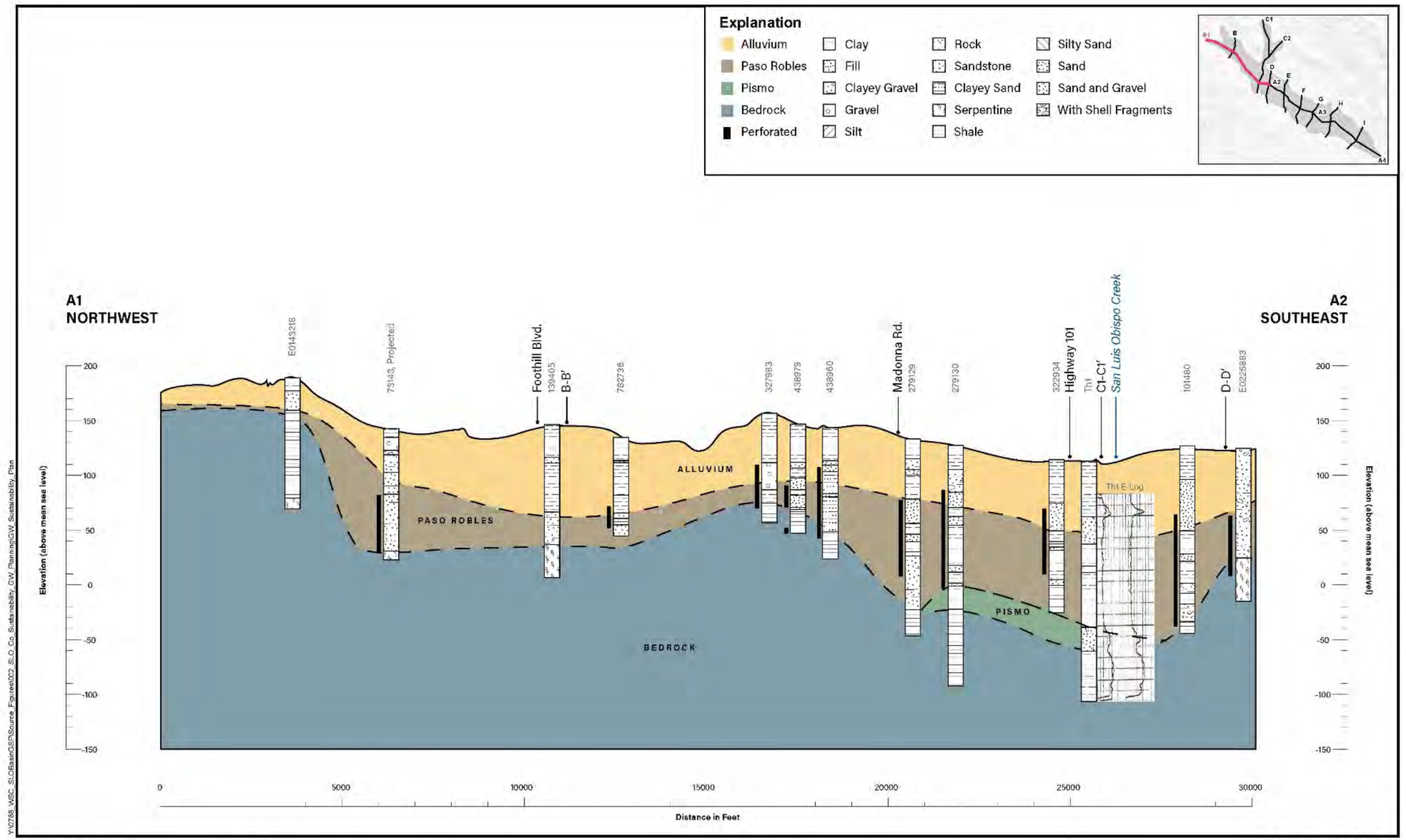
0 0.25 0.5 1 Miles
0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.San Luis Obispo County
3. USGS

Lithologic Data Points and Cross Section Lines

Figure 4-9



Y:\0788_WSC_SLOBasinGSP\Source_Figures\002_SLO_Co_Sustainability_GW_Planning\GW_Sustainability_Plan

Prepared for:

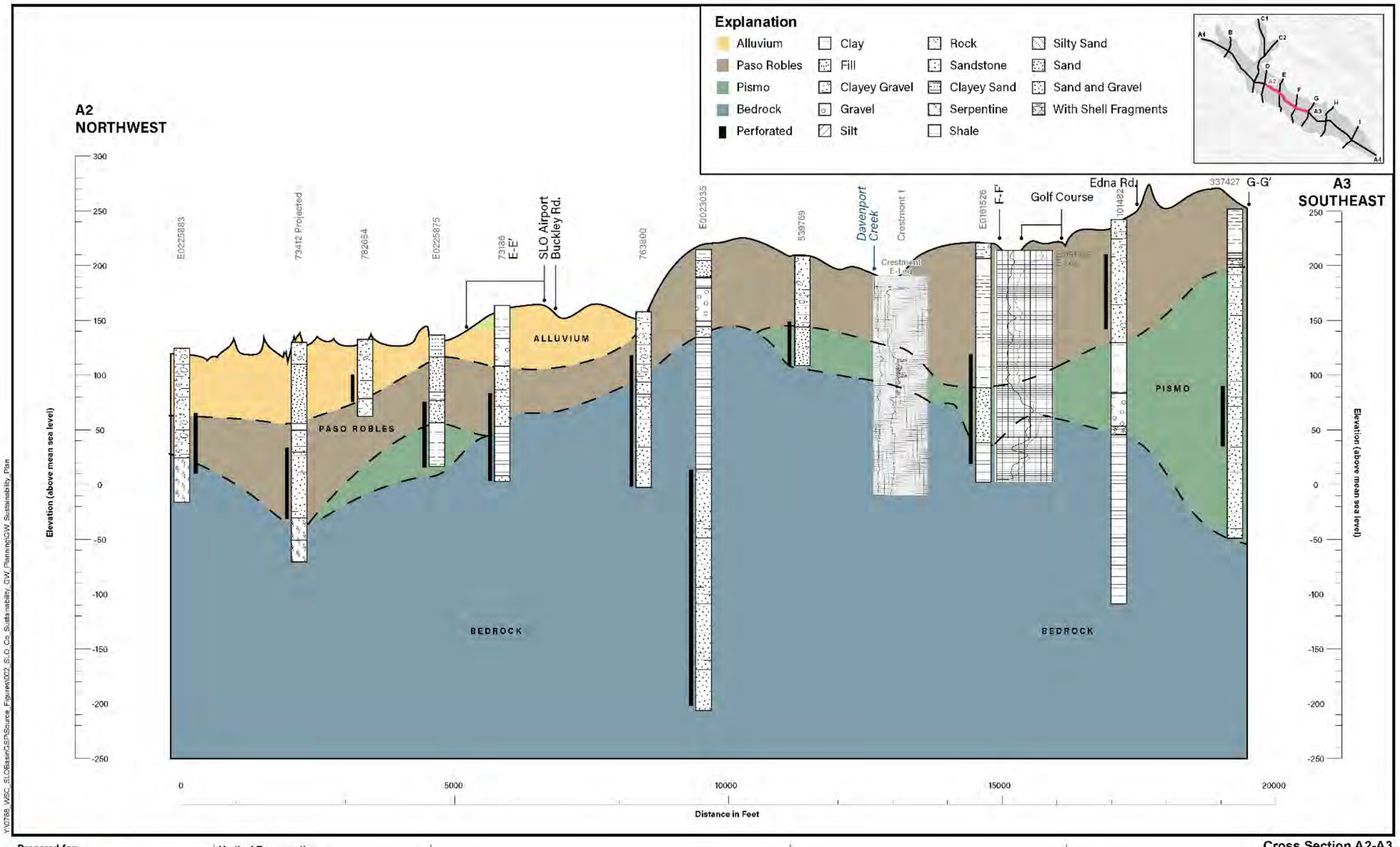
SAN LUIS OBISPO VALLEY BASIN GSP

Author: NP
Date: 10/31/2019

Vertical Exaggeration
30X

Cross Section A1-A2

Figure 4-10



Prepared for:

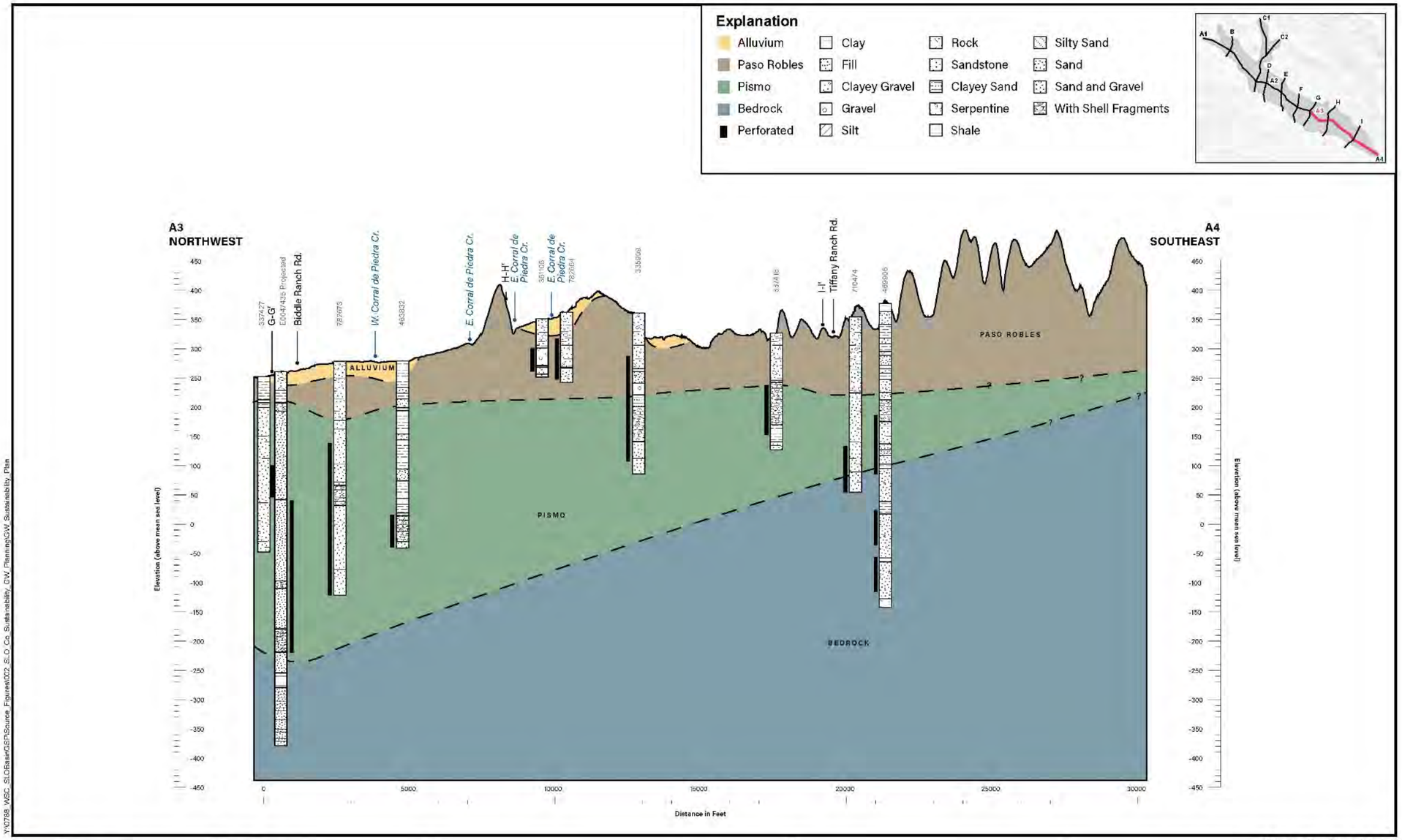
SAN LUIS OBISPO VALLEY BASIN GSP

Author: NP
Date: 10/31/2019

Vertical Exaggeration
20X

Cross Section A2-A3

Figure 4-11



Prepared for:

COUNTY OF SAN LUIS OBISPO

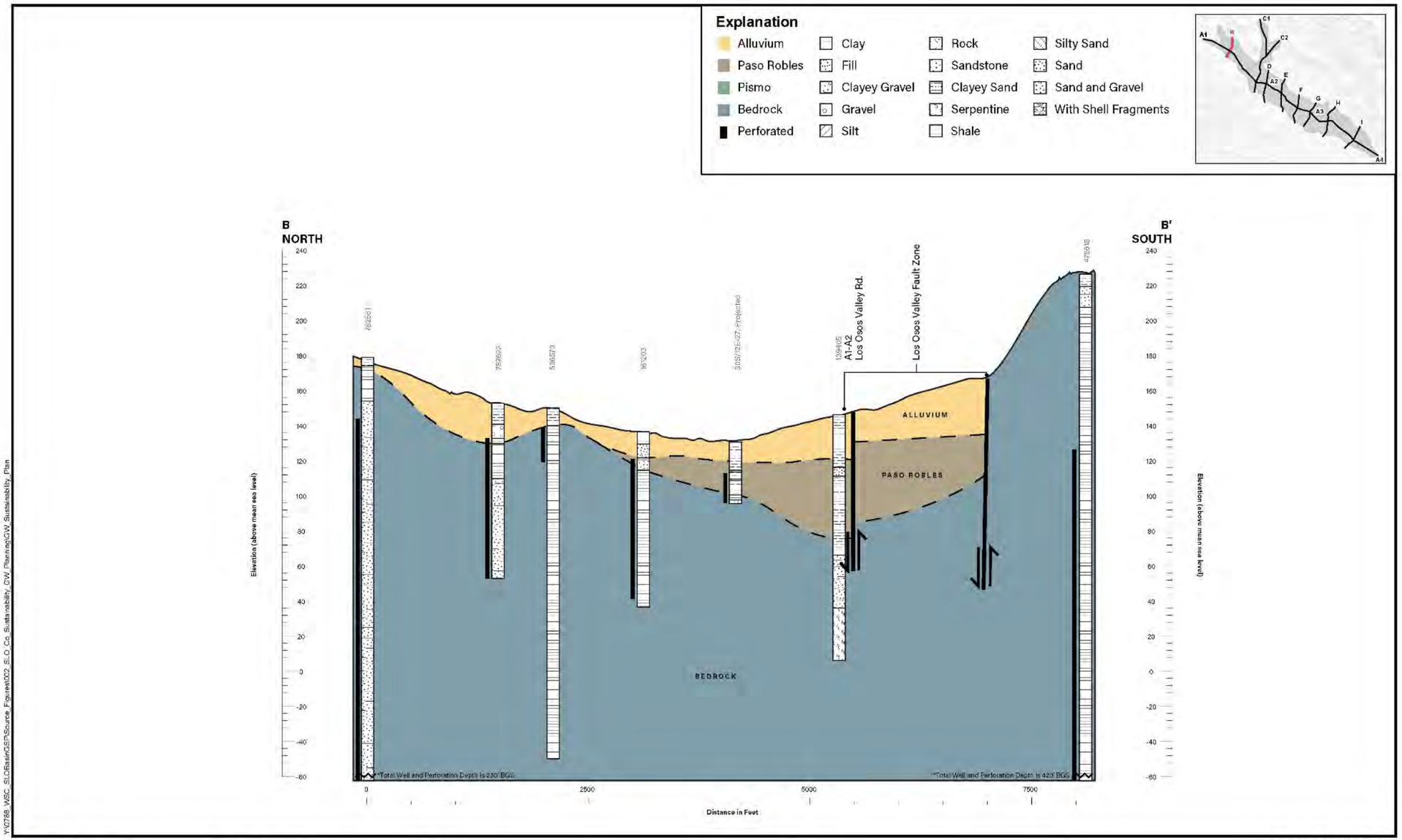
Author: NP
Date: 10/31/2019

SAN LUIS OBISPO VALLEY BASIN GSP

Vertical Exaggeration
20X

Cross Section A3-A4

Figure 4-12



Prepared for:

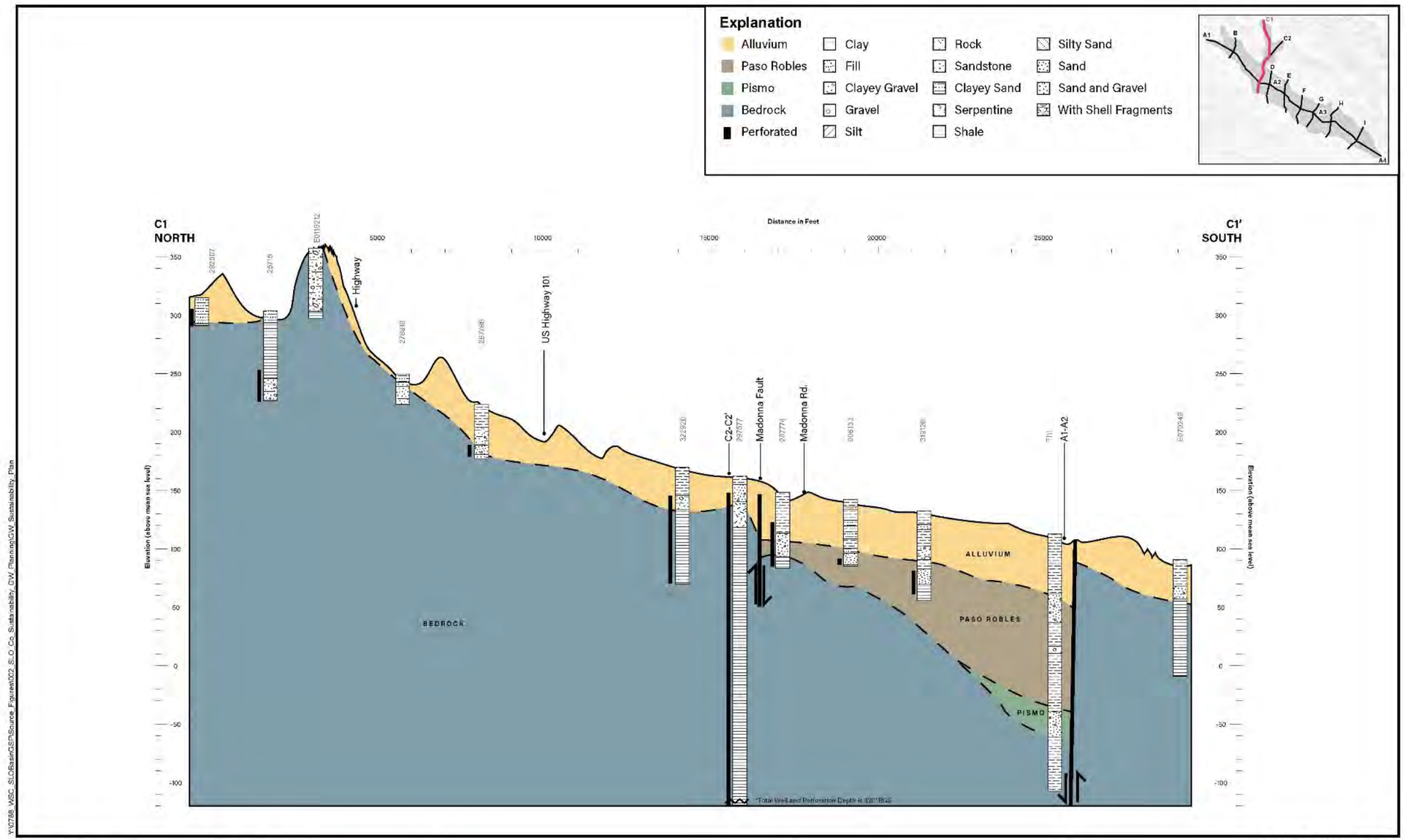
Author: NP
Date: 10/31/2019

SAN LUIS OBISPO VALLEY BASIN GSP

Vertical Exaggeration
20X

Cross Section B-B'

Figure 4-13



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COUNTY OF SAN LUIS OBISPO

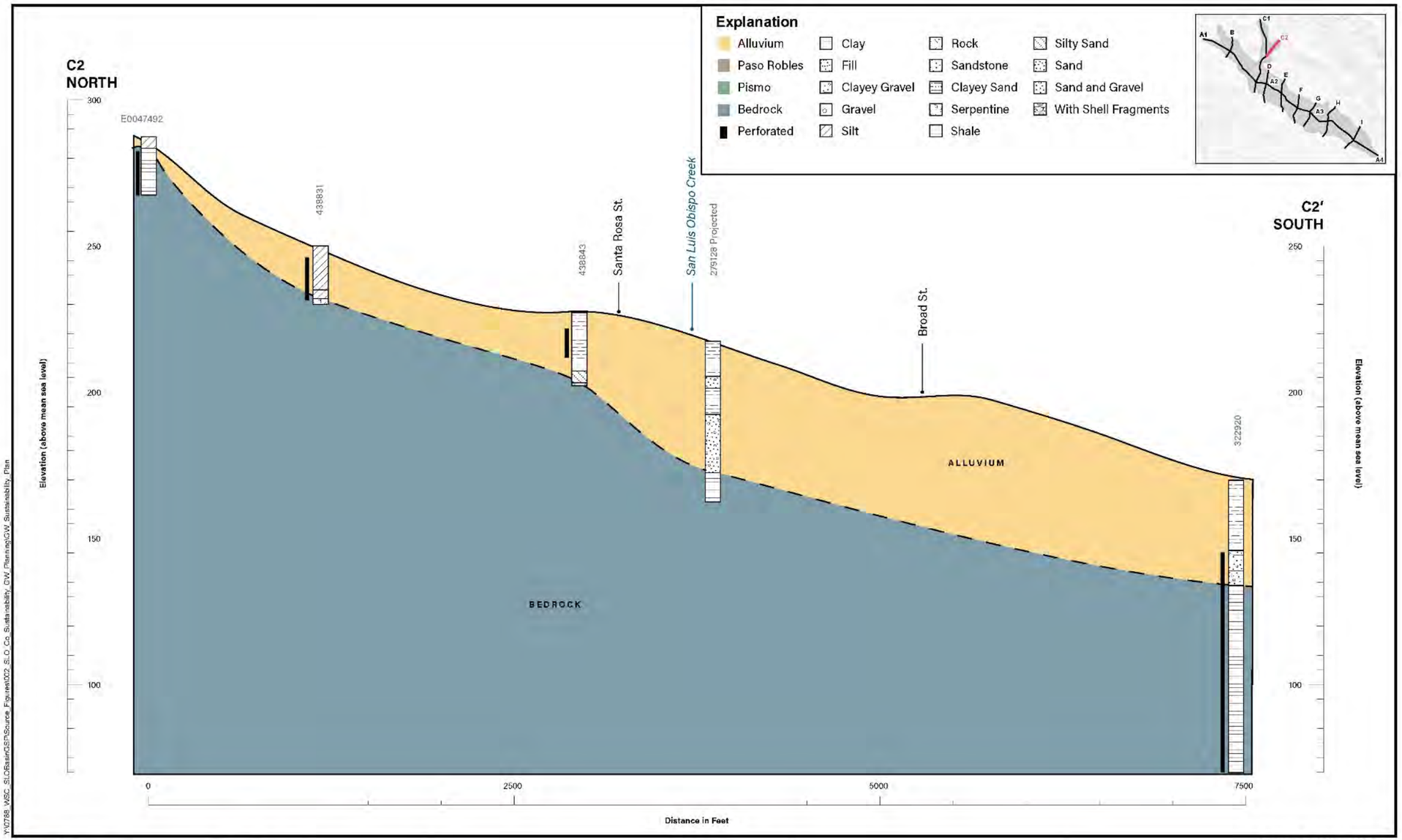
Author: NP
Date: 10/31/2019

SAN LUIS OBISPO VALLEY BASIN GSP

Vertical Exaggeration
3SX

Cross Section C1-C1'

Figure 4-14



Prepared for:

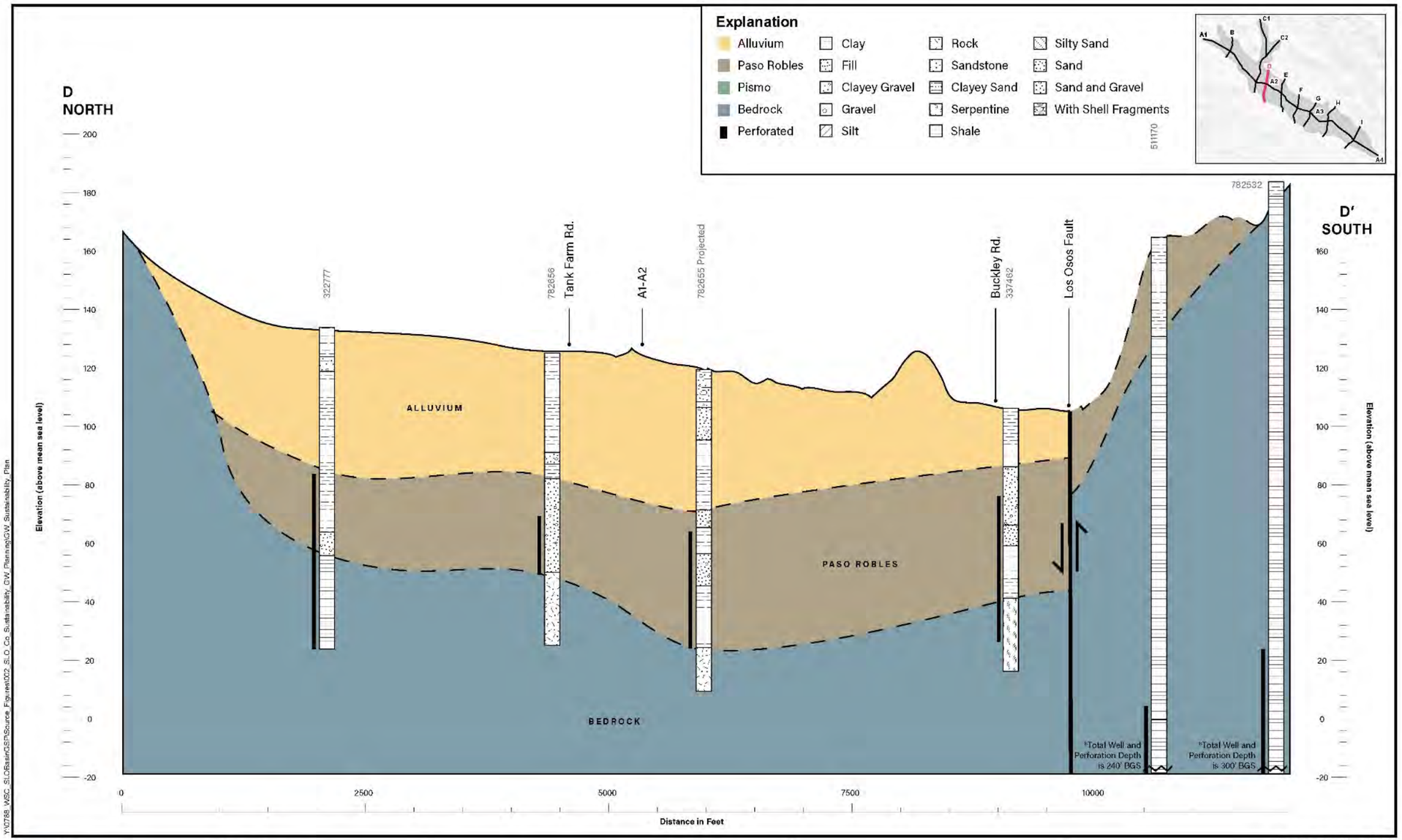
SAN LUIS OBISPO VALLEY BASIN GSP

Author: NP
Date: 10/31/2019

Vertical Exaggeration
20X

Cross Section C2-C2'

Figure 4-15



Prepared for:

Author: NP
Date: 10/31/2019

SAN LUIS OBISPO VALLEY BASIN GSP

Vertical Exaggeration
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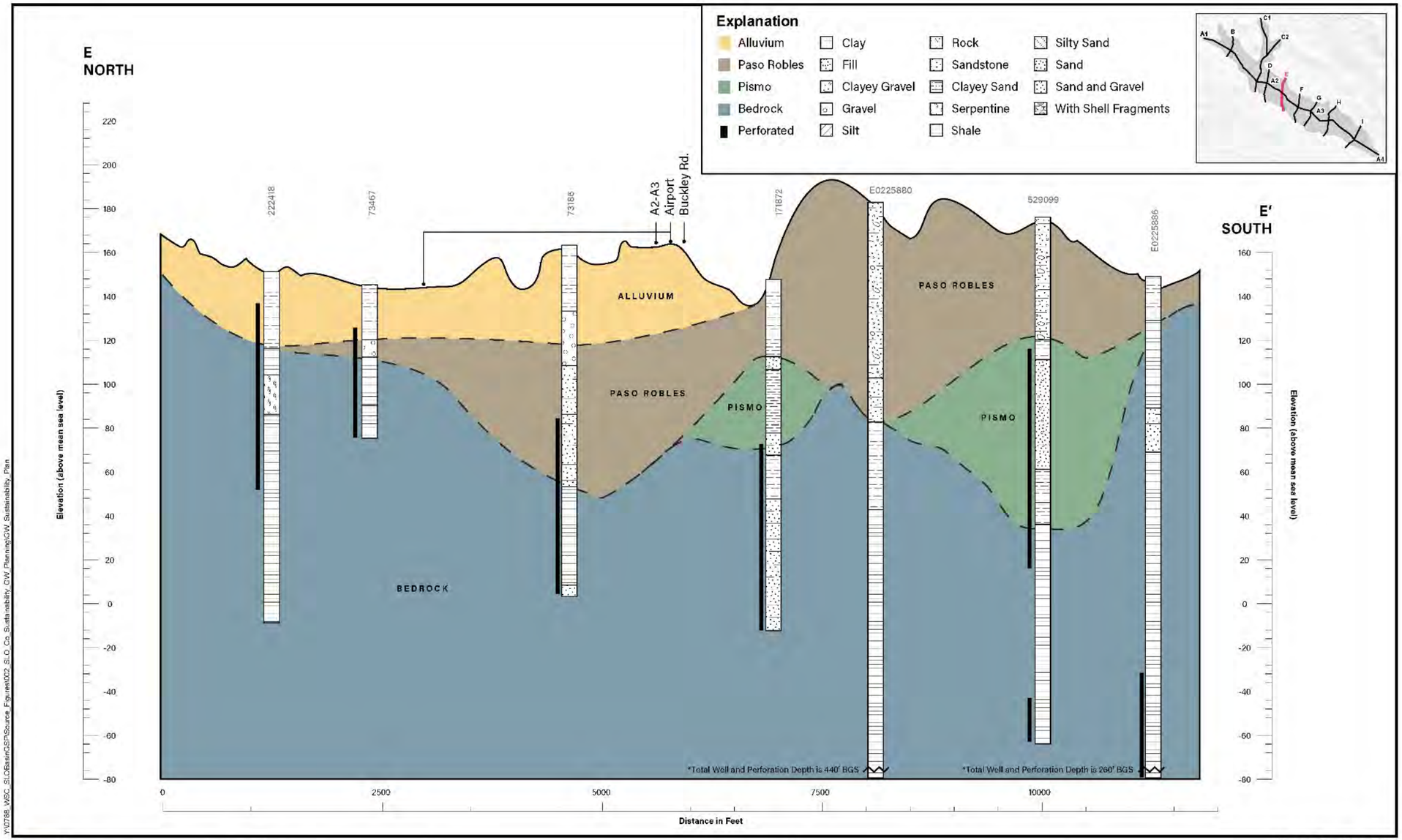
Cross Section D-D'

Figure 4-16



Prepared for:

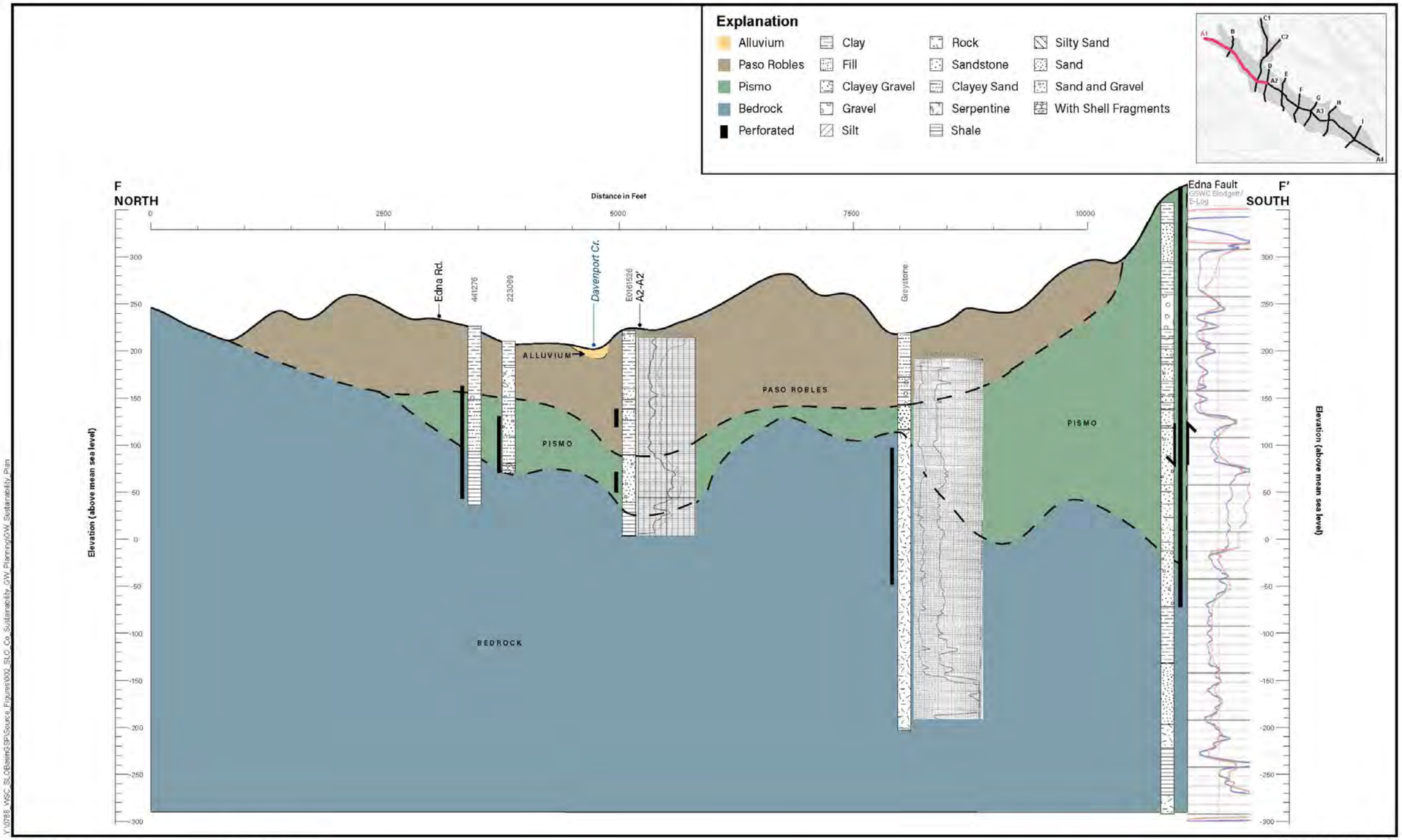
Author: NP
Date: 10/31/2019

SAN LUIS OBISPO VALLEY BASIN GSP

Vertical Exaggeration
25X

Cross Section E-E'

Figure 4-17



Prepared for:

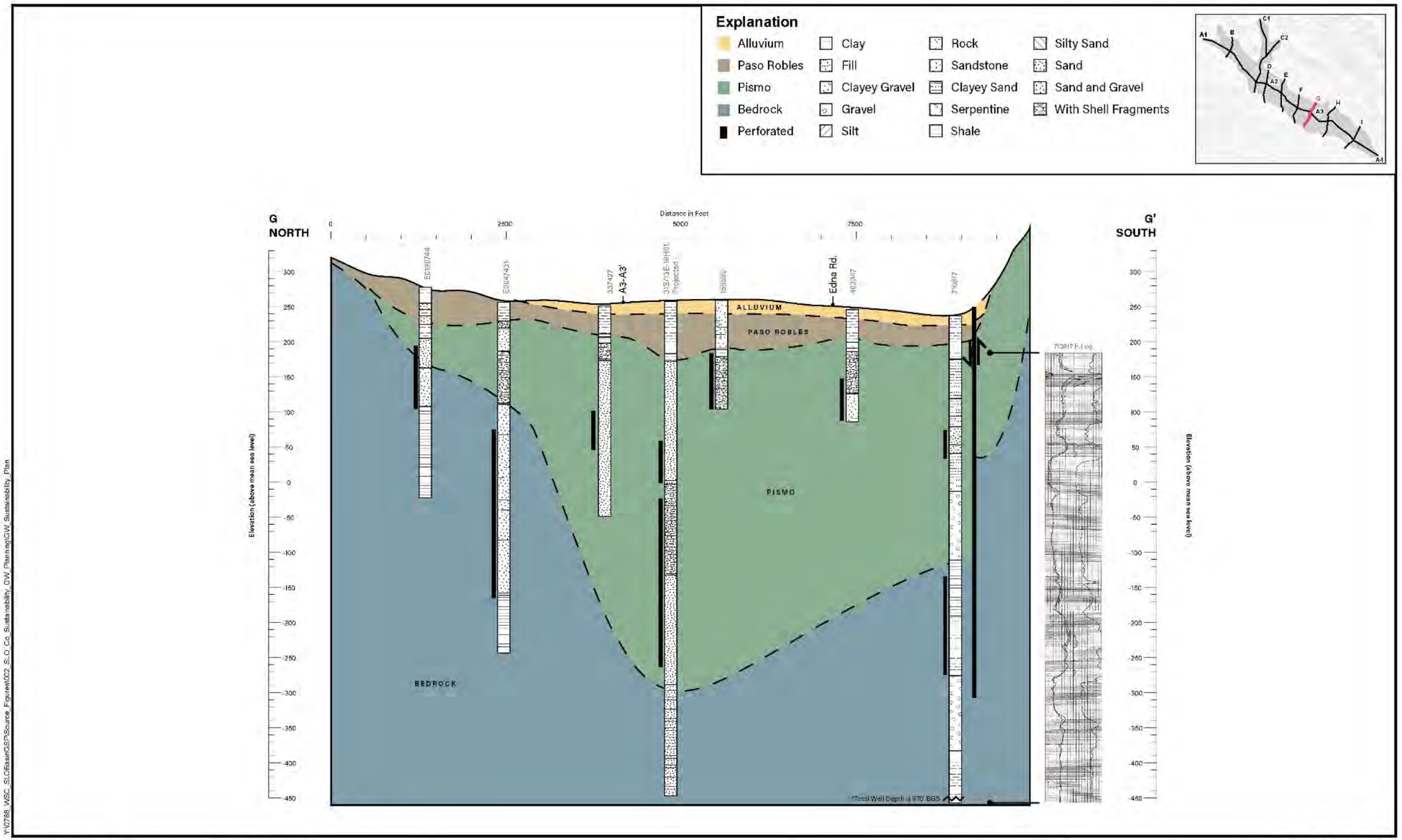
Author: NP
Date: 10/31/2019

Vertical Exaggeration
30X

SAN LUIS OBISPO VALLEY BASIN GSP

Cross Section F-F'

Figure 4-18



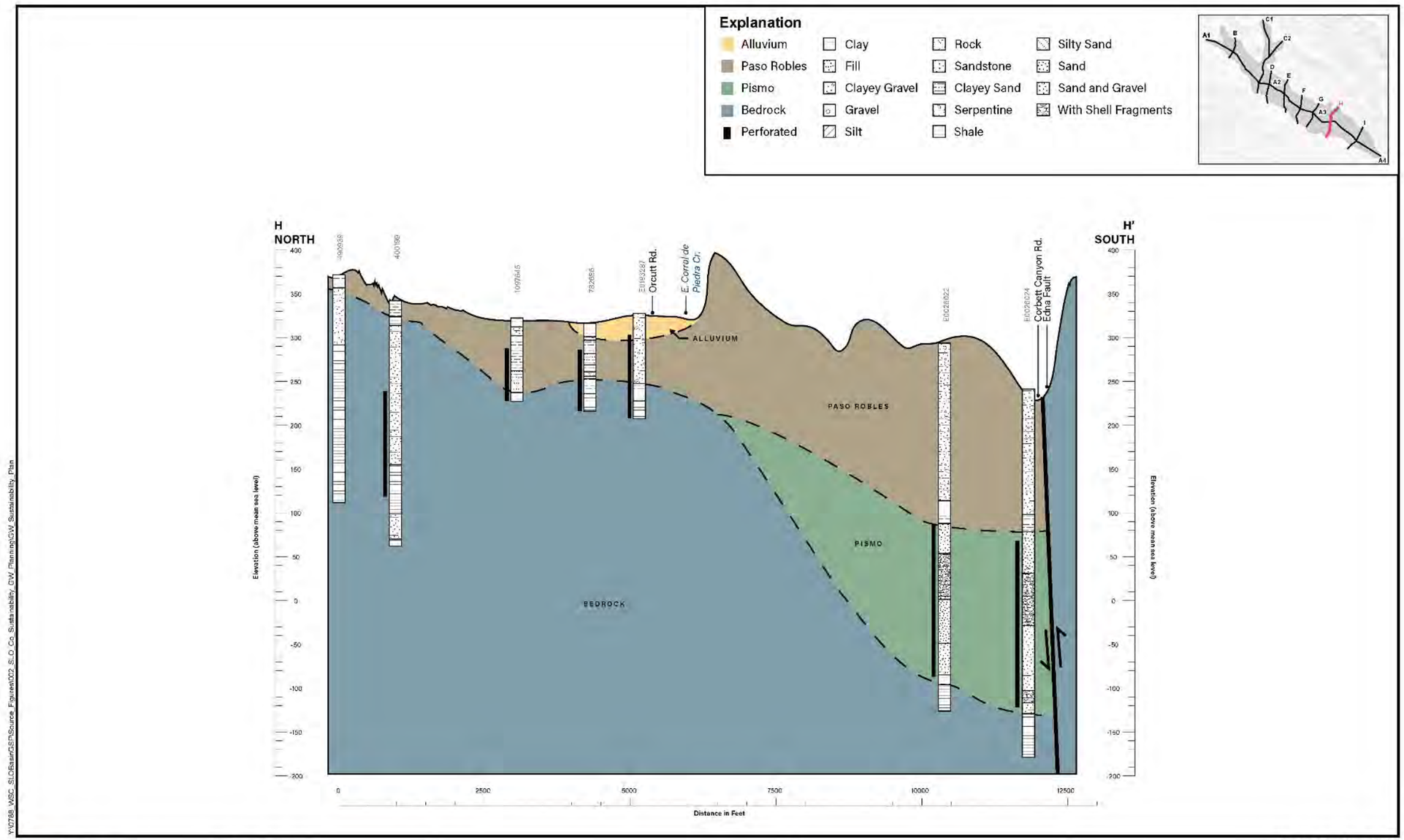
Prepared for:
SAN LUIS OBISPO VALLEY BASIN GSP

Author: NP
Date: 10/31/2019

Vertical Exaggeration
10X

Cross Section G-G'

Figure 4-19

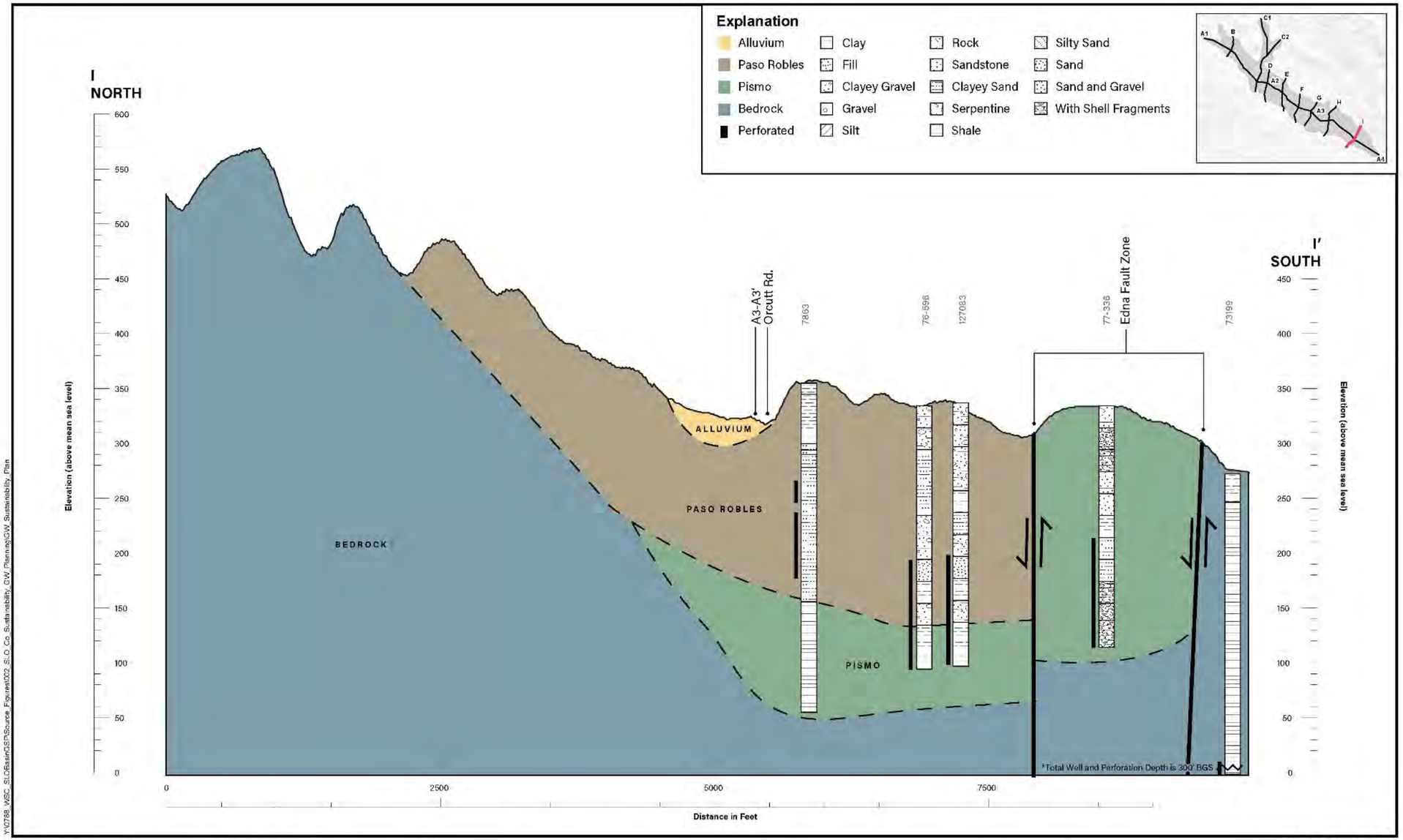


Prepared for:
COUNTY OF SAN LUIS OBISPO
Author: NP
Date: 10/31/2019
SAN LUIS OBISPO VALLEY BASIN GSP

Vertical Exaggeration
15X

Cross Section H-H'

Figure 4-20



Prepared for:
COUNTY OF SAN LUIS OBISPO
Author: NP
Date: 10/31/2019
SAN LUIS OBISPO VALLEY BASIN GSP

Vertical Exaggeration
10X

Cross Section I-I'

Figure 4-21

4.5.2 Aquifer Characteristics

The relative productivity of an aquifer can be expressed in terms of transmissivity, hydraulic conductivity, or specific capacity. The most robust method is measuring transmissivity using a long-term (frequently 24 hours or more) constant-rate pumping test. Water level drawdown data collected during this test can be analyzed and used to calculate transmissivity. Specific capacity is a simple measure of flow rate (gpm) divided by drawdown (feet), routinely measured by well service contractors during well maintenance and reported in units of gpm per foot of drawdown (gpm/ft). Specific capacity measurements may be affected by well construction details, and, therefore, are not only related to aquifer characteristics. Nevertheless, the following commonly accepted empirical relationships allows transmissivity to be estimated from specific capacity measurements.

T (gpd/ft) = SC (gpm/ft) * (1,500 – 2,000), where
T = Transmissivity (gpd/ft)
SC = Specific Capacity (gpm/ft)
1500 – 2000 = Empirical factor, (1,500 used for unconfined, 2,000 for confined aquifer)

Data describing these data from water wells throughout the Basin were compiled. The data was obtained from Previous regional studies or reports, previous pumping tests and well service information provided by local stakeholders. All available reports and documents that were made available through data requests, report reviews, etc., were reviewed for technical information, and included in this summary if the data were judged to be sufficient.

DWR (1958) reports a range of irrigation well pumping rates from 300 to 600 gpm, and a range of specific capacity values of 15 to 20 gpm/ft for the Basin, corresponding to transmissivity estimates from 22,500 to 40,000 gallons per day per foot (gpd/ft). Boyle (1991) evaluated five constant-rate aquifer tests for City wells, all in the San Luis Valley, and reported transmissivity values ranging from 11,200 to 71,000 gpd/ft, with an average of 41,240 gpd/ft. DWR (1997) discussed the range of hydraulic conductivity values used in the preparation of its groundwater model, which averaged about 15 ft/day in the San Luis Obispo Creek Valley, and about 6 ft/day in the Edna area.

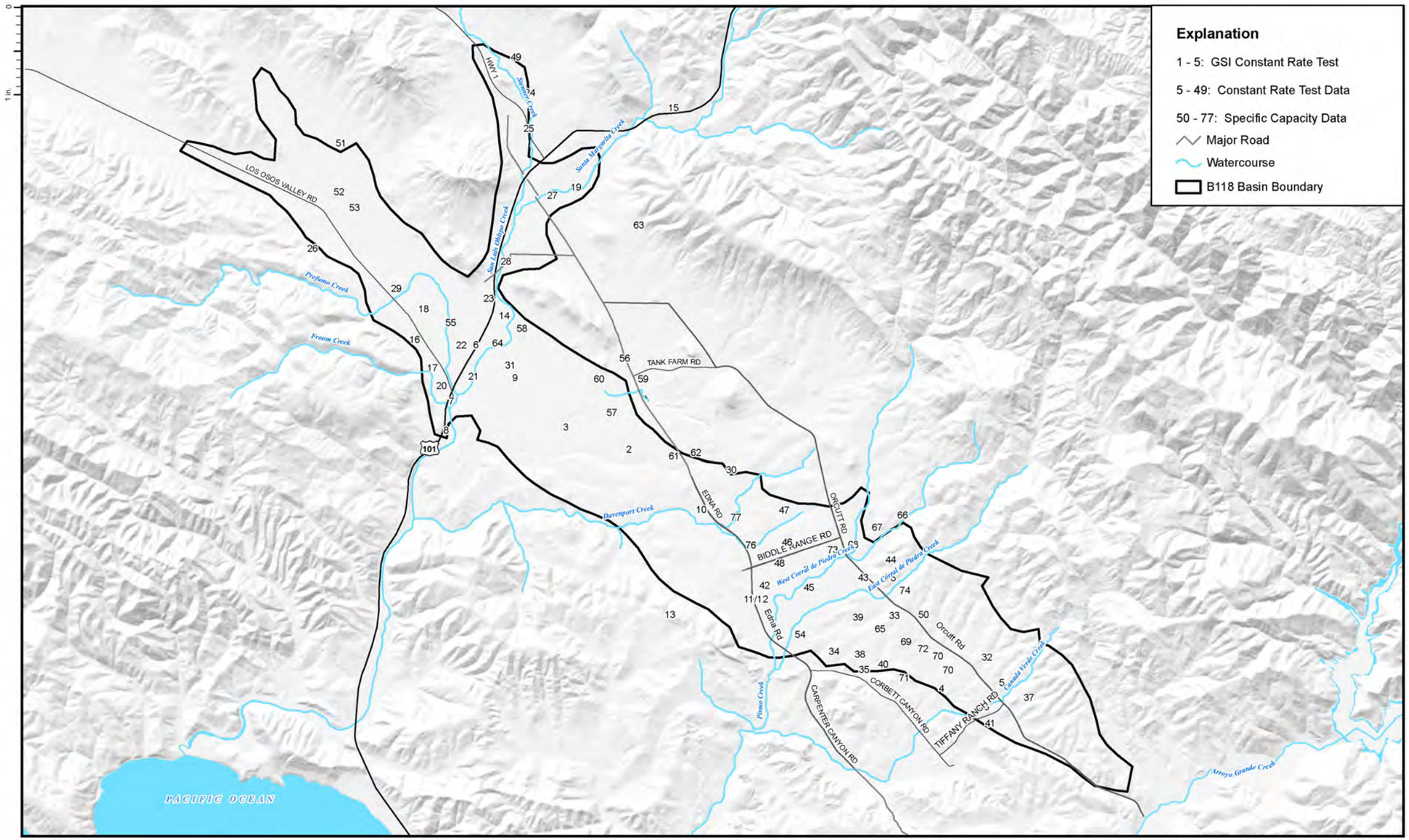
Figure 4-22 displays the spatial distribution of the available data locations for well tests in the Basin. Inspection of Figure 4-22 indicates a good spatial coverage of locations, with reasonable data density throughout the Basin.

Table 4-1 presents a compilation of all constant rate aquifer test data compiled during the preparation of this GSP. Table 4-2 presents a compilation of the specific capacity data. This information is used in the groundwater model development, and in the technical work supporting preparation of the GSP for the Basin.

Table 4-1 presents a data summary for the constant rate aquifer test that was available, including information on pumping rate, static and pumping water levels, screened intervals, total depth, and formations screened. It was not always readily apparent which formations are screened from the available data, and sometimes well screens may span more than one formation. If there is uncertainty regarding this designation, it is indicated with a question mark in Table 4-1. Calculated transmissivity values range from less than 1,000 gpd/ft to a maximum of 158,400 gpd/ft. (The highest reported transmissivity value of 158,400 gpd/ft is an outlier, and was likely influenced by recharge from a nearby stream.

Table 4-2 presents all available information for the specific capacity well tests identified. Table 4-2 includes a transmissivity estimate based on the empirical relationship discussed previously.

Data presented tables 4-1 and 4-2 indicate that wells screened in the Alluvium and Paso Robles Formation have transmissivities ranging from about 5,000 to 158,000 gallons per day per foot (gpd/ft), and averaging over 42,000 gpd/ft. Wells screened in Paso Robles and Pismo Formations have transmissivities ranging from less than 1,000 to about 40,000 gpd/ft, and average about 10,000 gpd/ft.



Prepared for:

Author: AB
Date: 11/25/2019

SAN LUIS OBISPO VALLEY BASIN GSP

N

0 0.25 0.5 1 Miles
0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County

Hydraulic Parameter Data Locations

Figure 4-22

Table 4-1 - San Luis Obispo Valley Groundwater Basin Water Well Pump Test Data Summary

Label No.	Date Drilled	Pump Test Date	Pumping Rate (GPM)	Static Water Level (feet bgs)	Pumping Water Level (feet bgs)	Drawdown (feet)	Specific Capacity (gpm/foot)	Est. Transmissivity (gpd/foot)	Screen Length (feet)	Hydraulic Conductivity (ft/day)	Total Depth (feet)	Perforations	Formation Screened
1		7/31/2017	60	74.3	133	58.7	1.02	2,880 - 4,525	280	1.37 - 2.15	440	180-200; 240-380; 320-440	Pismo
2		8/8/2017	27	21	27.5	6.5	4.2	3,605 - 4,620			98		Paso Robles
3		8/24/2017	55	15.58	78	62.42	0.9	3,227 - 4,840					Paso Robles
4		11/21/2017	265	67.6	155.2	87.6	3.03	1,600	300	2.82 - 3.11	500	200-500	Pismo
5	12/4/2017	12/9/2017	37	132	144.9	12.9	2.87	5,692 - 9,678	200	3.8 - 6.5	300	90-290	Paso Robles/Pismo
6	2/7/2003	2/18-21/2003	350	7.5	39.6	32.1	11	23,100	60	51.3	145	45-85; 115-135	Alluvium/Paso Robles
7	1/31/2003	2/6/2003	400-450	8.92	28.67	19.75	33.3	66,600	45	197.3	80	25-70	Alluvium/Paso Robles
8	2/10/2003	2/19/2003	250	5.5	28.92	23.42	9.3	18,600	30	82.7	70	30-60	Alluvium/Paso Robles
9	4/18/1996	4/19-21/1996	3.7	11.86	23.36	11.5	0.32	187	15	1.7	70	52-67	Alluvium
10	1/23/2013	2/5-9/2013	135	46.78	114.41	67.63	2	3,992	60	8.9		80-100; 140-180	Paso Robles/Pismo
11	8/18/1992	5/31/1992	656	52.4	122.3	69.90	9.38	5,773	200	3.8	440	130-190; 290-430	Pismo/Bedrock
12	4/4/2001	5/9/2001	500	70	85	15	33.33	66,667	180	49.4	520	160-200; 370-510	Pismo/Bedrock
13		5/12-16/2014	149	258.25	295.1	36.85	4.35	8,700	190	6.1	550	280-420; 490-540	Pismo/Obispo or Bedrock
14	6/15/1988	6/30/1988	135	20.5	25.9	5.4	25	50,000	20	333.3	80	50-70	Alluvium/Paso Robles
15	7/12/1988	7/15/1988	80	24	42	18	4.44	8,889	30	39.5	57	27-57	Alluvium
16	7/22/1988	7/26/1988	300	11.5	Incomplete Data						140	40-130	Alluvium/Paso Robles
17	4/20/1989	5/16/1989	250	11.5	53.3	41.8	5.98	15,000	70	28.6	140	60-130	Alluvium/Paso Robles
18	7/27/1988	9/2/1988	95	22	59	37.0	2.57	5,135	70	9.8	180	55-125	Alluvium/Paso Robles
19	7/25/1988	8/4/1988	70	24	27.3	3.3	21.21	42,424	20	282.8	48	28-48	Alluvium
20	10/6/1989	10/24/1989	375	10.42	33.58	23.16	16.19	21,300	95	29.9	175	60-120; 140-175	Paso Robles/Pismo
21	6/28/1989	7/6/1989	200	10.4	38.5	28.1	7.12	21,120	60	46.9	175	50-90; 150-170	Alluvium/Paso Robles
22	4/26/1989	5/10/1989	900	11	39.3	28.3	31.80	63,604	80	106.0	140	42-122	Alluvium/Paso Robles
23		6/14/1989	500	20	47	27	18.52	37,037			60	?	Alluvium
24	12/22/1989	12/27/1989	50	11	31.2	20.2	2.48	4,950	15	44.0	53	33-48	Bedrock
25	4/18/1989	4/20/1989	100	14	26	12	8.33	16,667	10	222.2	44	34-44	Alluvium
26		7/18/1986	60	55	280	225	0.27	533	80	0.9	296	220-300	Bedrock
27		5/15/1989	80	9.92	31	21.08	3.80	26,400	20	176	49	29-49	Alluvium
28		4/22/1993	165	19.63	33.4	13.77	11.98	87,120	30	387.2	65	30-60	Alluvium
29		10/10/1990	25	39.5	78.5	39	0.64	400	80	0.67	145	60-140	Paso Robles
30		7/20/2011	20	46.5	272	225.5	0.09	177	140	0.169	300	160-300	Bedrock
31		6/26/1991	100	20	58	38	2.63	24,000	40	80	140	90-130	Paso Robles
32		4/12/1994	90	53.46	120	66.54	1.35	2,640	85	4.141	170	85-170	Pismo
33		6/26/1989	596	51.2	147.5	96.3	6.19	3,311	280	1.577	400	60-120; 160-360; 380-400	Paso Robles/Squire
34		6/15/2007	350	65.5	138	72.5	4.83	10,266				200-?	
35		6/15/2007	300	37.5	134	96.5	3.11	7,401				170-?	
36		6/9/1985	295	36.25	98.45	62.2	4.74	33,807			240		Paso Robles/Pismo
37		2/10/1997	300	110.2(?)	131.3	21.2	14.15	39,600	220	24	490	190-290; 350-410; 430-490	Pismo
38		8/6/2014	150	166	215	49	3.06	3,046			300		
39		8/7/2014	158	171	219	48	3.29	3,627			310		
40		12/12/2008	170	116	186	70	2.43	5,081					
41		12/22/2005	350	39.6	82	42.4	8.25	18,480	230	10.71	430?	200-430	
42		6/29/2016	150	131.8	226.1	94.3	1.59	10,850	100	14.47	290	180-280	Pismo
43		6/30/1993	100	39.66	78.83	39.17	2.55	1,508	60	3.35	110	50-110	Paso Robles
44		7/21/1993	70	10.5	21.5	11	6.36	2,174	40	7.25	100	20-40; 80-100	Paso Robles/Bedrock
45		3/25/2008	200	76.7	219.3	142.6	1.40	3,105	200	2.07	400	130-170; 220-380	Pismo
46		4/3/2007	300	34.6	112.3	77.7	3.86	9,542	260	4.89	480	220-480	Bedrock
47		4/9/2007	400	28.3	78	49.7	8.05	26,400	240	14.67	420	180-420	Pismo
48		12/17/2015	150	114	266	152	0.99	851 - 1,414	?		299	?	Pismo
49		10/28/2010	600	26.5	32.3	5.8	103.45	158,400					Alluvium/Paso Robles

Table 4-2 - San Luis Obispo Valley Groundwater Basin Water Well Specific Capacity Data Summary

Label No.	Specific Capacity Test Date	Pumping Rate (GPM)	Static Water Level (feet bgs)	Pumping Water Level (feet bgs)	Drawdown (feet)	Specific Capacity (gpm/foot)	Duration (hours)	Est. Transmissivity (gpd/foot)	Screen Length (feet)	Estimated Hydraulic Conductivity (ft/day)	Total Depth (feet)	Perforations	Formation Screened
50		435				6-10		10,000-20,000			250?		Paso Robles/Pismo
51	May 1999	12	10	24	14	0.86	4	1,714	?		30		Alluvium
52	2002	18	19	63	44	0.41	12	818			86		Alluvium/Paso Robles
53	2003	3.5	16	42	26	0.13	72	269			80		Alluvium/Paso Robles
54	7/18/1966	130			60	2.17	20	4,333	30	19.3	90	60-90	Paso Robles
55	4/15/1987	200			30	6.67	12	13,333	30	59.3	110	80-110	Paso Robles
56	12/22/1972	60			30	2	8	4,000	25	21.3	75	50-75	Alluvium
57	1980	24			110	0.22	8	436	80	0.7	160	80-160	Bedrock
58	9/11/1991	15			13	1.15	8	2,308	40	7.7	90	50-90	Alluvium
59	9/12/1959	1.25			8	0.16	4	313	10	4.2	28	18-28	Alluvium
60	3/4/1957	45			18	2.5	12	5,000	17	39.2	37	20-37	Alluvium
61	3/15/1961	12			6	2	5	4,000	5	106.7	85	40-43; 75-77	Alluvium/Paso Robles
62	3/30/1956	8			4	2	2	4,000	15	35.6	32	17-32	Paso Robles
63	9/18/1989	5			20	0.25	1	500	10	6.7	50	40-50	Bedrock
64	8/29/1990	4			14	0.29	4	571	30	2.5	50	20-50	Alluvium
65	8/7/2014	47	206	257	51	0.92	1.5	1,843			340		Unknown
66	7/21/1993	75	22	33	11	6.82	4	13,636	50	36.36	100	50-100	Bedrock
67	7/23/1993	69	11	16.25	5.25	13.14	4.5	26,286	55	63.72	100	25-65; 85-100	Paso Robles/Bedrock
68	July 1993?	32	40	95?			4				120	60-120	Paso Robles
69	7/19/2012	83	45	87	42	2.0							Paso Robles/Pismo
	5/19/2014	104	82	123	41	2.5							
	4/24/2017	109	178	212	34	3.2							
70	5/9/2014	94	182	196	14	6.7							Paso Robles/Pismo
	4/24/2017	124	85	117	32	3.9							
71	4/24/2017	206	100	123	23	9.0							Paso Robles/Pismo
72	7/19/2012	320	98	101	3	106.7							Paso Robles/Pismo
	5/19/14	367	133	183	50	7.3							
	4/24/17	483	104	141	37	13.1							
73	12/5/12	93	86	101	15	6.2							Paso Robles/Pismo
	5/19/14	55	140	65	12	4.6							
	4/24/17	81	50	152	15	5.4							
74	12/11/12	23	55	57	2	15.5							Paso Robles/Pismo
	4/24/17	30	25	26	1	30.0							
75	12/11/2012	17	62	66	4	4.7							Paso Robles/Pismo
76	12/5/2012	133	73	98	25	5.3							Paso Robles/Pismo
	5/19/14	104	96	152	56	1.9							
	4/24/17	127	89	126	37	3.4							
77	12/5/2012	96	71	98	27	3.6							Paso Robles/Pismo
	5/19/14	91	94	123	29	3.1							
	4/24/17	91	85	99	14	6.5							
34	7/19/2012	183	107	135	28	6.5							Paso Robles/Pismo
	5/19/14	169	86	132	46	3.7							
	4/24/17	259	75	135	60	4.3							
33	4/24/2017	311	116	176	60	5.2							Paso Robles/Pismo
1	4/24/2017	65	29	49	20	3.3							Paso Robles/Pismo

4.5.3 Aquitards

An aquitard is a layer of low permeability, usually comprised of fine-grained materials such as clay or silt, which vertically separates adjacent layers of higher permeability formations that may serve as aquifers. Although there is some amount of clay present in nearly all of the boring logs reviewed for this plan, there are no formally defined or laterally continuous clay layers that function as aquitards within the Basin. In the San Luis Valley, wells are commonly screened across both the Recent Alluvium and the underlying Paso Robles Formation, and these two formations essentially function as a single hydrogeologic unit is this area. Similarly, in the Edna Valley, wells are commonly screened across both the Paso Robles Formation and the underlying Pismo Formation, and these two formations essentially function as a single hydrogeologic unit is this area.

4.6 SURFACE WATER BODIES

Surface water/groundwater interactions represent a small, but significant, portion of the water budget of an aquifer system. In the Basin, these interactions occur primarily at streams and lakes.

As previously discussed, there are several named creeks that flow across the Basin. In the San Luis Valley area of the Basin, these include San Luis Obispo Creek, Stenner Creek, Prefumo Creek, Froom Creek, and Davenport Creek, in addition to smaller unnamed tributaries. In the Edna Valley these include East and West Corral de Piedras Creeks (which join to form Pismo Creek just south of the Basin Boundary), and Canada de Verde Creek in southeastern Edna Valley. The watersheds support important habitat for native fish and wildlife, including the federally threatened South-Central California Coast steelhead (*Oncorhynchus mykiss)* (Stillwater Sciences et al. 2012, Stillwater Sciences 2014).

Laguna Lake is the only lake in the Basin. It is a naturally occurring lake just north of Los Osos Valley Road and west of Highway 101. The downstream outlet of the lake flows into the Prefumo Creek culvert under Madonna Road. In the past, flashboards were used to maintain water elevation in the lake to support recreation and maintain wildlife habitat. However theseare no longer used.. The water in the lake is partially supplied by seasonal flow in Prefumo Creek, which flows into Laguna Lake. and at least partially supplied by subsurface groundwater inflow.

Groundwater interaction with streams in the Basin is not well quantified, but it is recognized as an important component of recharge in the water budget. Where the water table is above the streambed and slopes toward the stream, the stream receives groundwater flow from the aquifer; this is known as a gaining reach (i.e., the stream gains flow as it moves through the reach). Where the water table is beneath the streambed and slopes away from the stream, the stream loses water to the aquifer; this is known as a losing reach. During seasonal dry flow conditions, it is clear that groundwater elevation is deeper than the streambed. Therefore, it is generally understood that the streams in the Basin discharge to the underlying aquifer, at least in the first part of the wet-weather flow season. If there is constant seasonal surface water flow, it is possible that groundwater elevations may rise to the point that they are higher than the stream elevation, and the creek may become a seasonally gaining stream in some reaches. Groundwater modeling can help evaluate surface water groundwater interaction..

The amount of flow in surface water/groundwater interaction is difficult to quantify. Boyle (1991) assumed that 10 percent of the measured surface water flow coming into the Basin in San Luis Obispo Creek and Stenner Creek was recharged to the aquifer, and used an average rate of 430 acre-feet/yr (AFY). In its draft

report, DWR (1997) reports model-generated estimates ranging from streams gaining 2,700 AFY from the aquifer, to streams losing 680 AFY to the aquifer.

The County, through its coordination with Zone 9 and the City, maintains a network of five stream gauges in the San Luis Valley Basin to record heights of flow throughout the year for flood warning purposes (Figure 3-10). The gauges were constructed in November 2001 and have periods of record from that year to the present. Continuous data monitoring of height of flow at the gages is recorded, but equivalent discharge (cubic feet per second) is not recorded.

4.7 SUBSIDENCE POTENTIAL

Subsidence is the gradual settling or sinking of the earth's surface due to material movement at depth in a location, and is frequently associated with groundwater pumpage, and is one of the undesired results identified in SGMA. Subsidence has been documented in parts of the San Luis Valley. The most severe subsidence that has occurred in the Basin was in the 1990s along the Los Osos Valley Road corridor. Subsidence occurred within young organic soil (i.e., peat) in response to extraction of groundwater within a relatively shallow aquifer and resulted in significant settlement of the ground surface. The settlement caused local damage to businesses and homes in that area as local groundwater pumping dewatered the soft soil units beneath buildings and the surrounding area. Subsidence of more than 1 foot of settlement of the ground surface in some locations damaged buildings and resulted in reconstruction or retrofitting buildings.
Another area of known subsidence is along the shores of Laguna Lake. Homes located along the shoreline have experienced settlement that has cracked foundations, patios, and window and door openings. Many homes in that area have been retrofitted to address the settlement. While the subsidence near Laguna Lake is not specifically related to extraction of groundwater, lowering of the groundwater table in that area could result in further settlement and subsidence.

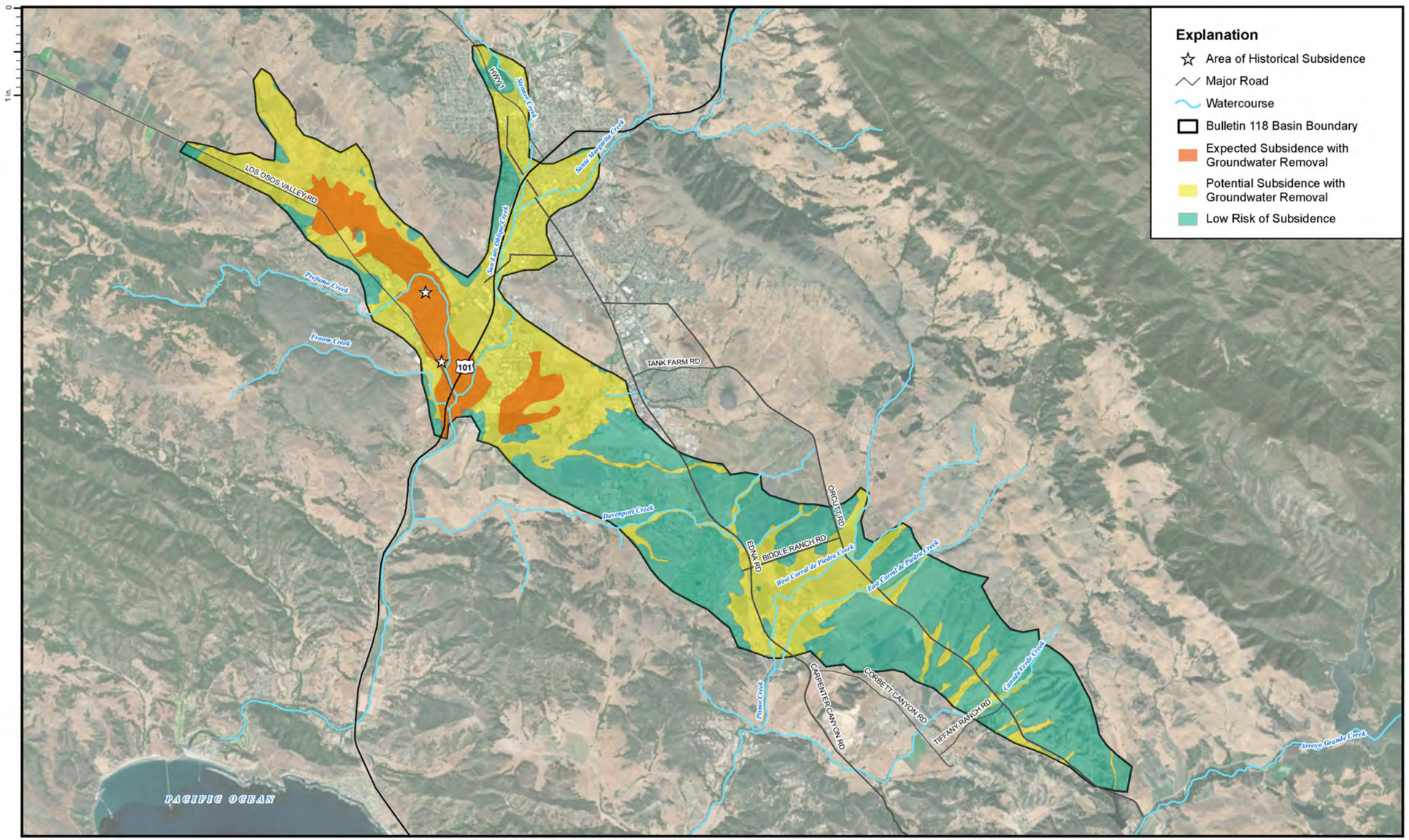
The historical manifestation of subsidence generally has been limited to a the area along Los Osos Valley Road and downstream, where compressible soil types that were particularly vulnerable to large settlements in response to lowering of the local groundwater table. This history emphasizes the importance of considering subsurface conditions that may be associated with subsidence. Not all soil and rocks are vulnerable to the type of subsidence that occurred along Los Osos Valley Road. The potential for subsidence to occur, and the severity of the subsidence, is dependent on the geology, groundwater levels, and the properties of the soil and rock that may be dewatered in association with groundwater pumping. The subsidence evaluation consisted of a review of published data and studies performed by local, state, and federal agencies, as well as a familiarity of local geology and soil. The following is a summary of the key findings.

DWR identifies the Basin as having a low subsidence potential. However, historical subsidence is known to have occurred in specific geographic areas of the Basin because of groundwater pumping. The Basin was evaluated on the basis of the extent of known and mapped geologic units within the Basin (Yeh, 2018). The relative potential for subsidence was divided into three categories and delineated as shown in Figure 4-23.

- Category 1. Category 1 has the highest likelihood of future subsidence if subject to lowered groundwater levels in the future. Based on a review of public data and consultant reports, alluvium mapped in these areas contains young organic soil known in areas around Los Osos Valley Road, Laguna Lake, and low-lying wetland areas near Tank Farm Road. These areas are known to have experienced historical subsidence or to contain soft or organic soil and were identified as having a potential for subsidence in relation to geology and groundwater pumping. These areas are

identified as Category 1 in in Figure 4-23, with star symbols marking approximate areas of known historical subsidence. Extraction of groundwater resources in these areas could cause further subsidence.

- Category 2. Low-lying topographic areas in the Basin that are mapped as young alluvial soil were identified as potentially containing soft or organic soil layers that may have a potential for subsidence in relation to groundwater pumping, but currently there is no historical or subsurface information to further evaluate those areas. Those areas are mostly located along Prefumo Creek and San Luis Obispo Creek and the main drainages through the west end of the Edna Valley near Price Canyon. These areas are identified as Category 2 in in Figure 4-23. This screening criteria recognizes the unconsolidated nature typical of young alluvium that has been mapped in these areas potentially could subside because of compaction of the aquifer if groundwater levels were lowered.
- Category 3. Geographic areas in the Basin that were mapped as bedrock or older surficial sediments, and are not known to be underlain by young organic soil or young alluvium, were identified as Category 3 in in Figure 4-23. These areas were evaluated and characterized as not having factors known to be susceptible to subsidence in relation to groundwater pumping. Generally, these are upland areas where bedrock is shallow or where bedrock is mapped at the ground surface, such as in the areas around the airport and Orcutt Road (in Figure 4-23).



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: AB
Date: 11/25/2019

N

0 0.25 0.5 1 Miles
0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. Digiglobe 2018

Subsidence Potential

Figure 4-23

5 REFERENCES

Boyle Engineering. 1991. *City of San Luis Obispo Groundwater Basin Evaluation. January.* 1991.
Carollo. 2012. *San Luis Obispo County Master Water Report.* 2012.
City of San Luis Obispo. 2016. *2015 Urban Water Management Plan.* 2016.
—. 2018. *General Plan.* 2018.
—. 2015. *Water Resources Status Report.* 2015.
Cleath & Associates, Inc. 2001. *Well Construction and Testing Report for Lewis Lane #4, Edna Valley, San Luis Obispo County. Prepared for Southern California Water Company. July.* 2001.
—. 2003. *Well Construction and Testing Report for Water Supply and Irrigation Wells, City of San Luis Obispo, Hayashi Irrigation Wells and Highway 101 Water Supply Well. March.* 2003.
Cleath-Harris Geologists, Inc. 2010. *Edna Valley Water System Groundwater Study. Prepared for Golden State Water Company. May.* 2010.
—. 2013. *Summary of Drilling,. Testing, and Destruction of the Golden State Water Company Country Club Test Well, Edna Road System, 6110 Lewis Lane, San Luis Obispo, California. Prepared for Golden State Water Company. June.* 2013.
—. 2013. *Summary of Exploration and Testing, 5061 Hacienda Avenue, San Luis Obispo, California. Prepared for Golden State Water Company. February.* 2013.
—. 2014. *Summary of Exploration and Testing, Blodgett parcel, Whiskey Run Lane, Country Club Area, San Luis Obispo, California. Prepared for Golden State Water Company. July.* 2014.
County of San Luis Obispo. 2014. *San Luis Obispo County Integrated Regional Water Management Plan (IRWMP).* 2014.
Cuesta Engineering Corporation. 2007. *San Luis Obispo Creek Watershed Calibration Study.* 2007.
Dibble, T.W. 2004. *Geologic Map of the Lopez Mountain Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2004. #DF-130.
Dibblee, T.W. 2006. *Geologic Map of the Arroyo Grande NE Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2006. #DF-211.
—. 2006. *Geologic Map of the Pismo Beach Quadrangle, San Luis Obispo County, California.* s.l. : Dibblee Geology Center Map, 2006. #DF-212.
—. 2004. *Geologic Map of the San Luis Obispo Quadrangle, San Luis Obispo County, California. .* s.l. : Dibble Geology Center Map, 2004. #DF-129.
DWR. 2003. *California's Groundwater: Bulletin 118 – Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2016. *California's Groundwater: Bulletin 118 - Interim Update 2016, Working Towards Sustainability.* 2016.
—. 2003. *California's Groundwater: Bulletin 118 - Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2014. DWR Atlas - Aglricultural Lang Use and Irrigated Areas. [Online] 2014. gis.water.ca.gov.
—. 1964. *San Luis Obispo and Santa Barbara Counties Land and Water Use Survey, 1959. .* s.l. : California Department of Water Resources (DWR), 1964.
—. 1958. *San Luis Obispo County Investigation. State Water Resources Board Bulletin No. 18. .* s.l. : California Department of Water Resources (DWR). May., 1958.
—. 1997. *San Luis-Edna Valley Groundwater Basin Study, Draft Report. .* s.l. : California Department of Water Resources (DWR)., 1997.
—. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization - Process and Results Document.* 2019.
ESA Consultants, Inc. 1994. *Hydrologic Investigation, Edna Valley Well Location Study. September.* 1994.

GSI Water Solutions. 2018. *San Luis Obispo Valley Basin Characterization and Monitoring Well Installation.* 2018.
Hall, C.A. 1979. *Geologic map of the San Luis Obispo – San Simeon Region, California.* s.l. : U.S. Geological Survey, 1979. Map I-1097.
—. 1973. *Geology of the Arroyo Grande Quadrangle, California. .* s.l. : California Division of Mines and Geology, 1973. Map Sheet 24.
SLO-FCWCD. 2014. *CASGEM Monitoring Plan for High and Medium Priority Groundwater Basins in the San Luis Obispo County Flood Control & Water Conservation District. September.* s.l. : San Luis Obispo Flood Control & Water Conservation District, 2014.
Stillwater Sciences. 2015. *Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California. September.* 2015.
TEAM Engineering & Management. 2000. *Groundwater Yield Analysis. July.* 2000.
USBR. 1955. *Reconnaissance Report San Luis Obispo County Basin, California. .* s.l. : U.S. Bureau of Reclamation, Region 2, Sacramento., 1955.
USDA-NRCS. 2007. *Soil Survey Geographic Database (SSURGO).* s.l. : U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), 2007.
WSC. 2018. *Salinas and Whale Rock Reserviors Safe Annual Yield TM.* 2018.

Draft

Groundwater Sustainability Plan
Chapter 5 – Ground Water Conditions

for the

San Luis Obispo Valley Groundwater Basin
Groundwater Sustainability Agencies

Prepared by

3/1/2020

TABLE OF CONTENTS

Table of Contents

List of Figures i
Tables iv
Appendices v
List of Terms Used vi
Executive Summary 1
1 Introduction to the SLO Basin GSP .....
1.1 Purpose of the Groundwater Sustainability Plan .....
1.2 Description of SLO Basin .....
1.3 Basin Prioritization .....
2 Agency Information (§ 354.6) .....
2.1 Agencies Names and Mailing Addresses .....
2.2 Agencies Organization and Management Structures .....
2.2.1 County of San Luis Obispo .....
2.2.2 City of San Luis Obispo .....
2.2.3 Other Participating Parties in the MOA .....
2.2.3.1 Edna Valley Growers Mutual Water Company .....
2.2.3.2 Varian Ranch Mutual Water Company .....
2.2.3.3 Edna Ranch Mutual Water Company .....
2.2.3.4 Golden State Water Company .....
2.3 Authority of Agencies .....
2.3.1 Groundwater Sustainability Agencies .....
2.3.1.1 County of San Luis Obispo .....
2.3.1.2 City of San Luis Obispo .....
2.3.2 Memorandum of Agreement .....
2.3.3 Coordination Agreements .....
2.4 Contact information for Plan Manager .....
3 Description of Plan Area (§ 354.8) .....
3.1 SLO Basin Introduction .....
3.2 Adjudicated Areas .....
3.3 Jurisdictional Areas .....
3.3.1 Federal Jurisdictions .....
3.3.2 Tribal Jurisdiction .....

3.3.3 State Jurisdictions
3.3.4 County Jurisdictions
3.3.5 City and Local Jurisdictions
3.3.6 Special Districts
3.4 Land Use
3.4.1 Water Source Types
3.4.2 Water Use Sectors
3.5 Density of Wells
3.6 Existing Monitoring and Management Programs
3.6.1 Groundwater Monitoring
3.6.1.1 Groundwater Level Monitoring
3.6.1.2 Groundwater Quality Monitoring
3.6.1.3 Surface Water Monitoring
3.6.1.4 Climate Monitoring
3.6.2 Existing Management Plans
3.6.2.1 SLO Basin Characterization and Monitoring Well Installation
3.6.2.2 San Luis Obispo County Master Water Report (2012)
3.6.2.3 San Luis Obispo County Integrated Regional Water Management Plan (2014)
3.6.2.4 City of San Luis Obispo 2015 Urban Water Management Plan (2016)
3.6.3 Existing Groundwater Regulatory Programs
3.6.3.1 Groundwater Export Ordinance (2015)
3.6.3.2 Well Ordinances, County and City
3.6.3.3 Countywide Water Conservation Program Resolution 2015-288 (2015)
3.6.3.4 Agricultural Order R3-2017-002 (2017)
3.6.3.5 Water Quality Control Plan for the Central Coast Basins (2017)
3.6.3.6 California DWR Well Standards (1991)
3.6.3.7 Requirements for New Wells (2017)
3.6.3.8 Title 22 Drinking Water Program (2018)
3.6.3.9 Waterway Management Plan – San Luis Obispo Creek Watershed (2003)
3.6.3.10 Incorporation Into GSP
3.6.3.11 Limits to Operational Flexibility
3.7 Conjunctive Use Programs
3.8 Land Use Plans
3.8.1 City of San Luis Obispo General Plan
3.8.2 County of San Luis Obispo General Plan

3.8.3 Los Ranchos/Edna Village Plan
3.8.4 Plan Implementation Effects on Existing Land Use
3.8.5 Plan Implementation Effects on Water Supply
3.8.6 Well Permitting
3.8.7 Land Use Plans Outside of Basin
3.9 Management Areas
3.9.1 Reason for Creation
3.10 Additional GSP Elements, if Applicable
4 Basin Setting (§ 354.14)
4.1 Basin Topography and Boundaries
4.2 Primary Users of Groundwater
4.3 Soils Infiltration Potential
4.4 Regional Geology
4.4.1 Regional Geologic Structures
4.4.2 Geologic Formations within the Basin
4.4.2.1 Alluvium
4.4.2.2 Paso Robles Formation
4.4.2.3 Pismo Formation
4.4.3 Geologic Formations Surrounding the Basin
4.4.3.1 Monterey Formation
4.4.3.2 Obispo Formation
4.4.3.3 Franciscan Assemblage
4.5 Principal Aquifers and Aquitards
4.5.1 Cross Sections
4.5.2 Aquifer Characteristics
4.5.3 Aquitards
4.6 Surface Water Bodies
4.7 Subsidence Potential
5 Groundwater Conditions (§ 354.16) 2
5.1 Groundwater Elevations and Intepretation 2
5.1.1 Fall 1954 Groundwater Elevations 2
5.1.2 Spring 1990 Groundwater Elevations 5
5.1.3 Modeled 1990s Groundwater Elevations 7
5.1.4 Spring 1997 Groundwater Elevations 7
5.1.5 Spring 2011 Groundwater Elevations 9

5.1.6 Spring 2015 Groundwater Elevations 11
5.1.7 Spring 2019 Groundwater Elevations 13
5.1.8 Fall 2019 Groundwater Elevations 15
5.1.9 Changes in Groundwater Elevation 17
5.1.10 Vertical Groundwater Gradients 21
5.2 Groundwater Elevation Hydrographs 21
5.3 Groundwater Recharge and Discharge Areas 24
5.3.1 Groundwater Recharge Areas 24
5.3.1.1 Infiltration of Precipitation 24
5.3.1.2 Subsurface Inflow 28
5.3.1.3 Percolation of Streamflow 28
5.3.1.4 Anthropogenic Recharge 28
5.3.2 Groundwater Discharge Areas 29
5.4 Change in Groundwater Storage 29
5.5 Seawater Intrusion 29
5.6 Subsidence 29
5.7 Interconnected Surface Water 30
5.7.1 Depletion of Interconnected Surface Water 30
5.8 Potential groundwater dependent ecosystems 30
5.8.1 Hydrology 31
5.8.1.1 Overview of GDE Relevant Surface and Groundwater Hydrology 31
5.8.1.2 Losing and Gaining Reaches 32
5.8.2 Vegetation and Wetland Groundwater Dependent Ecosystem Identification 34
5.8.3 Identification of Special-Status Species and Sensitive Natural Communities Associates with GDE's 36
5.9 Groundwater Quality Distribution and Trends 37
5.9.1 Groundwater Quality Suitability for Drinking Water 37
5.9.2 Distribution and Concentrations of Point Sources of Groundwater Constituents 37
5.9.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents 41
5.9.3.1 Total Dissolved Solids 41
5.9.3.2 Nitrate 43
5.9.3.3 Arsenic 45
5.9.3.4 Boron 47
5.9.3.5 Other Constituents 47
6 Water Budget (§ 354.18) .....

6.1 Climate
6.1.1 Historical Climate
6.1.2 Projected Climate
6.2 Water Budget Data Sources and Groundwater Model
6.3 Historical Water Budget
6.3.1 Historical Time Period
6.3.2 Inflows
6.3.3 Outflows
6.3.4 Change in Storage
6.3.5 Sustainable Yield
6.3.6 Quantification of Overdraft
6.4 Current Water Budget
6.4.1 Inflows
6.4.2 Outflows
6.4.3 Change In Storage
6.4.4 Sustainable Yield
6.4.5 Quantification of Overdraft
6.5 Projected Water Budget
6.5.1 Assumptions
6.5.2 Inflows
6.5.3 Outflows
6.5.4 Change In Storage
7 Sustainable Management Criteria (§ 354.22-30)
7.1 Sustainability Goal
7.2 Process for Establishing Sustainable Management Criteria
7.2.1 Minimum Thresholds
7.2.2 Measurable Objectives
7.2.3 Undesirable Results
7.3 Chronic Lowering of Groundwater Levels Sustainability Indicator
7.3.1 Locally Defined Undesirable Results
7.3.2 Minimum Thresholds and Measurable Objectives
7.3.3 Relation to Other Sustainability Indicators
7.4 Change in Storage Sustainability Indicator
7.4.1 Locally Defined Undesirable Results
7.4.2 Minimum Thresholds

7.4.3 Measurable Objectives
7.4.4 Relation to Other Sustainability Indicators
7.5 Seawater Intrusion Sustainability Indicator
7.5.1 Locally Defined Undesirable Results
7.5.2 Minimum Thresholds
7.5.3 Measurable Objectives
7.5.4 Relation to Other Sustainability Indicators
7.6 Degraded Water Quality Sustainability Indicator
7.6.1 Locally Defined Undesirable Results
7.6.2 Minimum Thresholds
7.6.3 Measurable Objectives
7.6.4 Relation to Other Sustainability Indicators
7.7 Subsidence Sustainability Indicator
7.7.1 Locally Defined Undesirable Results
7.7.2 Minimum Thresholds
7.7.3 Measurable Objectives
7.7.4 Relation to Other Sustainability Indicators
7.8 Depletion of Interconnected Surface Water Sustainability Indicator
7.8.1 Locally Defined Undesirable Results
7.8.2 Minimum Thresholds
7.8.3 Measurable Objectives
7.8.4 Relation to Other Sustainability Indicators
7.9 Management Areas
7.9.1 Minimum Thresholds and Measurable Objectives
7.9.2 Monitoring and Analysis
7.9.3 Explanation of How Operation of Management Area Will Avoid Undesirable Results
8 Monitoring Networks (§ 354.34)
8.1 Monitoring Objectives
8.2 Monitoring Network
8.2.1 Chronic Lowering of Groundwater Levels
8.2.2 Reduction of Groundwater Storage
8.2.3 Seawater Intrusion
8.2.4 Groundwater Quality
8.2.5 Land Subsidence
8.2.6 Depletion of Interconnected Surface Water

8.3 Groundwater Monitoring Protocol
8.4 Data Management System
8.5 Assessment and Improvement of Monitoring Network
8.6 Annual Reports
8.7 Periodic Evaluation by Agency
9 Projects and Management Actions (§ 354.44)
9.1 Projects
9.1.1 Project A
9.2 Management Actions
9.2.1 Management Action A
9.3 Projects Needed to Mitigate Overdraft
10 Implementation Plan
10.1 Cost of Implementation
10.2 Funding Alternatives
10.3 Implementation Schedule
10.4 GSP Annual Reporting
10.5 Periodic Evaluations of GSP
11 Notice and Communications (§ 354.10)
11.1 Communications and Engagement Plan
11.2 Nature of Consultations
11.3 Public Meetings
11.4 Incorporation of Feedback in Decision-Making Process
11.5 Comments Received
11.6 Responses to Comments
12 Interagency Agreements (§ 357.2-4)
12.1 Coordination Agreements
13 References
14 Appendices

The grey highlighted sections in the Table of Contents (TOC) indicate that the section has been previously released (Chapters 1 through 4) or will be released in the future (Chapters 6 through 14). The complete list of the anticipated TOC is presented to give the reader context as to how Chapter 5 – Groundwater Conditions, connects with the complete Groundwater Sustainability Plan.

LIST OF FIGURES

Figure 5-1: Groundwater Elevation Surface Fall 1954. 4
Figure 5-2: Groundwater Elevation Surface Spring 1990. 6
Figure 5-3: Groundwater Elevation Surface Spring 1997. 8
Figure 5-4: Groundwater Elevation Surface Spring 2011. 10
Figure 5-5: Groundwater Elevation Surface Spring 2015. 12
Figure 5-6: Groundwater Elevation Surface Spring 2019. 14
Figure 5-7: Groundwater Elevation Surface Fall 2019. 16
Figure 5-8: Change in Groundwater Elevation Spring 1997 to Spring 2011. 18
Figure 5-9: Change in Groundwater Elevation Spring 2011 to Spring 2015. 19
Figure 5-10: Change in Groundwater Elevation Spring 2015 to Spring 2019. 20
Figure 5-11: Selected Hydrographs. 23
Figure 5-12: Stillwater Percolation Zone Study Results. 26
Figure 5-13: Soil Agricultural Groundwater Banking Index Study Results. 27
Figure 5-14: Losing and Gaining Reaches Within the Basin. 33
Figure 5-15: Potential Groundwater-Dependent Ecosystems (GDEs). 35
Figure 5-16: Location of Potential Point Sources of Groundwater Conditions 39
Figure 5-17: Distribution of TDS in Basin. 42
Figure 5-18: Distribution of Nitrate in Basin. 44
Figure 5-19: Distribution of Arsenic in Basin. 46

TABLES

Table 5-1: Potential Point Sources of Groundwater Contamination 40

APPENDICES

LIST OF TERMS USED

Abbreviation	Definition
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
AMSL	Above Mean Sea Level
Basin Plan	Water Quality Control Plan for the Central Coast Basin
Cal Poly	California Polytechnic State University
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of San Luis Obispo
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CPWS-52	Cal Poly Weather Station 52
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ERMWC	Edna Ranch Mutual Water Company
ET_0	Evapotranspiration
EVGMWC	Edna Valley Growers Ranch Mutual Water Company
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet
MCL	Maximum Contaminant Level

Abbreviation	Definition
MG	Million Gallons
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCDC	National Climate Data Center
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLO Basin	San Luis Obispo Valley Groundwater Basin
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SCML	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
VRMWC	Varian Ranch Mutual Water Company
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is complete.

5 GROUNDWATER CONDITIONS (§ 354.16)

This section describes the current and historical groundwater conditions in the Alluvial Aquifer, the Paso Robles Formation Aquifer, and the Pismo Formation Aquifer in the San Luis Obispo Valley Groundwater Basin. In accordance with the SGMA Emergency Regulations §354.16, current conditions are any conditions occurring after January 1, 2015. By implication, historical conditions are any conditions occurring prior to January 1, 2015. This Chapter focuses on information required by the GSP regulations and information that is important for developing an effective plan to achieve sustainability. The organization of Chapter 5 aligns with the six sustainability indicators specified in the GSP regulations, including:

1. Chronic lowering of groundwater elevations;
2. Groundwater storage reductions;
3. Seawater intrusion;
4. Land Subsidence;
5. Depletion of interconnected surface waters, and;
6. Degradation of groundwater quality.

5.1 GROUNDWATER ELEVATIONS AND INTEPRETATION

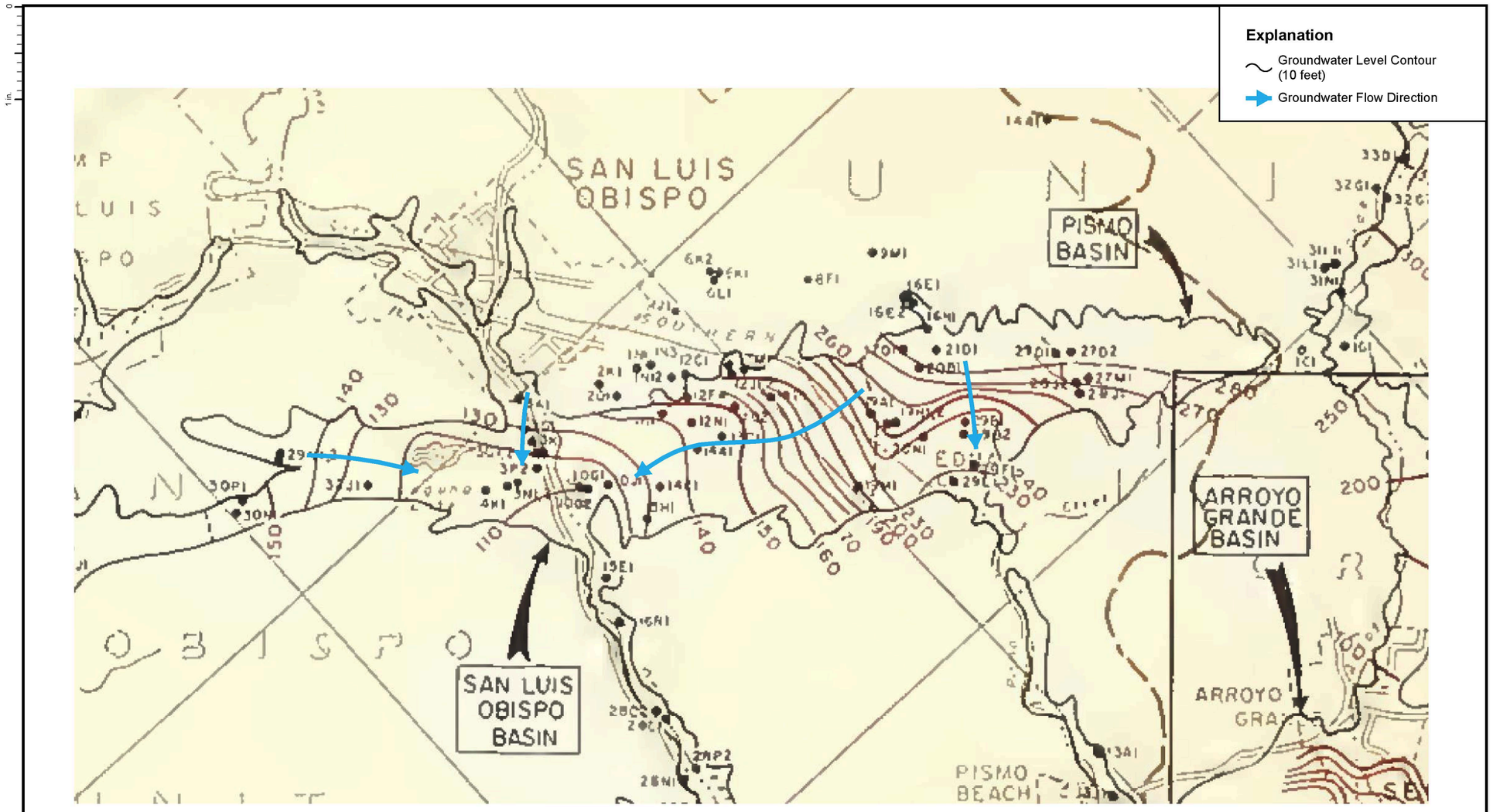
As discussed in Chapter 4, information from available boring logs indicates that there is no regional or laterally extensive aquitard separating the Alluvial Aquifer, Paso Robles Formation aquifer, and Pismo Formation aquifer in the Basin. In the San Luis Valley, a physical distinction between Alluvium and Paso Robles Formation is often not apparent, and information from well completion reports in the Basin indicate that wells are regularly screened across productive strata in both formations, which effectively function as a single hydrogeologic unit. Likewise, in the Edna Valley, information from well completion reports indicates that wells are routinely screened across productive strata in both the Paso Robles Formation Aquifer and the Pismo Formation Aquifer, which effectively function as a single hydrogeologic unit. Boyle (1991) states that there is no strict boundary between the Alluvial Aquifer and the Paso Robles Formation Aquifer in the Buckley Road area. DWR (1997) states that all the sediments in the Subbasin are in hydraulic continuity. Because there is no available groundwater elevation data specific to the three individual aquifers, and because these formations appear to function as combined hydrogeologic units, groundwater elevation data are combined and presented as a single groundwater elevation map for each time period presented.

In general, the primary direction of groundwater flow in the Basin is from the area of highest groundwater elevations in the Edna Valley northwestward toward San Luis Creek, where the flow leaves the Basin along the stream course. Groundwater in the northwestern areas of the Basin near the City of San Luis Obispo boundary and Los Osos Valley Road flows southeastward toward the San Luis Creek alluvium. In the southeastern portion of the Basin there are also local areas of flow discharging from the Basin along Pismo Creek tributaries of East and West Corral de Piedras Creek, and alluvium of other smaller tributaries further to the south. Groundwater Elevation maps for various recent and historical time periods are presented and discussed in the following sections.

5.1.1 Fall 1954 Groundwater Elevations

DWR (1958) published a series of maps depicting groundwater elevations for various basins in the County, including groundwater elevations in the San Luis Obispo Valley Groundwater Basin for fall 1954 (Figure 5-1),

with contours based on field measurements of over 40 control points in the Basin. Groundwater flow direction arrows were added to Figure 5-1 to illustrate the primary direction of flow in the Basin. This is the oldest Basin-wide groundwater elevation data available. In the Los Osos Valley portion of the Basin, this map displays dominant groundwater flow direction from higher elevations in the in the northwestern extent of the Basin southeastward toward the discharge area where San Luis Creek leaves the Basin. The hydraulic gradient (the ratio of horizontal distance along the groundwater flow path to the change in elevation) in this area is approximately 0.004 feet/feet (ft/ft). In the Edna Valley portion of the Basin, the dominant groundwater flow direction is northwestward from the higher groundwater elevations in the southeastern part of the Basin (over 280 ft AMSL) to lower elevations (less than 110 feet AMSL) where San Luis Creek exits the Basin. The gradient across this area is steeper than in Los Osos Valley, approximately 0.009 ft/ft. This map also displays local areas of discharge coincident with the areas where San Luis Creek and Pismo Creek tributaries leave the Basin.



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: AB
Date: 11/26/2019

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References:

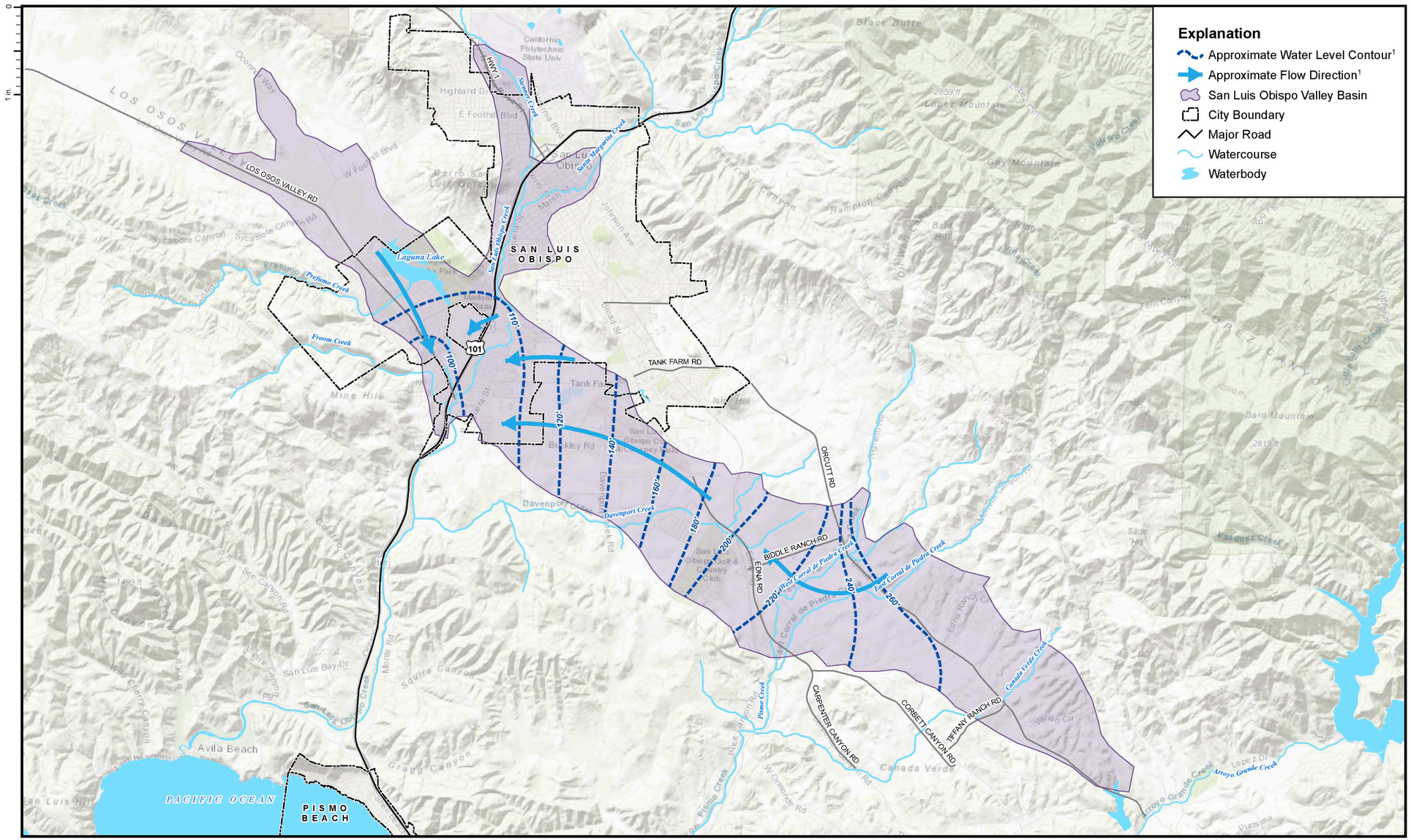
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obsipo County Investigationm State Water Resources Board Bulletin No. 18, Place 9B, May 1958.

Groundwater Elevation Surface
Fall 1954

Figure 5-1

5.1.2 Spring 1990 Groundwater Elevations

Boyle (1991) presents water level elevation contour maps for the spring of 1986 and 1990, based on water level data collected from 18 control points in the field. A digitized recreation of the Boyle groundwater elevation contours for spring of 1990 is presented in Figure 5-2 and displays patterns of groundwater flow direction in the Basin similar to those exhibited in the DWR 1954 map, although the flow gradient does not appear to be as steep as it is in the 1954 map. The year 1990 was in the midst of a significant period of drought in the Basin. The northwestward gradient across the central area of the Basin is approximately 0.006 ft/ft. Contours for the spring of 1986 are not re-presented in this report, but 1986 represents wetter conditions than the 1990 map, and it is noted in Boyle (1991) that there is a difference of approximately 10 feet of elevation between the two maps, representing the variation in water levels observed between wet and dry weather cycles in this time period. The contours in Figure 5-2 do not display an area of discharge where Corral de Piedras Creeks leave the Basin, but this is likely due to a lack of control points in this area.



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: AB
Date: 11/26/2019

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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. ESRI

Notes:
1. Contours and flow direction were adapted from 1991 Boyle Groundwater Basin Evaluation, Plate 8.
2. Control points not displayed due to confidentiality agreements.

Groundwater Elevation Surface
Spring 1990

Figure 5-2

5.1.3 Modeled 1990s Groundwater Elevations

In its draft report, DWR (1997) used a computer groundwater model to generate a series of modeled water level maps representing wet, dry, and average weather conditions. The model results are not re-presented in this GSP, but a review of the draft report indicates the maps display the same general flow direction patterns as the DWR (1958) and Boyle (1991) maps, which were based on data collected in the field. Water level elevations in the San Luis Valley in wet years were approximately 10 to 20 feet higher than in dry years. In the Edna Valley, the difference in groundwater elevations between wet and dry years was greater, approximately 20 to 30 feet.

5.1.4 Spring 1997 Groundwater Elevations

More recent groundwater level data collected as a part of San Luis Obispo County's groundwater monitoring program were obtained and used to generate groundwater elevation maps to evaluate more recent conditions. The following assessment of groundwater elevation conditions is based primarily on data from the San Luis Obispo County Flood Control and Water Conservation District's (SLOFCWCD) groundwater monitoring program. Groundwater levels are measured through a network of public and private wells in the Basin. Figure 5-3 through Figure 5-7 presents the contours generated from the data for the Spring 1997, Spring 2011, Spring 2015, Spring 2019, and Fall 2019 monitoring events.

The set of wells used in the groundwater elevation assessment were selected based on the following criteria:

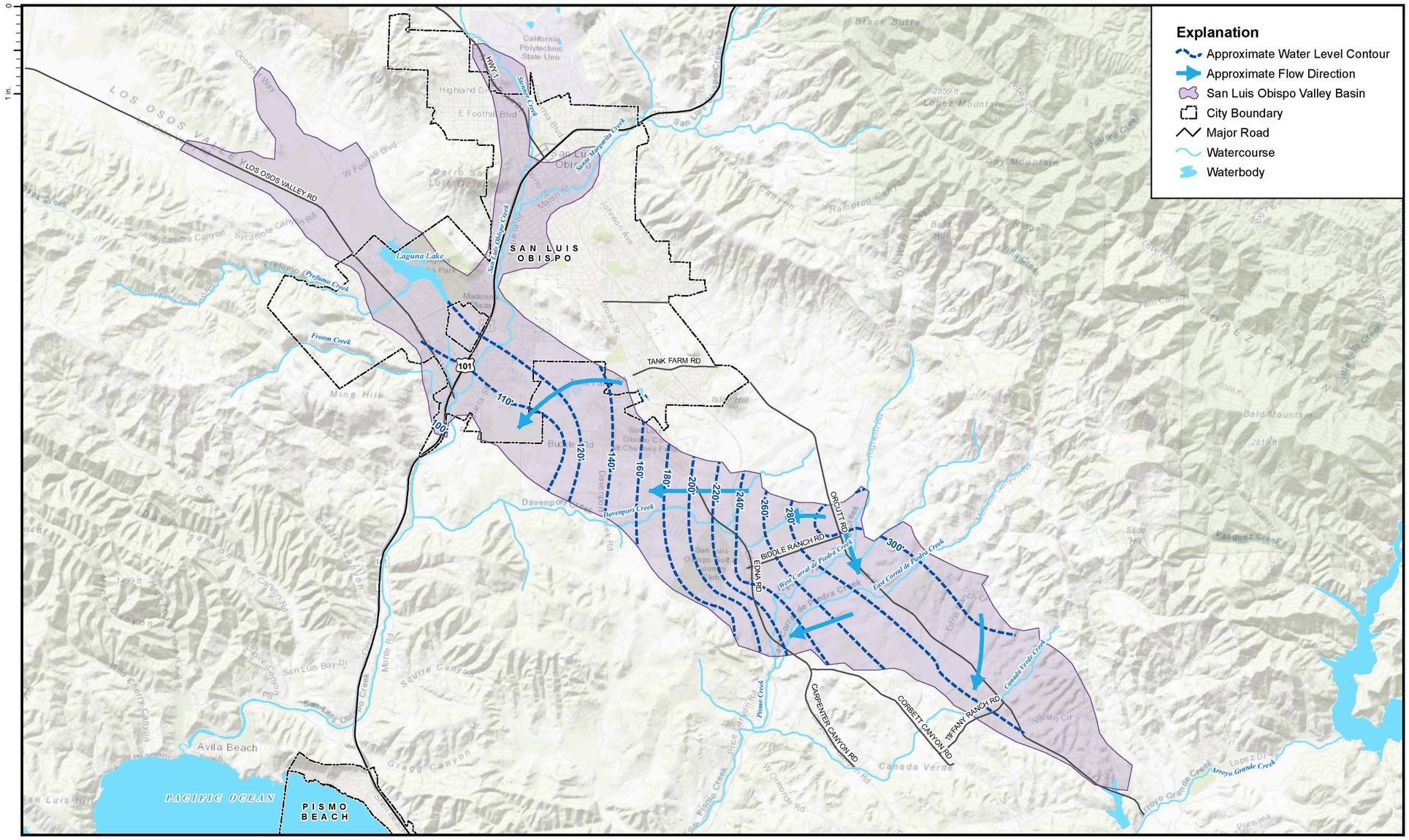
- The wells have groundwater elevation data for the periods of record of interest;
- Groundwater elevation data were deemed representative of static conditions.

Additional information on the monitoring network is provided in Chapter 8 – Monitoring Networks.

Based on available data, the following information is presented in subsequent subsections.

- Groundwater elevation contour maps for spring 1997, 2011, 2015, 2019, and Fall 2019;
- A map depicting the change in groundwater elevation between 1997 and 2011;
- A map depicting the change in groundwater elevation between 2011 and 2015;
- A map depicting the change in groundwater elevation between 2015 and 2019;
- Hydrographs for select wells with publicly available data.

Figure 5-3 presents a groundwater surface map for Spring 1997 based on field data collected by the County (control points are not displayed to maintain confidentiality agreements negotiated with well owners). The southeast (near Lopez Lake) and northwest (Los Osos Valley) areas of the Basin had no wells monitored during these events to calculate water levels, so contours are not presented for those areas. Several features on this map are apparent. First, a pronounced groundwater mound is evident at the location where West Corral de Piedras Creek enters the Basin in Edna Valley, near the corner of Biddle Ranch Road and Orcutt Road; three control points are present in this area, providing reliable documentation for water levels in this vicinity. This indicates that this is a groundwater recharge area. The regional northwesterly flow direction apparent in the previously discussed water level maps is still evident here; the groundwater flow gradient is about 0.011 ft/ft, somewhat steeper than the Spring 1990 gradient presented by Boyle.


Explanation
Approximate Water Level Contour
Approximate Flow Direction
San Luis Obispo Valley Basin
City Boundary
Major Road
Watercourse
Waterbody
SAN LUIS OBISPO
PISMO BEACH
PACIFIC OCEAN
Avila Beach
LOS OSOS VALLEY RD
TANK FARM RD
ORCUTT RD
BIDDLE RANCH RD
DANA RD
CARPENTER CANYON RD
CORBETT CANYON RD
TIFFANY RANCH RD
LOPEZ CANYON
Laguna Lake
Froom Creek
Prefumo Creek
San Luis Obispo Creek
Santa Margarita Creek
Davenport Creek
Pismo Creek
Arroyo Grande Creek
Canada Verde Creek
West Corral de Piedra Creek
East Corral de Piedra Creek
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160'
180'
200'
220'
240'
260'
280'
300'
Cal Poly
Highland Dr
E Foothill Blvd
W Foothill Blvd
Marsh St
Johnson Ave
Broad St
Madonna Plaza
Los Osos Valley Rd
Sycamore Canyon Rd
Prefumo Canyon Rd
Froom Ranch Rd
Mine Hill
Davenport Creek Rd
Squire Canyon
Monte Rd
San Luis Bay Dr
Avila Beach Dr
Gragg Canyon
Price Canyon Rd
W Ormonde Rd
Canada Verde
Varian Cir
Lopez Dr
Black Butte
Lopez Mountain
Gay Mountain
Bald Hill
Ruffner Ridge
Fern Canyon
Bald Mountain
Slide Hill
Vasquez Creek
Rattlesnake Canyon
Rainbow Canyon
Oceano
Arroyo Grande
Pismo Beach
Prepared for:
Author: AB
Date: 11/26/2019
SAN LUIS OBISPO VALLEY BASIN GSP
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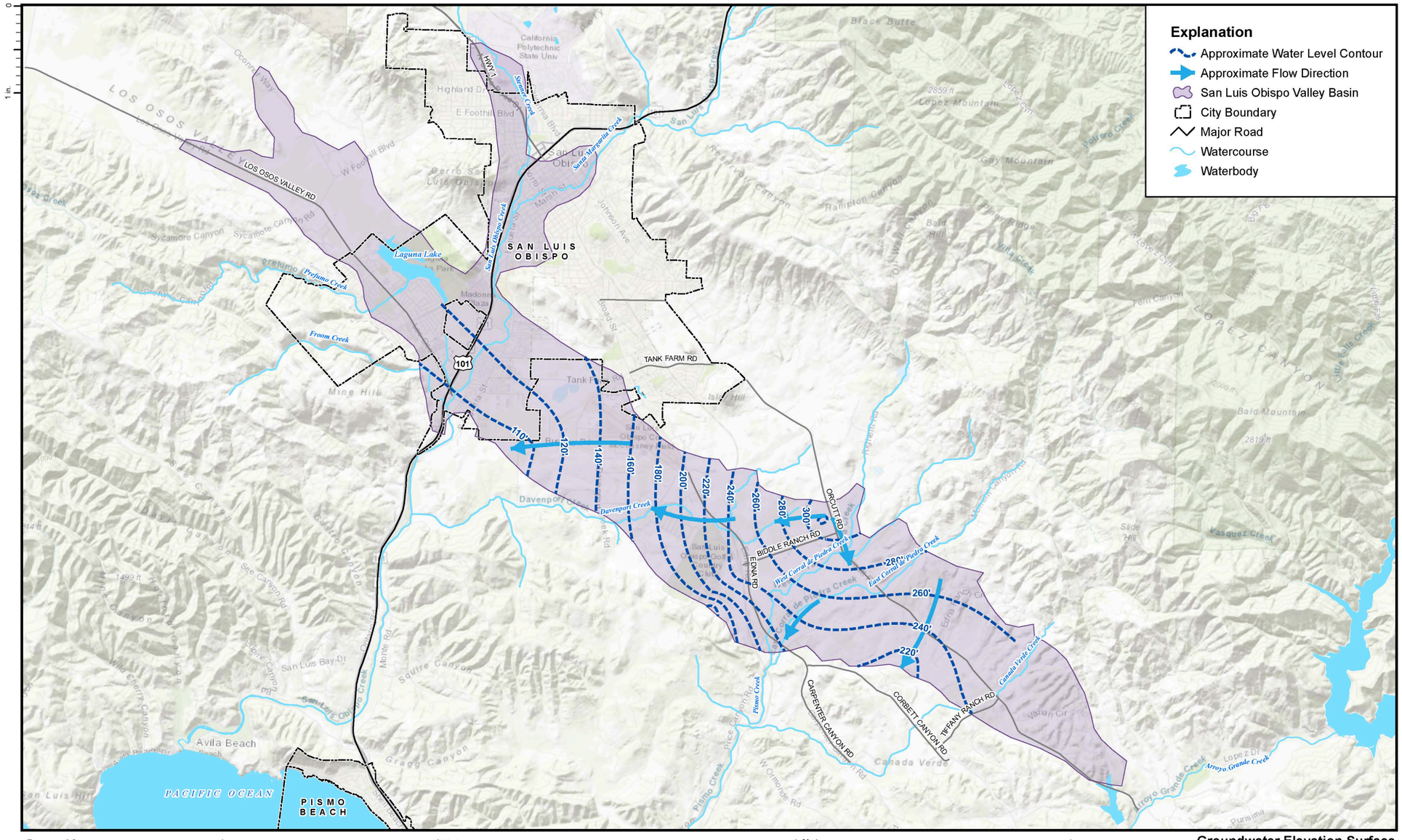
0 0.425 0.85 1.7 Kilometers
References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. ESRI
Note:
1. Control points not displayed dur to confidentiality agreements.
Groundwater Elevation Surface
Spring 1997

Figure 5-3

5.1.5 Spring 2011 Groundwater Elevations

Spring 2011 represents a time period just prior to the recent drought, but after the expansion of agricultural pumping in Edna Valley (discussed further in Chapter 6, Water Budget). As such, effects of the recent drought should not yet be apparent, but reduced groundwater levels due to expanded agricultural pumping should be evident.

Figure 5-4 displays groundwater elevation contours for Spring 2011. The groundwater mound near Biddle Ranch Road and Orcutt Road is again evident, with a maximum groundwater elevation of over 320 feet. Groundwater flow direction appears to indicate areas of discharge from the Basin in Edna Valley along Corral de Piedras Creeks and Canada Verde Creek, and along San Luis Creek in San Luis Valley. The area near Edna Road and Biddle Ranch Road indicates a steep local gradient, likely associated with local pumping. The contour near the exit of Corral de Piedras Creeks is 180 feet. The gradient across the central Basin is almost identical to the Spring 1997 map, about 0.011 ft/ft. The gradient is much shallower in the San Luis Valley part of the Basin.



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3. ESRI

Note:
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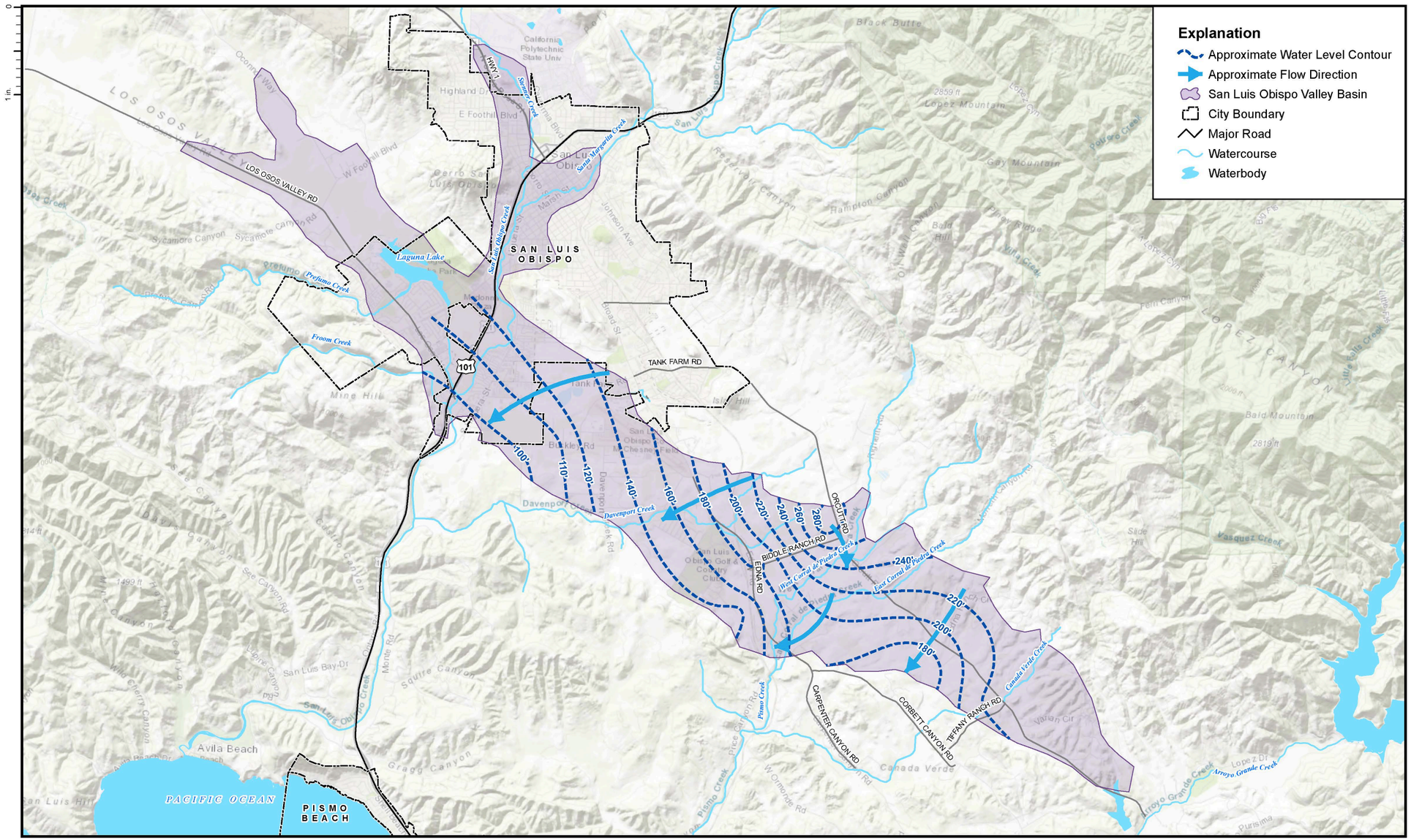
Groundwater Elevation Surface
Spring 2011

Figure 5-4

5.1.6 Spring 2015 Groundwater Elevations

Figure 5-5 presents groundwater elevation contours for Spring 2015. Spring 2015 represents a time period in the midst of the recent drought, and after the expansion of agricultural pumping in Edna Valley.

The effects of the drought are apparent upon close inspection of the contours in Figure 5-5. In the Edna Valley, the maximum contour of the recharge area near Orcutt Road and Biddle Ranch Road is 280 feet, about 40 feet lower than in the Spring 2011 map. The contours immediately west of the mound are still steep, but flatten out significantly along Davenport Creek, resulting in a much shallower gradient in this area than in the Spring 2011 map. Contours east of the mound along Orcutt Road are 20 to 40 feet lower than in the Spring 2011 map. In the San Luis Valley, a 100-foot contour is evident near the exit of San Luis Creek from the Basin, which is about 10 feet lower than the contour in the Spring 2011 map.



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References:
1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. ESRI

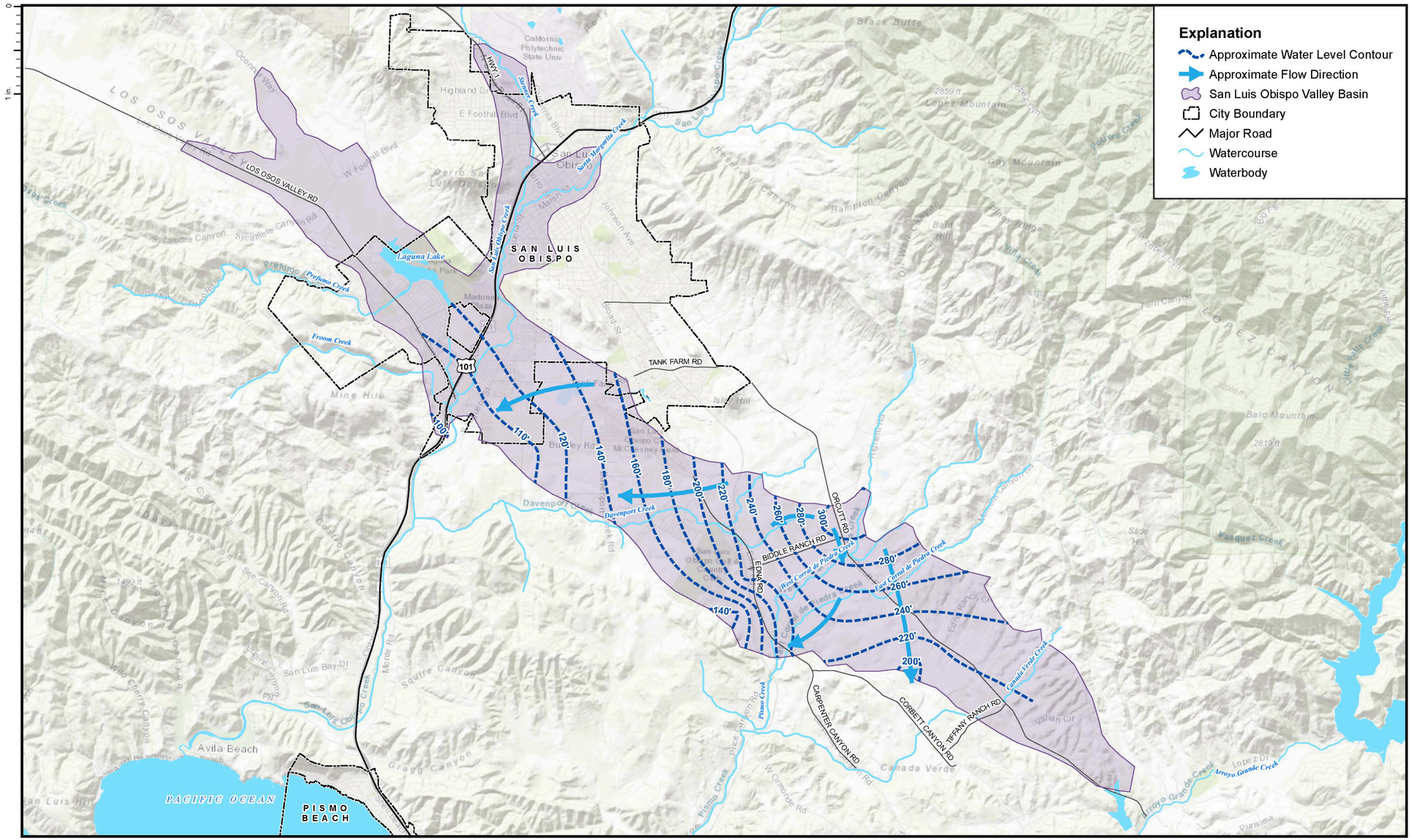
Note:
1. Control points not displayed dur to confidentiality agreements.

Groundwater Elevation Surface
Spring 2015

Figure 5-5

5.1.7 Spring 2019 Groundwater Elevations

Figure 5-6 presents a groundwater surface elevation map for Spring 2019. Spring 2019 represents a time period at the end of seasonal winter rains, and after the end of the recent drought. Rebounds of groundwater elevations from the drought are apparent upon inspection of the contours. In the Edna Valley, the maximum contour of the recharge area near Orcutt Road and Biddle Ranch Road is 300 feet, about 20 feet higher than in the Spring 2015 map. Contours east of the mound are about 20 feet higher than in the Spring 2015 map. Contours along Davenport Creek are about 20 feet higher than in the Spring 2015 map. The elevation at Edna Road and Biddle Ranch Road is about 230 feet, over 50 feet higher than in the Spring 2015 map.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Approximate Water Level Contour
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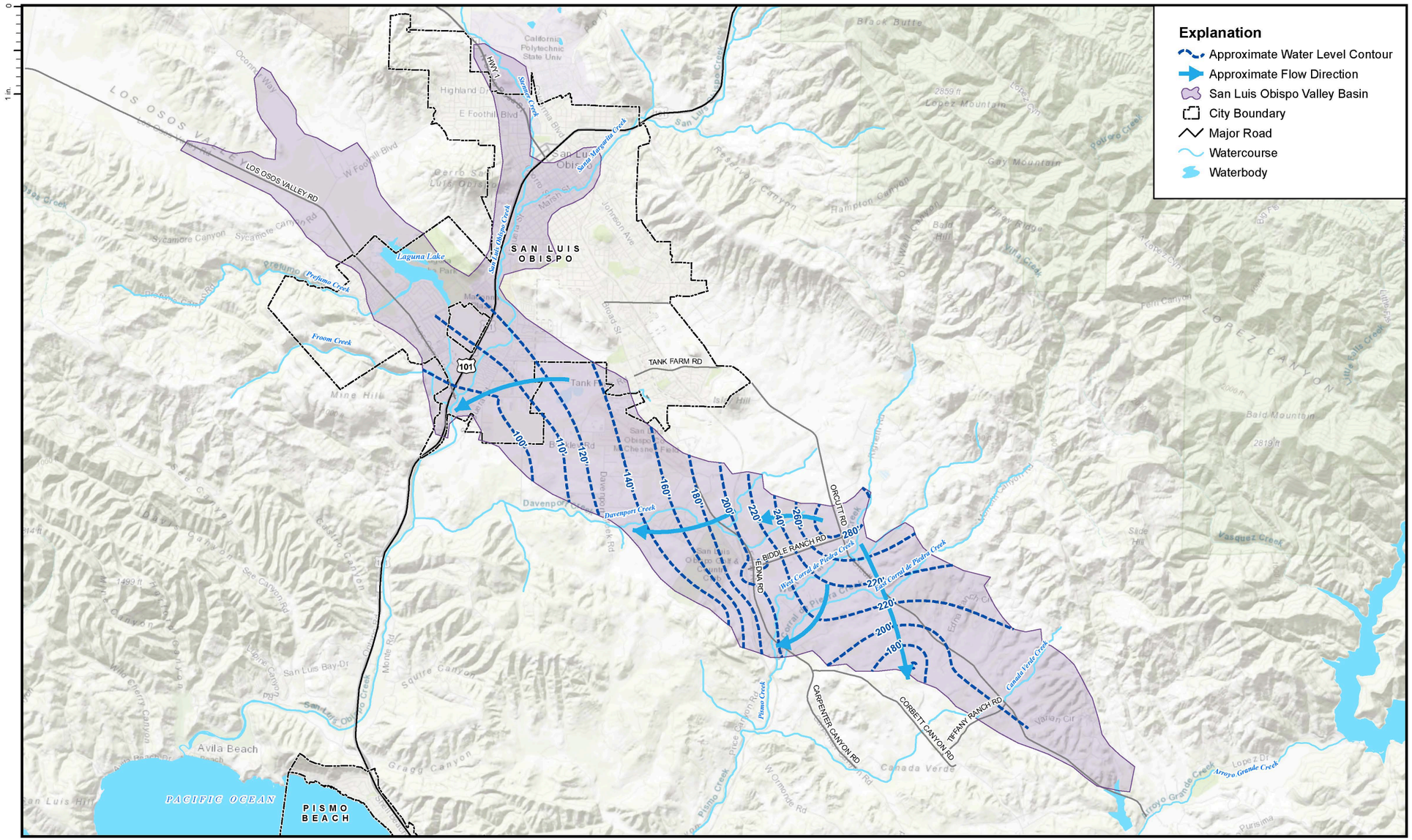
ORCUTT RD
ELKHORN RD
CARPENTER CANYON RD
CORBETT CANYON RD
TIFFANY RANCH RD
LOPEZ CANYON
Laguna Lake
Froom Creek
Prefumo Creek
San Luis Obispo Creek
Santa Margarita Creek
Davenport Creek
West Corral de Piedra Creek
East Corral de Piedra Creek
Canada Verde Creek
Arroyo Grande Creek
Pismo Creek
Los Osos Creek
Warden Creek
Toro Creek
Tank Farm Creek
Broad St
Johnson Ave
Marsh St
Higuera St
Monterey St
Madonna Plaza
Mine Hill
Bishop Peak
Cerro San Luis Obispo
Black Butte
Lopez Mountain
Gay Mountain
Bald Mountain
Bald Hill
Side Hill
Vasquez Creek
Pismo Creek
Price Canyon Rd
Squire Canyon
Wild Cherry Canyon
Davenport Canyon
Cave Landing
Avila Beach Dr
San Luis Bay Dr
Monte Rd
Ormonde Rd
Lopez Dr
Valley Rd
Via Concha
Via Carisa
Via Verde
Via Rancho
Via Linda
Via Alondra
Via Lucero
Via Lucia
Via Diana
Via Vista
Via Valmonte
Via Valle
Via Vaquero
Via Vallejo
Via Vaquero
Via Vallejo
Via Vaquero
Via Vallejo

5.1.8 Fall 2019 Groundwater Elevations

Figure 5-7 presents a groundwater surface elevation map for Fall of 2019. This time period represents recent conditions at the end of the summer dry season for comparison against the spring conditions. Overall, the contours indicate lower groundwater levels than those displayed in the Spring 2019 map. Groundwater contours east of the recharge mound at West Corral de Piedras are about 20 feet lower than the Spring 2019 map. The groundwater elevation at Edna Road and Biddle Ranch Road is about 220 feet, approximately 10-20 feet lower than in the Spring 2018 map.



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3. ESRI

Note:
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Groundwater Elevation Surface
Fall 2019

Figure 5-7

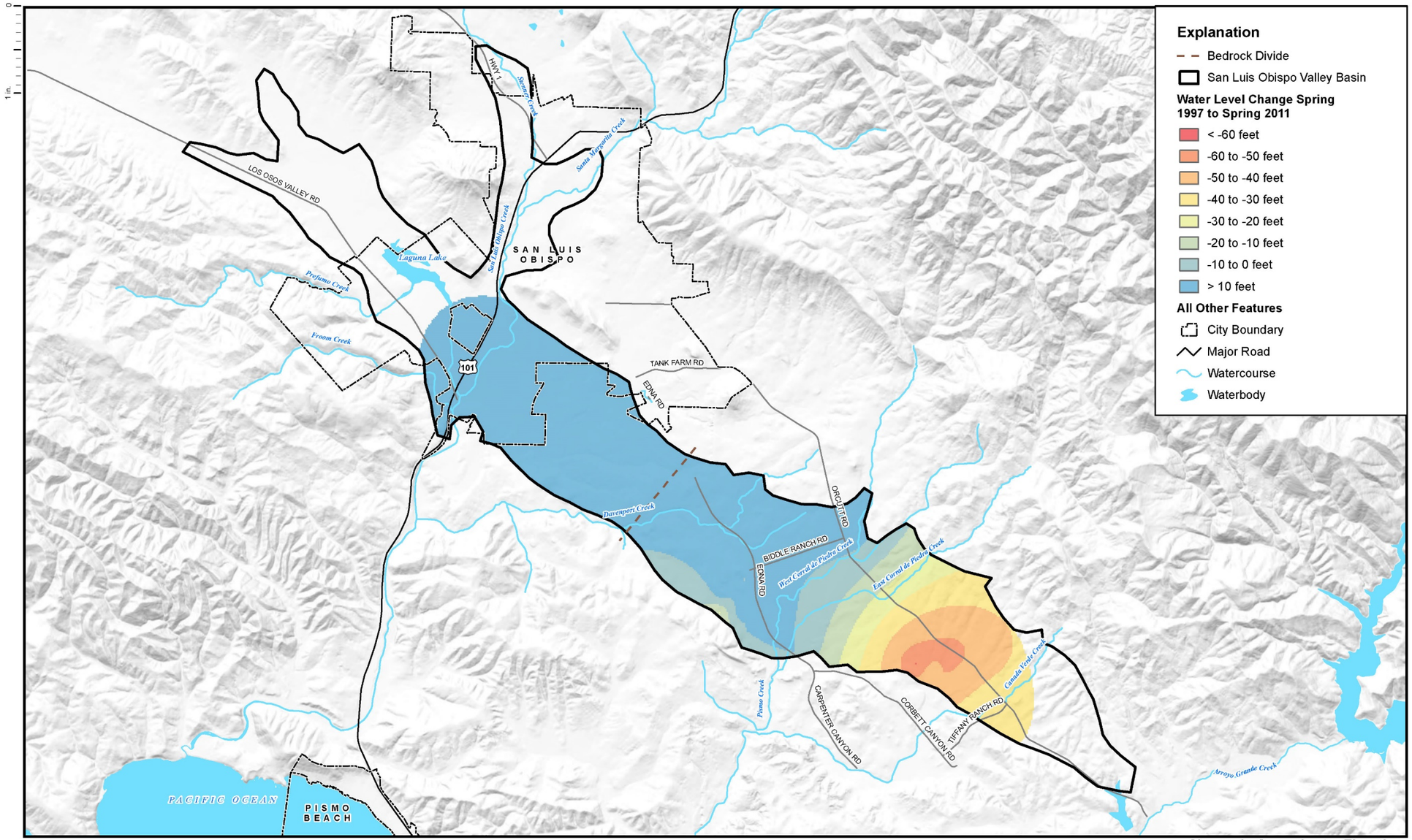
5.1.9 Changes in Groundwater Elevation

In order to demonstrate how groundwater elevations have varied over the recent history of the Basin, a series of maps were generated that display changes in groundwater elevation. These maps were developed by comparing groundwater elevations from one year to the next and calculating the differences in elevation over the specified time period. It should be noted that the results of this analysis are largely dependent on the density of data points, and should be viewed as indicative of general trends, not necessarily as accurate in specific areas where little data is available.

The first time period selected compares changes in groundwater elevation from 1997 through 2011. The year 1997 was selected as a starting point because it is assumed to represent conditions prior to the significant expansion of agricultural groundwater pumping in the Basin. The year 2011 was selected as the end point because it represents conditions prior the start of the recent drought. Calculated changes in groundwater elevation over this 14-year period are presented in Figure 5-8. This figure indicates a maximum decline in groundwater elevation of over 60 feet in the Edna Valley, southeast of East Corral de Piedras Creek between Orcutt Road and Corbett Canyon Road. The calculated groundwater elevation shows declining groundwater levels to the northwest of this location. No significant declines are indicated northwest of Biddle Ranch Road over this time period.

The next time period selected compares changes in groundwater elevation from 2011 through 2015. This time period was selected to capture the start of the drought to a point four years into the drought, thereby capturing the period of greatest groundwater elevation change. Calculated changes in groundwater elevation over this 4-year period are presented in Figure 5-9. This figure indicates a maximum decline in groundwater elevation of over 80 feet located in the Edna Valley, near the intersection of Edna Road and Biddle Ranch Road. The calculated reductions in groundwater elevation decline in all directions from this location. No significant declines are indicated in the San Luis Creek Valley portion of the Basin over this time period.

The next time period selected compares changes in groundwater elevation from 2015 through 2019. This time period was selected to capture the potential recovery of the Basin following the drought. Calculated changes in groundwater elevation over this 3-year period are presented in Figure 5-10. Groundwater elevations are shown to have rebounded throughout the entire area in which data was available. The greatest increase in groundwater elevation is coincident with the area of greatest declines from 2011-2015, near the intersection of Edna Road and Biddle Ranch Road.



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SAN LUIS OBISPO VALLEY BASIN GSP

Author: AB
Date: 2/28/2020

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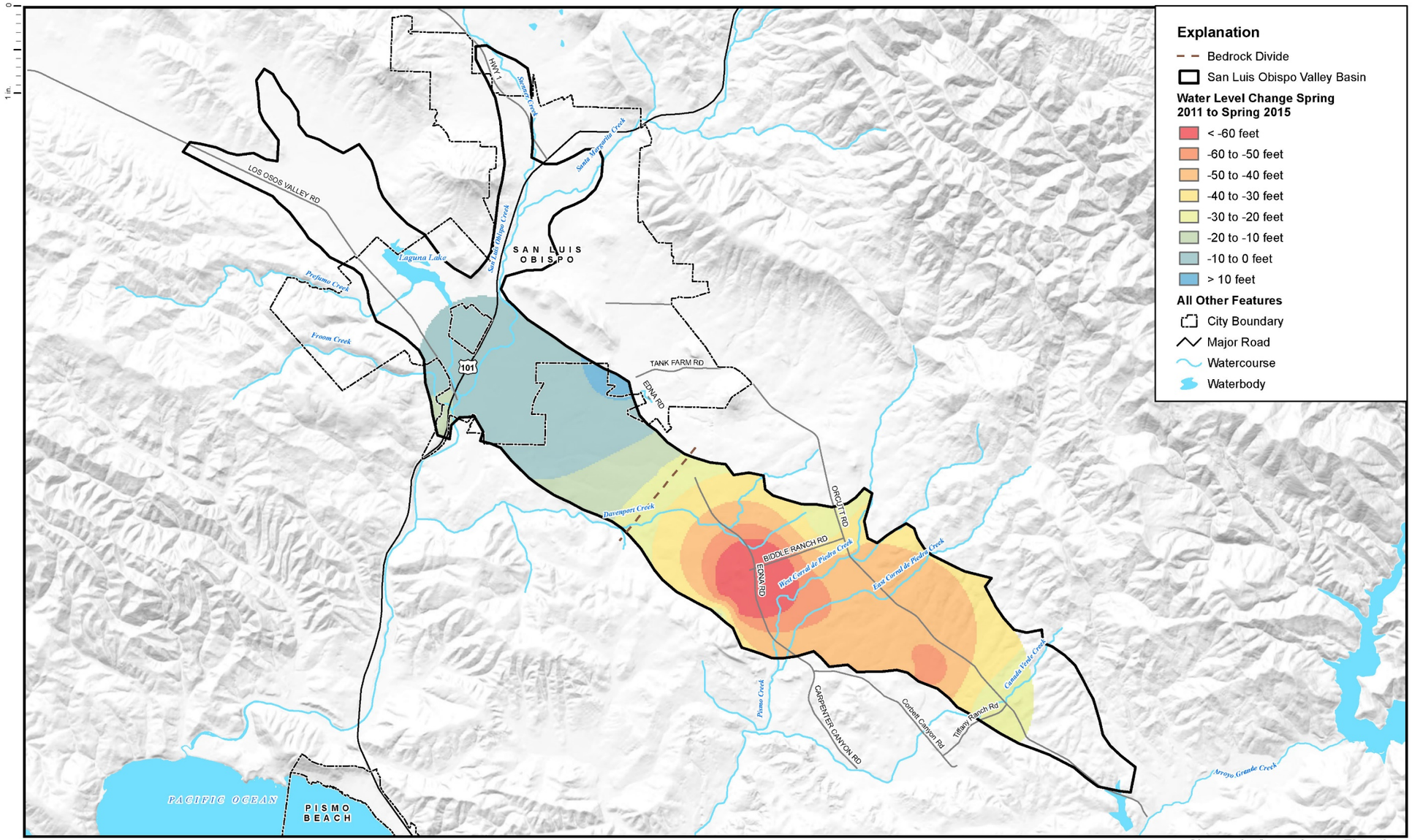
References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS

Change in Groundwater Elevation Spring 1997 to Spring 2011

Figure 5-8



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References:

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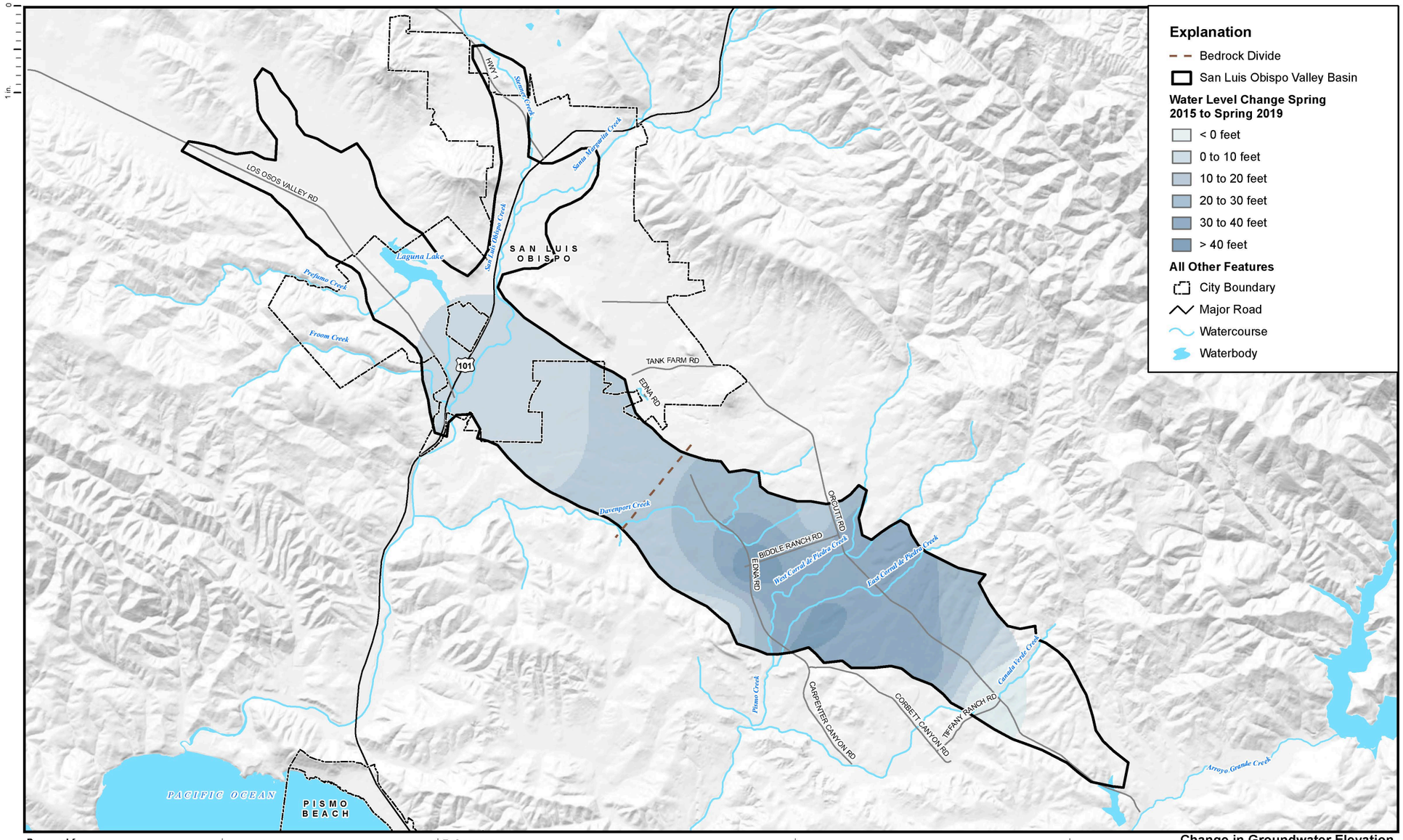
3. USGS

Change in Groundwater Elevation Spring 2011 to Spring 2015

Figure 5-9



Prepared for:

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References:

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3. USGS

Change in Groundwater Elevation Spring 2015 to Spring 2019

Figure 5-10

5.1.10 Vertical Groundwater Gradients

Vertical groundwater gradients are calculated by measuring the difference in head at a single location between specific and distinct strata or aquifers. The characterization of vertical gradients may have implications with respect to characterization of flow between aquifers, migration of contaminant plumes, and other technical details describing groundwater flow in specific areas. In order to accurately characterize vertical groundwater gradient, it is necessary to have two (or more) piezometers sited at the same location, with each piezometer screened across a unique interval that does not overlap with the screened interval of the other piezometers(s). If heads at one such piezometer are higher than the other(s), the vertical flow direction can be established, since groundwater flows from areas of higher heads to areas of lower heads. However, because such a "well cluster" must be specifically designed and installed as part of a broader investigation, limited data exists to assess vertical groundwater gradients. Previous hydrologic studies of the Basin (Boyle 1991, DWR 1997) indicate that groundwater elevations are generally higher in the Alluvial Aquifer than the underlying Paso Robles Formation Aquifer, resulting in groundwater flow from the Alluvial Aquifer to the underlying Paso Robles Formation aquifer (although this may change seasonally). The lack of nested or clustered piezometers to assess vertical gradients in the Basin is a data gap that will be discussed further in Chapter 8.

There are no paired wells that provide specific data comparing water levels in wells screening the bedrock and the Basin sediments. However, from a conceptual standpoint, the Monterey Formation is assumed to receive rainfall recharge in the surrounding mountains at higher elevations than the Basin sediments. For this reason, it is assumed that an upward vertical flow gradient exists between the bedrock and the overlying Basin sediments. Because the bedrock formations are significantly less productive than the Basin sediments, the rate of this flux is not expected to be significant.

5.2 GROUNDWATER ELEVATION HYDROGRAPHS

The San Luis Valley and the Edna Valley are characterized by different patterns of groundwater use. In the San Luis Valley, groundwater use has been dominated by municipal and industrial use, with total groundwater use decreasing since the 1990s, as the City has diversified its surface water supplies, and placed most of its wells on standby status. During this time several in-City agricultural operations have also been developed into housing and commercial districts and now rely on the City's surface water supplies in place of groundwater pumping. In the Edna Valley, groundwater use is dominated by agricultural use, with total use increasing since the 1990s. During the past 15 to 20 years, wine grapes have supplanted other crop types (such as pasture grass and row crops) as the dominant agricultural use within the Edna Valley. Available water level data was reviewed, and data from wells with the longest period of record are presented in Figure 5-11, and discussed in this section. Most of the data was obtained from the County's groundwater monitoring network database.

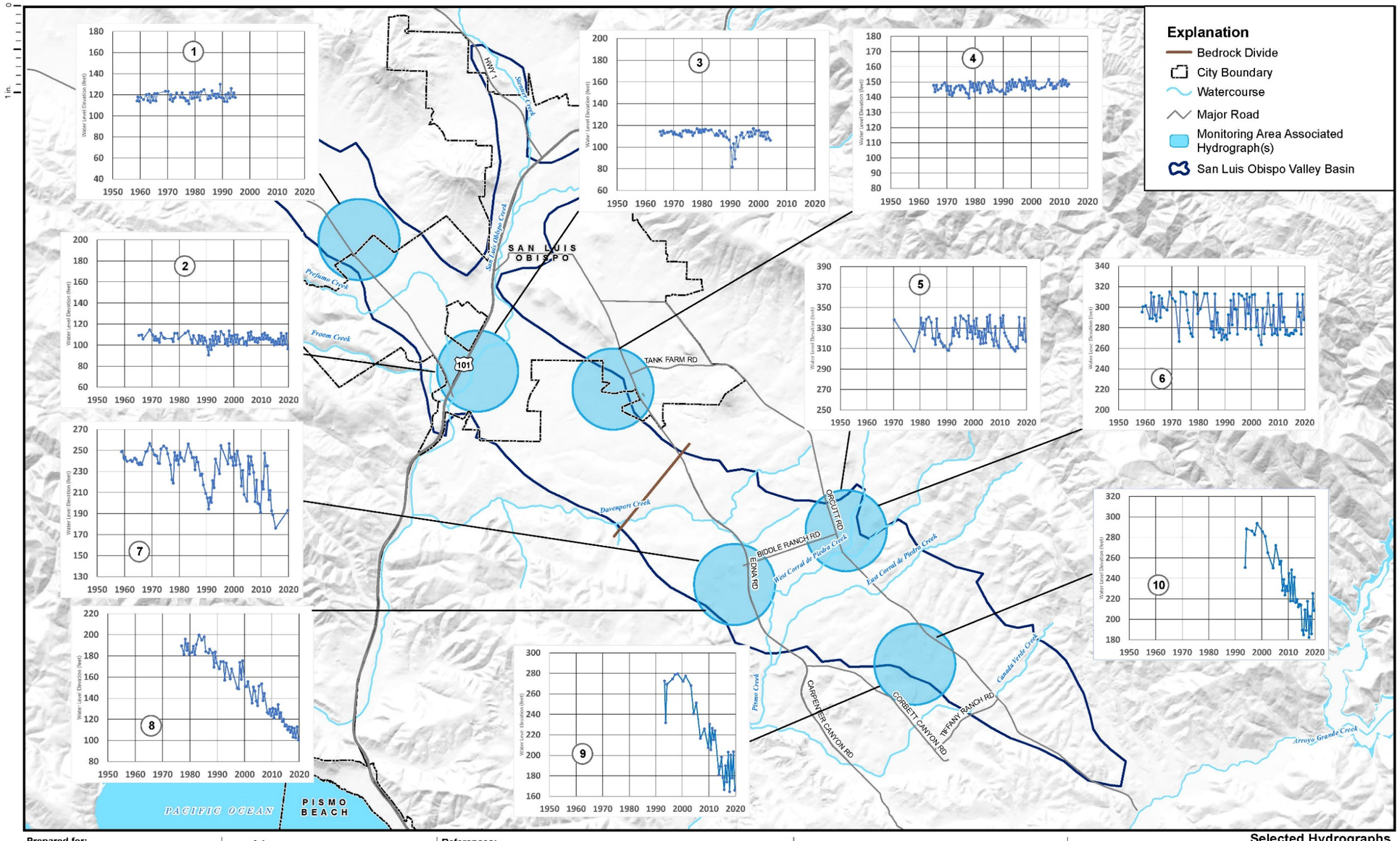
Figure 5-11 presents groundwater elevation hydrographs for the ten wells throughout the Basin with the longest period of record. State well identification numbers are not displayed for reasons of owner confidentiality. Appendix 5A presents depth to water hydrographs for all wells for which the county had water level data. Three distinct patterns are evident in different areas of the Basin and are discussed below.

The hydrographs for the wells in the San Luis Valley indicate that water levels in these wells, although somewhat variable in response to seasonal weather patterns, water use fluctuations, and longer-term dry weather periods, are essentially stable. There are no long-term trends indicating steadily declining or

increasing water levels in this area. The wells along Los Osos Valley Road (hydrographs 1 and 2 on Figure 5-11) display fluctuations within a range of less than 20 feet over a period of record from the late 1950s to the mid-1990s. This period includes the drought of the late 1980s to early 1990s. The well just west of the intersection of Tank Farm Road and Orcutt Road (hydrograph 4 in Figure 5-11) displays a similar pattern, with water level variations within a range of about 10 feet from 1965 to 2013. The wells in the vicinity of Highway 101 and Los Osos Valley Road (hydrograph 3 in Figure 5-11) also display water levels in relative equilibrium, with the exception of the early 1990s, when drought-related pumping and weather patterns resulted in noticeable declines in the water level in this well. These water levels recovered to their pre-drought levels by the mid-1990s. The long-term stability of groundwater elevations in these hydrographs indicates that groundwater extractions and natural discharge in the areas of these wells are in approximate equilibrium with natural recharge and subsurface capture, and that no trends of decreasing groundwater storage are evident.

A second distinct pattern is evident in hydrographs from wells in the area immediately east of the intersection of Biddle Ranch Road and Orcutt Road, where West Corral de Piedras Creek enters the Basin (hydrographs 5 and 6 in Figure 5-11). The hydrographs of the two wells in this area display much greater volatility in response to seasonal and drought cycle fluctuations than the wells in San Luis Valley, with water levels fluctuating within a range of over 40 feet, as opposed to the range of 10 to 20 feet in the San Luis Valley wells. However, water levels appear to rebound to pre-drought levels when each drought cycle ends. Groundwater elevations displayed in these two hydrographs do not display a long-term decline of water levels. This pattern is likely associated with local recharge of the aquifer derived from percolation of stream water in West Corral de Piedras Creek as it leaves the mountains and enters the Basin.

By contrast, several wells in the Edna Valley display steadily declining water levels during the past 15 to 20 years. Hydrographs for four wells (hydrographs 7, 8, 9, and 10 on Figure 5-11) in the Edna Valley display groundwater elevation declines of about 60 to 100 feet since the year 2000. Groundwater elevations in the Edna Valley displayed the largest historical declines in the Basin. This hydrograph pattern indicates that a reduction of groundwater storage has occurred over this period of record in the area defined by these well locations. It is understood, and will be discussed in greater detail in Chapter 6 (Water Budget), that agricultural pumping has increased in Edna Valley during this time period, likely explaining the patterns of declining groundwater elevations in these hydrographs.



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Author: AB
Date: 1/16/2020

SAN LUIS OBISPO VALLEY BASIN GSP

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0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2. San Luis Obispo County
3. USGS

Selected Hydrographs

Figure 5-11

5.3 GROUNDWATER RECHARGE AND DISCHARGE AREAS

Areas of significant areal recharge and discharge within the Basin are discussed below. Quantitative information about all natural and anthropogenic recharge and discharge is provided in Chapter 6: Water Budgets.

5.3.1 Groundwater Recharge Areas

In general, natural areal recharge occurs via the following processes:

1. Distributed areal infiltration of precipitation,
2. Subsurface inflow from adjacent "non-water bearing bedrock", and
3. Infiltration of surface water from streams and creeks.
4. Anthropogenic recharge

The following sections discuss each of these components.

5.3.1.1 Infiltration of Precipitation

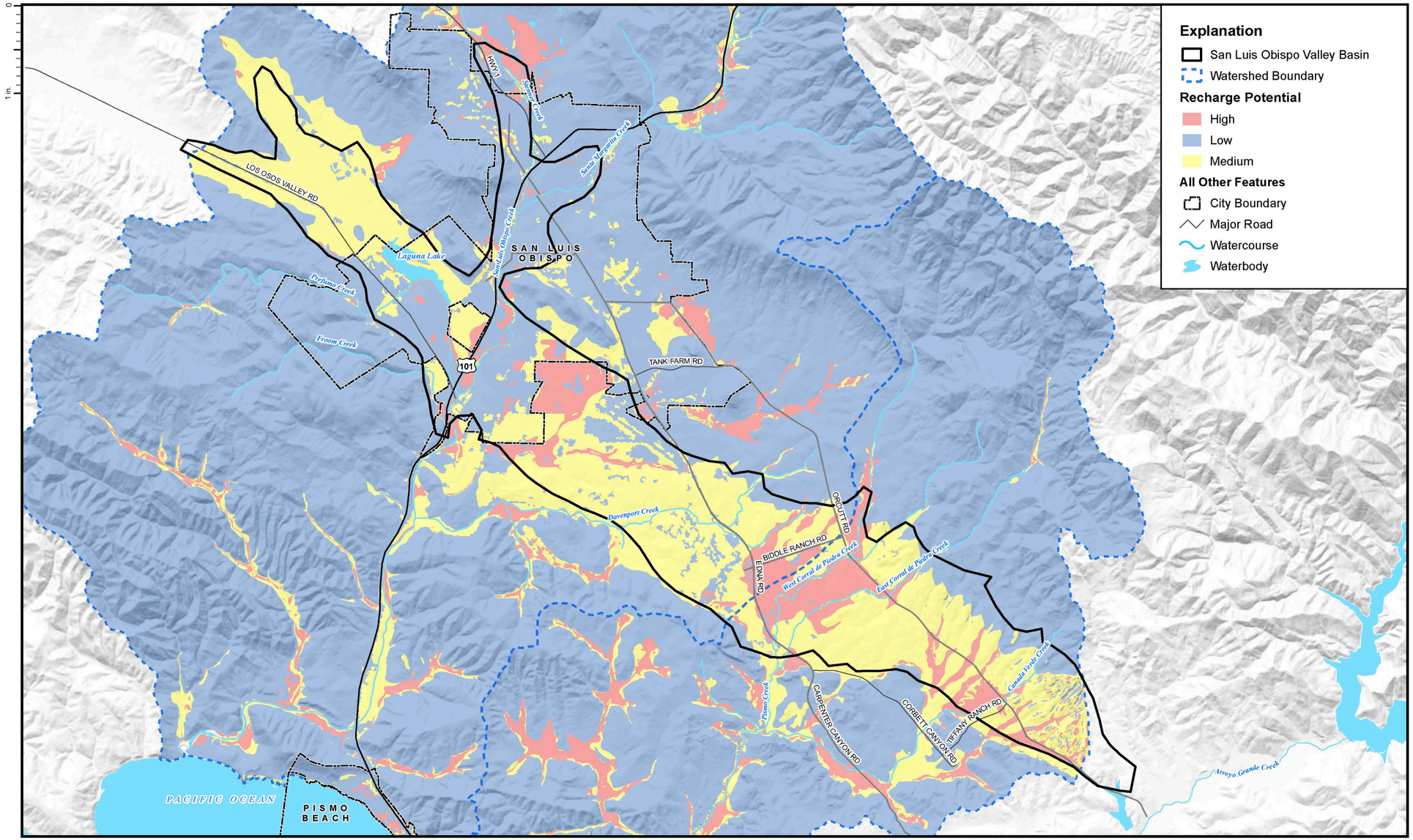
Areal infiltration of precipitation is a significant component of recharge in the Basin. Water that does not run off to stream or get taken up via evapotranspiration migrates vertically downward through the unsaturated zone until it reaches the water table. By leveraging available GIS data that defines key factors such as topography and soil type, locations with higher likelihood of recharge from precipitation have been identified. These examinations are desktop studies and therefore are conceptual in nature, and any recharge project would need a site-specific field characterization and feasibility study before implementation. Still, although they differ in scope and approach, the results of these studies provide an initial effort at identifying areas that may have the intrinsic physical characteristics to allow greater amounts of precipitation-based recharge in the Basin.

Stillwater Sciences (Stillwater), in cooperation with the Upper Salinas-Las Tablas Resource Conservation District (USLTRCD), published a grant funded study (Stillwater 2015) designed to improve data gaps in the County's Integrated Regional Water Management (IRWM) plan. The Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California identified areas with relatively high natural percolation potential that, through management actions, could enhance local groundwater supplies for human and ecological benefits to the aquatic environment for steelhead habitat. The study used existing data in a GIS analysis to identify potentially favorable areas for enhanced recharge projects in the combined San Luis Creek and Pismo Creek Watershed. The results of the Stillwater-USLTRCD study are presented in Figure 5-12. The analysis indicates that approximately 2,220 acres in the Basin are categorized with high potential for intrinsic percolation, and 6,583 acres have medium potential. Conceptually, areas with higher potential for intrinsic percolation would transmit a higher percentage of rainfall to aquifer recharge. The largest area in the Basin that is classified with high recharge potential is the alluvium along East and West Corral de Piedras Creeks in the Edna Valley.

The University of California (UC) at Davis and the UC Cooperative Extension published a study in 2015 that also uses existing GIS data to identify areas potentially favorable for enhanced groundwater recharge projects (UC Davis Cooperative Extension, 2015). While the Stillwater study focused on local San Luis

Obispo stream corridors and emphasized fish habitat conditions, the UC study is statewide in scope includes more than 17.5 million acres, is scientifically peer reviewed, and focuses on the possibilities of using fallow agricultural land as temporary percolation basins during periods when excess surface water is available. The UC study developed a methodology to determine a Soil Agricultural Groundwater Banking Index (SAGBI) to assign an index value to agricultural lands through the state. The SAGBI analysis incorporates deep percolation, root zone residence time, topography, chemical limitations (salinity), and soil surface conditions into its analysis. The results of the SAGBI analysis in the Basin are presented in Figure 5-13. Areas with excellent recharge properties are shown in green. Areas with poor recharge properties are shown in red. Not all land is classified, but similar to the Stillwater map in Figure 5-12, this map provides guidance on where natural recharge likely occurs.

The two studies discussed herein yield similar results in the Basin, particularly in Edna Valley. The Stillwater study identifies much of the drainage area of East and West Corral de Piedras Creeks, as well as area of alluvium of smaller streams t the southeast, as having high recharge potential. The SAGBI study identifies very similar areas in Edna Valley as having a moderately to good index value. These two studies, with differing methodologies, study areas, and objectives, converge on the characterization of the same portions of Edna Valley as having high natural recharge potential. By extension, areas with high natural recharge potential would be favorable locations to investigate the feasibility of enhanced recharge projects. If source water is available, water in these areas would have a higher likelihood of percolating to the underlying aquifers.



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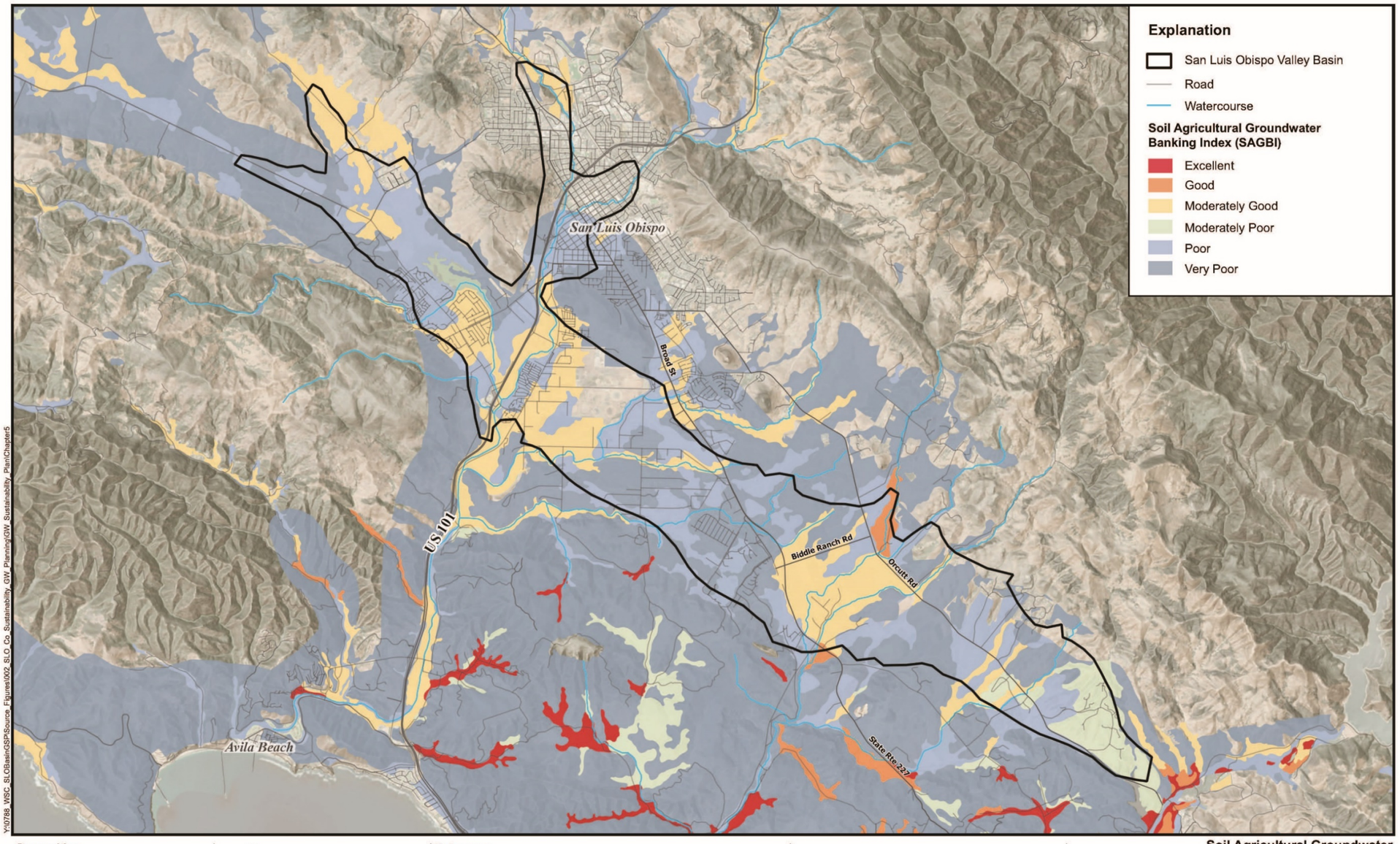
Projection: Lambert Conformal Conic
Datum: North American 1983
2.San Luis Obispo County
3. The Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California (Stillwater, 2015)

Stillwater Percolation Zone Study Results

Figure 5-12



Soil Agricultural Groundwater Banking Index Study Results

Figure 5-13

5.3.1.2 Subsurface Inflow

Subsurface inflow is the flow of groundwater from the surrounding bedrock into the basin sediments. This process is sometimes referred to as mountain front recharge. Groundwater flows from areas of high head to areas of lower head, and water levels in the mountains are at a higher elevation than the Basin. Flow across the basin boundary is predominantly via highly conductive, but random and discontinuous fracture systems. The rate of subsurface inflow to the Basin from the surrounding hill and mountain area varies considerably from year to year depending upon precipitation (intensity, frequency and duration, seasonal totals, etc.) and groundwater level gradients. There are no available published or unpublished inflow data for the hill and mountain areas surrounding the Basin. An estimate of this component of recharge is presented in Chapter 6 (Water Budget).

5.3.1.3 Percolation of Streamflow

Percolation of streamflow is a locally significant source of recharge in areas where the local creeks enter the Basin. Water levels in wells monitored by the County in the area where Corral de Piedras Creeks enter the Basin reflect this phenomenon, as discussed in the previous discussion of water level elevations in the Basin. Groundwater recharge from percolation of streamflow is thought to occur in the area along Davenport Creek, near Buckley Road as well. Most wells in this vicinity are on the order of 100 feet deep, which is too deep to be screened only in the local alluvium; these wells are assumed to screen the Paso Robles Formation Aquifer. During the seasonal winter rains when the creeks are flowing, groundwater levels are at approximately the same level as the water in the creek. During the dry season, water levels decrease to about 15 to 20 feet below land surface. Therefore, the alluvium appears to recharge the underlying Paso Robles Formation in this area. It is likely that similar processes contribute to recharge via percolation of streamflow along the San Luis Creek corridor, as well. Specific isolated monitoring of alluvial wells compared to the underlying aquifers' water levels could clarify this recharge component.

5.3.1.4 Anthropogenic Recharge

Significant anthropogenic recharge occurs via the three processes discussed below:

1. Percolation of treated wastewater treatment plant (WWTP) effluent,
2. Percolation of return flow from agricultural irrigation, and
3. Percolation of return flow from domestic septic fields.

A wastewater treatment plant serving the City of San Luis Obispo operates within the Basin on Prado Road along San Luis Creek. Treated wastewater effluent from this plant is discharged to San Luis Creek and used in the City's recycled water system for irrigation and construction-related uses. The County operates a small WWTP near the golf course in the service area of Golden State Water Company, and uses the effluent largely to irrigate the golf course. Residences in Edna Valley beyond the city or county WWTP service area dispose of wastewater via septic tanks. Water from septic fields can percolate into the underlying aquifers.

Irrigated agriculture is prevalent in the Basin, especially along Los Osos Valley Road and in Edna Valley. Return flows from irrigated agriculture occur when water is supplied to the irrigated crops in excess of the crop's water demand. This is done to avoid excess build-up of salts in the soil and overcome non-uniformity in the irrigation distribution system. These are all general standard practices.

5.3.2 Groundwater Discharge Areas

Natural groundwater discharge occurs as discharge to springs, seeps and wetlands, subsurface outflows, and evapotranspiration (ET) by phreatophytes. Figure 5-14 includes the locations of significant active springs, seeps, and wetlands within or adjacent to the Basin identified from previous studies or included on USGS topographic maps covering the watershed area. There are no mapped springs or seeps located within the Basin boundaries; most are located at higher elevations in the surrounding mountain areas.

Natural groundwater discharge can also occur as discharge from the aquifer directly to streams. Groundwater discharge to streams and potential groundwater dependent ecosystems (GDEs) are discussed in Section 5.8. In contrast to mapped springs and seeps, whose source water generally comes from bedrock formations in the mountains, groundwater discharge to streams is derived from the alluvium. Discharge to springs or streams can vary seasonally as precipitation and stream conditions change throughout the year. Groundwater discharge to the Corral de Piedras Creeks occur seasonally at the location where the creeks leave the basin, where relatively impermeable bedrock rises to the surface along the Edna Fault, causing groundwater to daylight at this location, at least in the wet season. Subsurface outflow and ET by phreatophytes are discussed in Chapter 6 (Water Budget).

5.4 CHANGE IN GROUNDWATER STORAGE

Changes in groundwater storage for the Alluvial Aquifer and Paso Robles Formation Aquifer are correlated with changes in groundwater elevation, previously discussed, and are addressed in Chapter 6 (Water Budget).

5.5 SEAWATER INTRUSION

Seawater intrusion is not an applicable sustainability indicator for the Basin. The Basin is not adjacent to the Pacific Ocean, a bay, or inlet.

5.6 SUBSIDENCE

Land subsidence is the lowering of the land surface. While several human-induced and natural causes of subsidence exist, the only process applicable to the GSP is subsidence due to lowered groundwater elevations caused by groundwater pumping. Historical incidence of subsidence within the Basin was discussed in Chapter 4 (Basin Setting).

Direct measurements of subsidence have not been made in the Basin using extensometers or repeat benchmark calibration; however, interferometric synthetic aperture radar (InSAR) has been used in the County to remotely map subsidence and DWR is expected to continue to collect InSAR data. This technology uses radar images taken from satellites that are used to map changes in land surface elevation. One study done in the area, which evaluates the time period between spring 1997 and fall 1997 (Valentine, D. W. et al., 2001), did not report any measurable subsidence within the Basin.

Subsidence as a sustainability indicator will be addressed further in Chapter 8.

5.7 INTERCONNECTED SURFACE WATER

Surface water/groundwater interactions may represent a significant, portion of the water budget of an aquifer system. Where the water table is above the streambed and slopes toward the stream, the stream receives groundwater from the aquifer; that is called a gaining reach (i.e., it gains flow as it moves through the reach). Where the water table is beneath the streambed and slopes away from the stream, the stream loses water to the aquifer; that is called a losing reach. In addition, a stream may be disconnected from the regional aquifer system if the elevation of streamflow and alluvium is significantly higher than the elevation of the water table in the underlying aquifer.

The spatial extent of interconnected surface water in the Basin was evaluated using water level data from Alluvial Aquifer and Paso Robles Formation Aquifer wells adjacent to the Basin creeks and streams. In accordance with the SGMA Emergency Regulations §351 (o), "Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". The interconnected surface water analysis for the Basin consisted of comparing average springtime water level elevations in wells adjacent to the San Luis Creek with the elevation of the adjacent San Luis Creek channel. In cases where average springtime water levels were greater than the elevation of the adjacent San Luis Creek channel, the stream reach was considered as potentially 'gaining'. In cases where average springtime water levels were below the adjacent channel elevation, the stream reach was considered 'losing' and potentially 'disconnected'. It is important to recognize that the results of these analyses may reflect conditions that occur occasionally, in response to precipitation events. They may not be representative of long-term average conditions.

The analysis outlined above resulted in identification of two areas of San Luis Creek that occasionally 'gain' water from the Alluvial Aquifer; the confluence of Stenner Creek and San Luis Creek, and the reach of San Luis Creek downstream from the Wastewater Treatment Plant to the confluence with Prefumo Creek. These are displayed in Figure 5-14. Several reaches of San Luis Creek are identified that occasionally 'lose' water to the Alluvial Aquifer. Groundwater levels in the San Luis Valley part of the Basin are generally high enough that the creek is connected to the underlying aquifer. Along most of Corral de Piedras Creeks, by contrast, surface water levels are generally greater than 30 feet above the groundwater level, and the streams are considered disconnected from the underlying Alluvial Aquifer in this area.

5.7.1 Depletion of Interconnected Surface Water

Groundwater withdrawals are balanced by a combination of reductions in groundwater storage and changes in the rate of exchange across hydrologic boundaries. In the case of surface water depletion, this rate change could be due to reductions in rates of groundwater discharge to surface water, and increased rates of surface water percolation to groundwater. Seasonal variation in rates of groundwater discharge to surface water or surface water percolation to groundwater occur naturally throughout any given year, as driven by the natural hydrologic cycle. However, they can also be affected by anthropogenic actions. Since, as presented in the discussion of hydrographs in the San Luis Valley in Section 5.2, there has been no long-term water level declines in this area, there is no evidence of long-term depletion of interconnected surface water in this area.

5.8 POTENTIAL GROUNDWATER DEPENDENT ECOSYSTEMS

The SGMA Emergency Regulations §351.16 require identification of groundwater dependent ecosystems within the Basin. Several datasets were utilized to identify the spatial extent of potential groundwater

dependent ecosystems (GDEs) in the Basin, as discussed in the following sections. In accordance with the SGMA Emergency Regulations §351 (o), "groundwater dependent ecosystems refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface". In areas where the water table is sufficiently high, groundwater discharge may occur as evapotranspiration (ET) from phreatophyte vegetation within these GDEs. The overall distribution of potential GDEs within the Basin has been initially estimated in the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset (DWR, 2018). This dataset was reviewed by Stillwater Sciences, and the resulting distribution of potential GDEs is shown in Figure 5-15. There has been no verification that the locations shown on this map constitute GDEs. Additional field reconnaissance is necessary to verify the existence and extent of these potential GDEs, and may be considered as part of the monitoring network for future planning efforts.

5.8.1 Hydrology

5.8.1.1 Overview of GDE Relevant Surface and Groundwater Hydrology

Instream flows in San Luis and Pismo Creeks can be divided into wet season flows, typically occurring from January to April, and dry season flows, typically from June to October. Short transitional periods occur between the wet and dry seasons. Wet season instream flows originate from a range of sources including precipitation-driven surface runoff events, water draining from surface depressions or wetlands, shallow subsurface flows (e.g., soil), and groundwater discharge. Dry season instream flows, however, are likely fed primarily by groundwater discharge. As groundwater levels fall over the dry season, so do the corresponding instream flows. If groundwater elevations remain above instream water elevations, groundwater discharges into the stream and surface flows continue through the dry season (creating perennial streams). If groundwater elevations fall below the streambed elevation, the stream can go dry. Streams that typically flow in the wet season and dry up in the dry season are termed intermittent. Over time, streams can transition from historically perennial to intermittent conditions due to climactic changes or groundwater pumping (Barlow and Leake 2012). Dry season flows supported by groundwater are critical for the survival of various special status species, including the federally threatened California red-legged frog (Rana draytonii) and Steelhead (Oncorhynchus mykiss).

San Luis Creek and Pismo Creek are underlain by the Alluvial Aquifer, the Paso Robles Formation Aquifer, and the Pismo Formation Aquifer, as previously discussed. These aquifers have hydraulic connection to one another, and to surface waters, but the degree of connection varies spatially. Aquifers can include confined aquifers, unconfined aquifers, and perched aquifers (Chapter 4). Aquifers can discharge into ponds, lakes or creeks or vice versa. In the San Luis Obispo Valley Groundwater Basin, little data exists to characterize the connection between surface water and groundwater.

While the groundwater in the San Luis Valley and Edna Valley is hydraulically connected, a shallow subsurface bedrock divide between the two sub-areas partially isolates the deeper portions of the two aquifers (Figure 5-10 and Figure 5-11). Groundwater in the Edna Valley flows both towards the San Luis Valley in the northwest portion of the basin and towards Price Canyon in the southwest portion of the basin. Groundwater flowing towards Price Canyon rises to the surface as it approaches the bedrock constriction of Price Canyon and the Edna fault system. The 1954 DWR groundwater elevation map (Figure 5-1) best illustrates the pre-development groundwater flow from the Edna Valley both towards San Luis Obispo and into Price Canyon. Observations of stream conditions indicate a perennial reach of Pismo Creek that flows through Price Canyon and supports year-round critical habitat for threatened steelhead just south of the Basin Boundary. A conceptual explanation for this is that groundwater from the Edna sub-area flows towards the discharge area at Price Canyon, and rises to the surface (daylights) as the groundwater

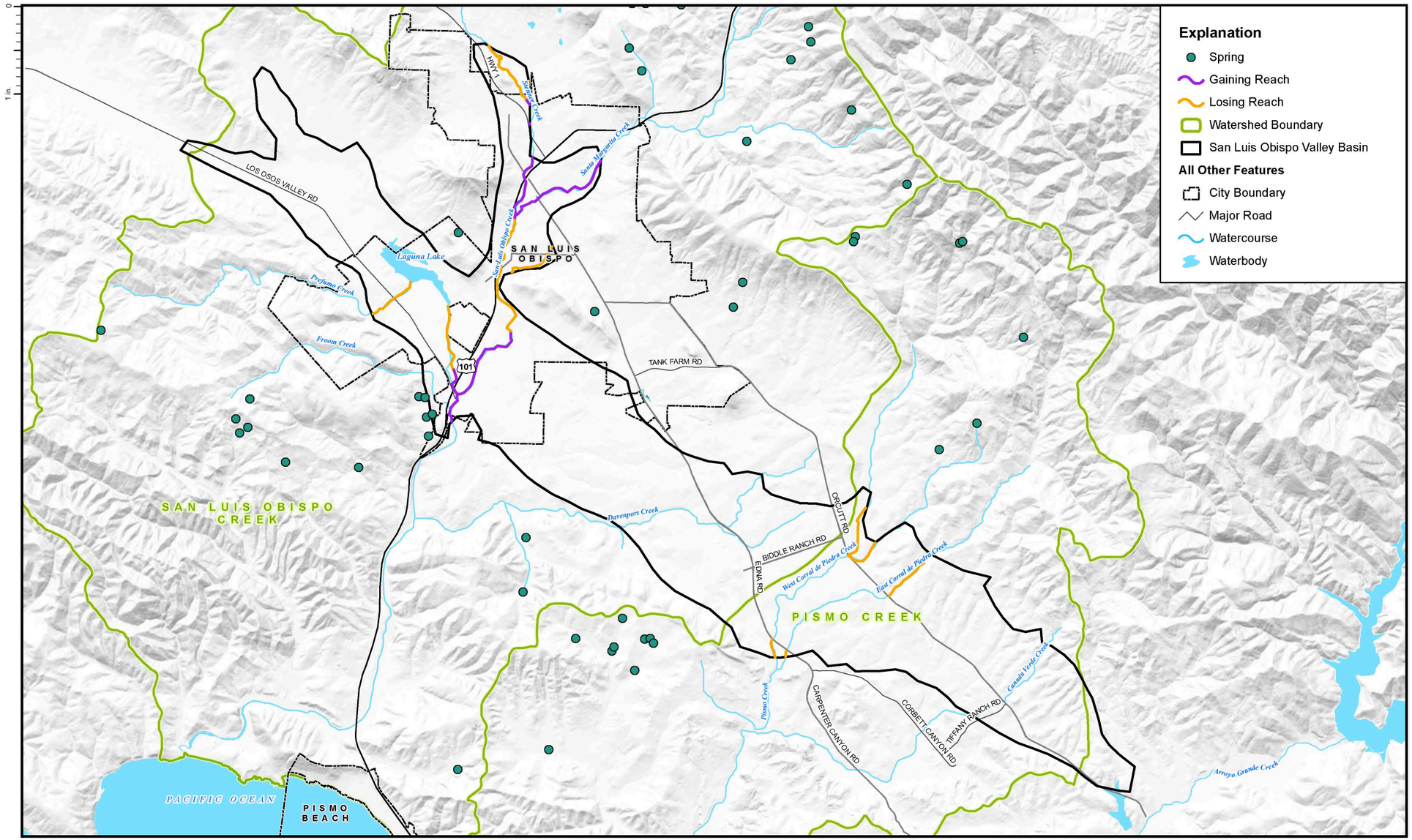
flow encounters the impermeable zone of the Edna Fault and the bedrock outside of the Basin. Piezometers in this area could confirm this interpretation of observed stream conditions.

5.8.1.2 Losing and Gaining Reaches

Streams are often subdivided into losing and gaining reaches to describe their interaction of surface water in the stream with groundwater in the underlying aquifer. In a losing reach water flows from the stream to the groundwater, while in a gaining reach water flows from the groundwater into the stream. The connection between losing reaches to the regional aquifer may be unclear as water can be trapped in perched aquifers above the regional water table. Figure 5-14 shows the likely extent of known gaining and losing reaches in San Luis and Pismo Creeks during typical dry season conditions. This map is compiled from various data sources, including:

- A field survey of wet and dry reaches of San Luis Creek (Bennett 2015),
- Field surveys and flow measurements of Pismo Creek (Balance Hydrologics 2008),
- An instream flow study of Pismo Creek (Stillwater Sciences 2012),
- A regional instream flow assessment that included San Luis and Pismo Creeks (Stillwater Sciences 2014),
- Spring and summer low flow measurements in San Luis and Pismo Creeks (2015–2018) (Creek Lands Conservation 2019), and
- Consideration of the effects of local geologic features such as bedrock outcrops and faults, both of which can force deeper groundwater to the surface.

The effect of faults and bedrock outcrops can be localized or extend for some distance downstream. Portions of the San Luis and Pismo Creeks and their tributaries for which no data exist are left unhighlighted in Figure 5-14. In general, the extent of losing or gaining reaches can vary by water year type or pumping conditions. East and West Corral de Piedras Creeks on the north-east side of the basin can be dry in the spring and summer during drier years but be flowing, losing reaches in wetter years (Creek Lands Conservation 2019). (To be clear, a stream segment can be a losing reach even if it is not hydraulically connected to the aquifer, since the stream will be losing surface flow to the subsurface via percolation.) In contrast, gaining reaches shown on San Luis Obispo Creek are fairly consistent across water year types (Bennett 2015, Creek Lands Conservation 2019). Figure 5-14 is based on limited data sources. Improved surface flow monitoring is recommended to refine and update the extent of losing and gaining reaches, as well as to provide data for unhighlighted reaches.



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Datum: North American 1983
2. San Luis Obispo County
3. USGS
4. ESRI
5. Stillwater Sciences

Losing and Gaining Reaches Within the Basin

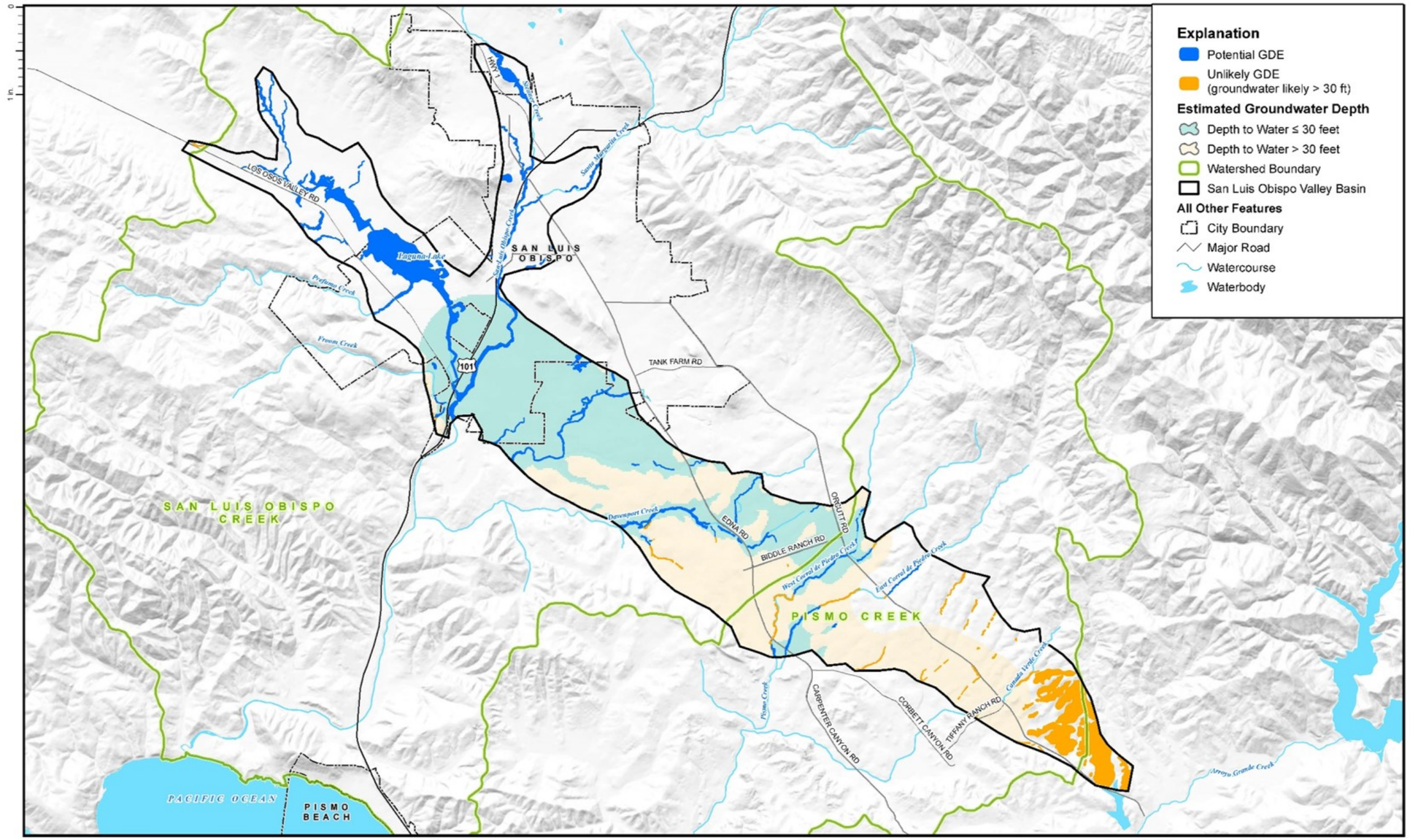
Figure 5-14

5.8.2 Vegetation and Wetland Groundwater Dependent Ecosystem Identification

DWR has compiled a statewide Natural Communities Commonly Associated with Groundwater (NCCAG) database (DWR 2019). This database identifies potentially groundwater dependent ecosystems based on the best available vegetation and wetland data (Klausmeyer et al. 2018). DWR identifies potentially groundwater dependent wetland areas using National Wetland Inventory (NWI) wetland data (USFWS 2018). These data were evaluated and assessed to accurately capture wetland and riverine features. In the Basin, the best available vegetation mapping data set was from the California Fire and Resource Assessment Program Vegetation (FVEG, California Department of Forestry and Fire Protection 2015). FVEG is a remotely sensed dataset that classifies vegetation to coarse types (i.e., the California Wildlife Habitat Relationship System). Given the limitations of this dataset to accurately capture and identify vegetation using a precise classification system, it was deemed inappropriate for use in determining potential GDEs. Instead, a manual assessment of vegetation with potential groundwater dependence was conducted using National Agricultural Imagery Program 2018 color aerial imagery (NAIP 2018). Vegetation communities identified as potentially groundwater dependent included riparian trees and shrubs, and oak woodlands. Oak woodlands were considered potentially groundwater dependent due to their deep rooting depths (up to 70 feet [Lewis and Burgy 1964]).

Potential vegetation and wetland GDEs were retained if the underlying depth to water in 2019 was inferred to be 30 feet or shallower based on the existing well network (Figure 5-15). Depth to groundwater was interpolated from seventeen wells for which groundwater level data was available in the spring of 2019 (Figure 5-6). The depth to groundwater estimated in Figure 5-15 is assumed to represent regional groundwater levels; however, the screening depth is known for only 6 of the 17 of the wells. Wells where the screened depth is unknown may be measuring groundwater levels for deeper aquifers that are unconnected to the shallow groundwater system, and thus groundwater deeper than 30 ft for a given well may not reflect the absence of shallow groundwater, but instead reflects the absence of data. To determine the hydraulic connectivity between potential perched aquifers to the regional aquifer, additional monitoring with nested piezometers could be utilized.

For the purposes of differentiating between potential and unlikely GDE's, different assumptions were made for the San Luis Valley versus Edna Valley in areas of no groundwater data. In the San Luis Valley, underlying San Luis Creek, it was assumed that the depth to regional groundwater was less than 30 feet because the limited available data indicate that groundwater in this sub-area is generally relatively shallow. In the Edna Valley (underlying Pismo Creek), it was assumed that the depth to regional groundwater was more than 30 feet because the limited available data indicate that the groundwater in this sub-area is generally deeper; therefore, much of the area of the lower reaches of East and West Corral de Piedras Creeks is unlikely to have GDEs. One exception to this assumption was made on upper East Corral de Piedra where the conditions were assumed to be similar to those on upper West Corral de Piedra where early dry season wet conditions have been observed by Stillwater Sciences and Balance Hydrologics (2008). The 30-foot depth criterion is consistent with guidance provided by The Nature Conservancy (Rohde et al. 2019) for identifying GDEs. Additionally, the area where East and West Corral de Piedras Creeks leave the Basin near Price Canyon has groundwater elevation data within 30 feet of the streams, and so are presented as having potential GDEs.



Prepared for:

Author: AB
Date: 2/28/2020

SAN LUIS OBISPO VALLEY BASIN GSP

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3. USGS
4. ESRI
5. Stillwater Sciences

Potential Groundwater-Dependent Ecosystems (GDEs)

Figure 5-15

5.8.3 Identification of Special-Status Species and Sensitive Natural Communities Associates with GDE's

For the purposes of this GSP, special-status species are defined as those:

- Listed, proposed, or under review as endangered or threatened under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA);
- Designated by California Department of Fish and Wildlife (CDFW) as a Species of Special Concern;
- Designated by CDFW as Fully Protected under the California Fish and Game Code (Sections 3511, 4700, 5050, and 5515);
- Protected under the federal Bald and Golden Eagle Protection Act;
- Designated as rare under the California Native Plant Protection Act (CNPPA); and/or
- Included on CDFW's most recent Special Vascular Plants, Bryophytes, and Lichens List (CDFW 2019a) with a California Rare Plant Rank (CRPR) of 1, 2, 3, or 4.

In addition, sensitive natural communities are defined as:

- Vegetation communities identified as critically imperiled (S1), imperiled (S2), or vulnerable (S3) on the most recent California Sensitive Natural Communities List (CDFW 2019b).

To determine the terrestrial and aquatic special-status species that may utilize potential GDE units overlying the Basin, Stillwater ecologists queried existing databases on regional and local occurrences and distributions of special-status species. Databases accessed include the California Natural Diversity Database (CNDDB) (CDFW 2019c), eBird (2019), and TNC freshwater species list (TNC 2019). Spatial database queries were centered on the potential GDEs plus a 1-mile buffer. Stillwater's ecologists reviewed the database query results and identified special-status species and sensitive natural communities with the potential to occur within or to be associated with the vegetation and aquatic communities in or immediately adjacent to the potential GDEs. The table in Appendix 5B lists these special-status species and sensitive natural communities, describes their habitat preferences and potential dependence on GDEs, and identifies known nearby occurrences (Appendix B - Table 1). Wildlife species were evaluated for potential groundwater dependence using the Critical Species Lookbook (Rohde et al. 2019).

The San Luis Obispo Valley Groundwater Basin supports steelhead belonging to the South-Central California Coast Distinct Population Segment (DPS) which is federally listed as "threatened." Within this DPS, the population of steelhead within the San Luis Creek, and Pismo Creek portions of the groundwater basin have both been identified as Core 1 populations which means they have the highest priority for recovery actions, have a known ability or potential to support viable populations, and have the capacity to respond to recovery actions (NMFS 2013). One critical recovery action listed by the National Marine Fisheries Service (NMFS) includes the management of groundwater extractions for protection and restoration of natural surface flow patterns to ensure surface flows allow for essential steelhead habitat functions (NMFS 2013).

Based on criteria promulgated by The Nature Conservancy (TNC), the San Luis Obispo Valley Groundwater Basin was determined to have high ecological value because: (1) the known occurrence and presence of suitable habitat for several special-status species including the Core 1 population status of South-Central California Coast Steelhead DPS and several special-status plants and animals that are directly or indirectly dependent on groundwater (Appendix B - Table 1); and (2) the vulnerability of these species and their habitat to changes in groundwater levels (Rohde et al. 2018).

5.9 GROUNDWATER QUALITY DISTRIBUTION AND TRENDS

Groundwater quality samples have been collected and analyzed throughout the Basin for various studies and programs and are collected on a regular basis for compliance with regulatory programs. Water quality data surveyed for this GSP were collected from:

- The California Safe Drinking Water Information System (SDWIS), a repository for public water system water quality data,
- The National Water Quality Monitoring Council water quality portal (this includes data from the recently decommissioned EPA STORET database, the USGS, and other federal and state entities [Note: in the Basin the agencies include USGS, California Environmental Data Exchange Network (CEDEN), and Central Coast Ambient Monitoring Program {CCAMP}]), and
- The California State Water Resources Control Board (SWRCB) GeoTracker GAMA database.

In general, the quality of groundwater in the Basin is good. Water quality trends in the Basin are stable, with no significant trends of ongoing deterioration of water quality based on the Regional Water Quality Control Board's Basin Objectives, outlined in the Water Quality Control Plan for the Central Coast Basin (Basin Plan, June 2019). The Basin Plan takes all beneficial uses into account and establishes measurable goals to ensure healthy aquatic habitat, sustainable land management, and clean groundwater. The distribution, concentrations, and trends of some of the most commonly cited major water quality constituents are presented in the following sections.

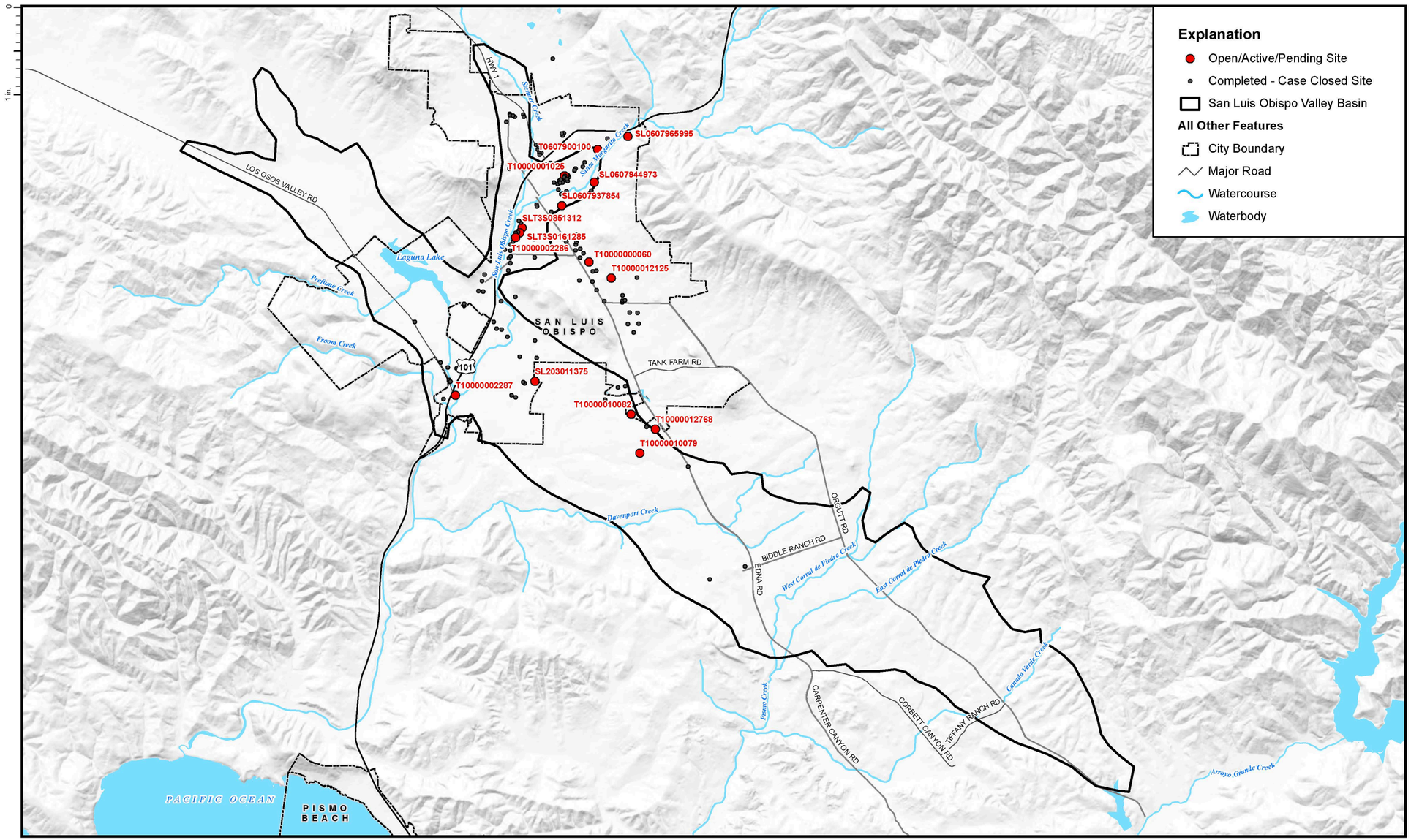
5.9.1 Groundwater Quality Suitability for Drinking Water

Groundwater in the Basin is generally suitable for drinking water purposes. Groundwater quality data was evaluated from the SDWIS and GeoTracker GAMA datasets. The data reviewed includes 2,885 sampling events from 403 supply wells and monitoring wells in the Basin, collected between June 1953 and September 2019. Primary drinking water standards Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) are established by Federal and State agencies. MCLs are legally enforceable standards, while SMCLs are guidelines established for nonhazardous aesthetic considerations such as taste, odor, and color. Primary water quality standard exceedances in the Basin include exceedance of the MCL for nitrate, which equaled or exceeded the standard in 269 samples out of 2,605 samples (or 10% of samples, with 190 of the exceedances occurring in four wells), and exceedance of the MCL for arsenic, which exceeded the MCL in 30 out of 771 samples (or 4% of samples collected). The SMCL for total dissolved solids (TDS) was equaled or exceeded in 126 out of 843 samples (or 15% of total samples). In the case of public water supply systems, these water quality exceedances are effectively mitigated with seasonal well use, treatment, or water blending practices to reduce the constituent concentrations to below their respective water quality standard. In general, these statistics meet the Central Coast Water Board Basin Plan measurable goals that by 2025, 80% of groundwater will be clean, and the remaining 20% will exhibit positive trends in key parameters.

5.9.2 Distribution and Concentrations of Point Sources of Groundwater Constituents

Potential point sources of groundwater quality degradation due to release of anthropogenic contaminants were identified using the State Water Resources Control Board (SWRCB) Geotracker website. Waste Discharge permits were also reviewed from on-line regional SWRCB websites. Table 5-1 summarizes information from these websites for open/active sites. Figure 5-16 shows the locations of these open

groundwater contaminant point source cases, and the locations of completed/case closed sites. Based on available information there are no mapped ground-water contamination plumes at these sites.



Location of Potential Point Sources of Groundwater Contaminants

Figure 5-19

Table 5-1: Potential Point Sources of Groundwater Contamination

Site ID	Site Name	Case Type	Status	Constituent(s) of Concern (COCs)	Potentially Affected Media
T0607900100	American Gas and Tire	LUST Cleanup Site	Open - Verification Monitoring	Benzene, Gasoline, MTBE / TBA / Other Fuel Oxygenates	Aquifer used for drinking water supply
SL203011375	Chevron (Former UNOCAL) - Tank Farm Road Bulk Storage	Cleanup Program Site	Open - Remediation	Arsenic, Lead, Asphalt, Crude Oil, Other Petroleum	Contaminated Surface / Structure, Other Groundwater (uses other than drinking water), Soil, Surface water
T10000002287	Conoco Phillips site # 5143	Cleanup Program Site	Open - Site Assessment	Crude Oil, Diesel, Gasoline	Soil
SL0607944973	COP Pipeline at San Luis Drive	Cleanup Program Site	Open - Assessment & Interim Remedial Action	Crude Oil	Other Groundwater (uses other than drinking water), Well used for drinking water supply
T10000001025	KIMBALL MOTORS	Cleanup Program Site	Open - Verification Monitoring	Other Chlorinated Hydrocarbons, Tetrachloroethylene (PCE), Trichloroethylene (TCE), Vinyl chloride	Aquifer used for drinking water supply, Soil
SLT3S0851312	MODEL INDUSTRIAL SUPPLY	Cleanup Program Site	Open - Site Assessment		Aquifer used for drinking water supply
SLT3S0161285	PG&E-FORMER MANUFACTURED GAS PLANT-SAN LUIS OBISPO	Cleanup Program Site	Open - Remediation		Aquifer used for drinking water supply
SL0607937854	PISMO ST. AND MORRO ST. PIPELINE RELEASE	Cleanup Program Site	Open - Site Assessment	Crude Oil	Aquifer used for drinking water supply
T10000012768	SAN LUIS COUNTY RGNL	Non-Case Information	Pending Review	Per- and Polyfluoroalkyl Substances (PFAS)	
T10000002286	South Higuera St & Pismo St Pipeline (Chevron Site 351317)	Cleanup Program Site	Open - Site Assessment	Crude Oil, Diesel, Gasoline	Aquifer used for drinking water supply, Soil
T10000010079	Thread Lane Properties, LLC	Cleanup Program Site	Open - Site Assessment		
SL0607965995	TRACT 1259	Cleanup Program Site	Open - Assessment & Interim Remedial Action	Crude Oil	Aquifer used for drinking water supply
T10000000060	Union Pacific Railroad - Round House/Pond Site	Cleanup Program Site	Open - Inactive	Waste Oil / Motor / Hydraulic / Lubricating	Other Groundwater (uses other than drinking water), Soil
T10000012125	UPRR Tie Fire	Non-Case Information	Pending Review		
T10000010082	Volny Investment Company	Cleanup Program Site	Open - Site Assessment		

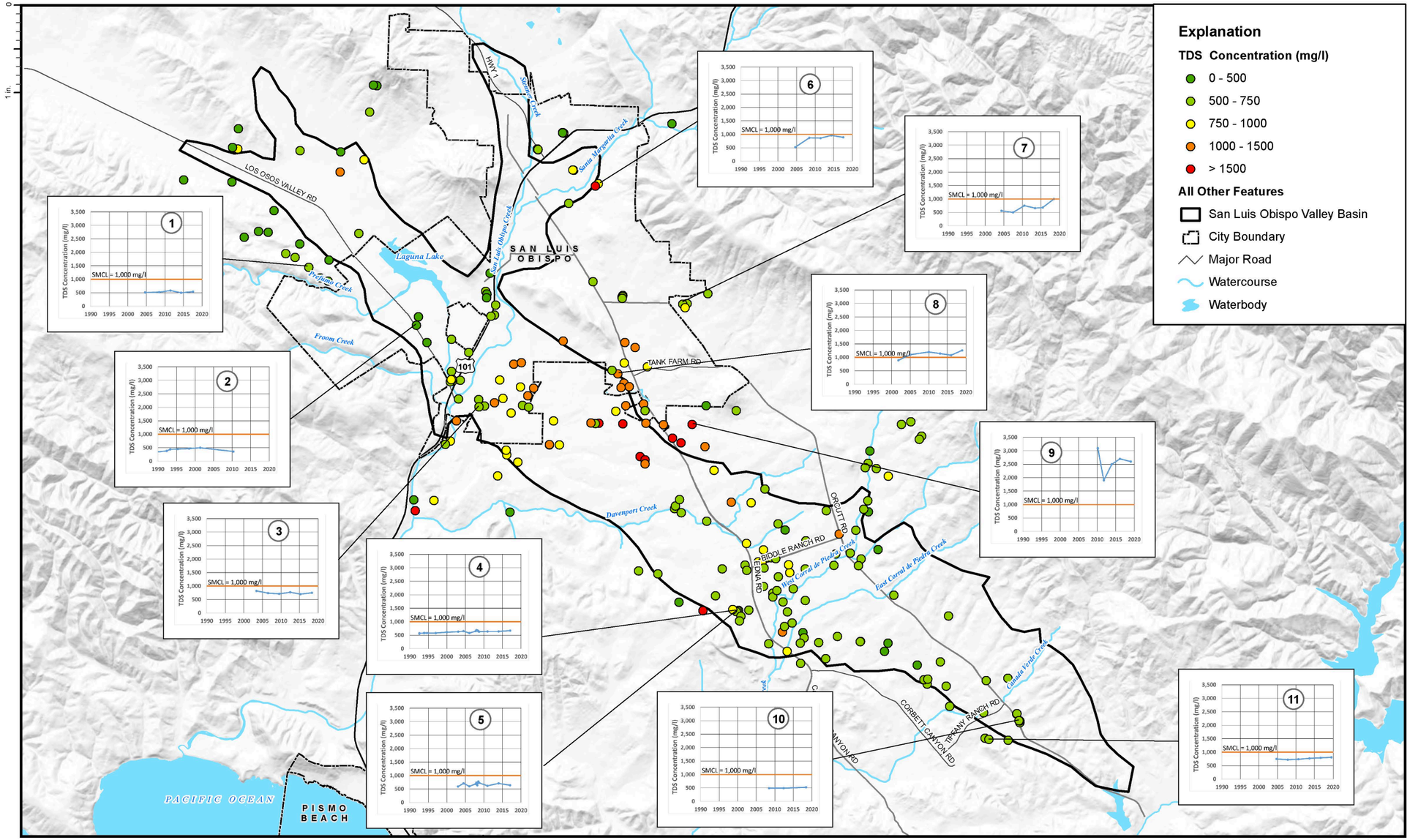
5.9.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents

The distribution and concentration of several constituents of concern are discussed in the following subsections. Groundwater quality data was evaluated from the SDWIS and GeoTracker GAMA datasets. The data reviewed includes 2,884 sampling events from 403 wells in the Basin, collected between June 1953 and June 2019. Each of the constituents are compared to their drinking water standard, if applicable, or their Basin Plan Median Groundwater Quality Objective (RWQCB Objective) (CCRWQCB, 2017). This GSP focuses only on constituents that might be impacted by groundwater management activities. The constituents discussed below are chosen because they have either a drinking water standard, a known effect on crops, or concentrations have been observed above either the drinking water standard or the level that affects crops.

5.9.3.1 Total Dissolved Solids

TDS is defined as the total amount of mobile charged ions, including minerals, salts or metals, dissolved in a given volume of water and is commonly expressed in terms of milligrams per liter (mg/L). Specific ions of salts such as chloride, sulfate, and sodium may be evaluated independently, but all are included in the TDS analysis, so TDS concentrations are correlated to concentrations of these specific ions. Therefore, TDS is selected as a general indicator of groundwater quality in the Basin. TDS is a constituent of concern in groundwater because it has been detected at concentrations greater than its RWQCB Basin Objective of 900 mg/l in the Basin. The TDS Secondary MCL has been established for color, odor and taste, rather than human health effects. This Secondary MCL includes a recommended standard of 500 mg/L, an upper limit of 1,000 mg/L and a short-term limit of 1,500 mg/l. TDS water quality results ranged from 180 to 3,100 mg/l with an average of 727 mg/l and a median of 613 mg/l.

The distribution and trends of TDS concentrations in the Basin groundwater are presented on Figure 5-16. TDS concentrations are color coded and represent the average result if multiple samples are documented. Most of the samples with the highest values (dark red in the figure) are outside or on the edge of the Basin. This is consistent with observations that groundwater from the Basin sediments generally has better water quality than groundwater from bedrock wells. Eleven wells with the greatest amount of data over time were selected. Graphs displaying TDS concentration with time are included on Figure 5-17. Most of these graphs do not display any upward trends in TDS concentrations with time. The sustainability projects and management actions implemented as part of this GSP are not anticipated to increase groundwater TDS concentrations in wells that are currently below the SMCL.



Distribution of TDS in Basin

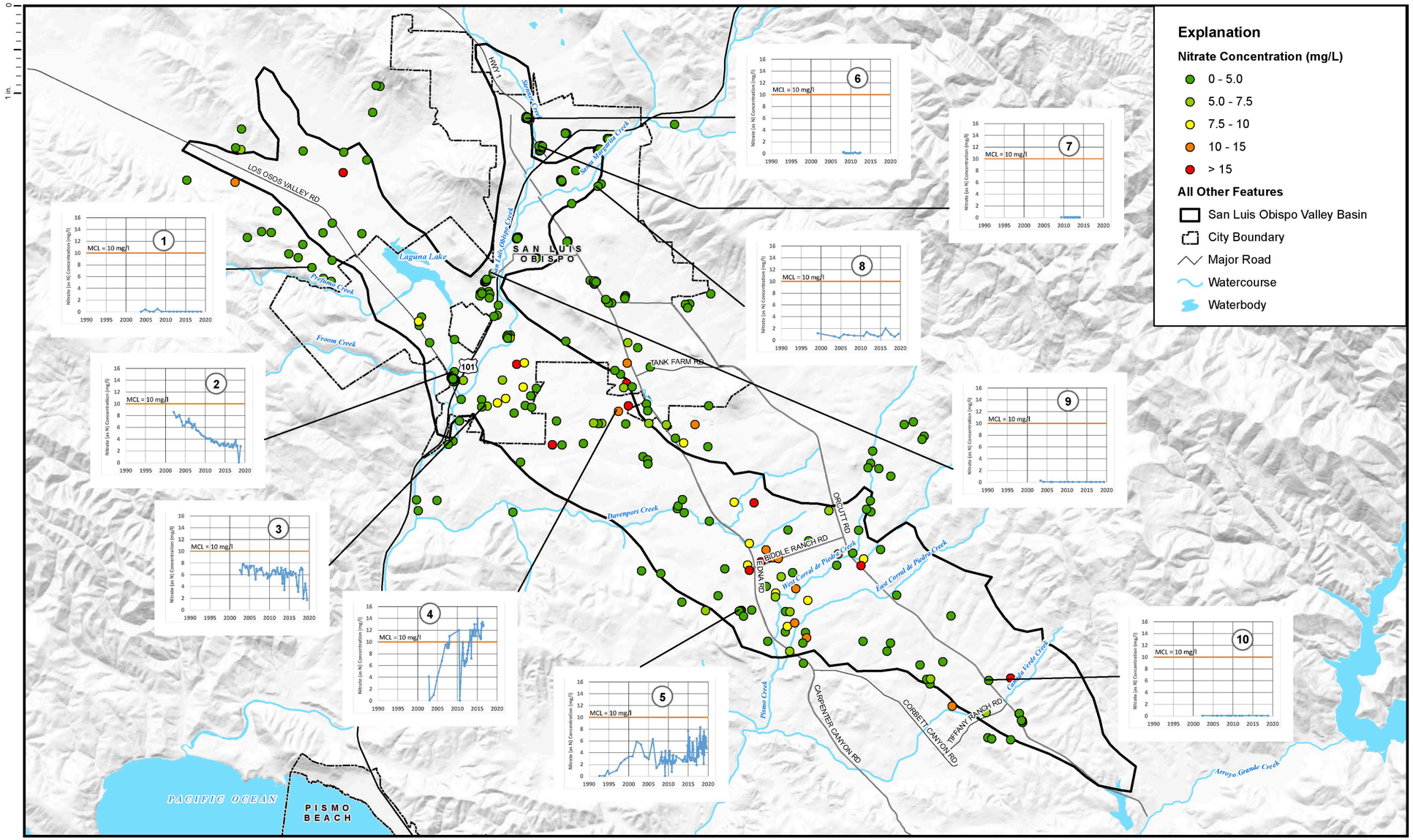
Figure 5-16

5.9.3.2 Nitrate

Nitrate (as Nitrogen) is a widespread contaminant in California groundwater. Although it does occur naturally at low concentrations, high levels of nitrate in groundwater are associated with agricultural activities, septic systems, confined animal facilities, landscape fertilizers and wastewater treatment facilities. Nitrate is the primary form of nitrogen detected in groundwater. It is soluble in water and can easily pass through soil to the groundwater table. Nitrate can persist in groundwater for decades and accumulate to high levels as more nitrogen is applied to the land surface each year. It is a Primary Drinking Water Standard constituent with an MCL of 10 mg/l.

Nitrate is a constituent of concern in groundwater because it has been detected at concentrations greater than its RWQCB Basin Objectives of 5 mg/l (as N) in the Basin. The Nitrate MCL has been established at 10 mg/l (as N). Overall, nitrate water quality results ranged from below the detection limit to 80 mg/l (as N) with an average of 3.9 mg/l (as N) and a median value of 2.0 mg/l (as N).

Figure 5-18 presents occurrences and trends for nitrate in the Basin groundwater. Wells with the most sampling data over time were selected for presentation. The color-coded symbols represent the average result if multiple samples are documented. Most of the chemographs displayed on Figure 5-18 indicate concentrations of nitrate well below the MCL, and do not indicate trends of increasing concentrations with time. Chemographs labelled number 4 and 5 on Figure 5-18 do appear to indicate a slight upward trend in nitrate (as nitrogen) concentrations over the data period of record. Sustainability projects and management actions implemented as part of this GSP are not anticipated to increase nitrate concentrations in groundwater in a well that would otherwise remain below the MCL to increase above the MCL.



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: AB
Date: 1/16/2020

N

0 0.25 0.5 1 Miles
0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.San Luis Obispo County
3. USGS

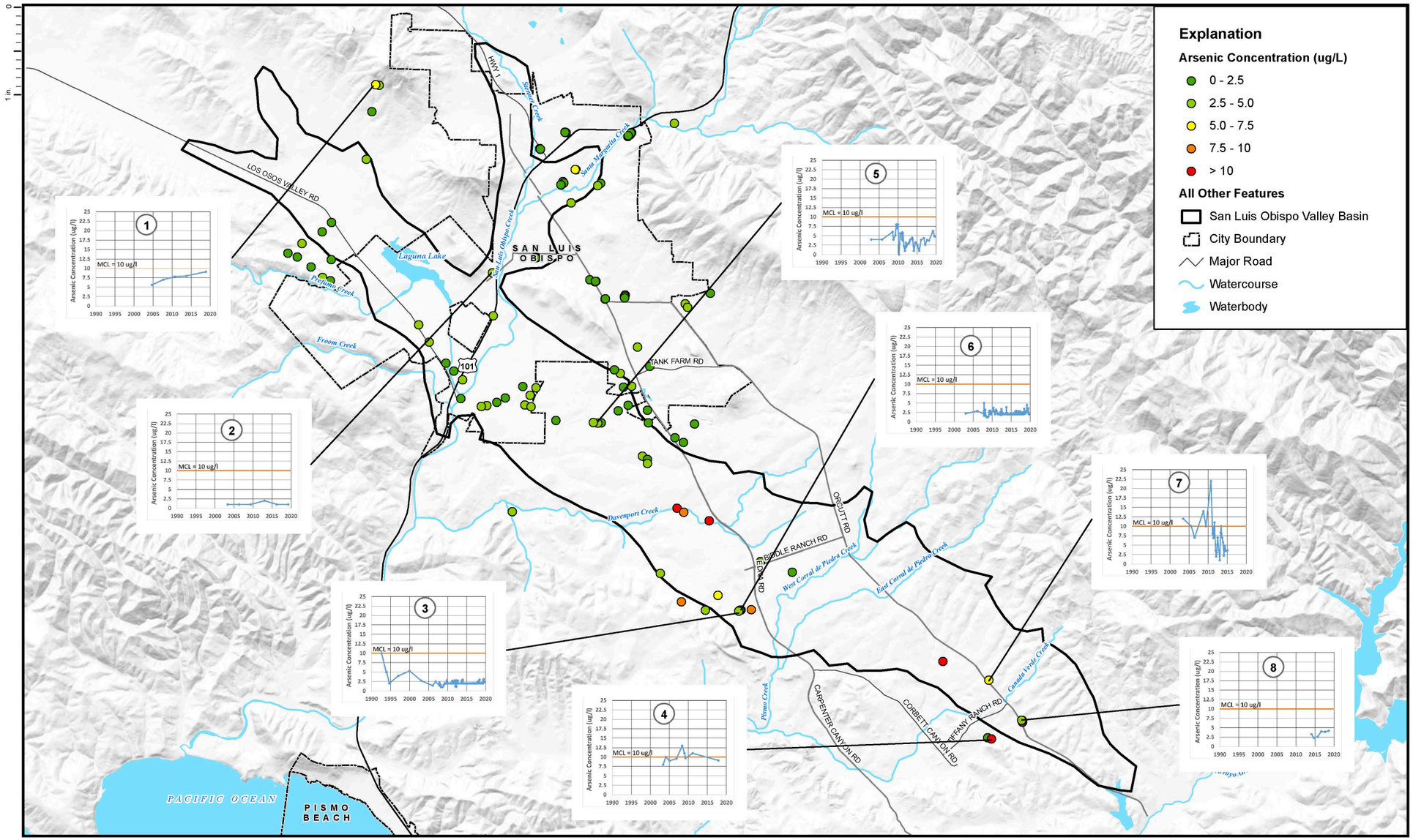
Distribution of Nitrate in Basin

Figure 5-17

5.9.3.3 Arsenic

Arsenic is also a common contaminant in California groundwater. Although it does occur naturally at low concentrations, elevated levels of arsenic in groundwater may be associated with pesticide use, mining activities, and release of industrial effluent. Arsenic has a Primary Drinking Water Standard with an MCL of 10 ug/l. Overall, arsenic concentrations ranged from below the detection limit to 28 ug/l, with an average value of 2.5 ug/l and a median value of 2 ug/l.

Figure 5-19 presents occurrences and trends for arsenic in the Basin groundwater from wells with the most arsenic analytical data over time. The color-coded symbols represent the average result if multiple samples are documented. Wells screened in the bedrock aquifers may be expected to have higher natural arsenic concentrations than wells screened in Basin sediments due to increased degrees of mineralization in these waters. Most of the chemographs displayed show stable or decreasing concentrations of arsenic over the data period of record. (Graph number 1 shows a slight increase over time, but is still below the MCL). Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause arsenic concentrations in groundwater in a well that would otherwise remain below the MCL to increase above the MCL.



Prepared for:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: AB
Date: 1/16/2020

N

0 0.25 0.5 1 Miles
0 0.425 0.85 1.7 Kilometers

References:

1. Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983
2.San Luis Obispo County
3. USGS

Distribution of Arsenic in Basin

Figure 5-18

5.9.3.4 Boron

Boron is an unregulated constituent and therefore does not have a regulatory standard. However, boron is a constituent of concern because elevated boron concentrations in water can damage crops and affect plant growth. Boron has been detected at concentrations greater than its RWQCB Basin Objective of 200 micrograms per liter (ug/l). Boron water quality results ranged from non-detect to 2,500 ug/l with an average of 0.16 ug/l and a median value of 0.12.

Boron concentrations in the Alluvial Aquifer have been relatively consistent throughout the period of record. Boron concentrations in the Paso Robles Formation Aquifer have generally remained steady or declined slightly over the period of record. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause boron concentrations in groundwater in a well to increase.

5.9.3.5 Other Constituents

Other constituents found in exceedance of their respective regulatory standard include arsenic, iron, gross alpha, manganese, selenium, and sulfate. Each of these exceedances occurred in samples from a small number of wells, indicating isolated occurrences of these elevated constituent concentrations rather than widespread occurrences, affecting the entire Basin. Isolated concentrations of arsenic, iron, gross alpha, and sulfate in the Basin have been relatively consistent throughout the period of record. Selenium concentrations have generally declined since 2007. There are not enough data to determine the trend of the elevated manganese concentrations in the Basin. Sustainability projects and management actions implemented as part of this GSP are not anticipated to directly cause concentrations of any of these constituents in groundwater to increase.

REFERENCES

Boyle Engineering. 1991. *City of San Luis Obispo Groundwater Basin Evaluation. January.* 1991.
Carollo. 2012. *San Luis Obispo County Master Water Report.* 2012.
City of San Luis Obispo. 2016. *2015 Urban Water Management Plan.* 2016.
—. 2018. *General Plan.* 2018.
—. 2015. *Water Resources Status Report.* 2015.
Cleath & Associates, Inc. 2001. *Well Construction and Testing Report for Lewis Lane #4, Edna Valley, San Luis Obispo County. Prepared for Southern California Water Company. July.* 2001.
—. 2003. *Well Construction and Testing Report for Water Supply and Irrigation Wells, City of San Luis Obispo, Hayashi Irrigation Wells and Highway 101 Water Supply Well. March.* 2003.
Cleath-Harris Geologists, Inc. 2010. *Edna Valley Water System Groundwater Study. Prepared for Golden State Water Company. May.* 2010.
—. 2013. *Summary of Drilling,. Testing, and Destruction of the Golden State Water Company Country Club Test Well, Edna Road System, 6110 Lewis Lane, San Luis Obispo, California. Prepared for Golden State Water Company. June.* 2013.
—. 2013. *Summary of Exploration and Testing, 5061 Hacienda Avenue, San Luis Obispo, California. Prepared for Golden State Water Company. February.* 2013.

—. 2014. *Summary of Exploration and Testing, Blodgett parcel, Whiskey Run Lane, Country Club Area, San Luis Obispo, California. Prepared for Golden State Water Company. July.* 2014.
County of San Luis Obispo. 2014. *San Luis Obispo County Integrated Regional Water Management Plan (IRWMP).* 2014.
Cuesta Engineering Corporation. 2007. *San Luis Obispo Creek Watershed Calibration Study.* 2007.
Dibble, T.W. 2004. *Geologic Map of the Lopez Mountain Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2004. #DF-130.
Dibblee, T.W. 2006. *Geologic Map of the Arroyo Grande NE Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2006. #DF-211.
—. 2006. *Geologic Map of the Pismo Beach Quadrangle, San Luis Obispo County, California.* s.l. : Dibblee Geology Center Map, 2006. #DF-212.
—. 2004. *Geologic Map of the San Luis Obispo Quadrangle, San Luis Obispo County, California. .* s.l. : Dibble Geology Center Map, 2004. #DF-129.
DWR. 2003. *California's Groundwater: Bulletin 118 – Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2016. *California's Groundwater: Bulletin 118 - Interim Update 2016, Working Towards Sustainability.* 2016.
—. 2003. *California's Groundwater: Bulletin 118 - Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2014. DWR Atlas - Aglricultural Lang Use and Irrigated Areas. [Online] 2014. gis.water.ca.gov.
—. 1964. *San Luis Obispo and Santa Barbara Counties Land and Water Use Survey, 1959. .* s.l. : California Department of Water Resources (DWR), 1964.
—. 1958. *San Luis Obispo County Investigation. State Water Resources Board Bulletin No. 18. .* s.l. : California Department of Water Resources (DWR). May., 1958.
—. 1997. *San Luis-Edna Valley Groundwater Basin Study, Draft Report. .* s.l. : California Department of Water Resources (DWR)., 1997.
—. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization - Process and Results Document.* 2019.
ESA Consultants, Inc. 1994. *Hydrologic Investigation, Edna Valley Well Location Study. September.* 1994.
GSI Water Solutions. 2018. *San Luis Obispo Valley Basin Characterization and Monitoring Well Installation.* 2018.
Hall, C.A. 1979. *Geologic map of the San Luis Obispo – San Simeon Region, California.* s.l. : U.S. Geological Survey, 1979. Map I-1097.
—. 1973. *Geology of the Arroyo Grande Quadrangle, California. .* s.l. : California Division of Mines and Geology, 1973. Map Sheet 24.
SLO-FCWCD. 2014. *CASGEM Monitoring Plan for High and Medium Priority Groundwater Basins in the San Luis Obispo County Flood Control & Water Conservation District. September.* s.l. : San Luis Obispo Flood Control & Water Conservation District, 2014.
Stillwater Sciences. 2015. *Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California. September.* 2015.
TEAM Engineering & Management. 2000. *Groundwater Yield Analysis. July.* 2000.
USBR. 1955. *Reconnaissance Report San Luis Obispo County Basin, California. .* s.l. : U.S. Bureau of Reclamation, Region 2, Sacramento., 1955.
USDA-NRCS. 2007. *Soil Survey Geographic Database (SSURGO).* s.l. : U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), 2007.
WSC. 2018. *Salinas and Whale Rock Reserviors Safe Annual Yield TM.* 2018.

Draft

Groundwater Sustainability Plan
Chapter 6 – Water Budget

for the

San Luis Obispo Valley Groundwater Basin
Groundwater Sustainability Agencies

Prepared by

WSC
Water Systems Consulting, Inc.
GEI Consultants
CHG
Stillwater Sciences
GSI Water Solutions, Inc.

6/25/2020

TABLE OF CONTENTS

Table of Contents

List of Figures i
Tables iv
Appendices v
List of Terms Used vi
Executive Summary 1
Introduction to the SLO Basin GSP .....
1.1 Purpose of the Groundwater Sustainability Plan .....
1.2 Description of SLO Basin .....
1.3 Basin Prioritization .....
2 Agency Information (§ 354.6) .....
2.1 Agencies Names and Mailing Addresses .....
2.2 Agencies Organization and Management Structures .....
2.2.1 County of San Luis Obispo .....
2.2.2 City of San Luis Obispo .....
2.2.3 Other Participating Parties in the MOA .....
2.2.3.1 Edna Valley Growers Mutual Water Company .....
2.2.3.2 Varian Ranch Mutual Water Company .....
2.2.3.3 Edna Ranch Mutual Water Company .....
2.2.3.4 Golden State Water Company .....
2.3 Authority of Agencies .....
2.3.1 Groundwater Sustainability Agencies .....
2.3.1.1 County of San Luis Obispo .....
2.3.1.2 City of San Luis Obispo .....
2.3.2 Memorandum of Agreement .....
2.3.3 Coordination Agreements .....
2.4 Contact information for Plan Manager .....
3 Description of Plan Area (§ 354.8) .....
3.1 SLO Basin Introduction .....
3.2 Adjudicated Areas .....
3.3 Jurisdictional Areas .....
3.3.1 Federal Jurisdictions .....
3.3.2 Tribal Jurisdiction .....

3.3.3 State Jurisdictions
3.3.4 County Jurisdictions
3.3.5 City and Local Jurisdictions
3.3.6 Special Districts
3.4 Land Use
3.4.1 Water Source Types
3.4.2 Water Use Sectors
3.5 Density of Wells
3.6 Existing Monitoring and Management Programs
3.6.1 Groundwater Monitoring
3.6.1.1 Groundwater Level Monitoring
3.6.1.2 Groundwater Quality Monitoring
3.6.1.3 Surface Water Monitoring
3.6.1.4 Climate Monitoring
3.6.2 Existing Management Plans
3.6.2.1 SLO Basin Characterization and Monitoring Well Installation
3.6.2.2 San Luis Obispo County Master Water Report (2012)
3.6.2.3 San Luis Obispo County Integrated Regional Water Management Plan (2014)
3.6.2.4 City of San Luis Obispo 2015 Urban Water Management Plan (2016)
3.6.3 Existing Groundwater Regulatory Programs
3.6.3.1 Groundwater Export Ordinance (2015)
3.6.3.2 Well Ordinances, County and City
3.6.3.3 Countywide Water Conservation Program Resolution 2015-288 (2015)
3.6.3.4 Agricultural Order R3-2017-002 (2017)
3.6.3.5 Water Quality Control Plan for the Central Coast Basins (2017)
3.6.3.6 California DWR Well Standards (1991)
3.6.3.7 Requirements for New Wells (2017)
3.6.3.8 Title 22 Drinking Water Program (2018)
3.6.3.9 Waterway Management Plan – San Luis Obispo Creek Watershed (2003)
3.6.3.10 Incorporation Into GSP
3.6.3.11 Limits to Operational Flexibility
3.7 Conjunctive Use Programs
3.8 Land Use Plans
3.8.1 City of San Luis Obispo General Plan
3.8.2 County of San Luis Obispo General Plan

3.8.3 Los Ranchos/Edna Village Plan
3.8.4 Plan Implementation Effects on Existing Land Use
3.8.5 Plan Implementation Effects on Water Supply
3.8.6 Well Permitting
3.8.7 Land Use Plans Outside of Basin
3.9 Management Areas
3.9.1 Reason for Creation
3.10 Additional GSP Elements, if Applicable
4 Basin Setting (§ 354.14)
4.1 Basin Topography and Boundaries
4.2 Primary Users of Groundwater
4.3 Soils Infiltration Potential
4.4 Regional Geology
4.4.1 Regional Geologic Structures
4.4.2 Geologic Formations within the Basin
4.4.2.1 Alluvium
4.4.2.2 Paso Robles Formation
4.4.2.3 Pismo Formation
4.4.3 Geologic Formations Surrounding the Basin
4.4.3.1 Monterey Formation
4.4.3.2 Obispo Formation
4.4.3.3 Franciscan Assemblage
4.5 Principal Aquifers and Aquitards
4.5.1 Cross Sections
4.5.2 Aquifer Characteristics
4.5.3 Aquitards
4.6 Surface Water Bodies
4.7 Subsidence Potential
5 Groundwater Conditions (§ 354.16)
5.1 Groundwater Elevations and Intepretation
5.1.1 Fall 1954 Groundwater Elevations
5.1.2 Spring 1990 Groundwater Elevations
5.1.3 Modeled 1990s Groundwater Elevations
5.1.4 Spring 1997 Groundwater Elevations
5.1.5 Spring 2011 Groundwater Elevations

5.1.6 Spring 2015 Groundwater Elevations
5.1.7 Spring 2019 Groundwater Elevations
5.1.8 Fall 2019 Groundwater Elevations
5.1.9 Changes in Groundwater Elevation
5.1.10 Vertical Groundwater Gradients
5.2 Groundwater Elevation Hydrographs
5.3 Groundwater Recharge and Discharge Areas
5.3.1 Groundwater Recharge Areas
5.3.1.1 Infiltration of Precipitation
5.3.1.2 Subsurface Inflow
5.3.1.3 Percolation of Streamflow
5.3.1.4 Anthropogenic Recharge
5.3.2 Groundwater Discharge Areas
5.4 Change in Groundwater Storage
5.5 Seawater Intrusion
5.6 Subsidence
5.7 Interconnected Surface Water
5.7.1 Depletion of Interconnected Surface Water
5.8 Potential groundwater dependent ecosystems
5.8.1 Hydrology
5.8.1.1 Overview of GDE Relevant Surface and Groundwater Hydrology
5.8.1.2 Losing and Gaining Reaches
5.8.2 Vegetation and Wetland Groundwater Dependent Ecosystem Identification
5.8.3 Identification of Special-Status Species and Sensitive Natural Communities Associates with GDE's
5.9 Groundwater Quality Distribution and Trends
5.9.1 Groundwater Quality Suitability for Drinking Water
5.9.2 Distribution and Concentrations of Point Sources of Groundwater Constituents
5.9.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents
5.9.3.1 Total Dissolved Solids
5.9.3.2 Nitrate
5.9.3.3 Arsenic
5.9.3.4 Boron
5.9.3.5 Other Constituents

6 Water Budget (§ 354.18) 2
6.1 Climate 17
6.1.1 Historical Climate/Base Period 17
6.2 Water Budget Data Sources 22
6.3 Historical Water Budget 22
6.3.1 Historical Time Period 22
6.3.2 Historical Land Use 23
6.3.3 Historical Surface Water Budget 26
6.3.4 Historical Groundwater Budget 33
6.3.5 Total Groundwater in Storage 44
6.3.6 Change in Storage 49
6.3.7 Sustainable Yield 52
6.3.8 Quantification of Overdraft (Historical) 53
6.4 Current Water Budget 53
6.5 Projected Water Budget 64
6.5.1 Assumptions 64
6.5.2 Inflows 64
6.5.3 Outflows 64
6.5.4 Change In Storage 64

6.5 Projected Water Budget .....
6.5.1 Assumptions .....
6.5.2 Inflows .....
6.5.3 Outflows .....
6.5.4 Change In Storage .....
7 Sustainable Management Criteria (§ 354.22-30) .....
7.1 Sustainability Goal .....
7.2 Process for Establishing Sustainable Management Criteria .....
7.2.1 Minimum Thresholds .....
7.2.2 Measurable Objectives .....
7.2.3 Undesirable Results .....
7.3 Chronic Lowering of Groundwater Levels Sustainability Indicator .....
7.3.1 Locally Defined Undesirable Results .....
7.3.2 Minimum Thresholds and Measurable Objectives .....
7.3.3 Relation to Other Sustainability Indicators .....

7.4 Change in Storage Sustainability Indicator
7.4.1 Locally Defined Undesirable Results
7.4.2 Minimum Thresholds
7.4.3 Measurable Objectives
7.4.4 Relation to Other Sustainability Indicators
7.5 Seawater Intrusion Sustainability Indicator
7.5.1 Locally Defined Undesirable Results
7.5.2 Minimum Thresholds
7.5.3 Measurable Objectives
7.5.4 Relation to Other Sustainability Indicators
7.6 Degraded Water Quality Sustainability Indicator
7.6.1 Locally Defined Undesirable Results
7.6.2 Minimum Thresholds
7.6.3 Measurable Objectives
7.6.4 Relation to Other Sustainability Indicators
7.7 Subsidence Sustainability Indicator
7.7.1 Locally Defined Undesirable Results
7.7.2 Minimum Thresholds
7.7.3 Measurable Objectives
7.7.4 Relation to Other Sustainability Indicators
7.8 Depletion of Interconnected Surface Water Sustainability Indicator
7.8.1 Locally Defined Undesirable Results
7.8.2 Minimum Thresholds
7.8.3 Measurable Objectives
7.8.4 Relation to Other Sustainability Indicators
7.9 Management Areas
7.9.1 Minimum Thresholds and Measurable Objectives
7.9.2 Monitoring and Analysis
7.9.3 Explanation of How Operation of Management Area Will Avoid Undesirable Results
8 Monitoring Networks (§ 354.34)
8.1 Monitoring Objectives
8.2 Monitoring Network
8.2.1 Chronic Lowering of Groundwater Levels
8.2.2 Reduction of Groundwater Storage
8.2.3 Seawater Intrusion

8.2.4 Groundwater Quality
8.2.5 Land Subsidence
8.2.6 Depletion of Interconnected Surface Water
8.3 Groundwater Monitoring Protocol
8.4 Data Management System
8.5 Assessment and Improvement of Monitoring Network
8.6 Annual Reports
8.7 Periodic Evaluation by Agency
9 Projects and Management Actions (§ 354.44)
9.1 Projects
9.1.1 Project A
9.2 Management Actions
9.2.1 Management Action A
9.3 Projects Needed to Mitigate Overdraft
10 Implementation Plan
10.1 Cost of Implementation
10.2 Funding Alternatives
10.3 Implementation Schedule
10.4 GSP Annual Reporting
10.5 Periodic Evaluations of GSP
11 Notice and Communications (§ 354.10)
11.1 Communications and Engagement Plan
11.2 Nature of Consultations
11.3 Public Meetings
11.4 Incorporation of Feedback in Decision-Making Process
11.5 Comments Received
11.6 Responses to Comments
12 Interagency Agreements (§ 357.2-4)
12.1 Coordination Agreements
13 References
14 Appendices

The grey highlighted sections in the Table of Contents (TOC) indicate that the section has been previously released (Chapters 1 through 5) or will be released in the future (Chapters 7 through 14). The complete list of the anticipated TOC is presented to give the reader context as to how Chapter 6 – Water Budget, connects with the complete Groundwater Sustainability Plan.

LIST OF FIGURES

Figure 6-1: The Hydrologic Cycle. Source: Department of Water Resources (Water Budget BMP, 2016) ... 3
Figure 6-2: Components of the Water Budget. Source: Modified from Department of Water Resources (Water Budget BMP, 2016) ... 4
Figure 6-3: Water Budget Subareas. ... 5
Figure 6-4: Surface Water Budget – San Luis Valley Subarea. ... 11
Figure 6-5: Surface Water Budget – Edna Valley Subarea. ... 12
Figure 6-6: Surface Water Budget – Basin Total. ... 13
Figure 6-7: Groundwater Budget – San Luis Valley Subarea. ... 14
Figure 6-8: Groundwater Budget – Edna Valley Subarea. ... 15
Figure 6-9: Groundwater Budget – Basin Total. ... 16
Figure 6-10: 1987-2019 Historical Base Period Climate. ... 18
Figure 6-11: Rainfall Correlation Cal Poly vs. Gas Company. ... 20
Figure 6-12: San Luis Obispo Valley Basin Irrigated Crops 2016. ... 24
Figure 6-13: Basin Sub-watershed Areas and Isohyetals. ... 28
Figure 6-14: Runoff vs Rainfall Correlation for Subareas. ... 29
Figure 6-15: Rainfall vs Infiltration. ... 35
Figure 6-16: Bedrock Subsurface Inflow Reaches. ... 38
Figure 6-17: Consumptive Use of Applied Water. ... 42
Figure 6-18: Groundwater Elevation Contours Spring 1986. ... 46
Figure 6-19: Groundwater Elevation Contours Spring 2019. ... 47
Figure 6-20: Storage Volume Grids. ... 48
Figure 6-21: Groundwater Storage Estimate Comparison for Basin Subareas. ... 51
Figure 6-22: Historical and Current Average Annual Surface Water Budget – San Luis Valley Subarea. ... 58
Figure 6-23: Historical and Current Average Annual Surface Water Budget – Edna Valley Subarea. ... 59
Figure 6-24: Historical and Current Average Annual Surface Water Budget – Basin Total. ... 60
Figure 6-25: Historical and Current Average Annual Groundwater Budget – San Luis Valley Subarea ... 61
Figure 6-26: Historical and Current Average Annual Groundwater Budget – Edna Valley Subarea. ... 62
Figure 6-27: Historical and Current Average Annual Groundwater Budget – Basin Total ... 63

TABLES

Table 6-1: Historical Water Budget - San Luis Valley Subarea. 8
Table 6-2: Historical Water Budget - Edna Valley Subarea. 9
Table 6-3: Historical Water Budget - San Luis Obispo Valley Groundwater Basin 10
Table 6-4: Historical Base Period Rainfall. 21
Table 6-5: Irrigated Agriculture Acreages. 25
Table 6-6: Land Cover Acreages. 26
Table 6-7: Stream Outflow Comparison. 33
Table 6-8: Minimum Rainfall for Infiltration. 36
Table 6-9: Subsurface Inflow Estimates. 37
Table 6-10: Rural Residential Water Use. 41
Table 6-11: Consumptive Use of Applied Water 43
Table 6-12: Subsurface Outflow Estimates. 44
Table 6-13: Specific Yield Averages. 45
Table 6-14: Spring Groundwater Storage Estimates. 49
Table 6-15: Change in Storage Comparison – Historical Base Period 1987 – 2019. 50
Table 6-16: Preliminary Sustainable Yield (AFY). 52
Table 6-17: Estimated Overdraft (AFY). 53
Table 6-18: Current Water Budget - San Luis Valley Subarea. 55
Table 6-19: Current Water Budget - Edna Valley Subarea. 56
Table 6-20: Current Water Budget - Basin Total. 57

APPENDICES

LIST OF TERMS USED

Abbreviation	Definition
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
AMSL	Above Mean Sea Level
Basin Plan	Water Quality Control Plan for the Central Coast Basin
Cal Poly	California Polytechnic State University
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of San Luis Obispo
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CPWS-52	Cal Poly Weather Station 52
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ERMWC	Edna Ranch Mutual Water Company
ET_0	Evapotranspiration
EVGMWC	Edna Valley Growers Ranch Mutual Water Company
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet
MCL	Maximum Contaminant Level

Abbreviation	Definition
MG	Million Gallons
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCDC	National Climate Data Center
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLO Basin	San Luis Obispo Valley Groundwater Basin
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SCML	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
VRMWC	Varian Ranch Mutual Water Company
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is complete.

6 WATER BUDGET (§ 354.18)

The purpose of a water budget is to provide an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the Basin, including historical, current, and projected water budget conditions, and the change in volume stored. Both numerical and analytical methods have been used during water budget preparations for the GSP. The analytical method as used in this document refers to application of the water budget equation and the inventory method using spreadsheets, with groundwater flow estimates based on Darcy's Law and change in storage calculations based on the specific yield method.

Numerical methods refer to surface water and groundwater flow modeling, which provide a dynamic and more rigorous analysis of both surface-groundwater interactions and the impacts from pumping on groundwater in storage. The historical and current analytical groundwater budget will be used as part of the Basin conceptual model to prepare input estimates and provide a check for the numerical model, from which the projected water budget will be produced. This chapter presents the analytical water budget for the historical and current periods and the numerical model water budget for the projected future period. Once the numerical model water budget is calibrated, the results will be presented as comparisons to the analytical water budget.

A water budget identifies and quantifies various components of the hydrologic cycle within a user-defined area, in this case the San Luis Obispo Valley groundwater Basin. Water circulates between the atmospheric system, land surface system, surface water bodies, and the groundwater system, as shown in Figure 6-1(DWR, 2016). The water budget equation used for the analytical method is as follows:

INFLOW – OUTFLOW = CHANGE IN STORAGE

Inflow is the sum of all surface water and groundwater entering the Basin and outflow is the sum of all surface water and groundwater leaving the Basin. The difference between total inflow and total outflow over a selected time period is equal to the change in total storage (surface water and groundwater) within the Basin over the same period. Components of inflow and outflow represented in the water budget are shown in Figure 6-2. Not all of the components shown are needed for the San Luis Obispo Valley Groundwater Basin GSP. A key using letters to represent components in this water budget has been added to Figure 6-2 for reference with the main water budget tables. Some components have been modified and renamed from the original DWR figure to better represent this specific water budget.

The water budget equation given above is simple in concept, but it is challenging to measure and account for all the components of inflow and outflow within a Basin. Some of these components can be measured or estimated independently, while others are calculated using the water budget equation. The water budget for this GSP has been prepared for the two subareas that cover the Basin, the San Luis Valley subarea and the Edna Valley subarea (Figure 6-3). Subareas are not to be confused with subbasins, and are defined for this water budget analysis. They are then combined into a single water budget for the entire Basin. Both subarea water budgets and the Basin water budget are included herein. Surface water (combined atmospheric, land surface, and stream systems) and groundwater budgets have been prepared for each subarea and for the Basin. The subarea approach for water budget calculations follows the approach used by prior investigators (Boyle, 1991; DWR, 1997).

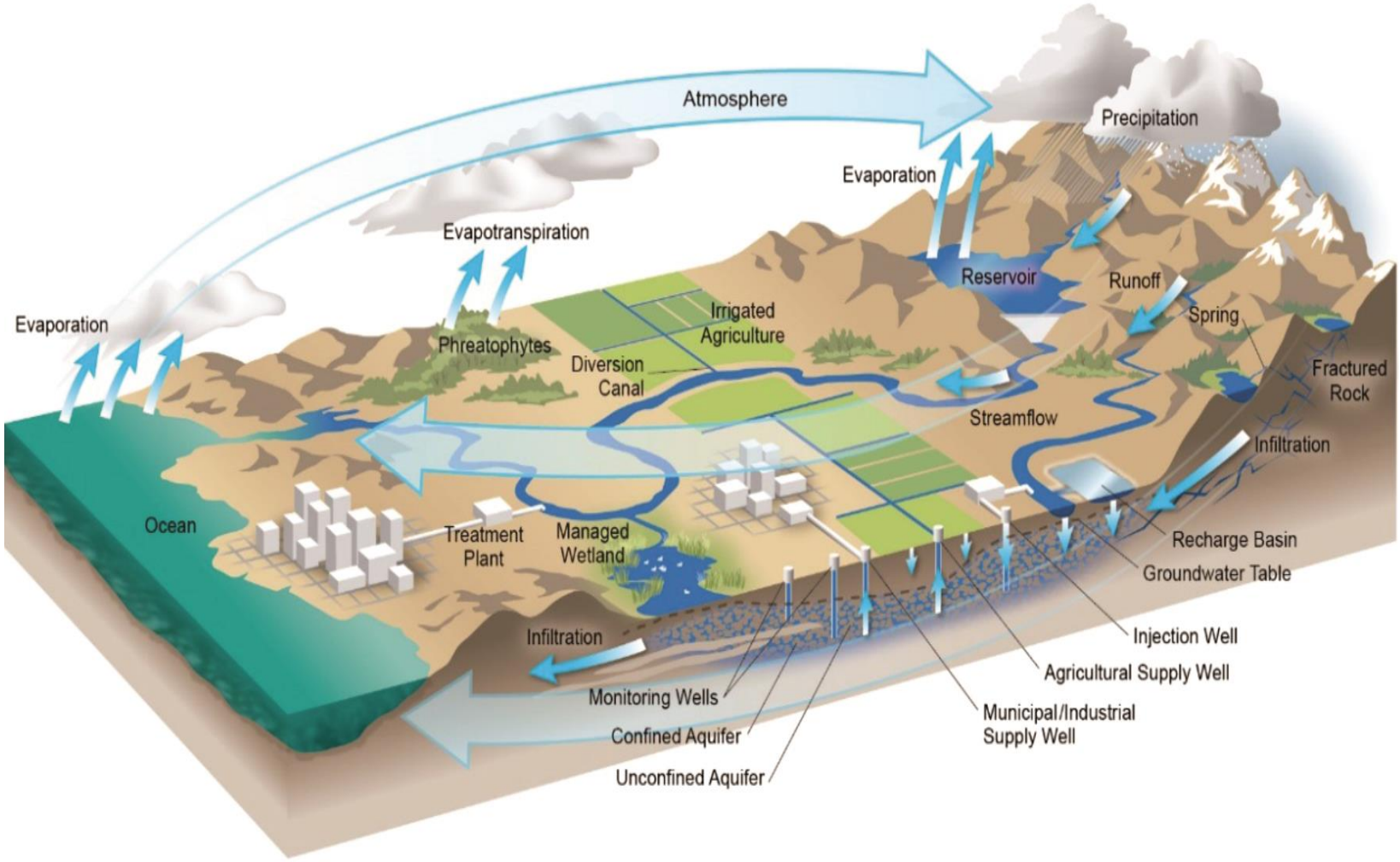


Figure 6-1: The Hydrologic Cycle. Source: Department of Water Resources (Water Budget BMP, 2016)

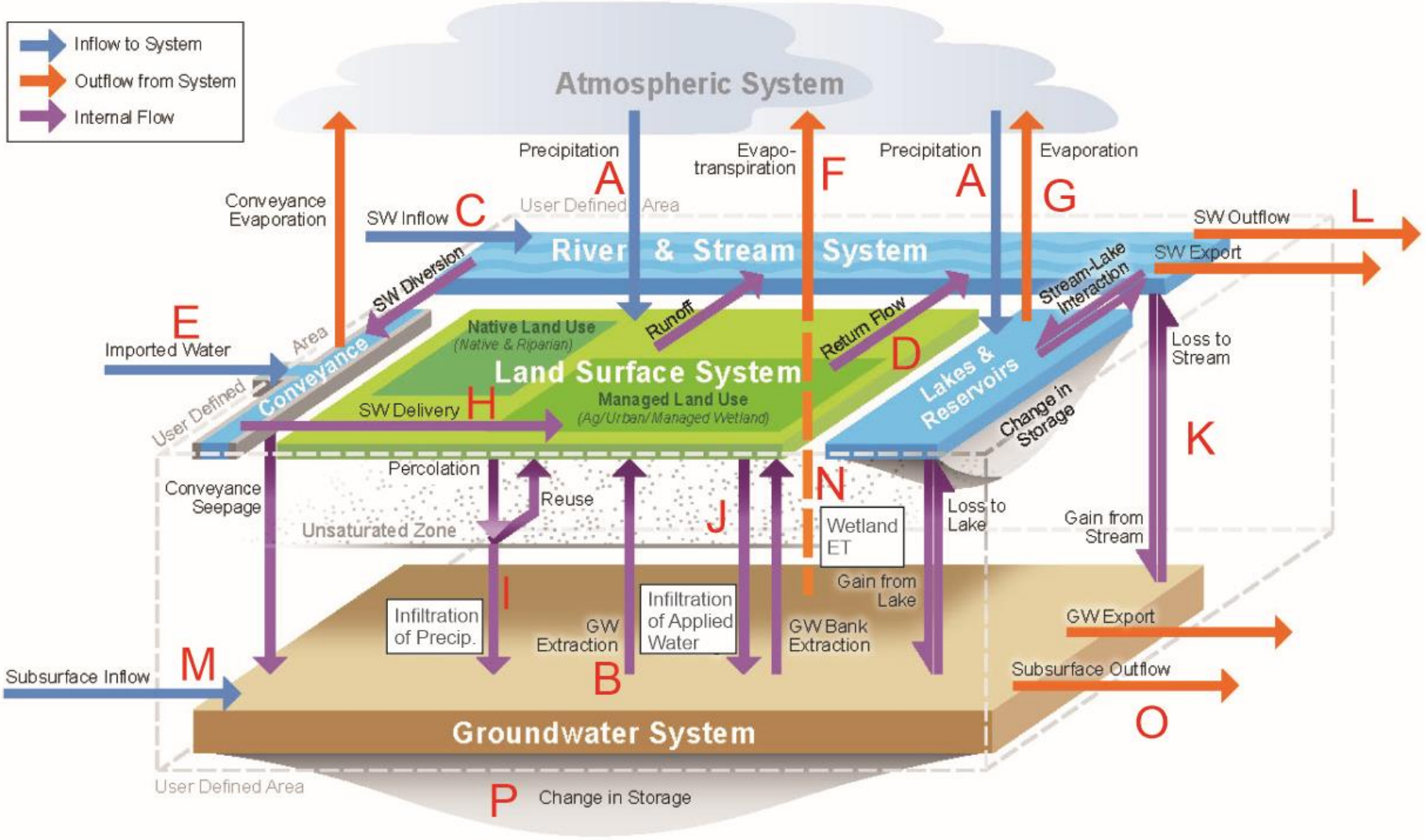
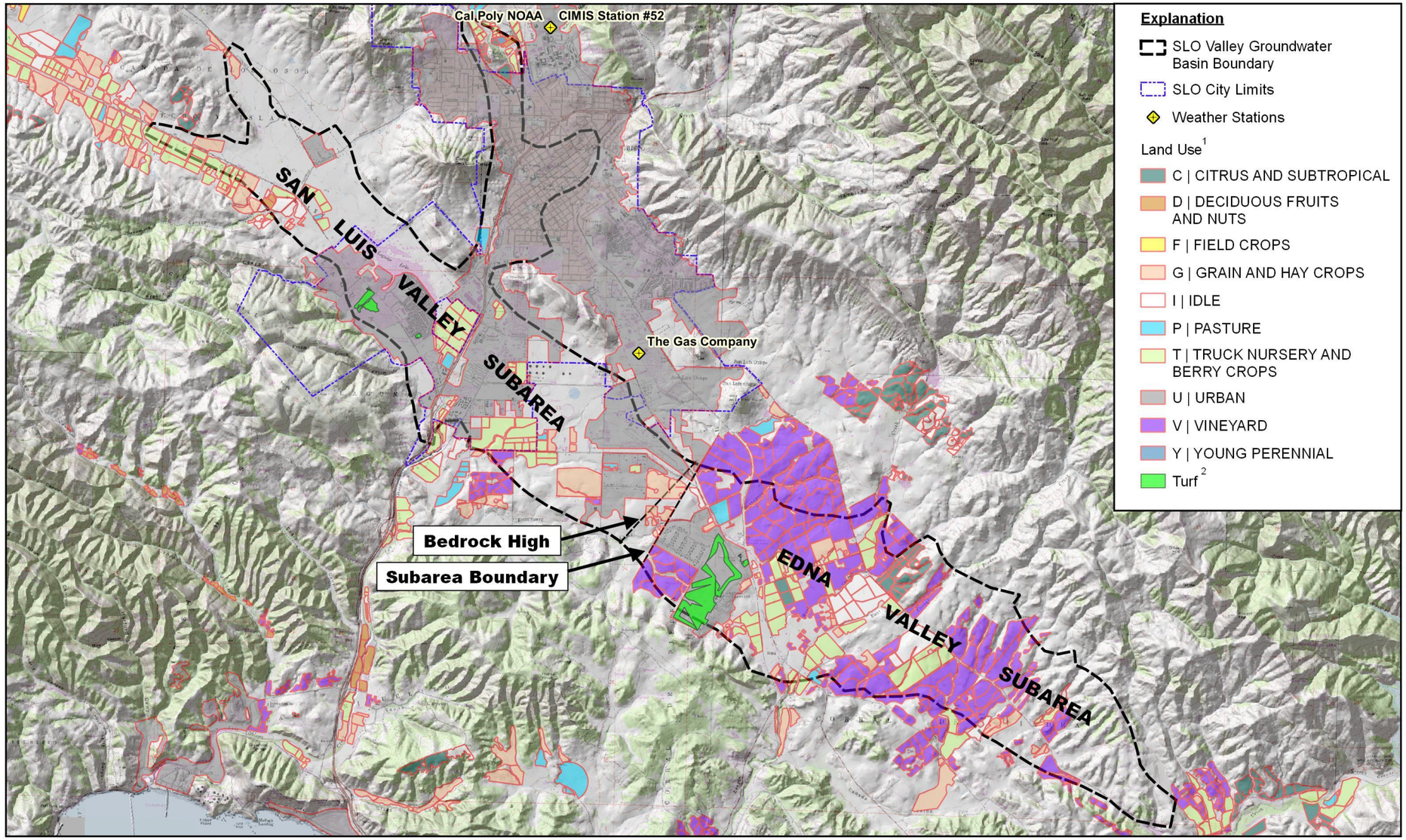


Figure 6-2: Components of the Water Budget. Source: Modified from Department of Water Resources (Water Budget BMP, 2016)



Prepared For:

Author: TK
Date: 06/25/2020

SAN LUIS OBISPO VALLEY BASIN GSP

N

0 0.25 0.5 0.75 1 mi
0 0.5 1 km

References:

1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hirozontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:

1. Land use designations from DWR (2016); data obtained from gis.water.ca.gov
2. Turf area not included in DWR (2016) dataset
3. Not all crops shown on figure are applicable to SLO Valley Groundwater Basin

Water Budget Subareas

Figure 6-3

As presented in Chapter 4, there is a topographic high point in bedrock elevations underlying the Basin that creates a bedrock high between the San Luis Valley and Edna Valley subareas (Figure 4-4). This bedrock high partially isolates the deeper portions of the Basin aquifers (Figure 4-5) and restricts underflow between the two subareas. Figure 6-3 shows the San Luis Valley and Edna Valley subareas used for the water budget, with the subarea boundary located along Hidden Springs Road. Note that the boundary between the subareas is shifted slightly to the west of the bedrock high (Figure 6-3) in order to better correlate with overlying land use. Land use for 2016 (DWR, 2016) is shown on the map to help illustrate differences across the subarea boundary. Immediately west of the subarea boundary is rural residential land and the County airport. To the east of the subarea boundary are residential subdivisions, a golf course, and irrigated agricultural lands. The two subareas of the Basin are hydrologically distinct, as evidenced by the differences in watershed area (Figure 3-10), sediment thickness (Figure 4-4), and water level hydrographs (Figure 5-11). The groundwater budgets are also very different between the subareas, and separating the two is necessary to properly characterize the Basin. The two subarea water budgets have also been combined to create a total Basin water budget.

The San Luis Valley subarea is 6,773 acres (10.6 square miles), and the Edna Valley subarea is 5,948 acres (9.3 square miles), with a total Basin area of 12,271 acres (19.2 square miles). The San Luis Valley subarea receives surface inflow from a watershed of 28,823 acres (45 square miles) and the Edna Valley subarea receives surface inflow from a watershed of 10,145 acres (15.9 square miles). The watershed divide between San Luis Obispo Creek and Pismo Creek is not coincident with the bedrock high or subarea boundary, and watershed area draining to Davenport Creek in the Edna Valley subarea is part of the San Luis Obispo Creek watershed (Figure 3-10; Chapter 3).

Table 6-1, Table 6-2, and Table 6-3 present the historical surface water and groundwater budgets for the San Luis Valley subarea, the Edna Valley subarea, and the Basin total, respectively. Bar graphs are included in Figure 6-4 through Figure 6-9. The three main water budget tables contain a detailed accounting of the water budget for the Basin and will be referred to throughout this chapter. A letter key has been added to provide a visual reference with Figure 6-3.

Note that Figure 6-3 breaks the water budget into four components (atmospheric system, land surface system, river & stream system, and groundwater system). The atmospheric system transfers evaporation to precipitation and overlies the other systems. The land surface system is the portion of the water budget that includes land surface and the unsaturated zone extending to the top of the groundwater system. The rivers & streams system is the portion of the water budget that includes rivers, streams, conveyance facilities and diversion ditches, and lakes and reservoirs. The atmospheric, land surface, and river & streams water budgets for this Basins have been combined into a single surface water budget. As a result, not all the components in Figure 6-3 have corresponding budget items listed for the Basin. For example, the runoff and return flow components of the land surface system into the river & stream system in Figure 6-3 are part of the surface water outflow component (Labeled “L”).

The six bar graphs are graphical representations of the water budget that allow quick comparisons of the various budget quantities, but are not individually referenced. Figure 6-4, Figure 6-5, and Figure 6-6 illustrate the surface water budget portions of Table 6-1, Table 6-2, and Table 6-3, while Figure 6-7, Figure 6-8, and Figure 6-9 illustrate the groundwater budget portions of the tables. Water budget climate, historical time period, methodology, sustainable yield, and overdraft interpretation are also presented in this chapter.

Some general observations on the water budget are worth noting. First, the surface water budget for the two subareas shows similar patterns of increasing and decreasing total flow from year to year, which is expected given similar precipitation with somewhat proportional stream flow. The San Luis Valley subarea

surface water budget is close to double the Edna Valley surface water budget, however. This is due to a larger watershed area for the San Luis Valley subarea and to the significant volume of surface water imported by the City of San Luis Obispo. Secondly, the groundwater budget for the Edna Valley subarea shows high groundwater recharge events during all wet years, which is expected, while the San Luis Obispo shows a more attenuated response, with some wet years (1993, 2017) providing greater recharge than others. This is because during some wet years, the aquifers in the San Luis Valley subarea fill up to the point where there is no more available storage volume, and therefore no additional recharge occurs (also inferred by the relatively flat water level hydrographs in Figure 5-11). In 1993 and 2017, there was sufficient storage room following drought to allow greater recharge than during other wet years when the subarea was effectively full.

Table 6-1: Historical Water Budget - San Luis Valley Subarea.

Water Year	SURFACE WATER INFLOW (AF)							SURFACE WATER OUTFLOW (AF)											GROUNDWATER INFLOW (AF)						GROUNDWATER OUTFLOW (AF)					Change in GW Storage (AF)
	Precipitation	GW extractions (Urban)	GW extractions (Ag)	Stream Inflow	Wastewater discharge	Local Imported Supplies	TOTAL IN	ET of Precipitation	ET of Applied Water (Urban)	ET of Applied Water (Ag)	Wetland/Lake Riparian ET	Surface Water delivery offset	Infiltration of Precipitation	Infilt. of Applied Water (Urban)	Infilt. of Applied Water (Ag)	GW-SW interaction	Stream outflow	TOTAL OUT	Infiltration of Precipitation	Infilt. of Applied Water (Urban)	Infilt. of Applied Water (Ag)	GW-SW interaction	Subsurface Inflow	TOTAL IN	GW Extractions (Urban)	GW Extractions (Ag)	Wetland direct ET	Subsurface Outflow	TOTAL OUT	
KEY	A	B	B	C	D	E		F	F	F	F/G	H	I	J	J	K	L		I	J	J	K	M		B	B	N	O		P
1987	7,720	410	1,300	6,410	5,520	8,490	29,850	7,450	2,850	1,050	740	5,520	220	530	260	1,090	10,150	29,860	220	530	260	1,090	340	2,440	410	1,300	1,050	120	2,880	-440
1988	10,080	430	1,750	9,660	5,320	8,180	35,420	8,540	2,780	1,410	780	5,320	1,260	520	350	1,640	12,840	35,440	1,260	520	350	1,640	340	4,110	430	1,750	1,320	120	3,620	490
1989	7,850	660	1,580	3,600	4,070	6,020	23,780	7,550	2,180	1,270	380	4,070	250	430	310	610	6,730	23,780	250	430	310	610	340	1,940	660	1,580	1,130	120	3,490	-1,550
1990	6,790	2,180	1,850	2,140	1,970	1,280	16,210	6,660	1,200	1,490	410	1,970	110	290	370	360	3,360	16,220	110	290	370	360	340	1,470	2,180	1,850	1,250	120	5,400	-3,930
1991	9,450	2,350	1,790	5,790	2,520	1,960	23,860	8,250	1,460	1,440	380	2,520	980	320	350	980	7,160	23,840	980	320	350	980	340	2,970	2,350	1,790	1,190	120	5,450	-2,480
1992	11,250	2,240	1,820	11,250	3,070	2,910	32,540	8,590	1,720	1,460	700	3,070	2,200	360	360	1,910	12,160	32,530	2,200	360	360	1,910	340	5,170	2,240	1,820	1,090	120	5,270	-100
1993	15,700	1,030	1,790	17,350	3,630	4,980	44,480	8,640	1,980	1,440	660	3,630	5,950	400	350	1,210	20,210	44,470	5,950	400	350	1,210	340	8,250	1,030	1,790	1,190	120	4,130	4,120
1994	8,620	790	1,690	7,640	3,750	5,400	27,890	7,900	2,030	1,360	740	3,750	580	410	330	1,300	9,480	27,880	580	410	330	1,300	340	2,960	790	1,690	1,090	120	3,690	-730
1995	16,930	660	1,870	26,690	3,780	5,590	55,520	8,630	2,060	1,500	540	3,780	6,070	410	370	1,870	30,300	55,530	6,070	410	370	1,870	340	9,060	660	1,870	1,110	120	3,760	5,300
1996	11,740	740	1,910	11,930	4,210	6,160	36,690	8,530	2,250	1,530	680	4,210	1,820	440	380	830	16,010	36,680	1,820	440	380	830	340	3,810	740	1,910	1,040	120	3,810	0
1997	15,930	780	2,280	17,670	4,400	6,440	47,500	8,580	2,370	1,830	690	4,400	2,690	460	450	530	25,510	47,510	2,690	460	450	530	340	4,470	780	2,280	1,290	120	4,470	0
1998	16,930	680	1,870	26,460	4,150	6,130	56,220	8,580	2,230	1,500	520	4,150	1,770	440	370	790	35,880	56,230	1,770	440	370	790	340	3,710	680	1,870	1,040	120	3,710	0
1999	8,670	660	2,510	7,720	4,350	6,470	30,380	7,870	2,340	2,020	810	4,350	650	450	500	1,310	10,100	30,400	650	450	500	1,310	340	3,250	660	2,510	1,330	120	4,620	-1,370
2000	12,620	670	1,810	13,130	4,410	6,560	39,200	8,530	2,360	1,450	670	4,410	2,950	450	360	920	17,090	39,190	2,950	450	360	920	340	5,020	670	1,810	1,040	120	3,640	1,380
2001	12,470	710	1,740	12,920	4,250	6,270	38,360	8,570	2,290	1,400	670	4,250	1,590	440	340	900	17,900	38,350	1,590	440	340	900	340	3,610	710	1,740	1,040	120	3,610	0
2002	7,510	630	1,850	6,130	4,530	6,340	26,990	7,240	2,000	1,490	770	4,530	220	440	360	1,040	8,900	26,990	220	440	360	1,040	340	2,400	630	1,850	1,140	120	3,740	-1,340
2003	11,630	610	1,470	11,780	4,610	6,300	36,400	8,640	1,860	1,180	680	4,610	2,490	440	290	820	15,390	36,400	2,490	440	290	820	340	4,380	610	1,470	1,040	120	3,240	1,140
2004	8,140	620	1,500	6,990	4,340	6,740	28,330	7,780	2,560	1,200	760	4,340	300	460	290	1,190	9,450	28,330	300	460	290	1,190	340	2,580	620	1,500	1,140	120	3,380	-800
2005	15,120	620	1,370	16,560	5,390	6,250	45,310	8,720	1,040	1,100	600	5,390	1,850	440	270	1,160	24,730	45,300	1,850	440	270	1,160	340	4,060	620	1,370	950	120	3,060	1,000
2006	13,180	610	1,280	6,500	4,950	6,280	32,800	8,710	1,500	1,030	660	4,950	1,580	440	250	450	13,220	32,790	1,580	440	250	450	340	3,060	610	1,280	1,050	120	3,060	0
2007	4,340	610	1,510	6,140	4,200	6,840	23,640	4,330	2,770	1,210	840	4,200	0	480	290	1,040	8,440	23,600	0	480	290	1,040	340	2,150	610	1,510	1,250	120	3,490	-1,340
2008	7,800	520	1,550	11,030	4,010	6,730	31,640	7,540	2,770	1,250	790	4,010	210	470	300	1,870	12,410	31,620	210	470	300	1,870	340	3,190	520	1,550	1,260	120	3,450	-260
2009	5,890	560	1,430	7,670	3,930	6,580	26,060	5,840	2,740	1,150	790	3,930	40	480	280	1,300	9,500	26,050	40	480	280	1,300	340	2,440	560	1,430	1,140	120	3,250	-810
2010	11,980	580	1,160	22,860	4,160	5,860	46,600	8,680	1,850	940	650	4,160	2,590	450	220	1,600	25,460	46,600	2,590	450	220	1,600	340	5,200	580	1,160	960	120	2,820	2,380
2011	16,930	530	1,260	21,360	4,480	5,530	50,090	8,750	1,170	1,020	610	4,480	1,400	430	240	640	31,350	50,090	1,400	430	240	640	340	3,050	530	1,260	1,150	120	3,060	-10
2012	8,470	530	1,420	5,430	3,950	5,770	25,570	7,940	1,910	1,150	770	3,950	430	450	270	920	7,770	25,560	430	450	270	920	340	2,410	530	1,420	1,200	120	3,270	-860
2013	5,290	510	1,790	3,670	4,060	6,330	21,650	5,260	2,320	1,450	430	4,060	30	470	340	620	6,670	21,650	30	470	340	620	340	1,800	510	1,790	1,350	120	3,770	-1,970
2014	5,220	540	1,560	3,270	3,660	6,190	20,440	5,190	2,620	1,260	420	3,660	20	470	300	560	5,940	20,440	20	470	300	560	340	1,690	540	1,560	1,290	120	3,510	-1,820
2015	5,960	400	1,680	1,620	3,420	5,750	18,830	5,900	2,300	1,360	410	3,420	50	440	330	270	4,340	18,820	50	440	330	270	340	1,430	400	1,680	1,270	120	3,470	-2,040
2016	10,150	400	1,690	4,850	3,550	5,490	26,130	8,490	1,920	1,360	730	3,550	1,350	430	330	820	7,130	26,110	1,350	430	330	820	340	3,270	400	1,690	1,170	120	3,380	-110
2017	16,930	400	1,550	18,450	4,400	5,370	47,100	8,730	960	1,250	590	4,400	6,910	440	300	550	22,970	47,100	6,910	440	300	550	340	8,540	400	1,550	1,260	120	3,330	5,210
2018	6,980	400	1,190	2,630	3,330	5,790	20,320	6,870	2,430	970	800	3,330	90	450	230	180	4,970	20,320	90	450	230	180	340	1,290	400	1,190	1,270	120	2,980	-1,690
2019	15,040	400	1,030	16,360	4,360	5,080	42,270	8,800	720	830	630	4,360	4,430	420	200	490	21,400	42,280	4,430	420	200	490	340	5,880	400	1,030	1,070	120	2,620	3,260

Type Year: Dry / Below Normal / Above Normal / Wet

AF = Acre-Feet; KEY = Referenced Components on Figure 6-3

Table 6-2: Historical Water Budget - Edna Valley Subarea.

Water Year	SURFACE WATER INFLOW (AF)					SURFACE WATER OUTFLOW (AF)										GROUNDWATER INFLOW (AF)						GROUNDWATER OUTFLOW (AF)				Change in GW Storage (AF)
	Precipitation	GW extractions (Urban)	GW extractions (Ag)	Stream Inflow	TOTAL IN	ET of Precipitation	ET of Applied Water (Urban)	ET of Applied Water (Ag)	Riparian ET	Infiltration of Precipitation	Infilt. of Applied Water (Urban)	Infilt. of Applied Water (Ag)	GW-SW interaction	Stream outflow	TOTAL OUT	Infiltration of Precipitation	Infilt. of Applied Water (Urban)	Infilt. of Applied Water (Ag)	GW-SW interaction	Subsurface Inflow	TOTAL IN	GW Extractions (Urban)	GW Extractions (Ag)	Subsurface Outflow	TOTAL OUT	
KEY	A	B	B	C		F	F	F	F	I	J	J	K	L		I	J	J	K	M		B	B	O		P
1987	6,780	630	2,450	2,150	12,010	6,610	450	2,000	40	140	190	440	300	1,840	12,010	140	190	440	300	110	1,180	630	2,450	100	3,180	-2,000
1988	8,860	760	2,750	3,240	15,610	7,970	560	2,240	40	660	210	510	450	2,960	15,600	660	210	510	450	110	1,940	760	2,750	100	3,610	-1,670
1989	6,900	640	2,670	1,210	11,420	6,670	470	2,190	20	180	180	480	170	1,070	11,430	180	180	480	170	110	1,120	640	2,670	100	3,410	-2,290
1990	5,960	740	3,040	730	10,470	5,860	530	2,490	20	90	220	550	100	620	10,480	90	220	550	100	110	1,070	740	3,040	100	3,880	-2,810
1991	8,300	760	2,810	1,940	13,810	7,550	530	2,300	20	570	240	510	270	1,840	13,830	570	240	510	270	110	1,700	760	2,810	100	3,670	-1,970
1992	9,880	790	2,810	3,770	17,250	8,030	530	2,300	40	1,460	270	510	530	3,590	17,260	1,460	270	510	530	110	2,880	790	2,810	100	3,700	-820
1993	13,780	840	2,710	5,810	23,140	8,000	570	2,220	40	4,800	290	490	810	5,940	23,160	4,800	290	490	810	110	6,500	840	2,710	100	3,650	2,850
1994	7,570	760	2,640	2,560	13,530	7,050	500	2,170	40	400	270	470	360	2,280	13,540	400	270	470	360	110	1,610	760	2,640	100	3,500	-1,890
1995	14,870	820	2,820	8,930	27,440	7,930	550	2,320	40	5,740	280	500	1,250	8,840	27,450	5,740	280	500	1,250	110	7,880	820	2,820	100	3,740	4,140
1996	10,310	850	3,000	3,990	18,150	7,880	550	2,470	40	1,920	310	530	560	3,900	18,160	1,920	310	530	560	110	3,430	850	3,000	100	3,950	-520
1997	13,990	1,030	3,460	5,910	24,390	7,840	690	2,850	40	5,010	350	610	830	6,190	24,410	5,010	350	610	830	110	6,910	1,030	3,460	100	4,590	2,320
1998	14,870	860	3,000	9,730	28,460	7,790	570	2,480	40	5,750	300	520	1,360	9,660	28,470	5,750	300	520	1,360	110	8,040	860	3,000	100	3,960	4,080
1999	7,620	1,020	3,720	2,590	14,950	6,990	690	3,070	40	470	340	650	360	2,340	14,950	470	340	650	360	110	1,930	1,020	3,720	100	4,840	-2,910
2000	11,080	940	2,700	4,400	19,120	7,710	600	2,230	40	2,650	350	480	620	4,470	19,150	2,650	350	480	620	110	4,210	940	2,700	100	3,740	470
2001	10,950	980	3,320	4,330	19,580	7,670	630	2,750	40	2,550	360	570	610	4,400	19,580	2,550	360	570	610	110	4,200	980	3,320	100	4,400	-200
2002	6,600	960	3,220	2,060	12,840	6,400	630	2,660	40	170	340	570	290	1,760	12,860	170	340	570	290	110	1,480	960	3,220	100	4,280	-2,800
2003	10,220	870	3,030	3,950	18,070	7,600	570	2,500	40	2,000	320	520	550	3,970	18,070	2,000	320	520	550	110	3,500	870	3,030	100	4,000	-500
2004	7,150	970	3,040	2,340	13,500	6,740	630	2,520	40	320	350	530	330	2,070	13,530	320	350	530	330	110	1,640	970	3,040	100	4,110	-2,470
2005	13,280	840	2,870	5,540	22,530	7,610	550	2,370	40	4,450	300	500	780	5,930	22,530	4,450	300	500	780	110	6,140	840	2,870	100	3,810	2,330
2006	11,570	900	3,040	2,180	17,690	7,580	590	2,520	40	3,100	320	530	310	2,730	17,720	3,100	320	530	310	110	4,370	900	3,040	100	4,040	330
2007	3,810	1,180	3,830	2,160	10,980	3,800	770	3,170	40	0	430	660	300	1,820	10,990	0	430	660	300	110	1,500	1,180	3,830	100	5,110	-3,610
2008	6,850	1,210	3,750	3,750	15,560	6,580	780	3,100	40	220	440	650	520	3,230	15,560	220	440	650	520	110	1,940	1,210	3,750	100	5,060	-3,120
2009	5,170	950	3,660	2,740	12,520	5,100	650	3,040	40	50	310	620	380	2,330	12,520	50	310	620	380	110	1,470	950	3,660	100	4,710	-3,240
2010	10,520	820	3,360	7,490	22,190	7,560	550	2,790	40	2,260	270	570	1,050	7,100	22,190	2,260	270	570	1,050	110	4,260	820	3,360	100	4,280	-20
2011	14,870	840	3,330	7,840	26,880	7,550	580	2,760	40	5,760	270	570	1,100	8,260	26,890	5,760	270	570	1,100	110	7,810	840	3,330	100	4,270	3,540
2012	7,440	940	3,560	1,810	13,750	6,830	650	2,950	40	450	290	610	250	1,660	13,730	450	290	610	250	110	1,710	940	3,560	100	4,600	-2,890
2013	4,640	1,040	3,780	1,260	10,720	4,600	740	3,120	20	40	310	660	180	1,070	10,740	40	310	660	180	110	1,300	1,040	3,780	100	4,920	-3,620
2014	4,590	960	3,580	1,120	10,250	4,550	680	2,960	20	30	280	620	160	950	10,250	30	280	620	160	110	1,200	960	3,580	100	4,640	-3,440
2015	5,230	880	4,230	490	10,830	5,160	650	3,500	20	60	230	720	70	410	10,820	60	230	720	70	110	1,190	880	4,230	100	5,210	-4,020
2016	8,920	790	3,200	1,560	14,470	7,550	580	2,680	40	980	220	530	220	1,680	14,480	980	220	530	220	110	2,060	790	3,200	100	4,090	-2,030
2017	14,870	850	3,640	6,240	25,600	7,570	640	3,030	40	5,730	220	610	870	6,890	25,600	5,730	220	610	870	110	7,540	850	3,640	100	4,590	2,950
2018	6,130	880	3,550	650	11,210	6,020	650	2,960	40	90	240	590	90	540	11,220	90	240	590	90	110	1,120	880	3,550	100	4,530	-3,410
2019	13,210	770	3,350	5,480	22,810	7,630	580	2,800	40	4,370	210	550	770	5,870	22,820	4,370	210	550	770	110	6,010	770	3,350	100	4,220	1,790

Type Year: Dry / Below Normal / Above Normal / Wet

AF = Acre-Feet; KEY = Referenced Components on Figure 6-3

Table 6-3: Historical Water Budget - San Luis Obispo Valley Groundwater Basin.

Water Year	SURFACE WATER INFLOW (GW)							SURFACE WATER OUTFLOW (GW)											GROUNDWATER INFLOW (GW)						GROUNDWATER OUTFLOW (GW)					
	Precipitation	GW extractions (Urban)	GW extractions (Ag)	Stream Inflow	Wastewater discharge	Local Imported Supplies	TOTAL IN	ET of Precipitation	ET of Applied Water (Urban)	ET of Applied Water (Ag)	Wetland/Lake Riparian ET	Surface Water deliveries	Infiltration of Precipitation	Infilt. of Applied Water (Urban)	Infilt. of Applied Water (Ag)	GW-SW interaction	Stream outflow	TOTAL OUT	Infiltration of Precipitation	Infilt. of Applied Water (Urban)	Infilt. of Applied Water(Ag)	GW-SW interaction	Subsurface Inflow	TOTAL IN	GW Extractions (Urban)	GW Extractions (Ag)	Wetland direct ET	Subsurface Outflow	TOTAL OUT	Change in GW Storage (AF)
KEY	A	B	B	C	D	E		F	F	F	F/G	H	I	J	J	K	L		I	J	J	K	M		B	B	N	O		P
1987	14,500	1,040	3,750	8,560	5,520	8,490	41,860	14,060	3,300	3,050	780	5,520	360	720	700	1,390	11,990	41,870	360	720	700	1,390	450	3,620	1,040	3,750	1,050	220	6,060	-2,440
1988	18,940	1,190	4,500	12,900	5,320	8,180	51,030	16,510	3,340	3,650	820	5,320	1,920	730	860	2,090	15,800	51,040	1,920	730	860	2,090	450	6,050	1,190	4,500	1,320	220	7,230	-1,180
1989	14,750	1,300	4,250	4,810	4,070	6,020	35,200	14,220	2,650	3,460	400	4,070	430	610	790	780	7,800	35,210	430	610	790	780	450	3,060	1,300	4,250	1,130	220	6,900	-3,840
1990	12,750	2,920	4,890	2,870	1,970	1,280	26,680	12,520	1,730	3,980	430	1,970	200	510	920	460	3,980	26,700	200	510	920	460	450	2,540	2,920	4,890	1,250	220	9,280	-6,740
1991	17,750	3,110	4,600	7,730	2,520	1,960	37,670	15,800	1,990	3,740	400	2,520	1,550	560	860	1,250	9,000	37,670	1,550	560	860	1,250	450	4,670	3,110	4,600	1,190	220	9,120	-4,450
1992	21,130	3,030	4,630	15,020	3,070	2,910	49,790	16,620	2,250	3,760	740	3,070	3,660	630	870	2,440	15,750	49,790	3,660	630	870	2,440	450	8,050	3,030	4,630	1,090	220	8,970	-920
1993	29,480	1,870	4,500	23,160	3,630	4,980	67,620	16,640	2,550	3,660	700	3,630	10,750	690	840	2,020	26,150	67,630	10,750	690	840	2,020	450	14,750	1,870	4,500	1,190	220	7,780	6,970
1994	16,190	1,550	4,330	10,200	3,750	5,400	41,420	14,950	2,530	3,530	780	3,750	980	680	800	1,660	11,760	41,420	980	680	800	1,660	450	4,570	1,550	4,330	1,090	220	7,190	-2,620
1995	31,800	1,480	4,690	35,620	3,780	5,590	82,960	16,560	2,610	3,820	580	3,780	11,810	690	870	3,120	39,140	82,980	11,810	690	870	3,120	450	16,940	1,480	4,690	1,110	220	7,500	9,440
1996	22,050	1,590	4,910	15,920	4,210	6,160	54,840	16,410	2,800	4,000	720	4,210	3,740	750	910	1,390	19,910	54,840	3,740	750	910	1,390	450	7,240	1,590	4,910	1,040	220	7,760	-520
1997	29,920	1,810	5,740	23,580	4,400	6,440	71,890	16,420	3,060	4,680	730	4,400	7,700	810	1,060	1,360	31,700	71,920	7,700	810	1,060	1,360	450	11,380	1,810	5,740	1,290	220	9,060	2,320
1998	31,800	1,540	4,870	36,190	4,150	6,130	84,680	16,370	2,800	3,980	560	4,150	7,520	740	890	2,150	45,540	84,700	7,520	740	890	2,150	450	11,750	1,540	4,870	1,040	220	7,670	4,080
1999	16,290	1,680	6,230	10,310	4,350	6,470	45,330	14,860	3,030	5,090	850	4,350	1,120	790	1,150	1,670	12,440	45,350	1,120	790	1,150	1,670	450	5,180	1,680	6,230	1,330	220	9,460	-4,280
2000	23,700	1,610	4,510	17,530	4,410	6,560	58,320	16,240	2,960	3,680	710	4,410	5,600	800	840	1,540	21,560	58,340	5,600	800	840	1,540	450	9,230	1,610	4,510	1,040	220	7,380	1,850
2001	23,420	1,690	5,060	17,250	4,250	6,270	57,940	16,240	2,920	4,150	710	4,250	4,140	800	910	1,510	22,300	57,930	4,140	800	910	1,510	450	7,810	1,690	5,060	1,040	220	8,010	-200
2002	14,110	1,590	5,070	8,190	4,530	6,340	39,830	13,640	2,630	4,150	810	4,530	390	780	930	1,330	10,660	39,850	390	780	930	1,330	450	3,880	1,590	5,070	1,140	220	8,020	-4,140
2003	21,850	1,480	4,500	15,730	4,610	6,300	54,470	16,240	2,430	3,680	720	4,610	4,490	760	810	1,370	19,360	54,470	4,490	760	810	1,370	450	7,880	1,480	4,500	1,040	220	7,240	640
2004	15,290	1,590	4,540	9,330	4,340	6,740	41,830	14,520	3,190	3,720	800	4,340	620	810	820	1,520	11,520	41,860	620	810	820	1,520	450	4,220	1,590	4,540	1,140	220	7,490	-3,270
2005	28,400	1,460	4,240	22,100	5,390	6,250	67,840	16,330	1,590	3,470	640	5,390	6,300	740	770	1,940	30,660	67,830	6,300	740	770	1,940	450	10,200	1,460	4,240	950	220	6,870	3,330
2006	24,750	1,510	4,320	8,680	4,950	6,280	50,490	16,290	2,090	3,550	700	4,950	4,680	760	780	760	15,950	50,510	4,680	760	780	760	450	7,430	1,510	4,320	1,050	220	7,100	330
2007	8,150	1,790	5,340	8,300	4,200	6,840	34,620	8,130	3,540	4,380	880	4,200	0	910	950	1,340	10,260	34,590	0	910	950	1,340	450	3,650	1,790	5,340	1,250	220	8,600	-4,950
2008	14,650	1,730	5,300	14,780	4,010	6,730	47,200	14,120	3,550	4,350	830	4,010	430	910	950	2,390	15,640	47,180	430	910	950	2,390	450	5,130	1,730	5,300	1,260	220	8,510	-3,380
2009	11,060	1,510	5,090	10,410	3,930	6,580	38,580	10,940	3,390	4,190	830	3,930	90	790	900	1,680	11,830	38,570	90	790	900	1,680	450	3,910	1,510	5,090	1,140	220	7,960	-4,050
2010	22,500	1,400	4,520	30,350	4,160	5,860	68,790	16,240	2,400	3,730	690	4,160	4,850	720	790	2,650	32,560	68,790	4,850	720	790	2,650	450	9,460	1,400	4,520	960	220	7,100	2,360
2011	31,800	1,370	4,590	29,200	4,480	5,530	76,970	16,300	1,750	3,780	650	4,480	7,160	700	810	1,740	39,610	76,980	7,160	700	810	1,740	450	10,860	1,370	4,590	1,150	220	7,330	3,530
2012	15,910	1,470	4,980	7,240	3,950	5,770	39,320	14,770	2,560	4,100	810	3,950	880	740	880	1,170	9,430	39,290	880	740	880	1,170	450	4,120	1,470	4,980	1,200	220	7,870	-3,750
2013	9,930	1,550	5,570	4,930	4,060	6,330	32,370	9,860	3,060	4,570	450	4,060	70	780	1,000	800	7,740	32,390	70	780	1,000	800	450	3,100	1,550	5,570	1,350	220	8,690	-5,590
2014	9,810	1,500	5,140	4,390	3,660	6,190	30,690	9,740	3,300	4,220	440	3,660	50	750	920	720	6,890	30,690	50	750	920	720	450	2,890	1,500	5,140	1,290	220	8,150	-5,260
2015	11,190	1,280	5,910	2,110	3,420	5,750	29,660	11,060	2,950	4,860	430	3,420	110	670	1,050	340	4,750	29,640	110	670	1,050	340	450	2,620	1,280	5,910	1,270	220	8,680	-6,060
2016	19,070	1,190	4,890	6,410	3,550	5,490	40,600	16,040	2,500	4,040	770	3,550	2,330	650	860	1,040	8,810	40,590	2,330	650	860	1,040	450	5,330	1,190	4,890	1,170	220	7,470	-2,140
2017	31,800	1,250	5,190	24,690	4,400	5,370	72,700	16,300	1,600	4,280	630	4,400	12,640	660	910	1,420	29,860	72,700	12,640	660	910	1,420	450	16,080	1,250	5,190	1,260	220	7,920	8,160
2018	13,110	1,280	4,740	3,280	3,330	5,790	31,530	12,890	3,080	3,930	840	3,330	180	690	820	270	5,510	31,540	180	690	820	270	450	2,410	1,280	4,740	1,270	220	7,510	-5,100
2019	28,250	1,170	4,380	21,840	4,360	5,080	65,080	16,430	1,300	3,630	670	4,360	8,800	630	750	1,260	27,270	65,100	8,800	630	750	1,260	450	11,890	1,170	4,380	1,070	220	6,840	5,050

Type Year: Dry / Below Normal / Above Normal / Wet
AF = Acre-Feet; KEY = Referenced Components on Figure 6-3

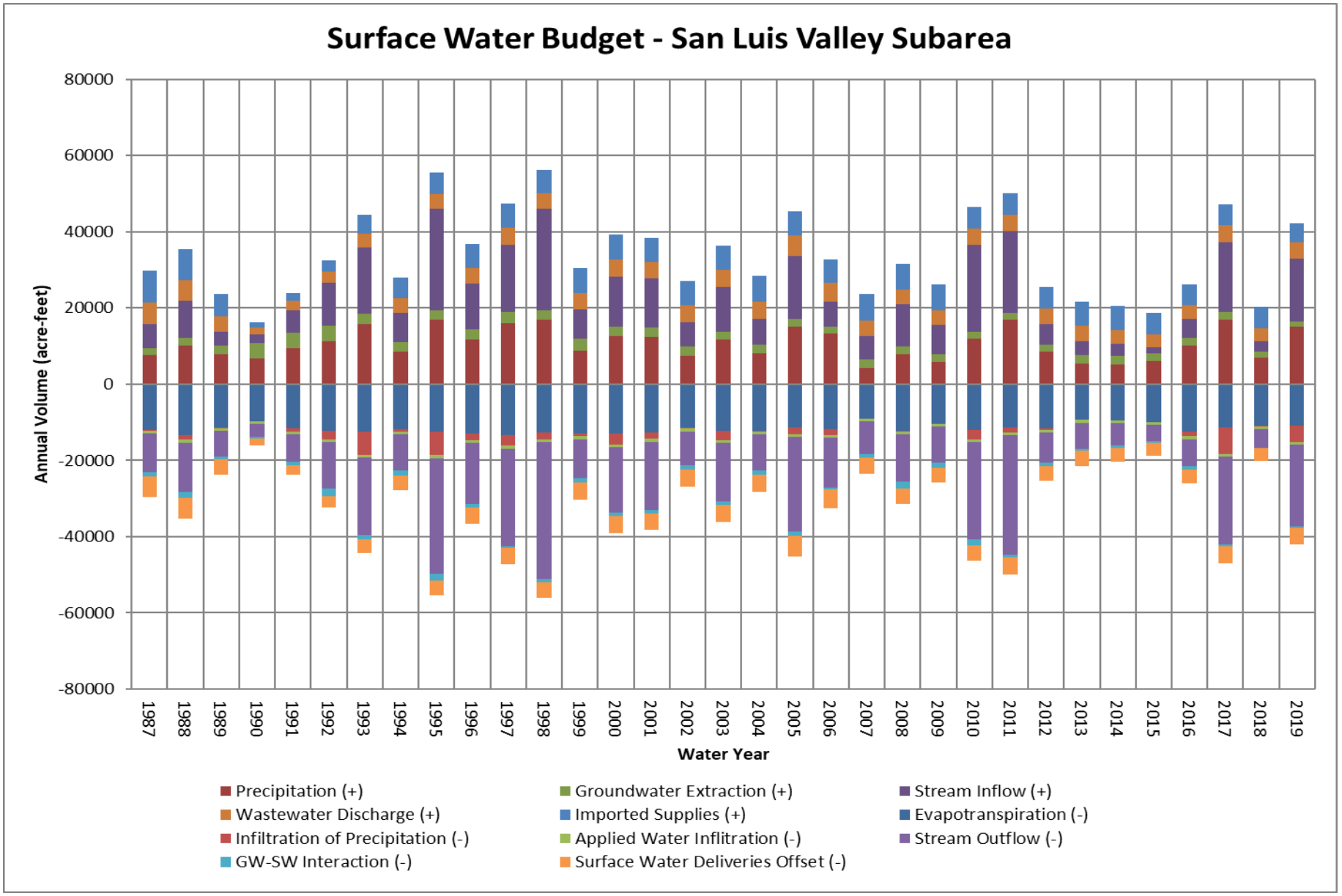


Figure 6-4: Surface Water Budget – San Luis Valley Subarea.

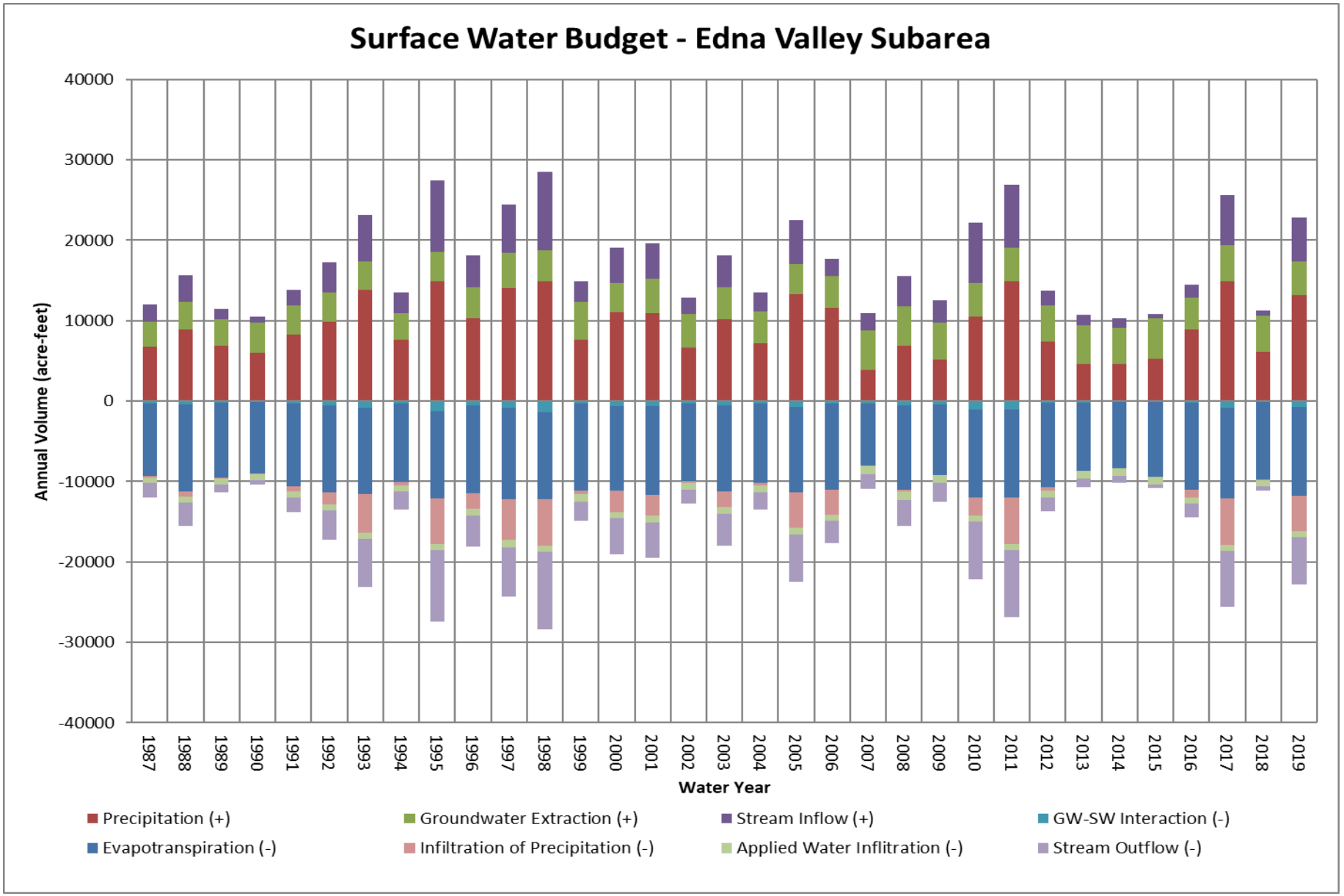


Figure 6-5: Surface Water Budget – Edna Valley Subarea.

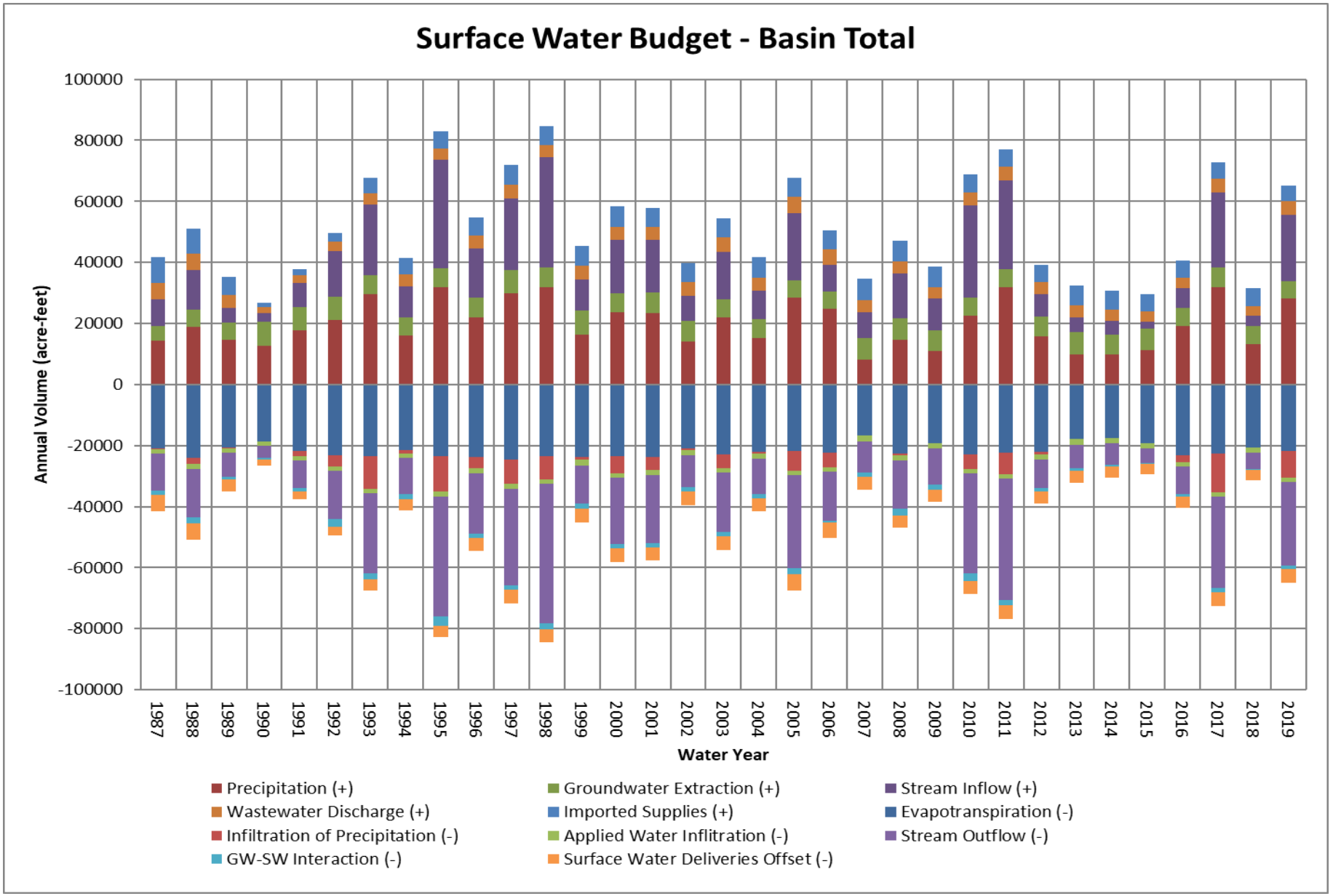


Figure 6-6: Surface Water Budget – Basin Total.

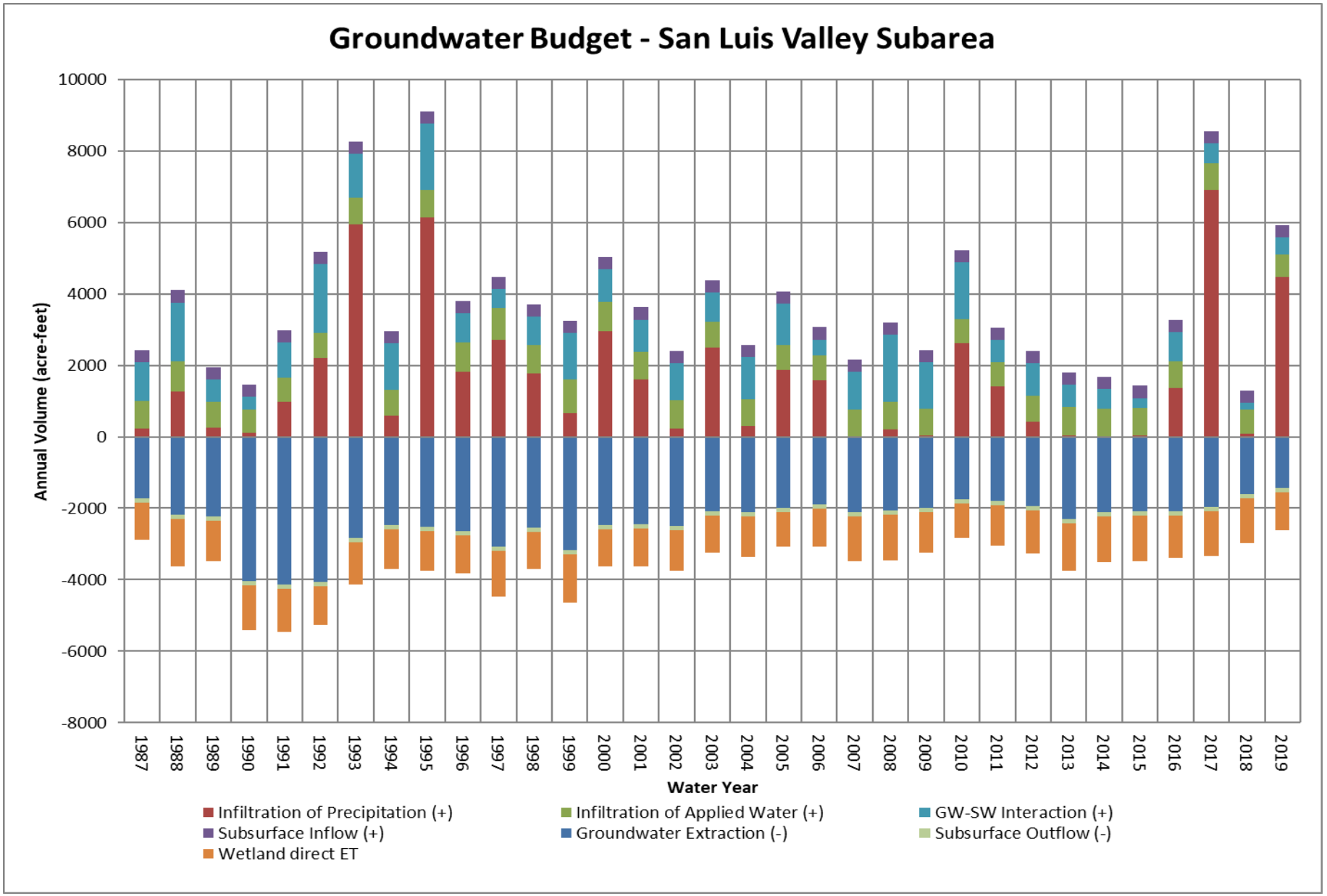


Figure 6-7: Groundwater Budget – San Luis Valley Subarea.

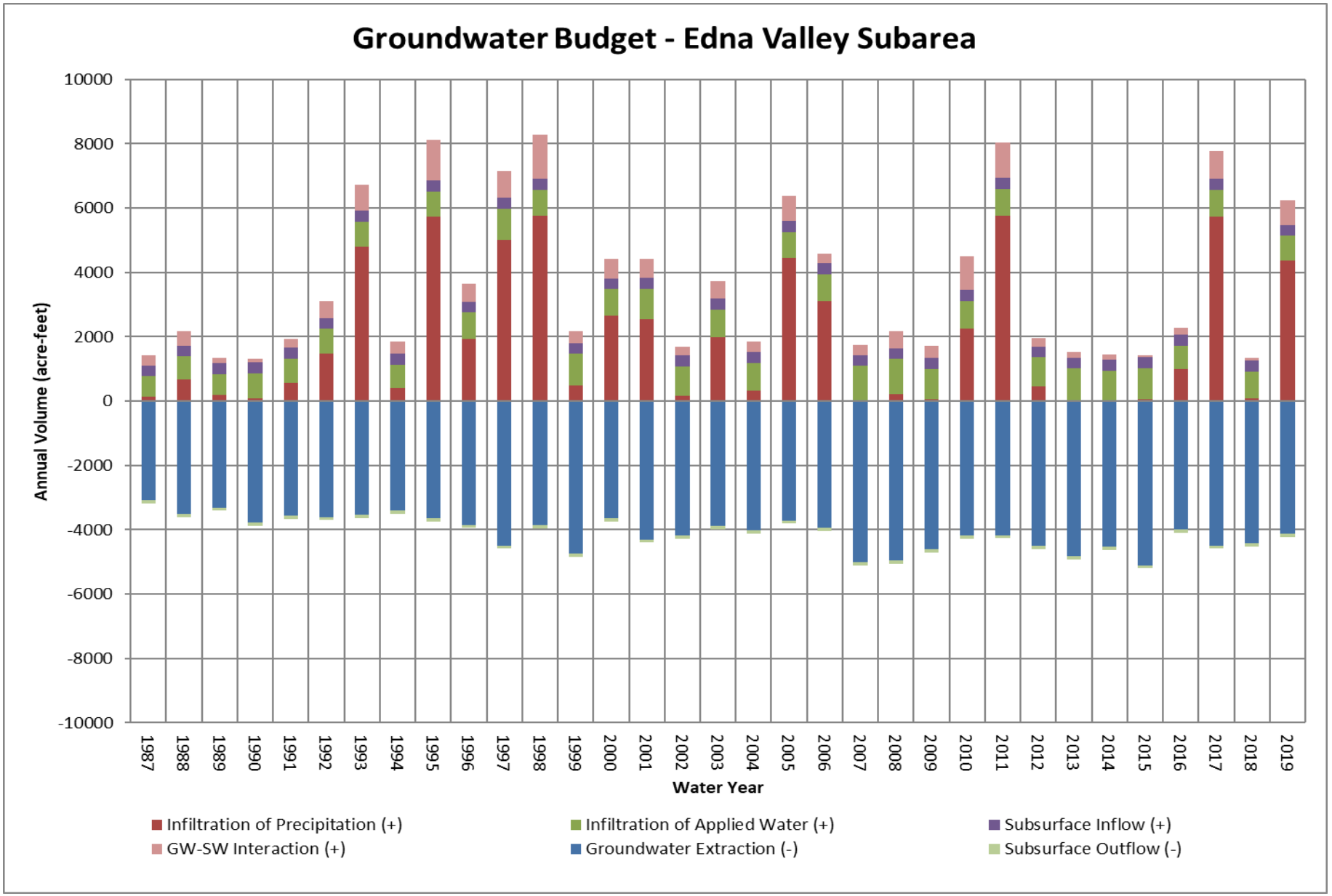


Figure 6-8: Groundwater Budget – Edna Valley Subarea.

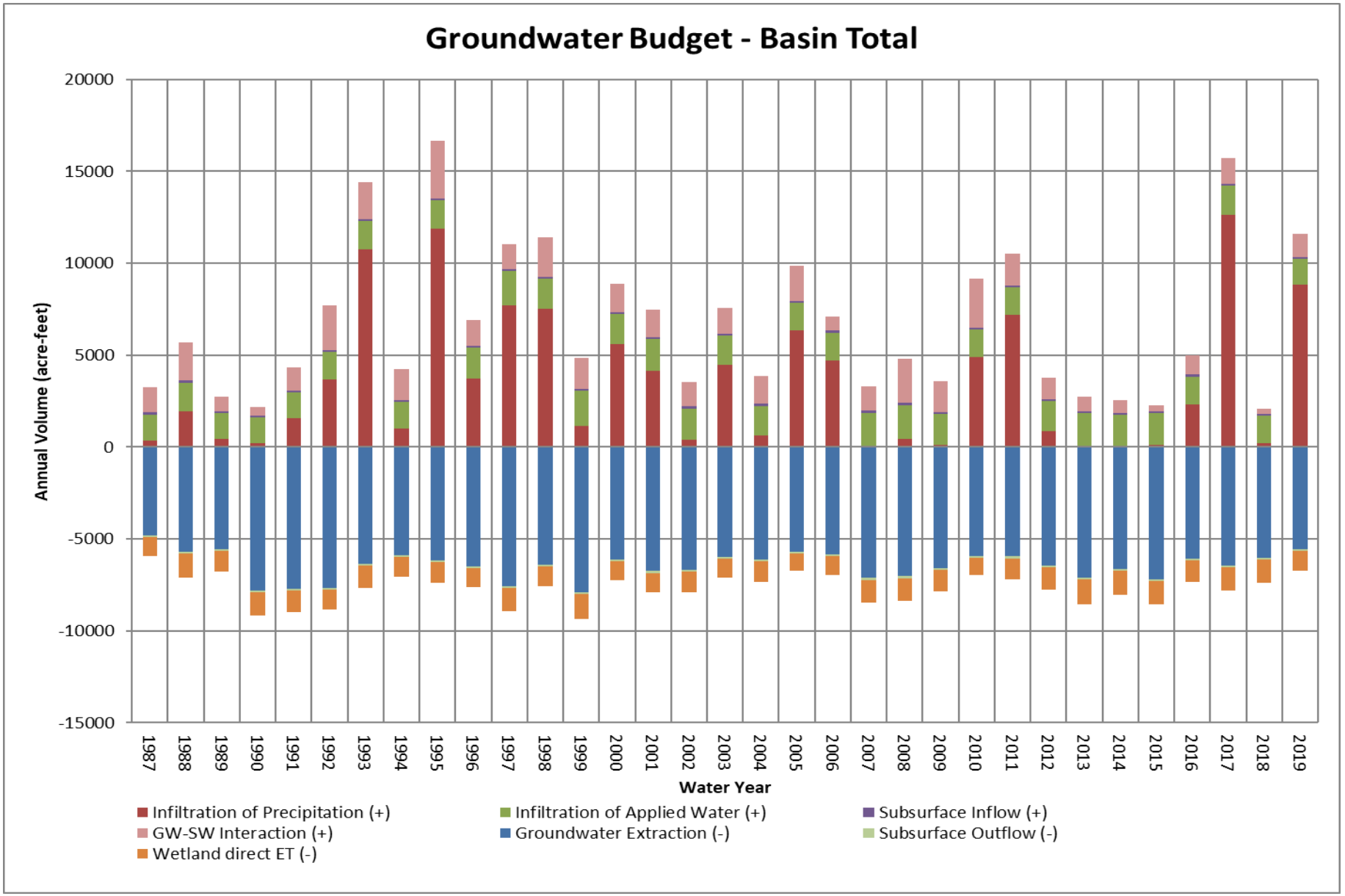


Figure 6-9: Groundwater Budget – Basin Total.

6.1 CLIMATE

Climate is one of the principal measures of water supply conditions and is used for hydrologic base period definition and for developing evapotranspiration estimates. The main component of climate monitoring in the Basin is rainfall, with records at the Cal Poly NOAA Station (formerly Cal Poly #1) beginning in the 1870-71 rainfall year. Rainfall is used in the water budget for establishing the hydrologic base period needed for representing long-term water supply conditions.

Another climate parameter used in the water budget is evapotranspiration. Evapotranspiration is calculated from a combination of monitored parameters, such as air temperature, wind speed, solar radiation, vapor pressure, and relative humidity. These parameters, along with precipitation, have been monitored at CIMIS Station #52 (San Luis Obispo – Cal Poly) since 1986. The water budget uses crop evapotranspiration for estimating the applied irrigation requirements for crops (see Section 6.3.4.2). Cal Poly, the San Luis Valle, and the Edna Valley are all within DWR reference evapotranspiration Zone 6, which is one of 18 climate zones in California based on long-term monthly average reference evapotranspiration (CIMIS, 1999).

6.1.1 Historical Climate/Base Period

The historical rainfall record at the Cal Poly NOAA Station has been used to define a period of years, referred to as a base period, which represents long-term hydrologic conditions. As described by DWR (2002):

> *The base period should be representative of long-term hydrologic conditions, encompassing dry, wet, and average years of precipitation. It must be contained in the historical record and should include recent cultural conditions to assist in determining projected Basin operations. To minimize the amount of water in transit in the zone of aeration, the beginning and end of the base period should be preceded by comparatively similar rainfall quantities.*

The historical rainfall record for the Cal Poly NOAA Station, which is the longest record in the San Luis Obispo area, was presented in Figure 3-11; Chapter 3. The water year in San Luis Obispo County for rainfall runs from July 1 through June 30 (also referred to as rainfall year), while other hydrologic data is reported from October 1 through September 30 (San Luis Obispo County, 2005). These conventions are maintained for the water budget, and water years are referenced herein based on the ending year.

The hydrologic base period selected to represent historical climatic conditions for the Basin encompasses the years 1987 through 2019 (33 years). Average precipitation at the Cal Poly NOAA gage over this base period was 21.76 inches, compared to the long-term average of 21.95 inches, and included wet, average, and dry periods (Figure 6-10). These periods are visually defined by the movement of the cumulative departure from mean precipitation curve, which declines over dry periods, is flat through average periods, and rises over wet periods.

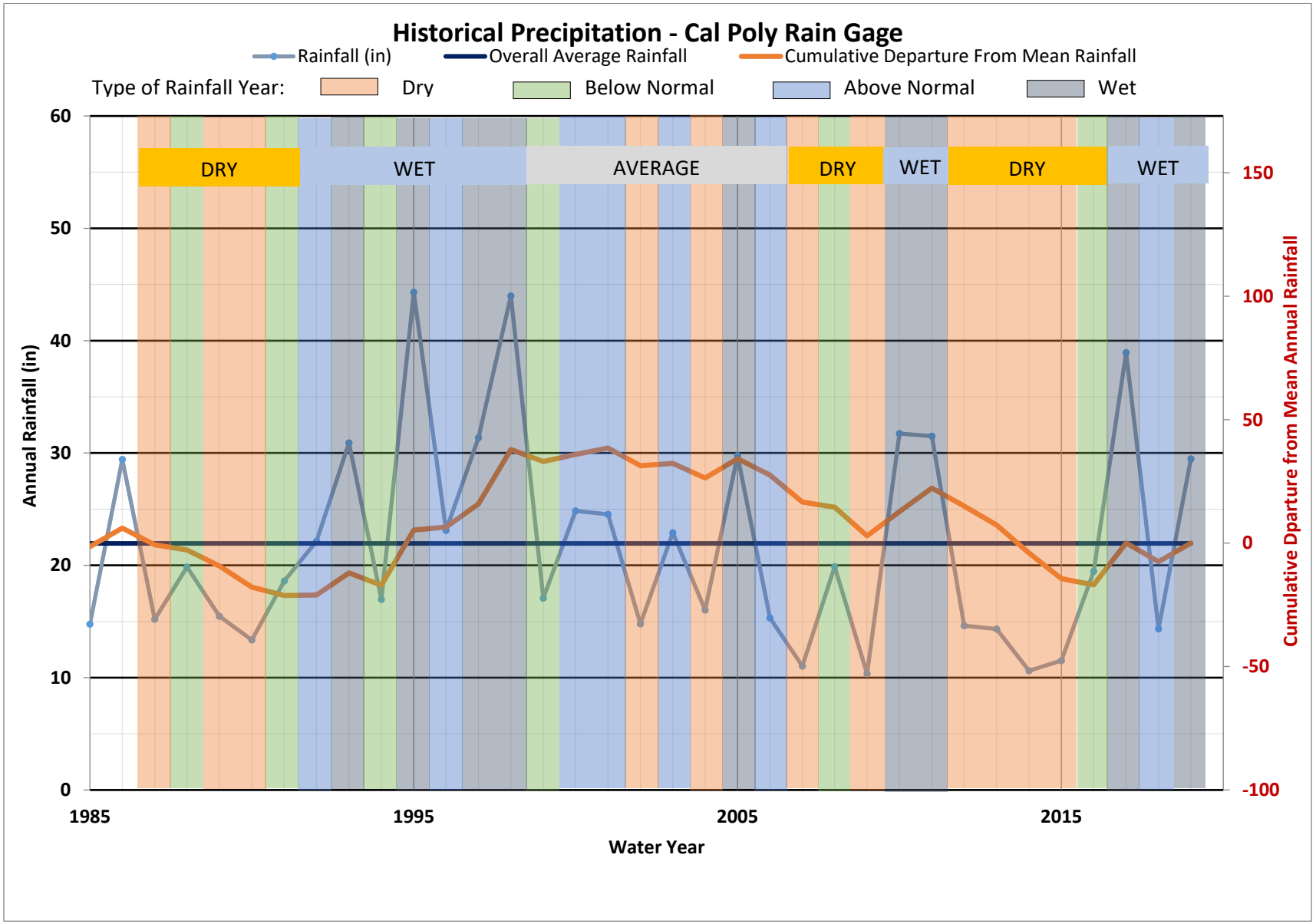


Figure 6-10: 1987-2019 Historical Base Period Climate.

Water year types for this water budget have been developed and classified based on annual precipitation as a percentage of the previous 30-year average precipitation. Each July 1 through June 30 rainfall year of the historical base period was given a ranking of 1 (wettest) through 30 (driest) based on a comparison to a 30-year (rolling) data set. The minimum precipitation threshold for wet type years was assigned based on the average for the 10th ranked year (26.3 inches). The maximum precipitation threshold for dry type years was assigned based on the average for the 21st ranked year (16.8 inches). Below normal (from 16.8 to less than 20.5 inches) represents the 16th through 20th ranked years, while above normal (from 20.5 to 26.3 inches) represents the 10th through 15th ranked years. Note that the division between below normal and above normal rainfall (20.5 inches) is less than the average over the base period (21.76 inches) because there are more below average rainfall years than above average years. The water year types were developed from Cal Poly NOAA rainfall records, with one exception. The exception is the 2006 rainfall year, which would be classified as dry based on 15.31 inches reported at Cal Poly NOAA, but which is considered above normal when reviewing other local rain gages, including the Gas Company rain gage (23.35 inches in 2006).

The base period includes recent cultural conditions, such as expanded recycled water use by the City and water conservation by Basin users in response to the recent drought period. Differences between water in transit in the vadose zone (deep percolation of precipitation and stream seepage) are minimal, based on comparing the two rainfall years leading up to the beginning and ending of the base period. The 1985 and 1986 rainfall years leading in the base period have 14.77 inches and 29.43 inches, respectively, compared to 14.34 and 29.48 inches of rainfall at the end of the base period in 2018 and 2019 (Figure 6-10).

There are other rainfall gages in the Basin (Table 3-5 and Figure 3-10; Chapter 3), and an isohyetal map of average annual rainfall is shown in Figure 4-3 (Chapter 4). The average annual precipitation across the Basin between 1981 and 2010 was approximately 19 inches (Figure 4-3; Chapter 4), compared to the Cal Poly NOAA rainfall gage, which averaged 23.03 inches over that same period.

Although the water budget uses the Cal Poly NOAA gage (formerly Cal Poly #1) to identify the historical base period and water year types due to the extensive period of record, the Gas Company rain gage is used in water budget calculations that involve precipitation volumes to account for the difference between rainfall at Cal Poly and the Basin. A correlation between the Gas Company and Cal Poly NOAA was performed to estimate rainfall prior to 2006 for the historical water budget (Figure 6-11). Based on linear regression using data recorded between 2006 and 2019, rainfall at the Gas Company gage is approximately 90 percent of rainfall at the Cal Poly NOAA gage. No precipitation data was recorded for the Gas Company rain gage prior to 2006, and the 90 percent correlation was used to estimate precipitation at the gage between 1987 and 2005 to complete the historical base period. Climate data from CIMIS Station #52 (located within same enclosure as the Cal Poly NOAA rain gage) has been used for evapotranspiration and applied agricultural water estimates.

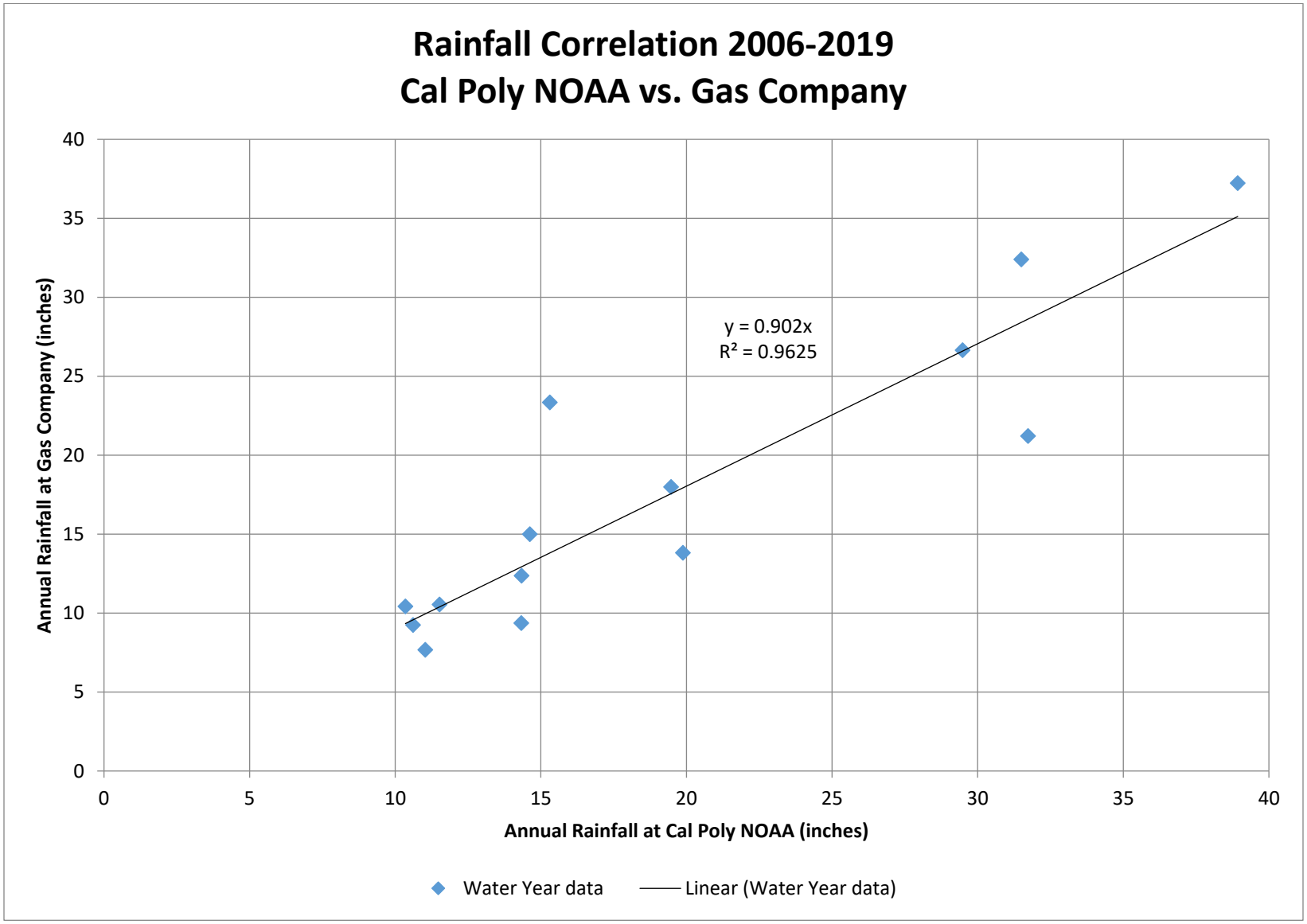


Figure 6-11: Rainfall Correlation Cal Poly vs. Gas Company.

Table 6-4 presents the annual rainfall for the historical water budget. Average annual rainfall within the Basin over the historical base period is estimated to be 19.6 inches. This average closely matches the estimated value for average rainfall across the Basin on the 30-year isohyetal map (Figure 4-3; Chapter 4).

Table 6-4: Historical Base Period Rainfall.

Year	Type	Cal Poly NOAA	Gas Company
		Rainfall (in.)	
1987	Dry	15.19	13.67
1988	Below Normal	19.85	17.87
1989	Dry	15.46	13.91
1990	Dry	13.36	12.02
1991	Below Normal	18.6	16.74
1992	Above Normal	22.14	19.93
1993	Wet	30.9	27.81
1994	Below Normal	16.96	15.26
1995	Wet	44.31	39.88
1996	Above Normal	23.11	20.8
1997	Wet	31.36	28.22
1998	Wet	43.98	39.58
1999	Below Normal	17.07	15.36
2000	Above Normal	24.84	22.36
2001	Above Normal	24.54	22.09
2002	Dry	14.79	13.31
2003	Above Normal	22.9	20.61
2004	Dry	16.02	14.42
2005	Wet	29.76	26.78
2006	Above Normal*	15.31	23.35
2007	Dry	11.03	7.68
2008	Below Normal	19.88	13.82
2009	Dry	10.35	10.43
2010	Wet	31.73	21.22
2011	Wet	31.5	32.4
2012	Dry	14.62	15
2013	Dry	14.33	9.37
2014	Dry	10.61	9.25
2015	Dry	11.52	10.55
2016	Below Normal	19.47	17.99
2017	Wet	38.93	37.23
2018	Dry	14.34	12.37
2019	Wet	29.48	26.65
Average		21.8	19.6

Gas Company Estimates **in blue** (approximately 90% of Cal Poly)

*2006 type year based on Gas Company gage reporting

6.2 WATER BUDGET DATA SOURCES

The following sources and types of data have been used for the water budget:

- Hydrogeologic and geologic studies and maps
- Groundwater monitoring reports
- County stream flow gages
- County and NOAA precipitation Stations
- PRISM 30-year normal dataset (1981-2010)
- CIMIS weather station data
- Aerial Imagery
- County water level monitoring program
- San Luis Obispo City, County and DWR land use data and planning documentation
- County Ag commissioner's office data sets
- County Water Master Plan
- Geotracker Groundwater Information System
- Stakeholder supplied information
- Environmental Impact Reports
- Water rights filings
- SRWQCB Drinking Water Division Water systems
- Wastewater discharge reports

6.3 HISTORICAL WATER BUDGET

In accordance with GSP regulations, the historical water budget shall quantify the following, either through direct measurement or estimates based on data (reference to location of data in Chapter 6 also listed):

(1) Total surface water entering and leaving a Basin by water source type (Table 6-3).
(2) Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs, and conveyance systems (Table 6-3).
(3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow (Table 6-3).
(4) The change in annual volume of groundwater in storage between seasonal high conditions (Table 6-3).
(5) If overdraft occurs, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions (Section 6.3.8).
(6) The water year type associated with the annual supply, demand, and change in groundwater stored (Table 6-3).
(7) An estimate of sustainable yield for the Basin (Section 6.3.7).

6.3.1 Historical Time Period

The time period over which the historical water budget is estimated is the hydrologic base period from 1987-2019 (33 years). Groundwater storage calculations using the specific yield method were performed for 1986, 1990, 1995, 1998, 2005, 2011, 2014, and 2019. These years include the beginning and ending years in the base period, along with sufficient intervening years to characterize change in storage trends through the base period.

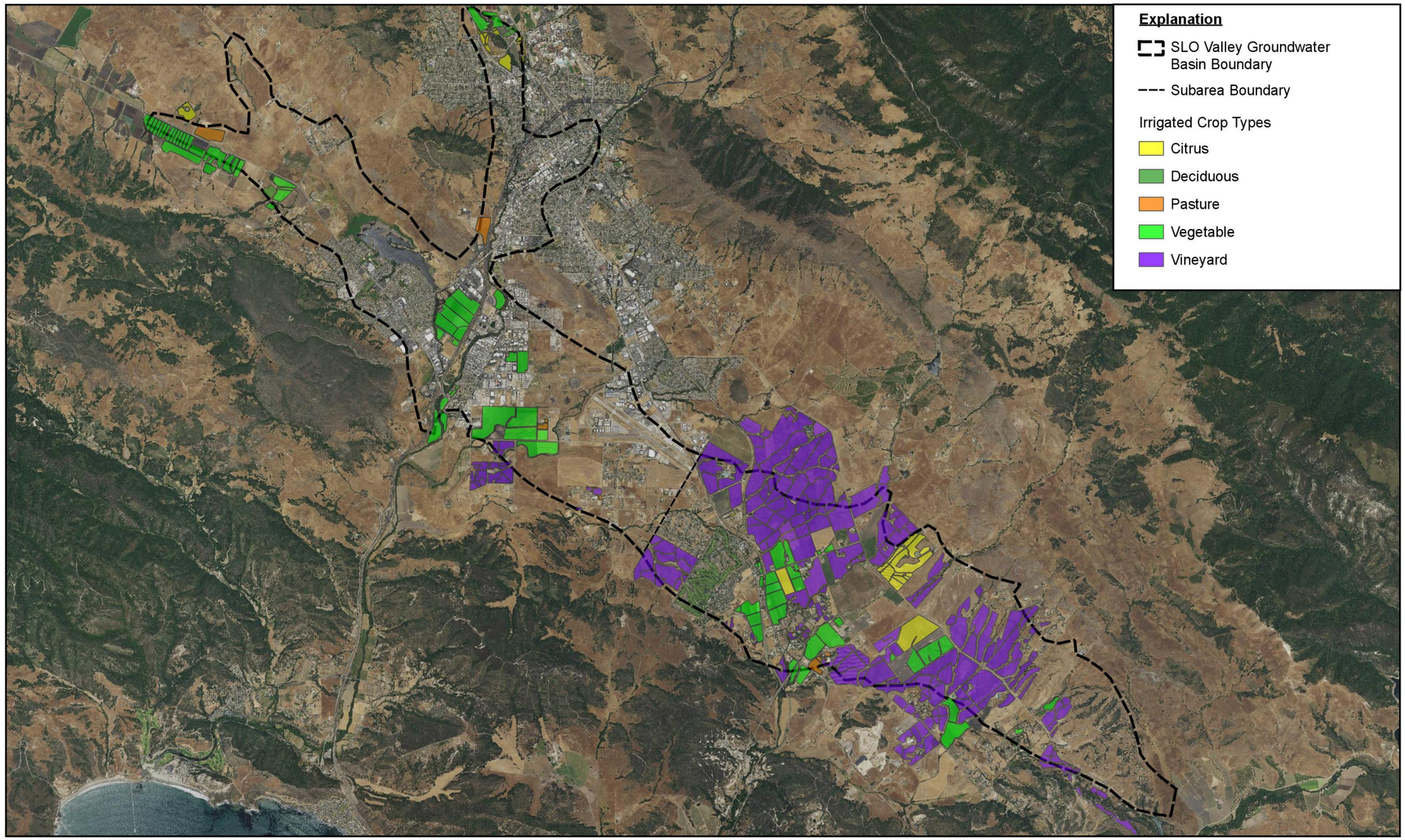
6.3.2 Historical Land Use

Land use is one of the primary data sets used in developing a water budget. Several types of land use/land cover in the basin have been used to estimate components of the water budget. For example, the acreages of various crops are multiplied by their respective water use factors to estimate agricultural groundwater extractions (Section 6.3.4.2), and acreages of various land covers are multiplied by empirical correlations to estimate their respective evapotranspiration and percolation of precipitation (Section 6.3.4.1). The land uses/land covers including the following:

- Irrigated Agriculture
    - Citrus
    - Deciduous
    - Pasture
    - Vegetable
    - Vineyard
- Native Vegetation
    - Brush, trees, native grasses
    - Wetlands/open water
- Urban/Suburban
    - Developed (City, subdivisions)
    - Open space (parks, empty lots)
    - Turf (golf courses, play fields)

Irrigated Agriculture

Irrigated crop acreage was estimated from aerial imagery of the Basin for the following years: 1987, 1994, 1999, 2003, 2005, 2007, 2009, 2010, and 2011. San Luis Obispo County land use data was used for crop acreage from 2013 to 2018. DWR land use surveys for 1985, 1995, and 2014 were also reviewed during the interpretation of aerial imagery. Figure 6-12 shows an example of the County irrigated crop data set for 2016.



Prepared For:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: TK
Date: 05/21/2020

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0 0.5 1 km

References:

1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hirozontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: 2016 NAIP Satellite Imagery

Notes:

1.
2.
3.

San Luis Obispo Valley Basin Irrigted Crops 2016

Figure 6-12

Irrigated acreage for years in the historical base period without aerial imagery, surveys, or County data were estimated from the nearest available year with data. Acreages for irrigated crops, estimated from aerial imagery and County datasets within the historical base period are shown in Table 6-5.

Table 6-5: Irrigated Agriculture Acreages.

Crop Type	1987	1994	1999	2003	2005	2007	2009	2010	2011	2013	2014	2015	2016	2017	2018
	San Luis Valley Subarea (acres)														
Citrus	26	26	30	51	49	49	49	49	49	45	44	44	44	46	46
Deciduous	12	12	12	12	12	12	12	12	12	67	21	17	17	17	17
Pasture	33	22	27	28	28	28	28	28	28	28	37	37	53	28	28
Vegetable	594	766	880	647	592	487	526	494	495	488	490	532	593	492	363
Vineyard	0	5	6	6	8	58	58	58	58	92	86	86	86	86	86
Subtotal	665	831	955	744	689	634	673	641	642	720	678	716	793	669	540
	Edna Valley Subarea (acres)														
Citrus	12	6	47	49	51	51	53	49	105	105	111	111	191	191	210
Deciduous	0	0	0	0	0	0	0	0	0	0	2	2	2	4	3
Pasture	138	19	19	19	19	19	19	19	19	16	19	19	15	14	13
Vegetable	533	703	685	686	646	699	663	679	647	671	670	691	394	505	453
Vineyard	1,180	1,344	1,900	2,252	2,297	2,377	2,377	2,372	2,380	2,423	2,419	2,419	2,454	2,415	2,323
Subtotal	1,863	2,072	2,651	3,006	3,013	3,146	3,112	3,119	3,151	3,215	3,221	3,242	3,056	3,129	3,002

Native Vegetation and Urban Areas

Native vegetation acreages were compiled using data sets from the National Land Cover Database (NLCD), which is derived primarily from satellite imagery. The years for which NLCD coverage is available are 2001, 2004, 2006, 2008, 2011, 2013, and 2016. Adjustments to the acreages in the NLCD data were performed to reconcile with the agricultural acreages and urban turf areas (golf course, play fields) compiled using the aerial imagery and crop survey data set. Where the NLCD data sets showed less agricultural acreage than the aerial imagery, the native vegetation (brush, trees, grassland) acreage was reduced so the total basin acreage remained constant. The estimated acreages for native vegetation and urban areas, along with irrigated agriculture interpolated from Table 6-5, are presented in Table 6-6 below.

Table 6-6: Land Cover Acreages.

Land cover	2001	2004	2006	2008	2011	2013	2016
	San Luis Valley Subarea (acres)						
Native - brush, trees, grassland	2,315	2,450	2,482	2,466	2,386	2,315	2,203
Native - wetlands/open water	566	566	573	571	569	569	575
Urban - Developed	2,150	2,142	2,219	2,219	2,325	2,312	2,353
Urban - Open Space	870	875	841	841	829	835	825
Urban - Turf	23	23	23	23	23	23	23
Irrigated Agriculture	849	716	636	653	642	720	793
Subarea Total	6,773	6,773	6,773	6,773	6,773	6,773	6,773
	Edna Valley Subarea (acres)						
Native - brush, trees, grassland	2,659	2,473	2,406	2,356	2,333	2,266	2,423
Native - wetlands/open water	13	17	13	13	15	13	13
Urban - Developed	230	230	232	232	232	235	237
Urban - Open Space	77	77	77	77	77	78	79
Urban - Turf	141	141	141	141	141	141	141
Irrigated Agriculture	2,829	3,010	3,079	3,129	3,150	3,215	3,056
Subarea Total	5,948	5,948	5,948	5,948	5,948	5,948	5,948

6.3.3 Historical Surface Water Budget

The surface water system is represented by water at the land surface within the boundaries of the Basin. Surface water systems for the water budget include streams and Laguna Lake.

6.3.3.1 Components of Surface Water Inflow

The surface water budget includes the following sources of inflow:

- Local Supplies
  - Precipitation
  - Groundwater extractions
  - Stream inflow at Basin boundary
  - Groundwater-Surface Water Interactions
  - Treated wastewater discharge into streams
- Local Imported Supplies
  - Nacimiento Project Water
  - Salinas Reservoir Water
  - Whale Rock Reservoir Water

Precipitation

Precipitation occurs as rainfall. The annual volume of rainfall within the Basin has been estimated by multiplying the rainfall year totals in Table 6-4 by each Basin subarea. Rainfall volumes falling within the Basin boundary are shown as precipitation in the surface water inflow budget of Table 6-1, Table 6-2, and Table 6-3.

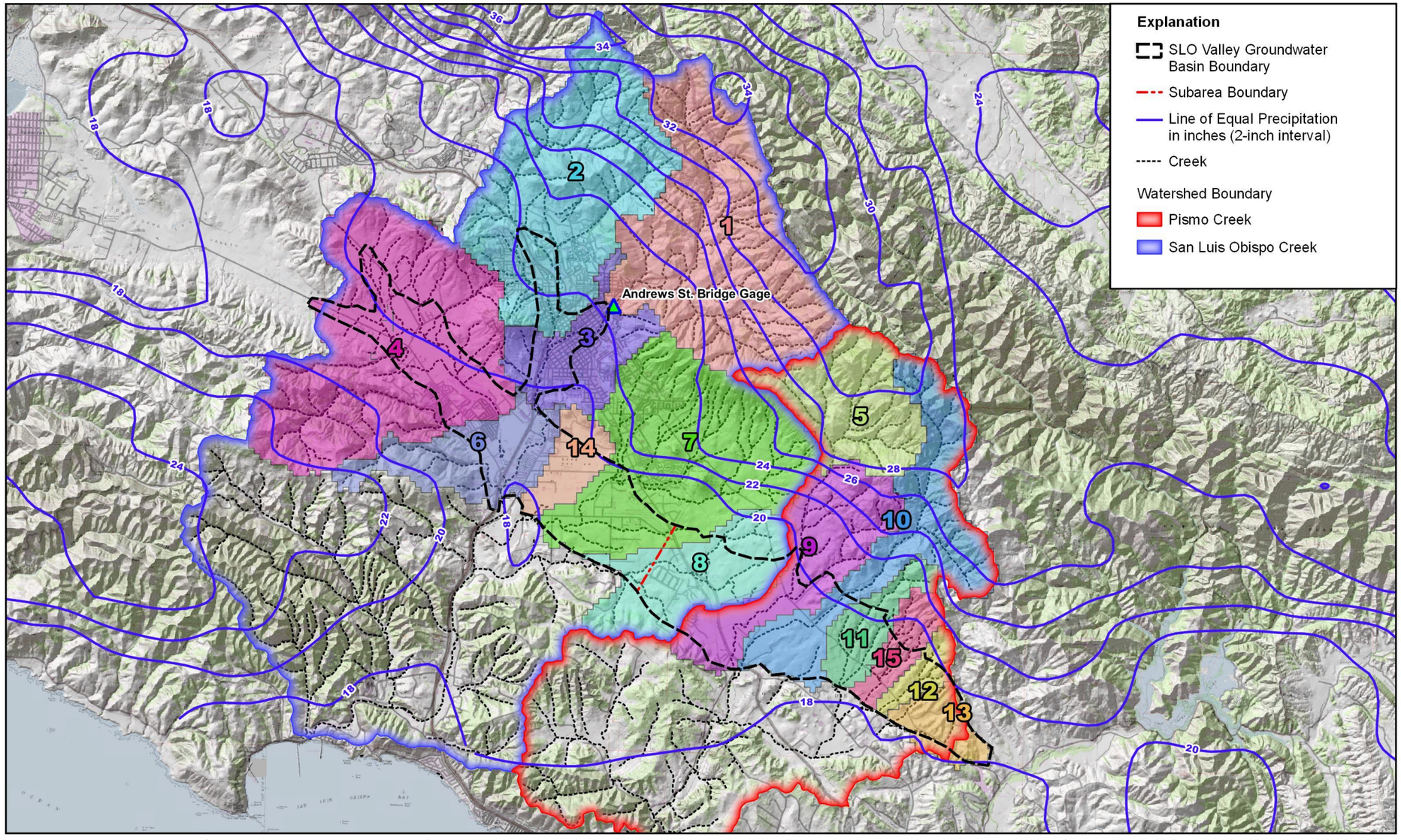
Groundwater Extractions

Groundwater extractions are included in the surface water budget as inflow because after extraction groundwater is distributed and applied at land surface. The surface water budget includes the land surface

system and rivers & streams system (Figure 6-2). These extractions are the divided into Urban and Agricultural water use sectors and match the groundwater extraction outflow values from the groundwater budget. Details on data collection and groundwater pumping estimates are provided in the Historical Groundwater Budget section (Section 6.3.3).

Stream Inflow at Basin Boundary

Inflow along stream channels at the Basin boundary has been estimated based on paired watershed methodology. The total watershed area drained by the Basin was divided into 15 sub-watershed areas, one of which was the subarea drained by San Luis Obispo Creek upstream of the Andrews Street gage (sub-watershed 1, Figure 6-13). Flow from 2007 through 2018 at the Andrews Street gage was reconstructed using stage records and a stage-discharge curve. The resulting annual flows were then processed using a watershed area factor and an isohyetal factor to estimate annual flows for each of the other 14 subareas. The watershed area factor was the ratio of the watershed area for which flow was being estimated to the Andrews Street gage watershed area. The isohyetal factor addressed differences between the average annual rainfall across each of the sub-watersheds being compared (Figure 6-13), and consisted of the ratio of average annual precipitation over 15 inches between sub-watersheds. Correlation between rainfall and runoff for the paired watersheds are shown in Figure 6-14. A drought period adjustment was also made for 1989-1991 inflow estimates (Figure 6-14) consisting of 3,000 AFY less inflow for the San Luis Valley subarea and 1,000 AFY less inflow for the Edna Valley subarea. Once these factors were applied, the estimated stream flow entering the respective SLO subarea watershed and Edna Valley subarea watershed were totaled.



Prepared For:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: TK
Date: 06/16/2020

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References:

1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hrizontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:

1. Precipitation data from: PRISM 30 yr Normal dataset (1981-2010)
2.
3.

Basin Sub-watershed Areas and Isohyetals

Figure 6-13

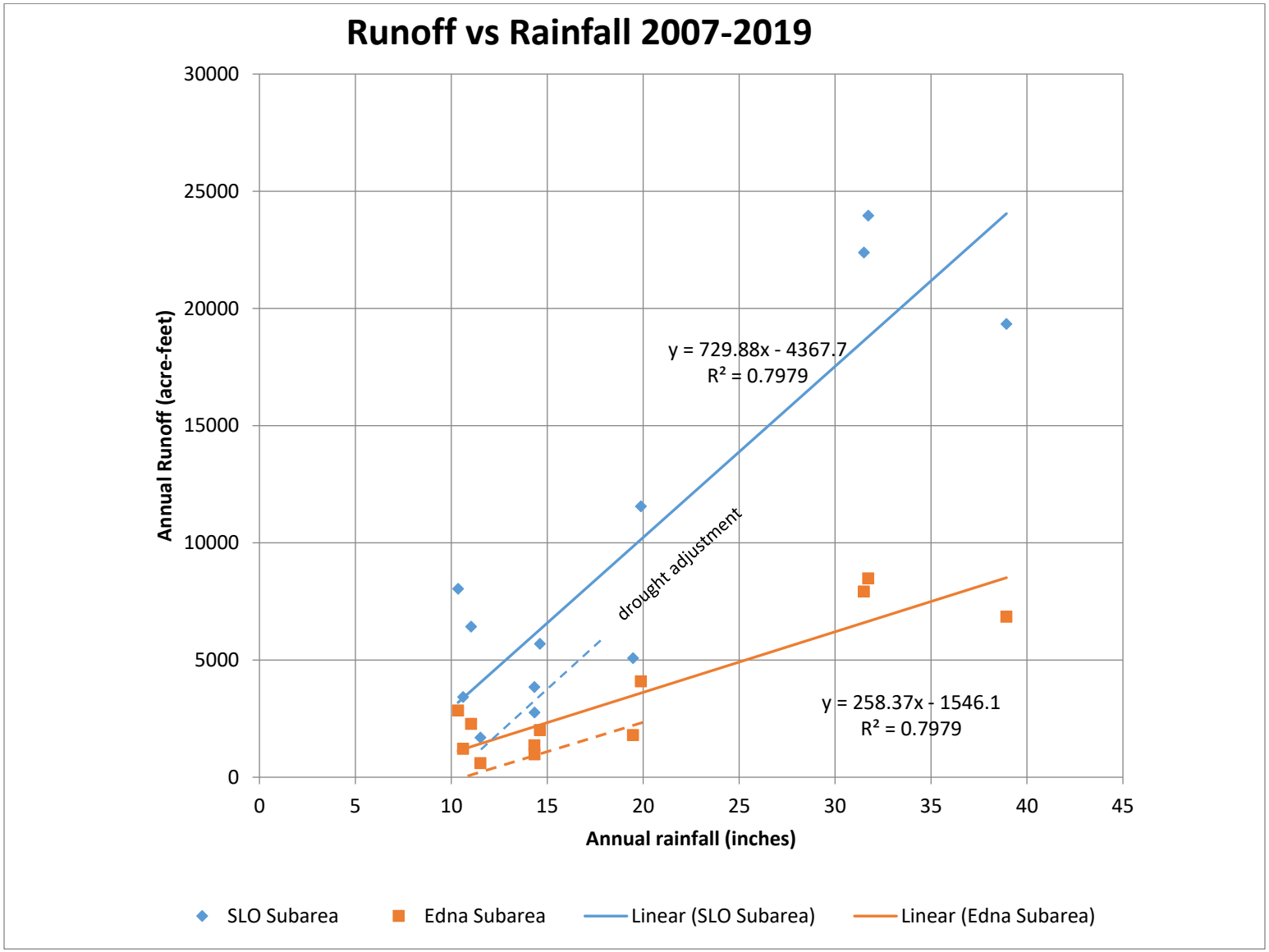


Figure 6-14: Runoff vs Rainfall Correlation for Subareas.

Stream inflow on the West Coral de Piedra sub-watershed 5 (Figure 6-13) was reduced to account for surface water diversions. There is a permitted reservoir where surface water diversion is utilized mainly for agricultural irrigation (SWRCB, 1990). The stream inflow adjustment consisted of correlating the total reported diversions from Statements of Diversion and Use between 2010 and 2018 with annual precipitation, and applying the correlation to other years in the base period (the r-squared value of the correlation 0.71) is. Reported annual surface water diversions ranged from 14 acre-feet to 900 acre-feet, with average annual diversion over the base period estimated at 350 acre-feet per year (AFY), including estimated reservoir evaporation which was added to the diversion. The resulting estimated stream inflow estimates for the historical base period are shown in the surface water budget of Table 6-1, Table 6-2, and Table 6-3.

Groundwater-Surface Water Interaction (Net)
Groundwater-surface water interactions take place primarily along stream channels. When groundwater is rising into streams (gaining reaches of a stream), the interaction is a surface water budget inflow and a groundwater budget outflow. Conversely, when stream flow is percolating to groundwater (losing reaches of a stream), the interaction is a surface water budget outflow and groundwater budget inflow. This water budget has combined the gaining and losing stream reaches into single (net) term, the result of which are net losing streams in the Basin which is an outflow component of the surface water budget and inflow component of the groundwater budget. Net groundwater-surface water interaction was estimated by adjusting the percent of stream inflow that recharges groundwater while optimizing the water balance. The optimization consisted of minimizing the sum of squares of the residual error between the calculated change in storage and measured change in storage (Section 6.3.4.1).

Treated wastewater discharge to streams
The City of San Luis Obispo discharges treated wastewater into San Luis Obispo Creek. Available records of wastewater treatment plant discharges have been compiled by water year. Daily discharge records provided by the City were compiled for water years 2001-2019. For water years 1987-2000, treated wastewater discharges were estimated as a nominal 65 percent of total City water deliveries, based on the average ratio of annual wastewater flows to water deliveries in the years 2001-2019. The treated wastewater discharges to San Luis Obispo creek are presented in the surface water budget of Table 6-1.

Local Imported Supplies
The City of San Luis Obispo imports water from three reservoirs. Surface water deliveries from Salinas and Whale Rock reservoirs occurred through the historical base period, while Nacimiento reservoir water deliveries to the City began in 2011. Surface water reservoirs have historically provided most of the water supply used by the City. Local imported water supplies are based on City records and Boyle (1991). Local imported supplies are presented in the surface water budget of Table 6-1.

Cal Poly imports surface water and also pumps groundwater for agricultural irrigation. Fields overlying and adjacent to the Basin are typically irrigated with groundwater, while imported surface water is generally used for irrigation outside of the Basin boundary. Therefore, only the local imported supplies used for potable water deliveries by the City have been accounted for in the GSP water budgets.

6.3.3.2 Components of Surface Water Outflow
The surface water budget includes the following sources of outflow:

- Evapotranspiration of Precipitation
- Evapotranspiration of Applied Water
- Infiltration of Precipitation
- Infiltration of Applied Water

- Surface Water Deliveries Offset
- Wetland/Lake ET
- Groundwater-Surface Water Interaction
- Stream outflow (runoff)

Evapotranspiration of Precipitation

The fate of precipitation that falls within the Basin boundaries can be divided into three components: evapotranspiration, infiltration, and runoff. Of these three, infiltration has the greatest influence on the groundwater budget and ultimately, Basin sustainable yield. Therefore, the approach to estimating the fate of precipitation uses a methodology focused primarily on infiltration, but from which the other two components may also be estimated. This methodology is based on work by Blaney (1933, 1963), and which has been used for other analytical water budgets in major studies of central coast Basins (DWR, 2002; Fugro, 2002).

Evapotranspiration is the evaporation of water from surfaces and the transpiration of water from plants. The first seasonal rains falling on the Basin are mostly evaporated directly from surfaces (vegetative canopy, soil, urban area hardscapes) and used to replenish soil moisture deficits that accumulate during the dry season. For the Arroyo Grande – Nipomo Mesa area of the Santa Maria groundwater Basin, DWR (2002) assumed that precipitation could begin to infiltrate to groundwater (deep percolate) only after 11 inches of annual precipitation had fallen in urban and agricultural irrigation areas, and when 17 inches of rainfall had fallen in areas of native vegetation. In the Paso Robles groundwater Basin, an estimated 12 inches of annual rainfall was needed for infiltration below agricultural lands, while 18 inches of rainfall was needed for infiltration beneath native ground cover and urban/suburban areas (Fugro, 2002).

These threshold values for minimum annual rainfall prior to infiltration are assumed to approximate the annual evapotranspiration of precipitation. Once these thresholds are exceeded, infiltration to groundwater and runoff would become dominant. It is recognized that a portion of the initial annual rainfall may result in runoff, depending on rain intensity, but this is assumed to be offset by the portion of the late season rainfall that is evapotranspired. Since infiltration is the critical component of precipitation with respect to Basin safe yield, offsetting of early wet season runoff with late wet season evapotranspiration in the water budget is considered a reasonable approach.

The specific thresholds for annual rainfall that is estimated to evapotranspire prior to infiltration and runoff have been developed from Blaney's field studies. Evapotranspiration of precipitation has been estimated by multiplying land use/land cover acreages by the infiltration threshold values. Results of these estimates are shown in the surface water budget of Table 6-1, Table 6-2, and Table 6-3. Additional details of the methodology are provided in section 6.3.4.1 (Components of Groundwater Inflow).

Evapotranspiration of Applied Water

The evapotranspiration of applied irrigation water has been divided into urban and agricultural sectors. Urban applied water includes residential outdoor irrigation, urban recycled water use, and golf course/play field irrigation. Much of the urban applied water is accounted for by City of San Luis Obispo or other water purveyor records. Estimation of applied water for urban and agricultural irrigation not supplied by purveyors involves a soil-moisture balance approach discussed in section 6.3.4.1 (Components of Groundwater Outflow).

Most water applied for irrigation is taken up by plants and transpired. Some water, however, is lost to evaporation or infiltrates to groundwater as return flow. The evapotranspiration of applied irrigation water has been calculated by subtracting the estimated return flow from the applied water estimates. Both

applied water and return flow estimates are presented under the historical groundwater budget section. Results of the calculations of evapotranspiration of applied water are shown in the surface water budget of Table 6-1, Table 6-2, and Table 6-3.

Riparian Corridor Evapotranspiration

Riparian plant communities present along the creeks can access surface flows and creek underflow. Riparian areas are included within the native brush, trees, and grasses acreage for the subareas (Table 6-6). Besides evapotranspiration of precipitation, however, an additional 0.8 acre-feet per acre of consumptive water use is estimated for riparian corridors (Fugro, 2002; Robinson, 1958) that lie within potential Groundwater Dependent Ecosystems, which cover approximately 200 acres in the San Luis Valley subarea and 50 acres in the Edna Valley Subarea (Figure 5-15; Chapter 5). Riparian corridor water use during severe drought is reduced a nominal 50 percent to reflect lack of creek underflow. Riparian evapotranspiration is included in Table 6-1, Table 6-2, and Table 6-3.

Infiltration of Precipitation and Applied Water

Infiltration of precipitation and applied water are both outflow components from the surface water budget and inflow components to the groundwater budget. Discussion of these components is provided in Section 6.3.4.1 (Components of Groundwater Inflow).

Surface Water Deliveries Offset

When imported surface water is brought into the Basin from local supplies (Salinas Reservoir, Whale Rock Reservoir, and Nacimiento Reservoir), it is counted as surface water inflow. This imported water is then provided to customers through surface water deliveries from the City water treatment plant. After residential and business use, most of the delivered water is conveyed by sewer to the wastewater treatment plant for recycling and discharge into San Luis Obispo Creek. Since wastewater discharges to the creek are also counted as surface water inflow, an offset factor is needed to avoid double counting that portion of imported surface water. The surface water deliveries offset is an outflow equal to the wastewater discharges inflow and is shown in the surface water budget of Table 6-1.

Laguna Lake

Laguna Lake is an approximate 100-acre open water body within the San Luis Valley subarea (Figure 3-10; Chapter 3). There are an additional 100 acres of adjacent wetlands connected to the lake. Evaporation from the water surface and transpiration by phreatophytes in the wetlands are included in the water budget as surface water outflow. Local pan evaporation is estimated at 70 inches per year (for all years), with a reservoir coefficient of 0.7, based on a review of information from nearby reservoirs (San Luis Obispo County, 2005). The resulting estimated annual evaporation rate for this water budget component is 4.1 feet (not including offset from direct precipitation). Evapotranspiration by phreatophytes were estimated to use lake water at a rate equal to irrigated pasture applied water demand. Results for Wetland/Lake ET outflow from the surface water budget are shown in Table 6-1. As with riparian water use, during severe drought the lake and wetland evapotranspiration is reduced by 50 percent.

Groundwater-Surface Water Interaction (Net)

Groundwater-surface water interaction involves both surface water and groundwater budgets. The net interaction is an outflow component for the surface water budget and an inflow component for the groundwater budget (losing streams. Details of the methodology used to develop the groundwater-surface water interaction are presented in the Sections 6.3.4.1 and 6.3.6.

Stream Outflow from Basin

Stream outflow from each subarea was estimated using the water balance method and compared to available flow records. No significant changes to surface water in storage are assumed in the water budget from year to year. Storm water runoff exits the Basin annually, and Laguna Lake storage fluctuations are considered minor compared to the total surface water budget. Surface water supply reservoirs are outside of the Basin boundary.

Using the water budget equation, stream outflow is estimated as the difference between total surface water inflow and all other components of surface water outflow. Results of stream outflow calculations are presented in the main water budget Tables.

There are limited annual stream flow records available for comparison to the estimates in the historical surface water budget. For the San Luis Valley subarea, the only applicable published records for stream outflow from the San Luis Valley subarea are two years of data recorded on Lower San Luis Obispo Creek at San Luis Bay Drive. In the 1971 water year, 20.46 inches of rainfall was recorded at Cal Poly and approximately 14,000 acre-feet of stream flow was reported at the San Luis Bay Drive gage (records missing in October). In the 1972 water year, 12.42 inches of rainfall was recorded at Cal Poly with 4,260 acre-feet of stream flow at the San Luis Bay Drive gage (San Luis Obispo County, 1974). These two years are outside of the historical water budget base period, and a comparison of flow for water years with similar precipitation suggests that the estimated Basin outflows are reasonable.

Measured annual flows on Pismo Creek downstream of the Basin boundary are also available for only two water years, 1991 and 1992 (Balance Hydrologics, 2008). These are years within the historical base period, although the flows were measured at Highway 101, where Pismo Creek has a watershed of 38 square miles, compared to 25 square miles upstream of the Basin boundary. Estimated outflow in the water budget from the Edna Valley subarea for 1991 and 1992 are lower than the flows measured at Highway 101, as would be expected. Table 6-7 shows the stream outflow comparisons.

Table 6-7: Stream Outflow Comparison.

Location	Water Year	Precipitation at Cal Poly (in.)	Flow (acre-feet)
San Luis Obispo Creek at San Luis Bay Drive gage	1971	20.46	13,705*
San Luis Valley subarea stream outflow estimate	2003	22.9	15,390
San Luis Obispo Creek at San Luis Bay Drive gage	1972	12.42	4,260
San Luis Valley subarea stream outflow estimate	1990	13.36	3,360
Pismo Creek at Highway 101 gage	1991	18.6	2,033
Edna Valley subarea stream outflow estimate			1,840
Pismo Creek at Highway 101 gage	1992	22.14	4,640
Edna Valley subarea stream outflow estimate			3,590

*October 1970 missing – estimate 300 acre-feet = approx. 14,000 acre-feet for year

6.3.4 Historical Groundwater Budget

The groundwater budget includes the following sources of inflow:

- Infiltration of Precipitation
- Groundwater-Surface Water Interaction
- Subsurface Inflow
- Infiltration of Applied Water

The groundwater budget includes the following sources of outflow:

- Groundwater Extractions
- Subsurface Outflow
- Groundwater-Surface Water Interaction

6.3.4.1 Components of Groundwater Inflow

Infiltration of Precipitation

Infiltration of precipitation refers to the amount of rainfall that directly recharges groundwater after moving through the soil and unsaturated zone (Figure 6-2). Direct measurement of infiltration has not been performed in the Basin, and estimates have been prepared based on prior work by Blaney (1933) in Ventura County Basins and Blaney et al. (1963) in the Lompoc Area. These studies involved soil moisture measurements at rainfall penetration test plots with various types of land cover, and the resulting deep percolation versus rainfall correlations have been considered applicable to central coast Basins (DWR, 2002; Fugro, 2002). The work by Blaney is several decades old, however, modeling efforts have shown the generalizations are relatively accurate for semi-arid climates (Rosenberg, 2001). The main advantage of Blaney's approach is that it is based on direct measurements of infiltration of precipitation.

Criteria based on Blaney et al. (1963) were used for analytical water budgets in the Santa Maria Valley and Tri-Cities Mesa areas , where it was assumed that precipitation could infiltrate only in urban and agricultural areas when 11 inches of precipitation had fallen annually, and on areas of native vegetation when 17 inches of precipitation had fallen annually. Any amount of rainfall above 30 inches annually was not considered to contribute to deep percolation of precipitation, regardless of the land use classification (DWR, 2002). Correlations between infiltration and annual rainfall based on Blaney (1933) were also used for the 2002 Paso Robles groundwater Basin analytical water budget (Fugro, 2002).

Estimates for infiltration of precipitation for the SLO Basin have been developed by applying Blaney correlations that restrict deep percolation to precipitation in agricultural areas that occurs after 11-12 inches of rainfall, and in native vegetation areas after approximately 18 inches of rainfall. Native vegetation was the most restrictive land cover for infiltration when tested by Blaney due to high initial soil moisture deficiencies.

Urban areas were not part of the original studies by Blaney. The low permeability of hardscape (buildings and paving) limits infiltration and increases surface evaporation, compared to other types of land cover, but hardscape also increases runoff, which can lead to greater infiltration in adjacent areas receiving the runoff. Therefore, the infiltration threshold was set higher than irrigated agricultural land, but not as high as native grasslands. The Blaney correlation that produces infiltration between irrigated agriculture and native grassland is the curve for non-irrigated grain, with an infiltration threshold of approximately 14 inches of rainfall. Figure 6-15 plots the data collected by Blaney (1933).

As with prior work by the DWR in northern Santa Barbara and southern San Luis Obispo Counties, rainfall above 30 inches was not considered to contribute to deep percolation in the Basin (DWR, 2002). Infiltration of precipitation results are shown in the water budget tables and graphs.

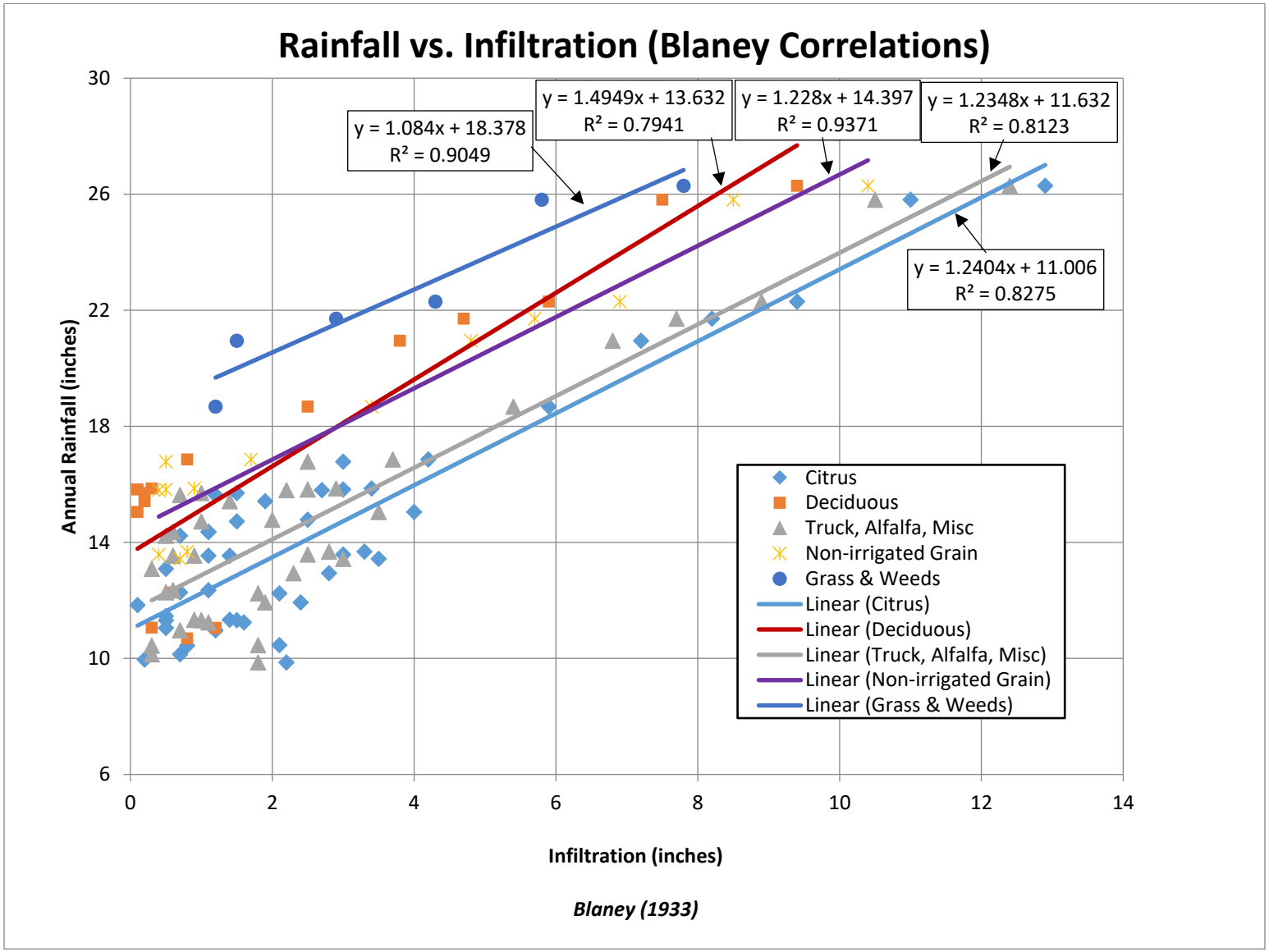


Figure 6-15: Rainfall vs Infiltration.

The land use classifications for which infiltration thresholds have been developed for this GSP include citrus, deciduous, pasture, vegetable, vineyard, native brush/grassland (includes riparian corridors), wetland, urban developed/open space, and Urban turf. The minimum rainfall needed before infiltration of precipitation can occur for various land uses and covers are summarized in Table 6-8.

Table 6-8: Minimum Rainfall for Infiltration.

Land Use/Cover	Infiltration Threshold (in.)
Citrus	11.0
Deciduous	13.6
Pasture	11.6
Vegetable	11.6
Vineyard	13.6
Native brush/grassland	18.4
Wetland*	11.6
Urban developed/open space	14.4
Urban turf	11.6

* ET of precip. prior to runoff (no infiltration)

Wetland soils are assumed to be close to field capacity due to shallow groundwater and the infiltration threshold is only used for estimating ET in the surface water budget, with the remaining precipitation as runoff (mainly into Laguna Lake).

Groundwater-Surface Water Interaction (Net)

As previously mentioned, groundwater-surface water Interaction involves both components of the surface water and groundwater budgets. The net interaction is an outflow component of the surface water budget and inflow component of the groundwater budget (losing streams).

The groundwater-surface water interaction component is estimated using a mass balance approach for the Edna Valley subarea by adjusting the percent of stream inflow that percolates to groundwater (as Basin recharge) while minimizing the sum of squares of the residual error between the calculated change in storage and the measured change in storage (specific yield method) for multiple years. A similar optimization was performed for the San Luis Valley subarea except a variable percentage was used depending on the type of year (a greater percentage of stream flow percolation during lower rainfall years). A spill mechanism was developed in the budget to allow groundwater outflow to streams when storage reached full capacity, which was set to a nominal 37,000 acre-feet based on historical storage estimates using the specific yield method. The groundwater-surface water interaction estimates are in the water budget tables. Additional details of the calibration methodology used to minimize the residual error are presented in Change in Storage (Section 6.3.6).

Subsurface inflow

Subsurface inflow from bedrock surrounding the groundwater Basin flows into both subareas. Subsurface inflows were estimated using Darcy's Law, which is an empirical formula describing the flow of fluid though a porous material, and expressed as:

$$Q = -K\frac{dh}{dl}A$$

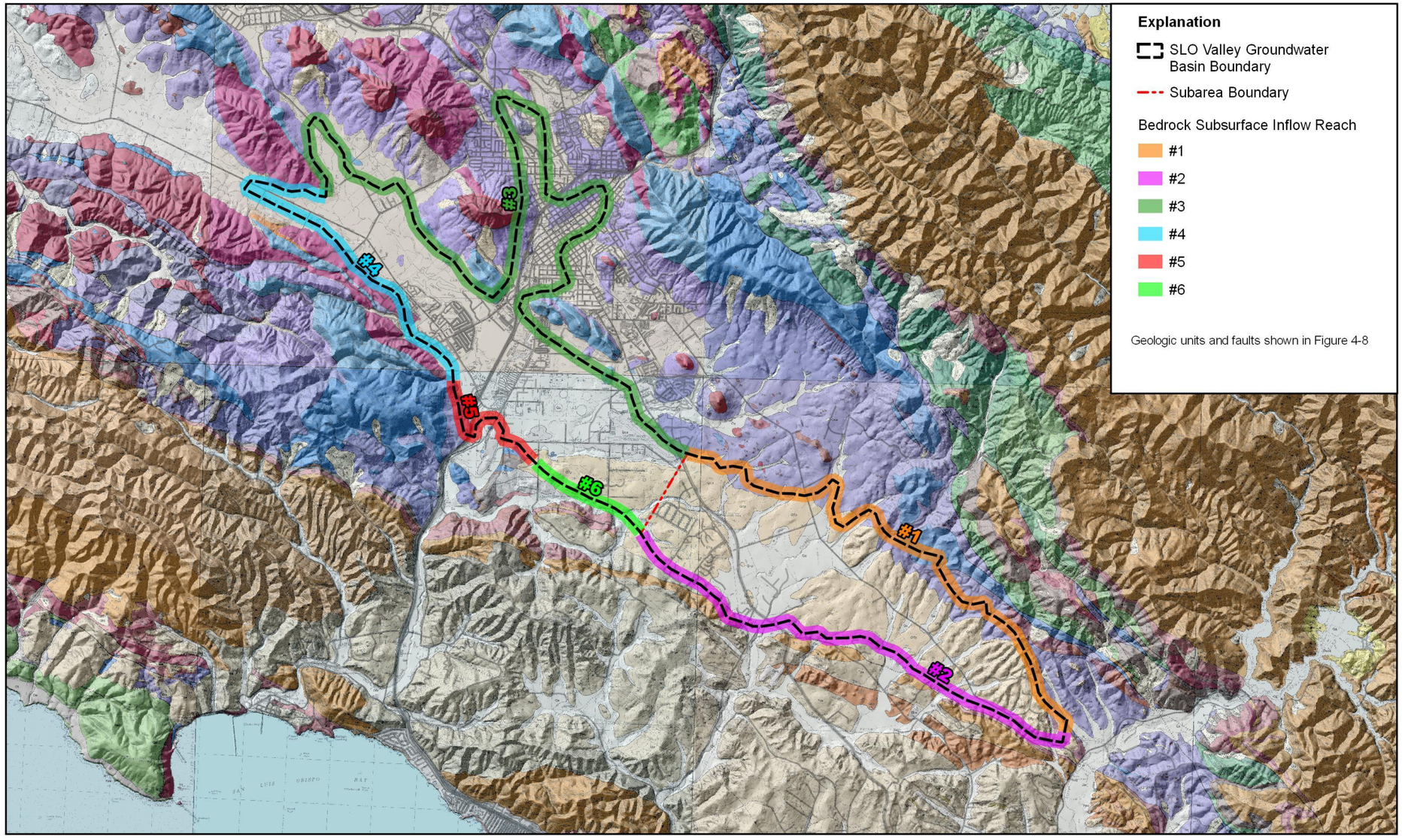
Where:
Q = groundwater discharge rate through a cross-sectional area of the porous material
K = hydraulic conductivity of the material
$\frac{dh}{dl}$ = hydraulic gradient at the cross-section
A = cross-sectional area

The negative sign denotes that flow is in the direction of decreasing pressure. Since groundwater pressures are greater within the bedrock hills surrounding the Basin than beneath the alluvial valleys, there is subsurface inflow to the Basin from bedrock. Similarly, groundwater elevations in the Edna Valley subarea are greater than in the San Luis Valley subarea and the direction of subsurface flow is from the Edna Valley to the San Luis Valley. The application of Darcy's Law to estimate subsurface inflow from bedrock involves simplification and assumptions of uniformity in the subsurface. The Basin boundary was divided into six reaches, each representing different boundary conditions. Cross-sectional areas for boundary flows were based on the length of each reach times the average thickness of adjacent saturated Basin sediments determined from cross-sections presented in Chapter 4. Hydraulic gradients for each reach were developed by averaging topographic slopes between a line along the Basin boundary and a line drawn at a 5,000-foot setback from the Basin boundary, and assuming the hydraulic gradient paralleled these slopes. Hydraulic conductivity was estimated for each reach based on the bedrock type, a review of pumping test data in the SLO Basin Characterization Report (GSI, 2018), and structural features. Table 6-9 summarizes the results of subsurface inflow estimates. Bedrock subsurface inflow reaches are shown on Figure 6-16.

Table 6-9: Subsurface Inflow Estimates.

Reach	Bedrock Formation	Boundary description	Length	Thickness	Hydraulic gradient	Hydraulic conductivity	Inflow
			ft	ft	ft/ft	ft/day	AFY
1	KJf melange w/serp.	Depositional	43,900	100	0.05	0.05	90
2	Monterey/Lower Pismo	Edna fault	38,100	200	0.01	0.03	30
3	KJf melange w/serp.	Depositional	88,300	20	0.09	0.05	130
4	JKf metavolcanics	Los Osos fault	28,600	40	0.09	0.2	220
5	KJf melange w/serp.	Los Osos fault	12,200	60	0.05	0.05	20
6	Obispo/Rincon w/ serp.	Depositional	9,500	60	0.06	0.05	10
Note: KJf - Fransiscan Assemblage				San Luis Valley subarea			320
Serp. = serpentinite				Edna Valley subarea			110
AFY = acre-feet per year				Basin total			430

Basin boundary types for evaluating subsurface inflow are depositional or fault-bounded. Depositional boundaries occur where Basin sediments gradually thin toward the Basin boundary, while fault boundaries are where Basin sediments are abruptly offset by faulting. Fault boundaries are generally on the south side



Prepared For:

COUNTY OF SAN LUIS OBISPO

Author: TK
Date: 06/18/2020

SAN LUIS OBISPO VALLEY BASIN GSP

N

0 0.5 1 1.5 mi
0 0.5 1 1.5 2 km

References:

1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hirozontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: Dibble (DF-129, DF-130, DF-210, DF-211, DF-212, DF-213, DF-214)

Notes:

1.
2.
3.

Bedrock Subsurface Inflow Reaches

Figure 6-16

of the Basin, while depositional boundaries are on the north side (see geologic-cross sections in Chapter 4). Thicknesses at the Basin boundary are estimated from Basin cross-sections (Chapter 4).

The hydraulic conductivity of bedrock across the Basin boundary was estimated at a nominal 0.05 feet per day, with two exceptions (Table 6-9). The Franciscan Assemblage metavolcanics are more permeable where fractured along the Los Osos fault zone (southwest Basin boundary; Figure 4-8), and are assigned a greater hydraulic conductivity. The Edna fault (Figure 4-8) offsets sedimentary beds along the Basin boundary and is interpreted to create a barrier to groundwater flow, corresponding to lower permeability.

Subsurface inflow to the San Luis Valley subarea also takes place as Basin cross-flow from the Edna Valley subarea. A subsurface profile of the bedrock high was developed as part of this GSP using geophysical methods (CHG, 2019). Darcy's Law was used to estimate subsurface flow based on a cross-sectional area of 140,000 square feet (approximately 3,500 feet in length and 40 feet saturated depth), a typical hydraulic gradient perpendicular to the boundary of 0.004 feet per foot (average of high and low values from 1986 and 2019 water level contour maps) and an estimated hydraulic conductivity for the sediments of 7 ft/day from local pumping tests listed in the SLO Basin Characterization Report (GSI,2018). The resulting estimated average subsurface cross-flow from the Edna Valley subarea to the San Luis Valley subarea is 30 AFY.

Infiltration of Applied Water (Return Flows)

Estimates for infiltration of applied water include urban return flow and agricultural return flow. Urban return flow comes from water delivered for domestic or commercial/industrial uses that infiltrates to groundwater, mainly through landscape/turf irrigation and septic system discharges (includes suburban/rural residential return flow and recycled water return flow). Urban return flow does not include City wastewater that is discharged to San Luis Obispo Creek, which is accounted for in the surface water budget. Agricultural return flows come from applied irrigation water to crops.

The first step in estimating urban return flows was to separate all delivered water (groundwater pumped from the Basin and imported surface water supplies) into indoor and outdoor use. An estimated 5 percent of indoor use is assumed to be consumptive use (95 percent return flow; EPA, 2008), while 85 percent of outdoor use is consumed (15 percent return flow) based on the typical range of estimates for other local Basins (DWR, 2002; Fugro, 2002). Almost all Indoor water use drains to septic systems or sewer systems. Outdoor water use is generally for irrigation, most of which evapotranspires into the atmosphere.

The distribution of indoor to outdoor water use will vary based on the user. City customers are estimated to average 70 percent indoor use and 30 percent outdoor use, based on approximately 65 percent of delivered water reaching the wastewater treatment plant (with 5 percent indoor consumptive use). Large parcel residential water users outside of City limits tend to use a greater percentage of water for outdoor use than City residents. Businesses served by small water companies can have a wide range of indoor and outdoor distribution, and were assigned values based on the results of a local study on business water use (City of San Luis Obispo, 2000).

The indoor and outdoor water use and associated return flows from water use by City, suburban/rural residential, and small water systems were compiled, together with estimated return flow from recycled water use. Infiltration of Applied Water estimates for urban and agricultural sectors are presented in the historical water budget Table 6-1, Table 6-2, and Table 6-3.

6.3.4.2 Components of Groundwater Outflow

Urban Groundwater Extractions

Groundwater extraction from wells is the primary component of outflow in the groundwater budget. Estimates for historical pumping were derived from various sources, including purveyor records, land use data and water duty factors, and daily soil-moisture budgets. Available purveyor records (meter records) were obtained from the following Basin users:

- City of San Luis Obispo
- Golden State Water Company
- Edna Valley East Mutual Water Company
- Varian Ranch Mutual Water Company

Production records ranged from weekly to quarterly, and were compiled to reflect the water year per GSP requirements. The City used groundwater from wells between 1989 and 2014, with the highest use in water years 1990, 1991, and 1992, averaging 1,830 AFY. Overall City groundwater use averaged 405 AFY between 1989 and 2014. Golden State Water Company averaged 335 AFY over the historical base period (1987-2019), although average water use over the last 5 water years is approximately 210 AFY. Edna Valley East MWC and Varian Ranch MWC have averaged approximately 100 AFY combined since reaching full development in the late 1990s, with 80 AFY combined over the last 5 years.

There are also 42 small water systems, mostly in the San Luis Valley subarea, which use groundwater from wells. Each water system was assigned a use category, and a corresponding water use factor. For example, groundwater use for commercial service connections were assigned water use based on building square footage (from aerial image review), with a 0.06 acre-foot per year per square foot use factor. Water use factors for local use categories were obtained from the results of a study conducted by the City of San Luis Obispo utilities conservation office (SLO City, 2000). The water use estimate was developed for current conditions, as almost all water companies were active throughout the historical base period. The total amount of water used by small water systems in the Basin is estimated at 270 AFY, with the majority of use (260 AFY) in the San Luis Valley subarea. Less than 10 of the 42 small water systems using groundwater are connected to the City sewer.

Urban groundwater extractions have also been used for golf course irrigation (turf). Laguna Lake golf course was served by groundwater wells through 2007, with recycled water use from the City beginning in 2008. San Luis Country Club uses a combination of recycled water use from County Service Area 18 and groundwater. The groundwater extractions and recycled water use components of urban turf irrigation are accounted for separately in the water budget. Estimates for turf irrigation water demand used the same daily soil moisture balance program as crop irrigation (see Agricultural Irrigation).

Rural Residential Groundwater Extractions

Rural residential groundwater use was estimated based on the number of residences identified on aerial images outside of water company service areas. Each rural residence was assigned a water use of 0.8 AFY, consistent with the San Luis Obispo County Master Water Plan (Carollo, 2012). As a comparison, the City study reported residential use for large parcels (>0.26 acres) at 0.6 AFY (City of San Luis Obispo, 2000), which is similar to the average estimated use per service connection in the Golden State Water Company service area over the historical base period. Water use per connection at Varian Ranch MWC and Edna Valley East MWC has ranged from 0.6 to 1.5 AFY, averaging approximately 1 acre-foot per year over the historical base period defined in Section 6.1.1.

Aerial images for 1986, 1994, 2009, and 2018 were reviewed for rural residential development. The estimated number of residences outside of water company service areas was compiled, and resulting computed rural residential water use for these years is presented in Table 6-10.

Table 6-10: Rural Residential Water Use.

Year	SLO subarea	Edna Subarea	Basin Total
	Estimated Number of Residences[1]		
1986	108	54	162
1994	119	61	180
2009	162	145	307
2018	173	158	331
	Estimated Water Use (AFY)[2]		
1986	86	43	130
1994	95	49	144
2009	130	116	246
2018	138	126	265

[1]outside of water company service areas
[2]based on 0.8 AFY per residence

Agricultural Groundwater Extractions

Groundwater use for agricultural irrigation has been estimated using the DWR Consumptive Use Program Plus (CUP+; DWR, 2015) which is a crop water use estimator that uses a daily soil moisture balance. CUP+ was developed as part of the 2013 California Water Plan Update to help growers and agencies estimate the net irrigation water needed to produce a crop.

Daily climate data from CIMIS Station #52 (San Luis Obispo) from 1986 to 2019 were used by the CUP+ program, along with estimates for various crop and soil parameters. The climate data is used to determine local reference evapotranspiration (ETo) on a daily basis. Crop coefficients are then estimated for up to four growth stages (initial, rapid, mid-season, late-season) which determine the crop evapotranspiration (ETc) values. Lastly, the CUP+ program uses variables related to the soil and crop type to determine the estimated applied water demand (ETaw), which is equivalent to the net irrigation requirement. Figure 6-17 shows the annual ETaw for various crops during the historical base period, along with the reference evapotranspiration (ETo) and precipitation at CIMIS Station #52.

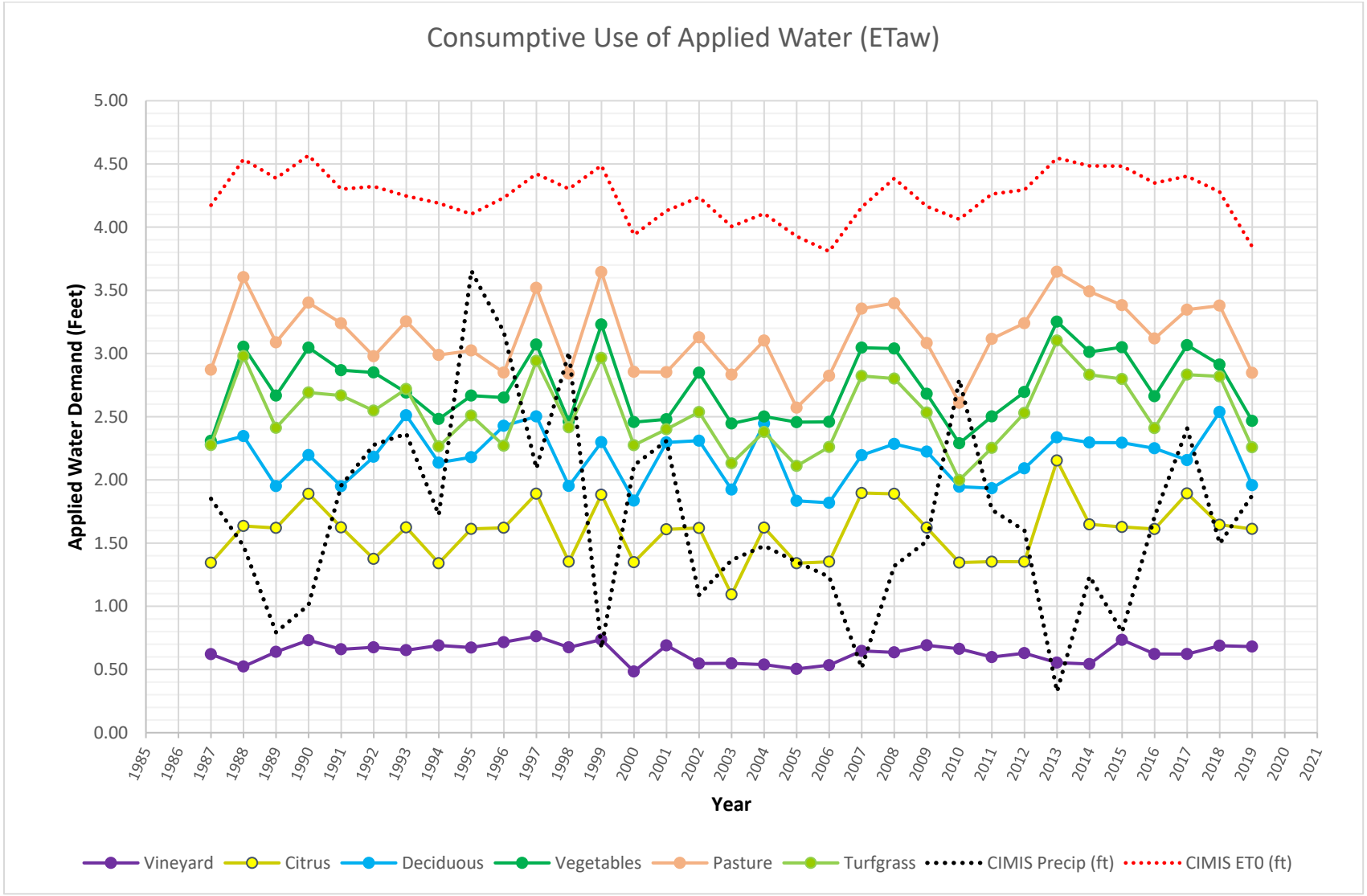


Figure 6-17: Consumptive Use of Applied Water.

Crop types were grouped according to the classification used by County Agricultural Commissioner's Office for crops overlying the Basin. These crop types included citrus, deciduous (non-vineyard), pasture, vegetable, and vineyard. A turf grass classification was added for estimating Urban sector water demand served by groundwater. The CUP+ program provides monthly water demand for each crop type during the hydrologic base period (1987-2019). Low, medium, and high consumptive use of applied irrigation water estimates are presented in Table 6-11. Low and high consumptive use are the respective annual minimum and maximum estimates over the base period, while medium consumptive use is the average. The CUP+ applied water requirement for vegetables was reduced by 40 percent to account for fallow acreage, which is not in production at any given time, based on historical aerial image review.

Table 6-11: Consumptive Use of Applied Water.

Crop Type	Acre-feet per acre per year		
	Low	Med	High
Citrus	1.1	1.6	2.2
Deciduous	1.8	2.2	2.5
Pasture	2.6	3.1	3.7
Vegetables*	1.4	1.6	2.0
Vineyard	0.5	0.6	0.8
Turfgrass	2	2.6	4.1

*60 percent of ETaw to account for fallow fields

As previously discussed in section 6.3.2 (Historical Land Use), the distribution of crop acreage was determined by a review and correlation of DWR and County crop surveys with aerial imagery. Crop acreages were interpolated between the years with data.

Applied water demand volumes were calculated by multiplying the annual acreage for each crop by the average annual applied water demand during each year. The final applied water estimates used for the water budget were adjusted to include efficiency (with system leakage) factors of 80 percent for drip/micro emitter and high-efficiency sprinkler irrigation (citrus, deciduous, vineyard, and turfgrass) and 75 percent for mostly sprinkler with some drip irrigation (pasture and vegetables). The estimated groundwater extractions for agricultural water use are shown in the main water budget Table 6-1, Table 6-2, and Table 6-3.

Wetland Direct ET

There are approximately 570 acres of wetlands and open water in the San Luis Obispo subsurface (Table 6-6), of which approximately 100 acres are open water and 100 acres are wetlands directly connected to Laguna Lake (based on aerial image review) and part of the surface water budget. The remaining 370 acres of wetlands, most of which extend northwest of Laguna Lake into the Los Osos Valley, are assumed to be areas with seasonally shallow groundwater where evapotranspiration by native grasses effectively draws from the groundwater reservoir.

The water demand of wetlands through direct groundwater use is assumed to be equivalent to average consumptive use of irrigated pasture as shown in Table 6-11. Any rainfall over 11.6 inches (Table 6-8) also contributes to meeting wetland water demand. Wetland direct ET estimates are shown in Table 6-1.

Subsurface Outflow

Subsurface outflow from Basin sediments occurs as underflow along the main creek channels (San Luis Obispo Creek and Pismo Creek). Outflow volumes were estimated using Darcy's Law (see Subsurface Inflow in Section 6.3.4.2). Table 6-12 presents the parameters used for subsurface outflow estimates.

Table 6-12: Subsurface Outflow Estimates.

Location	Cross-sectional Area	Hydraulic gradient	Hydraulic conductivity	Outflow
	ft^2	ft/ft	ft/day	AFY
San Luis Obispo Creek	46,800	0.004	65	100
Pismo Creek*	20,600	0.01	20	35

*begins at confluence of West Corral and East Corral de Piedra Creeks (Figure 4-2; Chapter 4)

Cross sectional areas for outflow were based on the estimated width and saturated depth of alluvial deposits in the vicinity of where the creeks exit the groundwater Basin. Hydraulic gradients are the approximate grade of the stream channel, and the hydraulic conductivities are based on pumping tests (GSI, 2018; CHG, 2018). Additional subsurface outflow from the San Luis Valley subarea occurs along Davenport Creek and East Fork Creek, but would be significantly less than San Luis Obispo Creek due to shallower and less permeable alluvial deposits. Total average subsurface outflow from the San Luis Valley subarea is estimated at 100 AFY from San Luis Obispo Creek and a nominal 20 AFY from the smaller tributaries, for a total of 120 AFY. Subsurface outflow from the Edna Valley subarea along the Canada Verde drainage and tributaries is estimated to be similar to Pismo Creek (35 AFY), for a total subsurface outflow from that subarea of 90 AFY (35 AFY each from Pismo Creek and Canada Verde, and 20 AFY cross-flow through the bedrock high; see Subsurface Inflow section above).

6.3.5 Total Groundwater in Storage

Groundwater is stored within the pore space of Basin sediments. The Specific yield is a ratio of the volume of pore water that will drain under the influence of gravity to the total volume of saturated sediments. The specific yield method for estimating groundwater in storage is the product of total saturated Basin volume and average specific yield. Calculation of total groundwater in storage for selected years was performed based on the specific yield method.

Estimates of specific yield for Basin sediments were obtained based on a review of 21 representative well logs. The lithology for each well log was correlated with specific yield values reported for sediment types in San Luis Obispo County (Johnson, 1967). A summary of the correlations is shown in Table 6-13. Locations of well logs used for the specific yield correlations are shown in the referenced cross-sections from the SLO Basin Characterization Report (GSI, 2018).

Groundwater in storage calculations were performed for the Spring conditions of 1986, 1990, 1995, 1998, 2011, 2014, and 2019 using the specific yield method. Water level contours for each year were prepared based on available water level data from various sources, including the County water level monitoring program, Geotracker Groundwater Information System data, groundwater monitoring reports, Stakeholder provided information, and Environmental Impact Reports. Water level contour maps for the Spring 1986 and Spring 2019 are shown in Figure 6-18 and Figure 6-19.

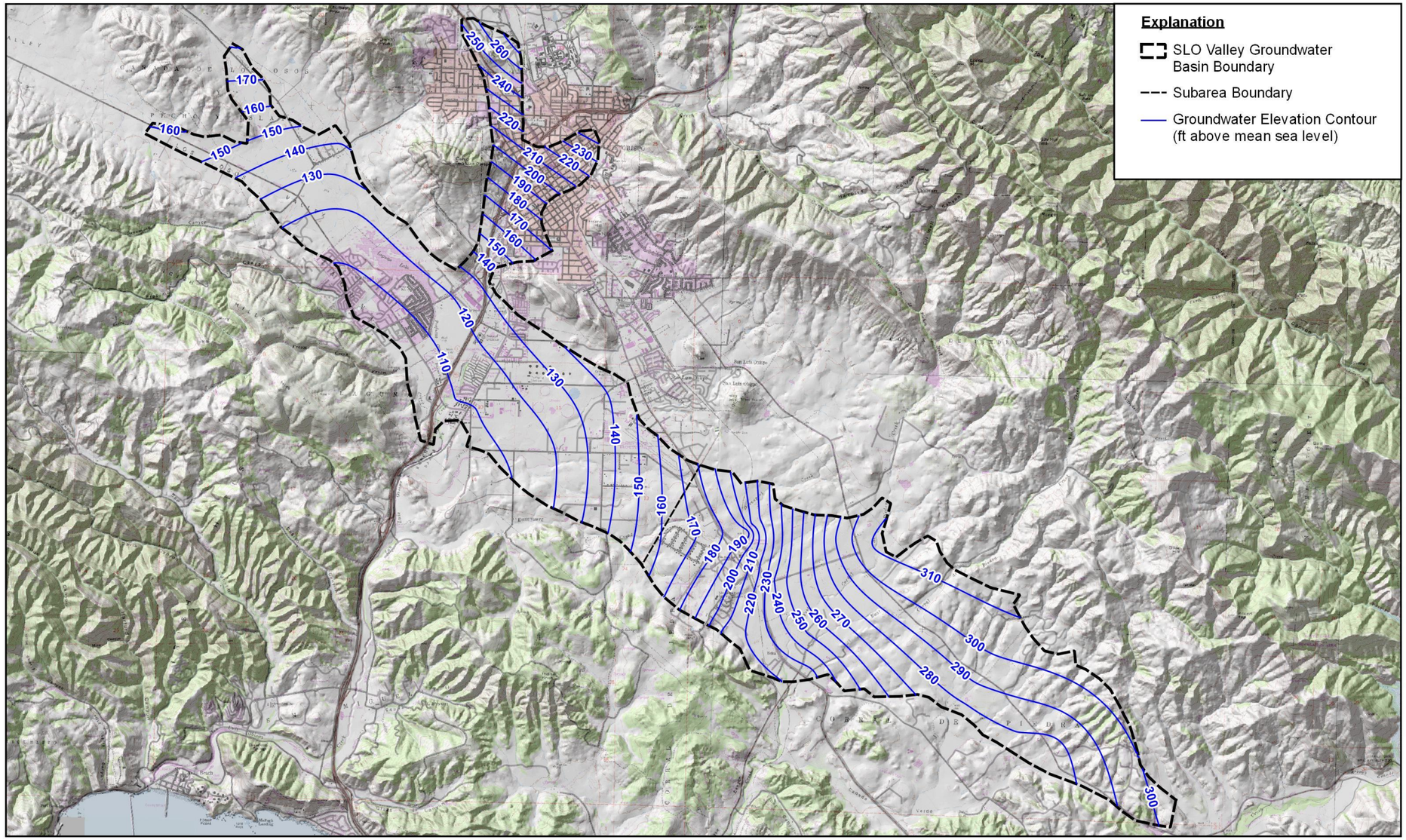
The water level contours for storage calculations extend to the Basin boundaries. Groundwater levels in the San Luis Valley subarea may contour at, or slightly above, ground surface in areas where wetlands are present, and there are no major differences between Spring 1986 and Spring 2019 water levels. In the Edna Valley subarea, water level contours show some notable areas of decline between 1986 and 2019 near the intersection of Edna Road (Highway 227) and Biddle Ranch Road and at the southeast end of the Basin. Declines in these areas are also shown for other time intervals in Figure 5-8 and 5-9 of Chapter 5. Of note, however, is that Spring 2019 water levels shown in Figure 6-18 are lower near the intersection of

Edna and Biddle Ranch Road than for the same period shown in Figure 5-6 (Chapter 5). This is because Figure 5-6 contours pressure in a shallow alluvial aquifer in this area while Figure 6-19 contours pressure in the deeper Pismo Formation aquifer that is the main supply aquifer for irrigation, and more appropriate for water budget storage calculations.

Table 6-13: Specific Yield Averages.

Well ID	Basin Cross-Section	Aquifer Specific Yield (percent)		
		Qal	QTp	Pismo
139405	B-B'	3.0	4.7	
158599	G-G'	6.8	6.9	18.0
279128	C2-C2'	11.0		
279130	A1-A2	8.2	6.5	3.0
287786	C1-C1'	7.2		
319126	C1-C1'	5.5	11.7	
438979	A1-A2	4.4	8.1	
469906	A3-A4		12.0	10.7
529099	E-E'		8.1	11.2
68734	A2-A3		5.9	8.0
710817	G-G'	3.0	5.0	10.8
73143	A1-A2	12.7	5.8	
782309	A2-A3	7.1	10.5	15.8
782656	D-D'	5.0	16.0	
e026022	H-H'		7.4	18.6
e0047435	G-G'	6.6	4.5	17.6
e0115806	offset I-I'		9.1	16.2
e0161526	F-F'		5.4	15.6
e0183287	H-H'	3.0	7.0	
e0225875	A2-A3	3.6	17.3	10.1
TH1	C1-C1'	5.9	8.9	18.0
Average Specific Yield		*6.2*	*8.5*	*13.4*
Basin Average (weighted)		10.5		
San Luis Valley Subarea (weighted)		8.0		
Edna Valley Subarea (weighted)		11.7		

Notes: Cross-sections shown in SLO Basin Characterization Report (GS1, 2018)
Qal = alluvium; QTp = Paso Robles Formation; Pismo = Pismo Formation
Weighted averages based on penetrated thicknesses of aquifer type.



Prepared For:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: TK
Date: 06/18/2020

References:

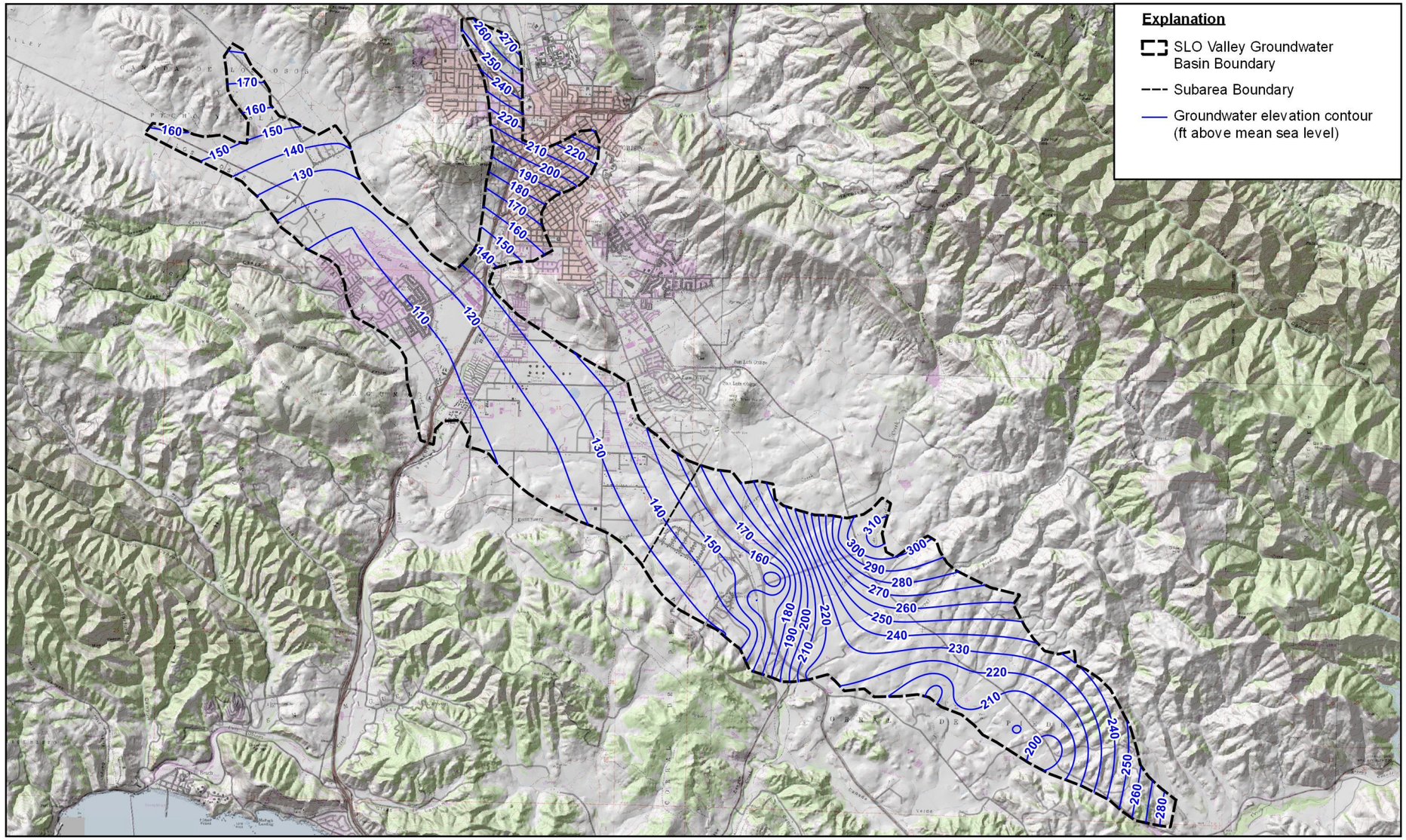
1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hirozontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:

1.
2.
3.

Groundwater Elevation Contours
Spring 1986

Figure 6-18



Prepared For:

SAN LUIS OBISPO VALLEY BASIN GSP

Author: TK
Date: 06/18/2020

N

0 0.25 0.5 0.75 1 mi
0 0.5 1 km

References:

1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hirozontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:

1.
2.
3.

Groundwater Elevation Contours Spring 2019

Figure 6-19

The water level contour maps and the base of permeable sediments were processed for volume calculation using Surfer, a grid-based mapping and graphic program. The methodology consisted of gridding and trimming surfaces to the Basin subarea boundaries, followed by volume calculation between surfaces. The gross volumes obtained were then multiplied by the representative specific yield for each subarea. An example of the methodology showing gridded surfaces for Spring 2019 water levels and the base of permeable sediments is presented in Figure 6-20. Estimated total storage volumes for selected years using the specific yield method are listed in Table 6-14.

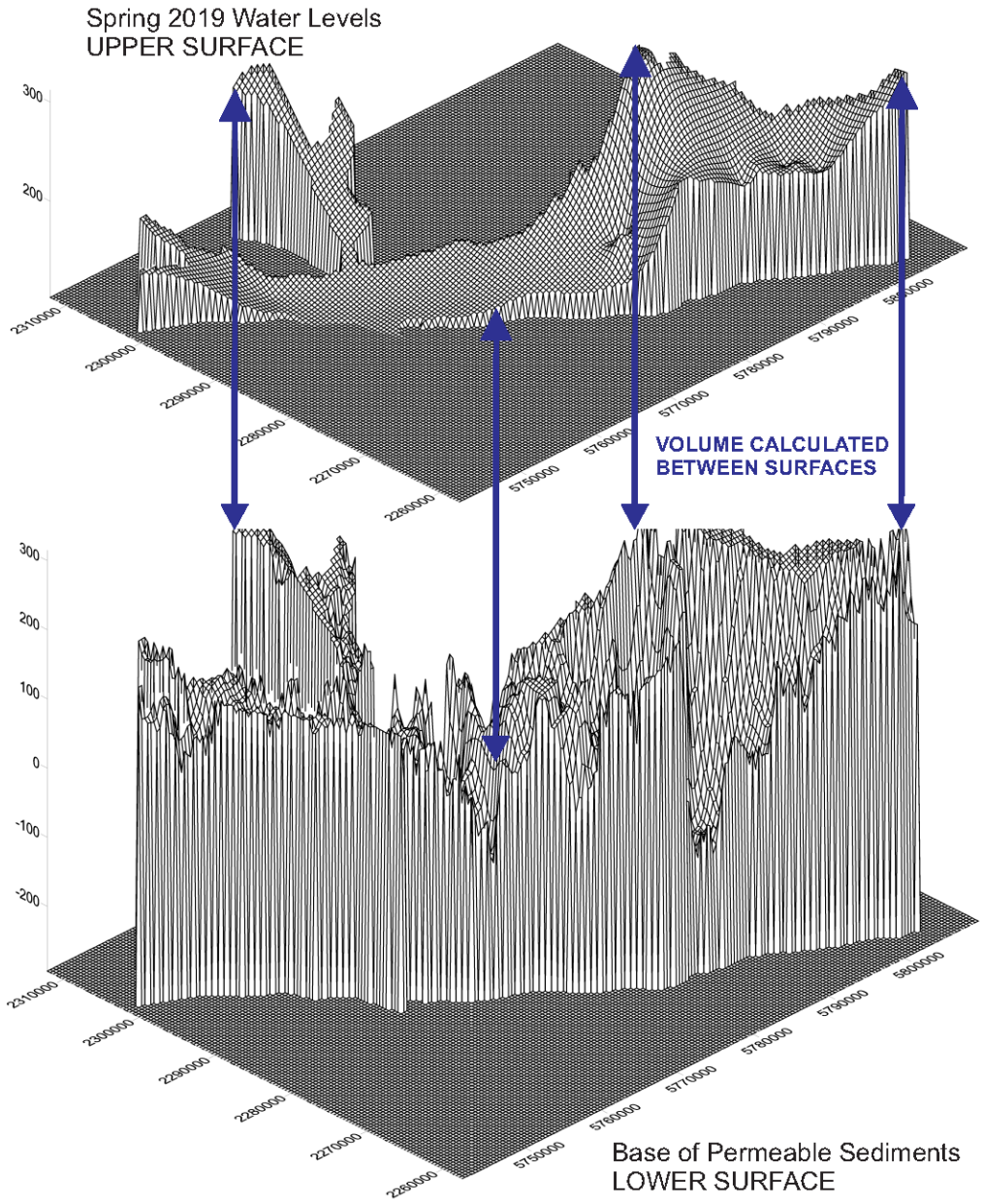


Figure 6-20: Storage Volume Grids.

Table 6-14: Spring Groundwater Storage Estimates.

Year	SLO Subarea	Edna Subarea	Basin Total
	Acre-Feet		
1986	36,310	132,840	169,150
1990	31,560	119,950	151,510
1995	36,750	131,020	167,770
1998	36,990	133,010	170,000
2005	38,080	126,210	164,290
2011	35,910	120,220	156,130
2014	34,280	104,950	139,230
2019	34,940	105,630	140,570

The groundwater storage estimates are much greater than previously reported, which was 23,300 acre-feet for the San Luis Valley subarea and 46,000 acre-feet for the Edna Valley subarea (Groundwater Basin Evaluation, Boyle Engineering, 1991). The Draft DWR study estimated an average storage of 16,000 acre-feet for the San Luis Valley subarea and 34,000 acre-feet for the Edna valley subarea (DWR, 1997). The increases are due primarily to improvements in characterizing Basin saturated thicknesses, specific yield, and methodology.

For example, the average saturated thickness of Basin sediments in the Edna Valley is listed as 102.9 feet by Boyle (1991). For Spring 1990, the average thickness of saturated sediments in the Edna Valley subarea using the base of permeable sediments in the SLO Basin Characterization Report (GSI, 2018) and Surfer gridding methodology is estimated to be approximately 150 feet, an increase of 50 percent. The estimated average specific yield value for the Edna Valley subarea is also close to 30 percent greater for GSP storage calculations (11.7 percent) than the prior estimate (9.1 percent). An additional 30-35 percent decrease in Basin storage areas was also incorporated into the prior methodology through the application of a subsurface configuration factor, which was not clearly described. (Boyle, 1991).

Increases in total groundwater in storage between prior work and current estimates does not imply an increase in sustainable yield or basin recharge rate. The purpose of total storage estimates for the water budget is to provide an independent calculation of change in storage over time, which is a critical part of the water budget equation.

6.3.6 Change in Storage

Balancing the water budget final step in water budget development. As previously mentioned, the water budget equation is as follows:

INFLOW – OUTFLOW = CHANGE IN STORAGE

The annual change in storage for the surface water budget is assumed to be zero, as surface flow moves quickly through the basin and any differences in storage are minor compared to the total budget. Therefore, the surface water balance equation can be simplified as INFLOW = OUTFLOW, and was used to estimate the stream outflow component of the surface water budget.

For the groundwater budget, groundwater-surface water interaction (as stream flow seepage) was adjusted to approximate the change in storage calculated using the specific yield method discussed above. The difference between the estimated change in storage shown in the water budget and the measured change in storage using the specific yield method is the mass balance error. Change in storage is reported between seasonal high (Spring) conditions per GSP regulations.

Change in storage and mass balance error for the groundwater budget is shown in Table 6-15. Figure 6-21 shows total storage using the water budget and specific yield method.

Table 6-15: Change in Storage Comparison – Historical Base Period 1987 – 2019.

Subarea	Water Budget	Specific Yield Method	Mass Balance Error		
	Change in Storage (acre-feet)		acre-feet	AFY	Percent*
San Luis Valley subarea	690	-1,370	2,060	62	6
Edna Valley Subarea	-27,440	-27,210	-230	-7	0

*Percent of total subarea water budget

The difference in change in storage estimates between the water budget and the specific yield method is approximately 60 AFY for the San Luis Valley subarea over the historical base. The water budget estimates a 690 acre-foot gain in storage, compared to a 1,370 acre-foot decline in storage using the specific yield method. A review of the contour maps indicates that the decline in San Luis Valley subarea storage shown by the specific yield method is due to the effects of groundwater level declines in the Edna Valley subarea being contoured across the bedrock high into the San Luis Valley subarea (Figure 6-18 and Figure 6-19). There are no hydrographs for water levels in the bedrock high area, and the extent to which water level declines in the Edna Valley subarea have influenced water levels in the eastern portion of the San Luis Valley subarea is uncertain. Available water level hydrographs do not show overall water level declines west of the bedrock high (Figure 5-11; Chapter 5).

The difference in change in storage estimates between the water budget and the specific yield method is less than 10 AFY for the Edna Valley subarea over the historical base period. The water budget estimates a 27,440 acre-foot decline in storage, compared to a 27,210 acre-foot decline in storage using the specific yield method. The change in storage mass balance error for the Basin historical groundwater budget is less than 100 acre-feet per year, which is reasonable for the purposes of preliminary sustainable yield estimates.

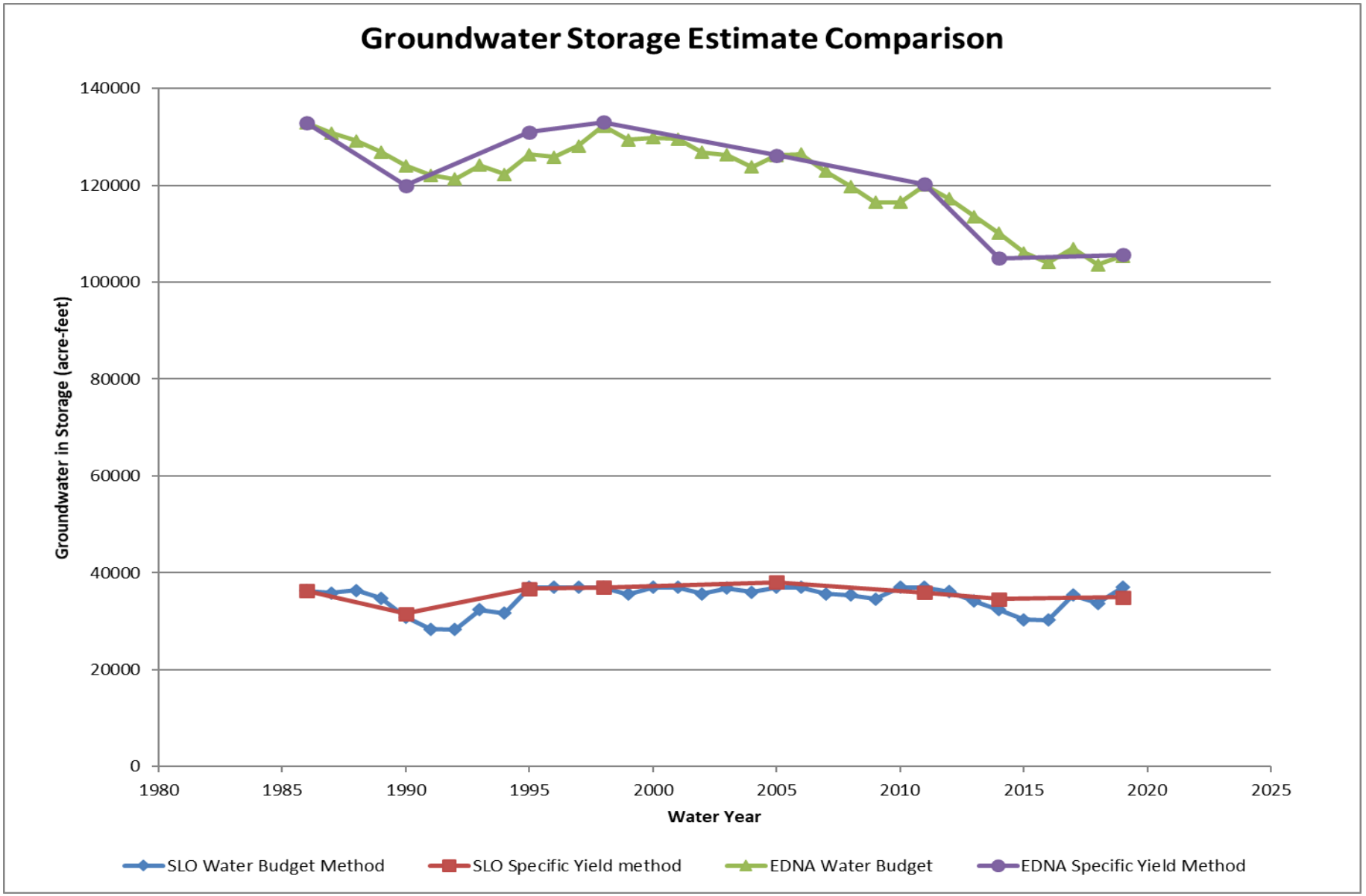


Figure 6-21: Groundwater Storage Estimate Comparison for Basin Subareas.

6.3.7 Preliminary Sustainable Yield Estimate

The sustainable yield is the maximum quantity of water, calculated over a base period representative of long-term conditions in the Basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result. Temporary surplus is the amount of water that may be pumped from an aquifer to make room to store future water that would otherwise be wasted and unavailable for use. Undesirable results will be defined for six sustainable management criteria in Chapter 7. Examples of potential undesirable results are related to long-term declines in water levels and associated loss in groundwater in storage.

Estimating sustainable yield includes evaluating historical, current, and projected water budget conditions. The analytical water budget method utilized in this analysis evaluates historical and current conditions, and provides a preliminary estimate for the Basin sustainable yield. The projected water budget will be evaluated using the Basin numerical model presented later in the projected water budget section of the chapter, at which time the minimum thresholds for the sustainable management criteria can be incorporated and the final sustainable yield will be determined. The preliminary sustainability estimate can be used for planning potential projects and management action scenarios for the Basin numerical model.

The preliminary sustainable yield of the San Luis Obispo groundwater Basin has been estimated separately for each of the subareas. The Edna Valley subarea has experienced cumulative storage declines since 1998, while the San Luis Valley subarea experiences storage declines during drought, but recovers and is typically close to full storage capacity (Figure 6-21).

For the Edna Valley subarea, sustainable yield is estimated as the amount of long-term recharge (groundwater inflow) to the Basin over the historical base period (3,400 AFY) minus subsurface outflow (100 AFY). The resulting preliminary sustainable yield is estimated at a 3,300 AFY.

The San Luis Valley subarea has not experienced cumulative and persistent storage declines. Long-term average recharge to groundwater in the San Luis Valley subarea is estimated to be 3,700 AFY, of which an estimated 1,200 AFY is used by wetlands, leaving 2,500 AFY for withdrawal without long-term declines in storage (subsurface outflow is supported by wastewater discharges). The historical recharge to the subarea may be less than the sustainable yield, however, because average annual recharge can increase with storage declines, particularly in a Basin that is at or near storage capacity.

The San Luis Valley subarea did experience significant undesirable results due to land subsidence during the period of high groundwater use and associated storage decline toward the end of the 1987-91 drought. Average groundwater production from 1990-1992 was 3,960 AFY. Land subsidence is not necessarily a risk over the entire subarea, and would generally require historical storage declines to be exceeded in affected areas for addition subsidence to occur. However, without mitigation for land subsidence or specific projects that increase recharge during dry periods, the preliminary sustainable yield of the San Luis Valley subarea is estimated at 2,500 AFY, based on the long-term average recharge of 3,700 AFY minus 1,200 AFY used by wetlands. Table 6-15 summarizes the preliminary sustainable yield estimates.

Table 6-16: Preliminary Sustainable Yield Estimate (AFY).

San Luis Valley Subarea	2,500
Edna Valley Subarea	3,300
Basin Total	5,800

The above values are lower overall than historical estimates by Boyle (1991) and DWR (1997 Draft). Boyle estimated 5,900 AFY of sustainable yield for the Basin while DWR estimated 2,000-2,500 for the San Luis Valley subarea and 4,000-4,500 for the Edna Valley Subarea.

6.3.8 Quantification of Overdraft

Overdraft is the condition of a groundwater Basin or subbasin where the amount of water withdrawn by pumping exceeds the amount of water that recharges a Basin over a period of years, during which the water supply conditions approximate average conditions.

While the 33-year historical base period is representative of the long-term climatic conditions needed for estimating sustainable yield, a shorter period is appropriate for characterizing water supply conditions with respect to Basin withdrawals and overdraft. Over the last 10 years the City has introduced recycled water reuse at Laguna golf course (historically irrigated by groundwater) and has stopped pumping groundwater from the San Luis Valley subarea, while total irrigated agriculture in the Edna Valley subarea has leveled off, after increasing from the beginning of the historical base period through the mid-2000's (Table 6-5). Overdraft for GSP planning purposes has been estimated as the difference between sustainable yield and average groundwater withdrawals over the last 10 years (2010-2019), with an adjustment in the San Luis Valley subarea to account for reductions in agricultural acreage due to recent development.

Groundwater extractions in the San Luis Valley subarea (adjusted for recent development) have averaged 1,800 AFY since 2010, which is 700 AFY less than the average recharge of 2,500 AFY over the same representative period, indicating a surplus of groundwater for the subarea. In the Edna Valley subarea, groundwater pumping has averaged 4,400 AFY since 2010, which is 1,100 AFY more than the sustainable yield of 3,300 AFY for the subarea. The Edna Valley subarea is an estimated 1,100 AFY in overdraft. Total Basin overdraft is estimated at 400 AFY. Table 6-16 summarizes the overdraft estimates.

Table 6-17: Estimated Overdraft (AFY).

San Luis Valley Subarea	-700*
Edna Valley Subarea	1,100
Basin Total	400

*surplus

In comparison, prior work by Boyle (1991) concluded that there was short-term overdraft in the Basin and that withdrawals in excess of sustainable yield was a common occurrence. However, during the period from 1978-1990, the Basin was not considered in a state of sustained overdraft. The Draft 1997 DWR study does not address overdraft, although there is a net deficit in the basin water budget for the 1969-1977 base period, a surplus for the 1983 water budget, and a deficit for the 1990 water budget. The draft DWR report concluded that additional water beyond the long-term dependable yield could be extracted from the Basin, but that there could be adverse impacts.

6.4 CURRENT WATER BUDGET

The current water budget quantifies inflows and outflows for the Basin based on the last four years of the historical water budget, from 2016 to 2019. These years provide the most recent population, land use, and hydrologic conditions. Recent Basin conditions have been characterized by above average rainfall, along with a decrease in urban extractions and imported surface water supplies assumed to be associated with greater conservation awareness by the public during the 2012-2016 drought. There have also been declines in agricultural acreage and associated groundwater extractions in the San Luis Valley subarea associated with urban development.

Comparisons of the current water budget to the 1987-2019 historical surface water budget used for the preliminary sustainable yield estimates for the two subareas and total Basin are shown in Table 6-17 through Table 6-19. Bar graphs are shown in Figure 6-22 through Figure 6-27. As expected, the average annual water budget inflows and outflows are greater under current conditions than the historical base period, primarily due to greater rainfall. There has been more groundwater inflow than outflow under the current water budget in the San Luis Valley subarea, leading to increased groundwater in storage. In the Edna valley subarea, the outflow has been slightly greater than inflow under the current water budget, with relatively little change to groundwater in storage since the end of the recent drought (Figure 6-21). As noted above, groundwater extractions for agriculture in the San Luis Valley subarea have declined between the historical and current water budgets.

Table 6-18: Current Water Budget - San Luis Valley Subarea.

SAN LUIS VALLEY SUBAREA		
SURFACE WATER BUDGET	**Historical Average (1987-2019)**	**Current (2016-2019)**
Inflow	**AFY**	
Precipitation	10,580	12,280
Groundwater extractions (Urban)	740	400
Groundwater extractions (Ag)	1,630	1,370
Stream Inflow at Basin Boundaries	10,720	10,570
Wastewater discharge to streams	4,080	3,910
Local Imported Supplies	5,820	5,430
TOTAL IN	33,580	33,960
Outflow		
ET of precipitation	7,770	8,220
ET of Applied Water (Urban)	2,050	1,510
ET of Applied Water (Ag)	1,310	1,100
ET of Lake/Wetland/Riparian	650	690
Surface Water Delivery Offset	4,080	3,910
Infiltration of Precipitation	1,610	3,190
Infiltration of Applied Water (Urban)	440	440
Infiltration of Applied Water (ag)	320	260
GW-SW interaction (net)	970	510
Stream outflow at Basin boundary	14,390	14,120
TOTAL OUT	33,580	33,960
GROUNDWATER BUDGET	**Historical Average (1987-2019)**	**Current (2016-2019)**
Inflow	**AFY**	
Infiltration of precipitation	1,610	3,190
Urban water return flow	440	440
Agricultural return flow	320	260
GW-SW interaction (net)	970	510
Subsurface from bedrock	340	340
TOTAL IN	3,670	4,750
Outflow		
Groundwater extractions (Urban)	740	400
Groundwater extractions (Ag)	1,630	1,370
Wetland direct ET	1,160	1,190
Subsurface outflow	120	120
TOTAL OUT	3,650	3,080

Table 6-19: Current Water Budget - Edna Valley Subarea.

EDNA VALLEY SUBAREA		
SURFACE WATER BUDGET	**Historical (1987-2019)**	**Current (2016-2019)**
Inflow	**AFY**	
Precipitation	9,300	10,780
Groundwater extractions (Urban)	880	820
Groundwater extractions (Ag)	3,210	3,440
Stream Inflow at Basin Boundaries	3,630	3,480
TOTAL IN	17,020	18,520
Outflow		
ET of precipitation	6,910	7,200
ET of Applied Water (Urban)	600	610
ET of Applied Water (Ag)	2,650	2,870
ET of Riparian	40	40
Infiltration of Precipitation	1,890	2,800
Infiltration of Applied Water (Urban)	280	210
Infiltration of Applied Water (ag)	560	570
GW-SW interaction (net)	510	490
Stream outflow at Basin boundary	3,580	3,750
TOTAL OUT	17,020	18,520
GROUNDWATER BUDGET	**Historical Average (1987-2019)**	**Current (2016-2019)**
Inflow	**AFY**	
Infiltration of precipitation	1,890	2,800
Urban water return flow	290	220
Agricultural return flow	560	570
GW-SW interaction (net)	510	490
Subsurface from bedrock	110	110
TOTAL IN	3,360	4,180
Outflow		
Groundwater extractions (Urban)	880	820
Groundwater extractions (Ag)	3,210	3,440
Subsurface outflow	100	100
TOTAL OUT	4,190	4,360

Table 6-20: Current Water Budget - Basin Total.

BASIN TOTAL		
SURFACE WATER BUDGET	**Historical Average (1987-2019)**	**Current (2016-2019)**
Inflow	**AFY**	
Precipitation	19,880	23,060
Groundwater extractions (Urban)	1,620	1,220
Groundwater extractions (Ag)	4,840	4,810
Stream Inflow at Basin Boundaries	14,350	14,050
Wastewater discharge to streams	4,080	3,910
Local Imported Supplies	5,820	5,430
TOTAL IN	50,600	52,480
Outflow		
ET of precipitation	14,680	15,420
ET of Applied Water (Urban)	2,650	2,120
ET of Applied Water (Ag)	3,960	3,970
ET of Lake/Wetland/Riparian	690	730
Surface Water Delivery Offset	4,080	3,910
Infiltration of Precipitation	3,500	5,990
Infiltration of Applied Water (Urban)	720	650
Infiltration of Applied Water (ag)	880	830
GW-SW interaction (net)	1,480	1,000
Stream outflow at Basin boundary	17,970	17,870
TOTAL OUT	50,600	52,480
GROUNDWATER BUDGET	**Historical Average (1987-2019)**	**Current (2016-2019)**
Inflow	**AFY**	
Infiltration of precipitation	3,500	5,990
Urban water return flow	730	660
Agricultural return flow	880	830
GW-SW interaction (net)	1,480	1,000
Subsurface from bedrock	450	450
TOTAL IN	7,030	8,930
Outflow		
Groundwater extractions (Urban)	1,620	1,220
Groundwater extractions (Ag)	4,840	4,810
Wetland direct ET	1,160	1,190
Subsurface outflow	220	220
TOTAL OUT	7,840	7,440

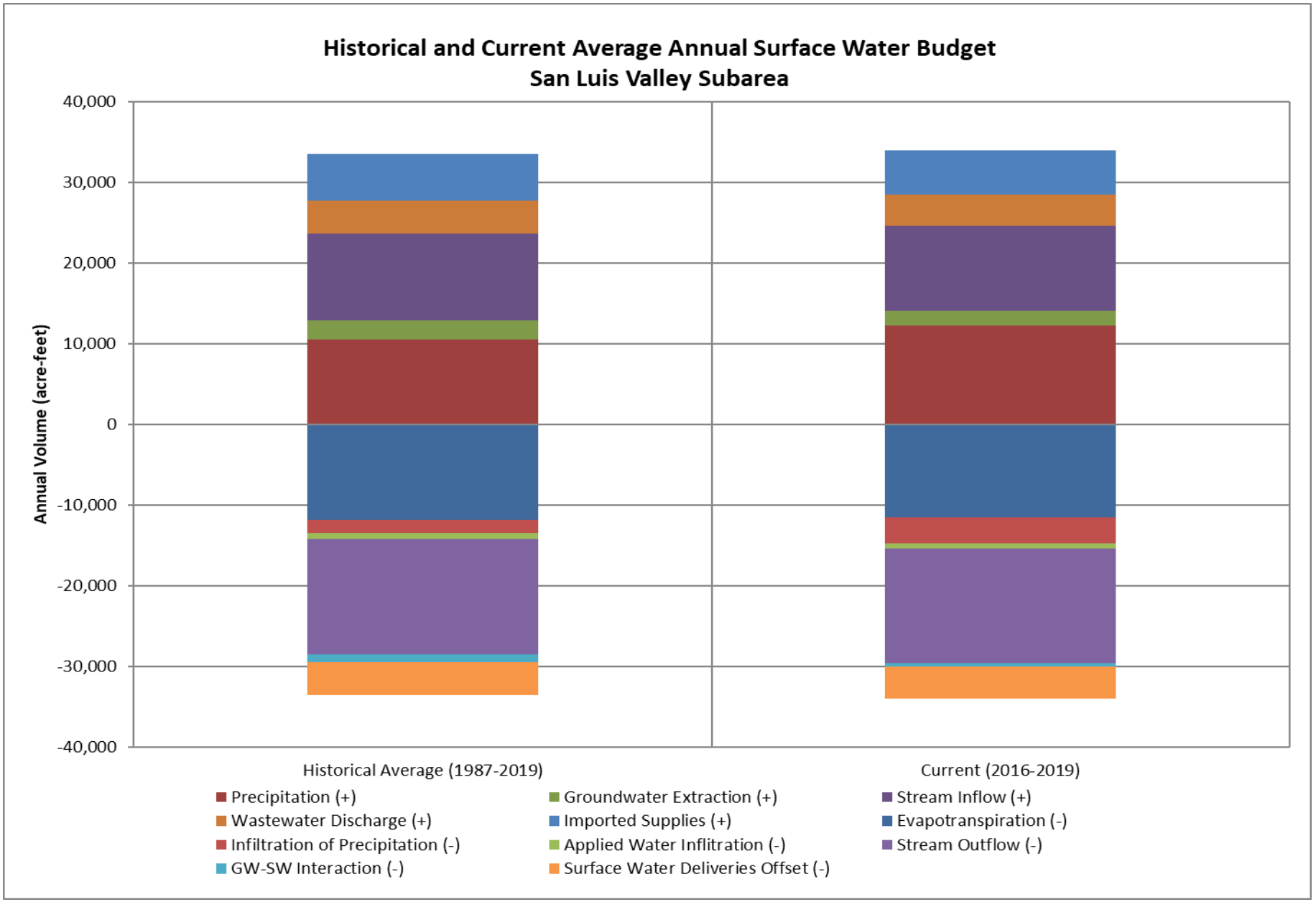


Figure 6-22: Historical and Current Average Annual Surface Water Budget – San Luis Valley Subarea.

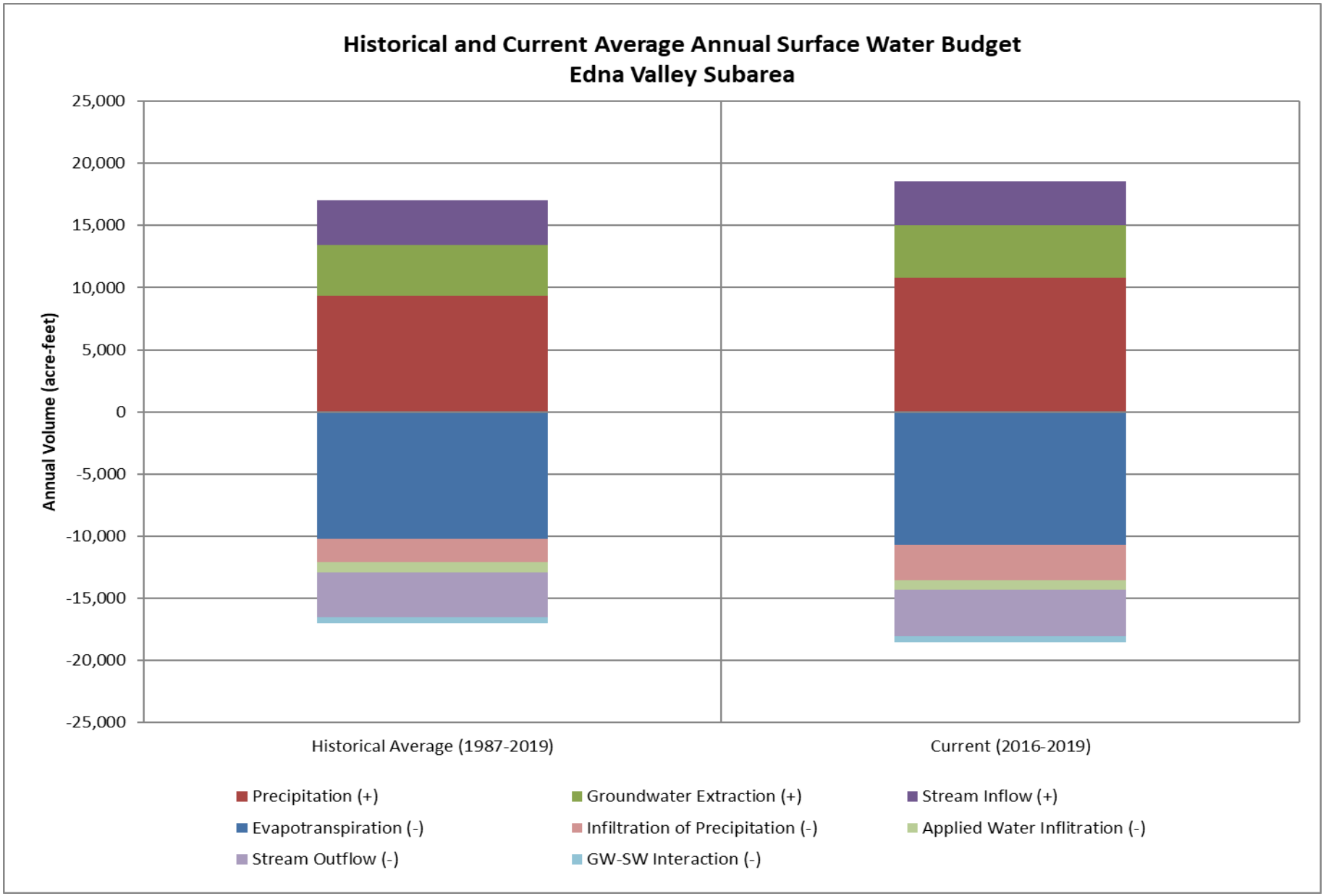


Figure 6-23: Historical and Current Average Annual Surface Water Budget – Edna Valley Subarea.

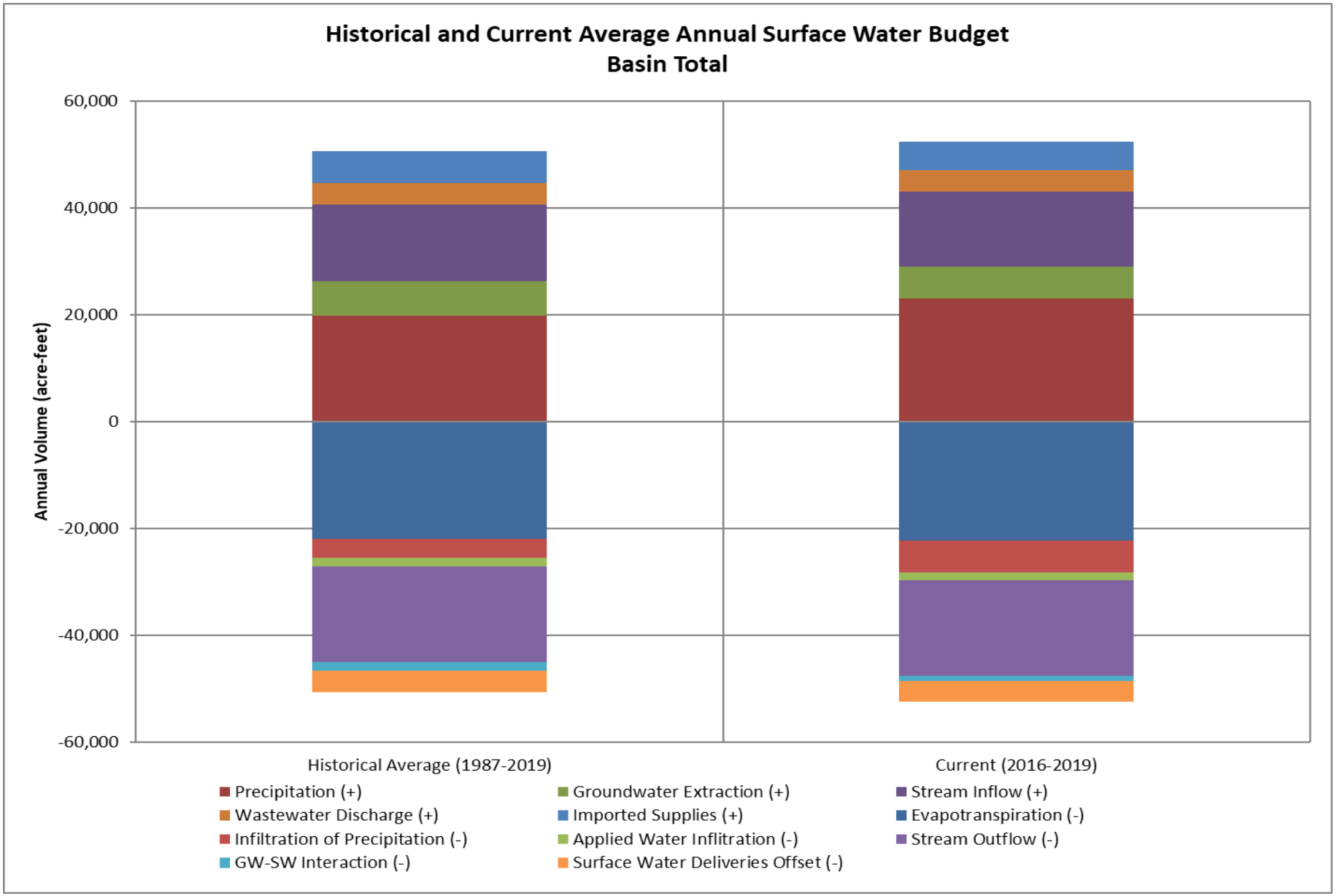


Figure 6-24: Historical and Current Average Annual Surface Water Budget – Basin Total.

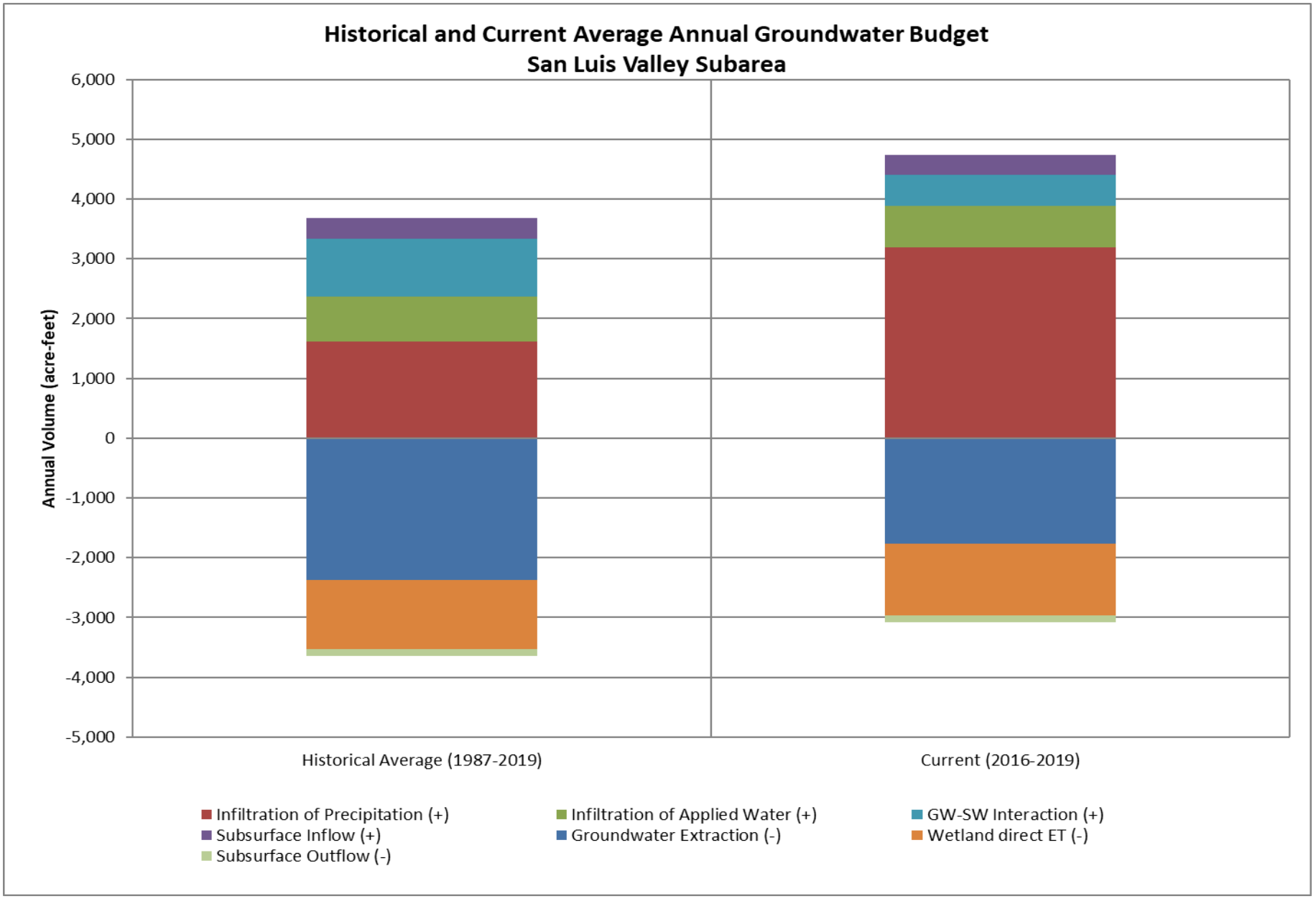


Figure 6-25: Historical and Current Average Annual Groundwater Budget – San Luis Valley Subarea.

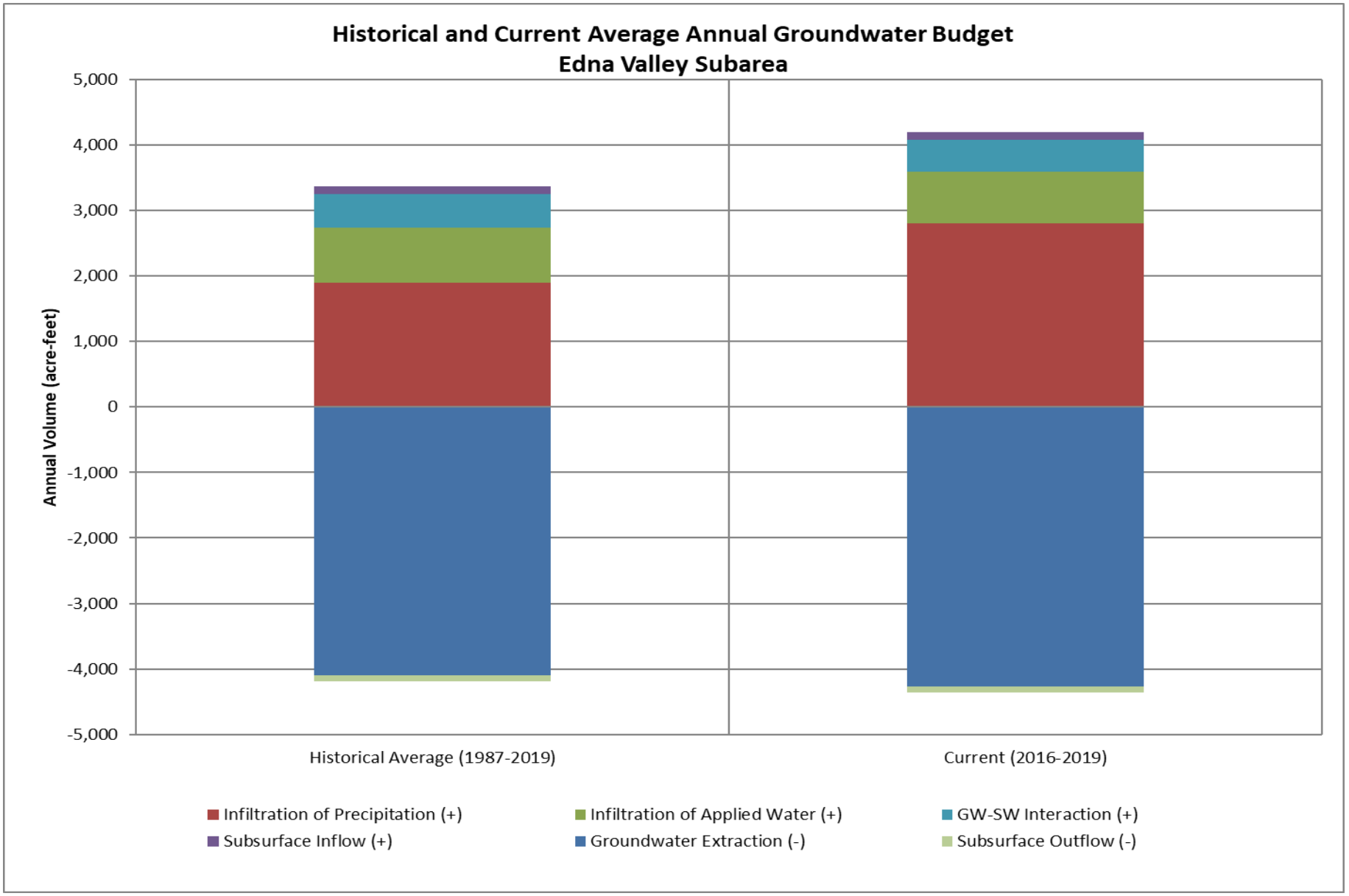


Figure 6-26: Historical and Current Average Annual Groundwater Budget – Edna Valley Subarea.

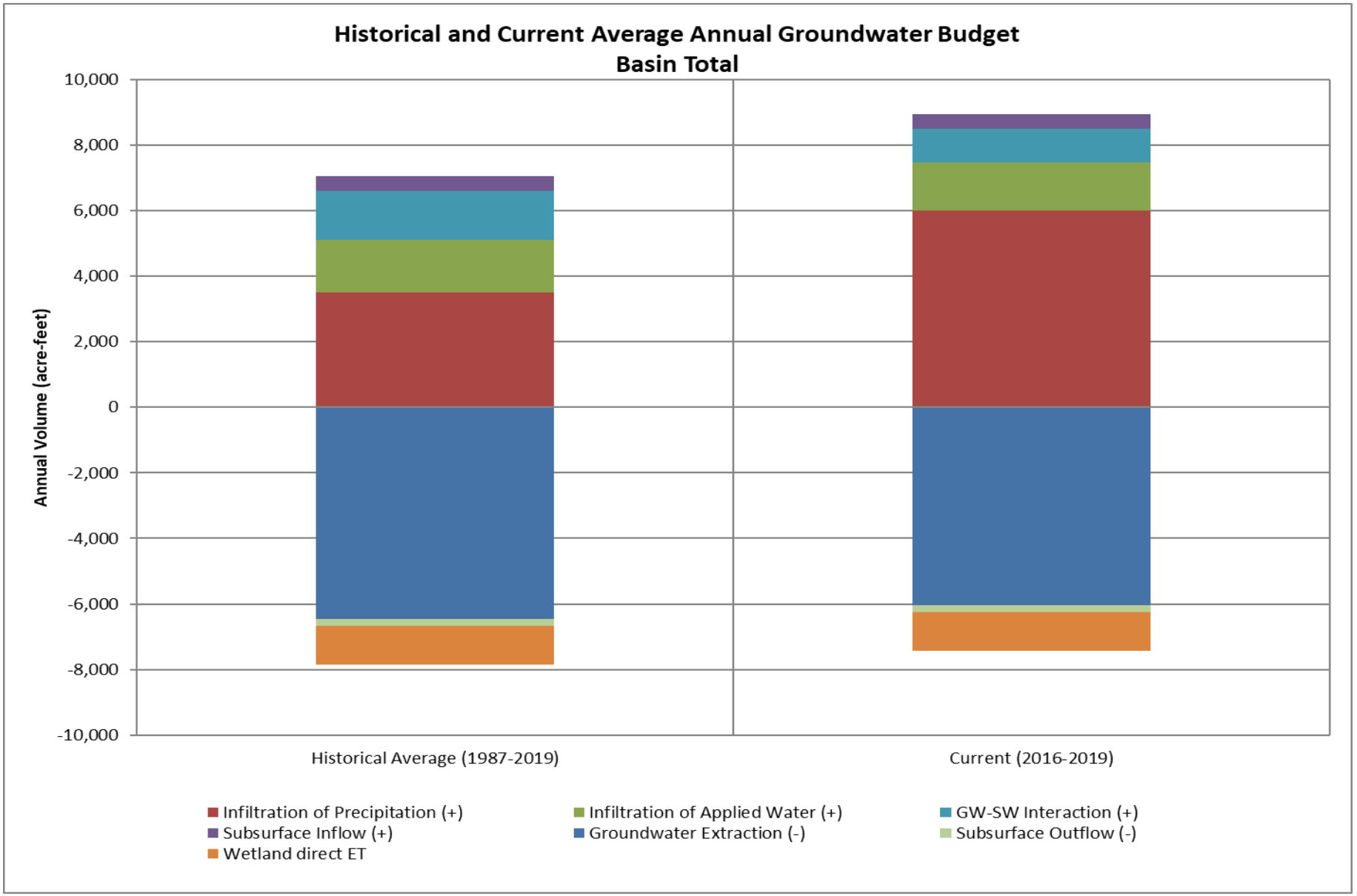


Figure 6-27: Historical and Current Average Annual Groundwater Budget – Basin Total.

6.5 PROJECTED WATER BUDGET

6.5.1 Assumptions

6.5.2 Inflows

6.5.3 Outflows

6.5.4 Change In Storage

REFERENCES

Balance Hydrologics. 2008. *Hydrology and Geology Assessment of the Pismo Creek Watershed, San Luis Obispo County, California.* 2008.
Blaney. 1963. *Utilization of the Water of the Santa Ynez River Basin in Southern Santa Barbara County California, United Stated Deparment of Agriculture.* 1963.
—. 1933. *Ventura County Investigation, Bulletin No. 46, California Deparment of Public Works, Division of Water Resources.* 1933.
Boyle Engineering. 1991. *City of San Luis Obispo Groundwater Basin Evaluation. January.* 1991.
Carollo. 2012. *San Luis Obispo County Master Water Report.* 2012.
CIMS. 2019. *Station 52, San Luis Obispo - Central Coast Valleys.* 2019.
City of San Luis Obispo. 2016. *2015 Urban Water Management Plan.* 2016.
—. 2018. *General Plan.* 2018.
—. 2015. *Water Resources Status Report.* 2015.
—. 2000. *Water Use Factors.* 2000.
Cleath & Associates, Inc. 2001. *Well Construction and Testing Report for Lewis Lane #4, Edna Valley, San Luis Obispo County. Prepared for Southern California Water Company. July.* 2001.
—. 2003. *Well Construction and Testing Report for Water Supply and Irrigation Wells, City of San Luis Obispo, Hayashi Irrigation Wells and Highway 101 Water Supply Well. March.* 2003.
Cleath-Harris Geologists. 2018. *Groundwater Flow Analysis, Recycled Water Recharge Project, San Luis Valley Subarea, San Luis Obispo Valley Groundwater Basin.* 2018.
—. 2019. *Optional Task 2.4B Geophysical Survey.* 2019.
Cleath-Harris Geologists, Inc. 2010. *Edna Valley Water System Groundwater Study. Prepared for Golden State Water Company. May.* 2010.
—. 2013. *Summary of Drilling,. Testing, and Destruction of the Golden State Water Company Country Club Test Well, Edna Road System, 6110 Lewis Lane, San Luis Obispo, California. Prepared for Golden State Water Company. June.* 2013.
—. 2013. *Summary of Exploration and Testing, 5061 Hacienda Avenue, San Luis Obispo, California. Prepared for Golden State Water Company. February.* 2013.
—. 2014. *Summary of Exploration and Testing, Blodgett parcel, Whiskey Run Lane, Country Club Area, San Luis Obispo, California. Prepared for Golden State Water Company. July.* 2014.
County of San Luis Obispo. 2014. *San Luis Obispo County Integrated Regional Water Management Plan (IRWMP).* 2014.
Cuesta Engineering Corporation. 2007. *San Luis Obispo Creek Watershed Calibration Study.* 2007.
Dibble, T.W. 2004. *Geologic Map of the Lopez Mountain Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2004. #DF-130.
Dibblee, T.W. 2006. *Geologic Map of the Arroyo Grande NE Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2006. #DF-211.
—. 2006. *Geologic Map of the Pismo Beach Quadrangle, San Luis Obispo County, California.* s.l. : Dibblee Geology Center Map, 2006. #DF-212.
—. 2004. *Geologic Map of the San Luis Obispo Quadrangle, San Luis Obispo County, California.* . s.l. : Dibble Geology Center Map, 2004. #DF-129.
DWR. 2003. *California's Groundwater: Bulletin 118 – Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2016. *California's Groundwater: Bulletin 118 - Interim Update 2016, Working Towards Sustainability.* 2016.
—. 2003. *California's Groundwater: Bulletin 118 - Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2015. *Consumptive Use Program Plus (CUP+) Model, in California Water Plan Update 2013, Volume 4. Reference Guide, Developed by DWR and UC Davis.* 2015.
—. 2014. DWR Atlas - Aglricultural Lang Use and Irrigated Areas. [Online] 2014. gis.water.ca.gov.

—. 1964. *San Luis Obispo and Santa Barbara Counties Land and Water Use Survey, 1959. .* s.l. : California Department of Water Resources (DWR), 1964.
—. 1958. *San Luis Obispo County Investigation. State Water Resources Board Bulletin No. 18. .* s.l. : California Department of Water Resources (DWR). May., 1958.
—. 1997. *San Luis-Edna Valley Groundwater Basin Study, Draft Report. .* s.l. : California Department of Water Resources (DWR)., 1997.
—. 1996. *South Central Coast Land Use Survey.* 1996.
—. 1987. *Southern Central Coast Land Use Survey, 1985. Morro Bay South 54-30 and San Luis Obispo 54-31 Survey Maps.* 1987.
—. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization - Process and Results Document.* 2019.
—. 2016. *Water Budget Best Management Practices for the Sustainable Management of Groundwater.* 2016.
—. 2002. *Water Resources of the Arroyo Grande - Nipomo Mesa Area.* 2002.
EPA. 2008. *Water Sense Factsheet - Indoor Water Use in the United States, EPA-832-F-06-004.* 2008.
ESA Consultants, Inc. 1994. *Hydrologic Investigation, Edna Valley Well Location Study. September.* 1994.
Fugro West and Cleath & Associates. 2002. *Paso Robles Groudnwater Study, Final Report.* 2002.
GSI Water Solutions. 2018. *San Luis Obispo Valley Basin Characterization and Monitoring Well Installation.* 2018.
Hall, C.A. 1979. *Geologic map of the San Luis Obispo – San Simeon Region, California.* s.l. : U.S. Geological Survey, 1979. Map I-1097.
—. 1973. *Geology of the Arroyo Grande Quadrangle, California. .* s.l. : California Division of Mines and Geology, 1973. Map Sheet 24.
ITRC. 2020. *Official Cal Poly Precipitation Data, Cal Poly/NOAA Station Rain Gage.* 2020.
Johnson, A.I. 1967. *Specific Yield - Compilation of Specific Yield for Various Materials, U.S. Geological Survey Water-Supply Paper 1662-D, prepared in cooperation with the California Deparment of Water Resources.* 1967.
National Land Cover Database. Multi-Resolution Land Characteristics Consortium. *2016.* Multi-Resolution Land Characteristics Consortium.
Rosenberg, L.I. 2001. *Potential Aquifer Recharge Areas: Monterey County, California.* s.l. : Monterey County Planning Department, 2001.
San Luis Obispo County Deparment of Agriculture/Weights and Measures. 2019. *Crop Surveys for San Luis Obispo Valley Groundwater Basin 2013-2018.* 2019.
San Luis Obispo County Department of Public Works. 2020. *Andrews Street Bridge Stream Flow Gage 745.* 2020.
—. 2020. *Gas Company Rain Sensor 3099.* 2020.
San Luis Obispo County Engineering Department. 1974. *Hydrologic & Climatological Data, Seasons of 1970-71 & 1971-72.* 1974.
SLO-FCWCD. 2014. *CASGEM Monitoring Plan for High and Medium Priority Groundwater Basins in the San Luis Obispo County Flood Control & Water Conservation District. September.* s.l. : San Luis Obispo Flood Control & Water Conservation District, 2014.
Stillwater Sciences. 2015. *Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California. September.* 2015.
SWRCB. 1990. *Ernest Righetti & Sons Application 28883, Decision 1627.* 1990.
TEAM Engineering & Management. 2000. *Groundwater Yield Analysis. July.* 2000.
USBR. 1955. *Reconnaissance Report San Luis Obispo County Basin, California. .* s.l. : U.S. Bureau of Reclamation, Region 2, Sacramento., 1955.
USDA-NRCS. 2007. *Soil Survey Geographic Database (SSURGO).* s.l. : U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), 2007.
WSC. 2018. *Salinas and Whale Rock Reserviors Safe Annual Yield TM.* 2018.

DRAFT

Chapter 7 - Monitoring Networks

San Luis Obispo Valley Basin Groundwater Sustainability Plan

Available for viewing in the December 9, 2020 Agenda Packet:	**Dec 2, 2020**
Recommended the GSAs to receive and file for public comments:	**Dec 9, 2020**
Available for public comments on www.slowaterbasin.com:	**Dec 11, 2020**
Close of public comment period:	**Jan 30, 2021**

Per the GSC's recommendation on December 9, 2020, the Draft Chapter 7- Monitoring Networks will be distributed to the City and County GSAs to receive and file. This Draft document is also posted on the online portal: www.slowaterbasin.com for public comments. Comments from the public are being collected using a comment form available at www.slowaterbasin.com by clicking on "Submit Comment". If you require a paper form to submit by postal mail, please contact your local Groundwater Sustainability Agency (GSA).

DRAFT

Groundwater Sustainability Plan
Chapter 7 – Monitoring Networks

for the

San Luis Obispo Valley Groundwater Basin
Groundwater Sustainability Agencies

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12/2/2020

TABLE OF CONTENTS

Table of Contents

List of Figures i
Tables iv
Appendices v
List of Terms Used vi
Executive Summary 1
1 Introduction to the SLO Basin GSP .....
1.1 Purpose of the Groundwater Sustainability Plan .....
1.2 Description of SLO Basin .....
1.3 Basin Prioritization .....
2 Agency Information (§ 354.6) .....
2.1 Agencies Names and Mailing Addresses .....
2.2 Agencies Organization and Management Structures .....
2.2.1 County of San Luis Obispo .....
2.2.2 City of San Luis Obispo .....
2.2.3 Other Participating Parties in the MOA .....
2.2.3.1 Edna Valley Growers Mutual Water Company .....
2.2.3.2 Varian Ranch Mutual Water Company .....
2.2.3.3 Edna Ranch Mutual Water Company .....
2.2.3.4 Golden State Water Company .....
2.3 Authority of Agencies .....
2.3.1 Groundwater Sustainability Agencies .....
2.3.1.1 County of San Luis Obispo .....
2.3.1.2 City of San Luis Obispo .....
2.3.2 Memorandum of Agreement .....
2.3.3 Coordination Agreements .....
2.4 Contact information for Plan Manager .....
3 Description of Plan Area (§ 354.8) .....
3.1 SLO Basin Introduction .....
3.2 Adjudicated Areas .....
3.3 Jurisdictional Areas .....
3.3.1 Federal Jurisdictions .....
3.3.2 Tribal Jurisdiction .....

3.3.3 State Jurisdictions
3.3.4 County Jurisdictions
3.3.5 City and Local Jurisdictions
3.3.6 Special Districts
3.4 Land Use
3.4.1 Water Source Types
3.4.2 Water Use Sectors
3.5 Density of Wells
3.6 Existing Monitoring and Management Programs
3.6.1 Groundwater Monitoring
3.6.1.1 Groundwater Level Monitoring
3.6.1.2 Groundwater Quality Monitoring
3.6.1.3 Surface Water Monitoring
3.6.1.4 Climate Monitoring
3.6.2 Existing Management Plans
3.6.2.1 SLO Basin Characterization and Monitoring Well Installation
3.6.2.2 San Luis Obispo County Master Water Report (2012)
3.6.2.3 San Luis Obispo County Integrated Regional Water Management Plan (2014)
3.6.2.4 City of San Luis Obispo 2015 Urban Water Management Plan (2016)
3.6.3 Existing Groundwater Regulatory Programs
3.6.3.1 Groundwater Export Ordinance (2015)
3.6.3.2 Well Ordinances, County and City
3.6.3.3 Countywide Water Conservation Program Resolution 2015-288 (2015)
3.6.3.4 Agricultural Order R3-2017-002 (2017)
3.6.3.5 Water Quality Control Plan for the Central Coast Basins (2017)
3.6.3.6 California DWR Well Standards (1991)
3.6.3.7 Requirements for New Wells (2017)
3.6.3.8 Title 22 Drinking Water Program (2018)
3.6.3.9 Waterway Management Plan – San Luis Obispo Creek Watershed (2003)
3.6.3.10 Incorporation Into GSP
3.6.3.11 Limits to Operational Flexibility
3.7 Conjunctive Use Programs
3.8 Land Use Plans
3.8.1 City of San Luis Obispo General Plan
3.8.2 County of San Luis Obispo General Plan

3.8.3 Los Ranchos/Edna Village Plan
3.8.4 Plan Implementation Effects on Existing Land Use
3.8.5 Plan Implementation Effects on Water Supply
3.8.6 Well Permitting
3.8.7 Land Use Plans Outside of Basin
3.9 Management Areas
3.9.1 Reason for Creation
3.10 Additional GSP Elements, if Applicable
4 Basin Setting (§ 354.14)
4.1 Basin Topography and Boundaries
4.2 Primary Users of Groundwater
4.3 Soils Infiltration Potential
4.4 Regional Geology
4.4.1 Regional Geologic Structures
4.4.2 Geologic Formations within the Basin
4.4.2.1 Alluvium
4.4.2.2 Paso Robles Formation
4.4.2.3 Pismo Formation
4.4.3 Geologic Formations Surrounding the Basin
4.4.3.1 Monterey Formation
4.4.3.2 Obispo Formation
4.4.3.3 Franciscan Assemblage
4.5 Principal Aquifers and Aquitards
4.5.1 Cross Sections
4.5.2 Aquifer Characteristics
4.5.3 Aquitards
4.6 Surface Water Bodies
4.7 Subsidence Potential
5 Groundwater Conditions (§ 354.16)
5.1 Groundwater Elevations and Intepretation
5.1.1 Fall 1954 Groundwater Elevations
5.1.2 Spring 1990 Groundwater Elevations
5.1.3 Modeled 1990s Groundwater Elevations
5.1.4 Spring 1997 Groundwater Elevations
5.1.5 Spring 2011 Groundwater Elevations

5.1.6 Spring 2015 Groundwater Elevations
5.1.7 Spring 2019 Groundwater Elevations
5.1.8 Fall 2019 Groundwater Elevations
5.1.9 Changes in Groundwater Elevation
5.1.10 Vertical Groundwater Gradients
5.2 Groundwater Elevation Hydrographs
5.3 Groundwater Recharge and Discharge Areas
5.3.1 Groundwater Recharge Areas
5.3.1.1 Infiltration of Precipitation
5.3.1.2 Subsurface Inflow
5.3.1.3 Percolation of Streamflow
5.3.1.4 Anthropogenic Recharge
5.3.2 Groundwater Discharge Areas
5.4 Change in Groundwater Storage
5.5 Seawater Intrusion
5.6 Subsidence
5.7 Interconnected Surface Water
5.7.1 Depletion of Interconnected Surface Water
5.8 Potential groundwater dependent ecosystems
5.8.1 Hydrology
5.8.1.1 Overview of GDE Relevant Surface and Groundwater Hydrology
5.8.1.2 Losing and Gaining Reaches
5.8.2 Vegetation and Wetland Groundwater Dependent Ecosystem Identification
5.8.3 Identification of Special-Status Species and Sensitive Natural Communities Associates with GDE's
5.9 Groundwater Quality Distribution and Trends
5.9.1 Groundwater Quality Suitability for Drinking Water
5.9.2 Distribution and Concentrations of Point Sources of Groundwater Constituents
5.9.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents
5.9.3.1 Total Dissolved Solids
5.9.3.2 Nitrate
5.9.3.3 Arsenic
5.9.3.4 Boron
5.9.3.5 Other Constituents

6 Water Budget (§ 354.18)
6.1 Climate
6.1.1 Historical Climate/Base Period
6.2 Water Budget Data Sources
6.3 Historical Water Budget
6.3.1 Historical Time Period
6.3.2 Historical Land Use
6.3.3 Historical Surface Water Budget
6.3.4 Historical Groundwater Budget
6.3.5 Total Groundwater in Storage
6.3.6 Change in Storage
6.3.7 Sustainable Yield
6.3.8 Quantification of Overdraft (Historical)
6.4 Current Water Budget
6.5 Projected Water Budget
6.5.1 Assumptions
6.5.2 Inflows
6.5.3 Outflows
6.5.4 Change In Storage

6.5 Projected Water Budget
6.5.1 Assumptions
6.5.2 Inflows
6.5.3 Outflows
6.5.4 Change In Storage
7 Monitoring Networks (§ 354.32 and § 354.34)
7.1 Monitoring Objectives
7.1.1 Management Areas
7.1.2 Representative Monitoring Sites
7.1.3 Scientific Rationale
7.1.4 Existing Monitoring Programs
7.2 MONITORING NETWORKS
7.2.1 Groundwater Level Monitoring Network
7.2.2 Groundwater Quality Monitoring Network
7.2.3 Surface Water Flow Monitoring Network

7.3 Sustainability Indicator Monitoring
7.3.1 Chronic Lowering of Groundwater Levels
7.3.2 Reduction of Groundwater Storage
7.3.3 Seawater Intrusion
7.3.4 Degraded Groundwater Quality
7.3.5 Land Subsidence
7.3.6 Depletion of Interconnected Surface Water
7.4 Monitoring Technical and Reporting Standards
7.4.1 Groundwater Levels
7.4.2 Groundwater Quality
7.4.3 Surface Water Flow
7.4.4 Monitoring Frequency
7.5 Data Management System
7.6 Assessment and Improvement of Monitoring Network
7.7 Annual Reports and Periodic Evaluation by the GSA$_s$
8.0 Sustainable Management Criteria (§ 354.22-30)
8.1 Sustainability Goal
8.2 Process for Establishing Sustainable Management Criteria
8.2.1 Minimum Thresholds
8.2.2 Measurable Objectives
8.2.3 Undesirable Results
8.3 Chronic Lowering of Groundwater Levels Sustainability Indicator
8.3.1 Locally Defined Undesirable Results
8.3.2 Minimum Thresholds and Measurable Objectives
8.3.3 Relation to Other Sustainability Indicators
8.4 Change in Storage Sustainability Indicator
8.4.1 Locally Defined Undesirable Results
8.4.2 Minimum Thresholds
8.4.3 Measurable Objectives
8.4.4 Relation to Other Sustainability Indicators
8.5 Seawater Intrusion Sustainability Indicator
8.5.1 Locally Defined Undesirable Results
8.5.2 Minimum Thresholds
8.5.3 Measurable Objectives
8.5.4 Relation to Other Sustainability Indicators

8.6 Degraded Water Quality Sustainability Indicator
8.6.1 Locally Defined Undesirable Results
8.6.2 Minimum Thresholds
8.6.3 Measurable Objectives
8.6.4 Relation to Other Sustainability Indicators
8.7 Subsidence Sustainability Indicator
8.7.1 Locally Defined Undesirable Results
8.7.2 Minimum Thresholds
8.7.3 Measurable Objectives
8.7.4 Relation to Other Sustainability Indicators
8.8 Depletion of Interconnected Surface Water Sustainability Indicator
8.8.1 Locally Defined Undesirable Results
8.8.2 Minimum Thresholds
8.8.3 Measurable Objectives
8.8.4 Relation to Other Sustainability Indicators
8.9 Management Areas
8.9.1 Minimum Thresholds and Measurable Objectives
8.9.2 Monitoring and Analysis
8.9.3 Explanation of How Operation of Management Area Will Avoid Undesirable Results
9 Projects and Management Actions (§ 354.44)
9.1 Projects
9.1.1 Project A
9.2 Management Actions
9.2.1 Management Action A
9.3 Projects Needed to Mitigate Overdraft
10 Implementation Plan
10.1 Cost of Implementation
10.2 Funding Alternatives
10.3 Implementation Schedule
10.4 GSP Annual Reporting
10.5 Periodic Evaluations of GSP
11 Notice and Communications (§ 354.10)
11.1 Communications and Engagement Plan
11.2 Nature of Consultations
11.3 Public Meetings

11.4 Incorporation of Feedback in Decision-Making Process.....
11.5 Comments Received .....
11.6 Responses to Comments.....
12 Interagency Agreements (§ 357.2-4) .....
12.1 Coordination Agreements.....
13 References.....
14 Appendices.....

The grey highlighted sections in the Table of Contents (TOC) indicate that the section has been previously released (Chapters 1 through 6) or will be released in the future (Chapters 8 through 14). The complete list of the anticipated TOC is presented to give the reader context as to how Chapter 7-Monitoring Network, connects with the complete Groundwater Sustainability Plan.

LIST OF FIGURES

Figure 7-1: Water Level Monitoring Network
Figure 7-2: Water Quality Monitoring Network
Figure 7-3: Surface Water Flow Monitoring Network

TABLES

Table 7-1: Groundwater Level Monitoring Network
Table 7-2: Recommended Groundwater Level Monitoring Additions
Table 7-3 Groundwater Quality Monitoring Network
Table 7-4 Existing Surface Water Flow Monitoring Network
Table 7-5 Recommended Surface Water Flow Monitoring Network Additions
Table 7-6 Interconnected Surface Water and Associated GDE indicator Monitoring Locations

APPENDICES

Appendix 7A Groundwater-Dependent Ecosystems in the San Luis Obispo Valley Groundwater Basin
Appendix 7B Groundwater Level Measurement Procedures for the San Luis Obispo Valley Groundwater Basin GSP
Appendix 7C Streamflow Measurement in Natural Channels
Appendix 7D Data Management Plan

LIST OF TERMS USED

Abbreviation	Definition
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
AMSL	Above Mean Sea Level
Basin Plan	Water Quality Control Plan for the Central Coast Basin
BMP	Best Management Practices (DWR)
Cal Poly	California Polytechnic State University
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of San Luis Obispo
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CPWS-52	Cal Poly Weather Station 52
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ERMWC	Edna Ranch Mutual Water Company
ET_0	Evapotranspiration
EVGMWC	Edna Valley Growers Ranch Mutual Water Company
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
ILRP	Irrigated Lands Regulatory Program
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element

Abbreviation	Definition
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet
MCL	Maximum Contaminant Level
MG	Million Gallons
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCDC	National Climate Data Center
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLO Basin	San Luis Obispo Valley Groundwater Basin
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SCML	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
VRMWC	Varian Ranch Mutual Water Company
WCR	Well Completion Report
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is complete.

7 MONITORING NETWORKS (§ 354.32 AND § 354.34)

This chapter describes the proposed monitoring networks for the GSP in accordance with SGMA regulations in Subarticle 4: Monitoring Networks. Monitoring is a fundamental component of the GSP necessary to identify impacts to beneficial uses or Basin users, and to measure progress toward the achievement of any management goal. The monitoring networks must be capable of capturing data on a sufficient temporal and spatial distribution to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface water conditions, and to yield representative information about groundwater conditions for GSP implementation. There are three monitoring networks for the Basin: a groundwater level network, a groundwater quality network, and a surface water flow network.

Chapter 7 describes the monitoring objectives, rationale, protocols, and data reporting requirements of the monitoring networks. Monitoring requirements for sustainability indicators are presented, and data gaps are identified, along with steps to be taken to fill the data gaps before the first five-year assessment. The following is a list of applicable SGMA sustainability indicators that will be monitored in the Basin:

- Chronic lowering of groundwater levels.
- Reduction in groundwater storage.
- Degradation of groundwater quality.
- Land subsidence.
- Depletion of interconnected surface water (includes GDE sustainability).

Sustainability indicators are discussed in detail in Chapter 8. This monitoring networks chapter focuses on the monitoring sites and data collection needed to support the evaluation of each sustainability indicator.

7.1 MONITORING OBJECTIVES

The proposed monitoring network must be able to adequately measure changes in groundwater conditions to accomplish the following monitoring objectives:

- Demonstrate progress toward achieving measurable objectives.
- Monitor impacts to the beneficial uses and users of groundwater.
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds for sustainability indicators.
- Quantify annual changes in water budget components.

The monitoring network must provide adequate spatial resolution to properly monitor changes to groundwater and surface water conditions relative to measurable objectives and sustainability indicators within the Basin. The network must also provide data with sufficient temporal resolution to demonstrate short-term, seasonal and long-term trends in groundwater and related surface conditions.

7.1.1 Management Areas

Although there are differences in land use and associated water budgets between the San Luis Valley and Edna Valley subareas, as described in Chapter 6, separate management areas have not been formally established. The monitoring network includes representative wells across the Basin for which minimum thresholds and measurable objective have been selected based on local conditions, as described in Chapter 8.

7.1.2 Representative Monitoring Sites

Monitoring sites are the individual locations within a monitoring network and consist of groundwater wells and stream gages. While a monitoring network uses a sufficient number of sites to observe the overall groundwater conditions and the effects of Basin management projects, a subset of the monitoring sites may be used as representative for meeting the monitoring objectives for specific sustainability criteria.

Representative monitoring sites are the locations at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined. The criteria that were used to determine which wells to utilize are as follows:

- A minimum 10-year period of record of historical measurements spanning wet and dry periods.
- Available well information (well depth, screened interval).
- Access considerations.
- Proximity and frequency of nearby pumping wells.
- Spatial distribution relative to the applicable sustainability indicators.
- Groundwater use.
- Impacts on beneficial uses and Basin users.

7.1.3 Scientific Rationale

GSP monitoring program development is based on a combination of SGMA monitoring networks best management practices (BMPs), local hydrogeology, and the monitoring requirements for individual sustainability criteria. Some of the SGMA monitoring network BMPs implemented for this GSP include the following:

- Defining the monitoring objectives.
- Utilizing existing monitoring networks and data sources to the greatest extent possible to meet those objectives.
- Adjusting the temporal/spatial coverage to provide monitoring data consistent with the need.
- Efficient use of representative monitoring sites to provide data for more than one sustainability indicator.

County monitoring programs that existed before SGMA include sites that do not meet SGMA monitoring network BMPs with respect to known construction information, such as wells with no available Well Construction Report (WCR) and active wells that are used for groundwater supply. While not prohibiting the use of these wells as a monitoring site, SGMA regulations require that the GSP identify sites that do not meet BMPs and describe the nature of the divergence. If the monitoring network uses wells that lack construction information, the GSP shall include a schedule for acquiring monitoring wells with the necessary information or shall demonstrate that such information is not necessary to understand or manage groundwater in the Basin.

As discussed in Chapters 4 and 5, information from available boring logs indicates that there is no regional or laterally extensive aquitard separating the Alluvial aquifer, Paso Robles Formation aquifer, and Pismo Formation aquifer in the Basin. In the San Luis Valley, a physical distinction between Alluvium and Paso Robles Formation sediments is often not apparent, and information from WCRs indicates that wells are regularly screened across productive strata in both formations, which effectively function as a single hydrogeologic unit. DWR (1997) also concluded that there are no continuous confining layers, and unconfined groundwater table conditions essentially prevail throughout the Basin, including the Edna Valley. A minor exception is recognized in Chapter 6 (Section 6.3.5) near the intersection of Biddle Ranch Road and Edna Road, where there is a shallow (semi-perched) alluvial aquifer tapped by a former windmill well. Therefore, with respect to groundwater level monitoring, data collected from wells completed in one or more of the three principal aquifers (Alluvium, Paso Robles Formation, and Pismo Formation) can be used collectively for groundwater elevation contouring and storage estimates. Obtaining well construction

information for all monitoring network wells is not an immediate necessity and will be addressed (see Section 7.6).

7.1.4 Existing Monitoring Programs

Existing monitoring programs are discussed in Chapter 3. Figure 3-9 (Chapter 3) shows the locations of monitoring wells identified in the GAMA program (publicly available groundwater quality data), the SLOFCWCD semi-annual groundwater level program, and the CCRWQCB Irrigated Lands Regulatory Program (groundwater quality data). There are also groundwater level and quality data collected for various contaminant investigations and monitoring programs that are publicly available from the SWRCB Geotracker website.

7.2 MONITORING NETWORKS

This section introduces the proposed GSP monitoring networks and describes the networks in relation to the following SGMA sustainability indicators applicable to the Basin:

- Chronic lowering of groundwater levels.
- Reduction of groundwater in storage.
- Groundwater quality degradation.
- Land subsidence.
- Depletion of interconnected surface water (includes GDE sustainability).

The GSP monitoring program consists of three separate networks, one for groundwater levels, one for groundwater quality, and one for surface water flow. Each network is described below.

7.2.1 Groundwater Level Monitoring Network

Groundwater level monitoring is a fundamental tool in characterizing Basin hydrology. Groundwater levels (often reported as elevations relative to a reference point) in wells are measures of the hydraulic head in an aquifer. Groundwater moves in the direction of decreasing head (downgradient), and groundwater elevation contours can be used to show the general direction and hydraulic gradient associated with groundwater movement. Changes in the amount of groundwater in storage within an aquifer can also be estimated based on changes in hydraulic head, along with other parameters.

There are 40 monitoring wells in the GSP groundwater level monitoring network, 22 wells in the San Luis Valley and 18 wells in the Edna Valley (Figure 7.1 and Table 7-1). Construction information is available for 31 of the 40 wells. Based on the available information, 16 of the wells are interpreted to be alluvial wells, while the remaining 24 wells tap into the Paso Robles Formation, Pismo Formation, or are mixed aquifer wells that utilize groundwater from more than one aquifer. Half the wells are used for irrigation, seven are private domestic wells, and 13 are dedicated monitoring wells.

Groundwater levels may be used as a proxy for monitoring other sustainability indicators (besides chronic lowering of water levels) provided that significant correlation exists between groundwater elevations and the sustainability indicator for which the groundwater elevations serve as a proxy. Ten of the groundwater level monitoring network wells are representative monitoring site wells used for evaluating sustainability criteria. Six representative monitoring site wells are used for evaluating chronic lowering of groundwater level and reduction of groundwater in storage, which is correlated with groundwater levels (Chapter 6, Section 6.3.5). Two wells are used for evaluating subsidence, which is correlated with groundwater levels

in the area being monitored (Chapter 4, Section 4.7), and three wells are used to evaluate depletion of interconnected surface water, which is correlated with groundwater levels (Chapter 5, Section 5.7). One of the wells used to evaluate depletion of interconnected surface water is also a representative monitoring site for subsidence. The sustainability criteria and associated minimum thresholds and measurable objectives are presented in Chapter 8.

7.2.1.1 ***Groundwater Level Monitoring Data Gaps***

SGMA regulations do not require a specific density of monitoring wells, other than being sufficient to represent groundwater conditions for GSP Implementation. The monitoring network well density is roughly 20 wells per 10 square miles, which is 10 times greater density than guidelines for the statewide CASGEM program. There are currently sufficient wells in the network to provide information for overall sustainable management of the Basin, although some local data gaps have been identified that will be addressed during GSP implementation.

A groundwater level monitoring well is recommended in the Foothill Boulevard/O'Conner Way area to improve groundwater level contour control and associated groundwater storage estimates in the Los Osos Valley within the Basin. Other groundwater level monitoring locations are recommended for GDE indicator evaluation and are in the vicinity of existing or proposed stream gage locations. The background and rationale for the GDE indicator monitoring sites are presented in a separate technical memorandum (Appendix 7A).

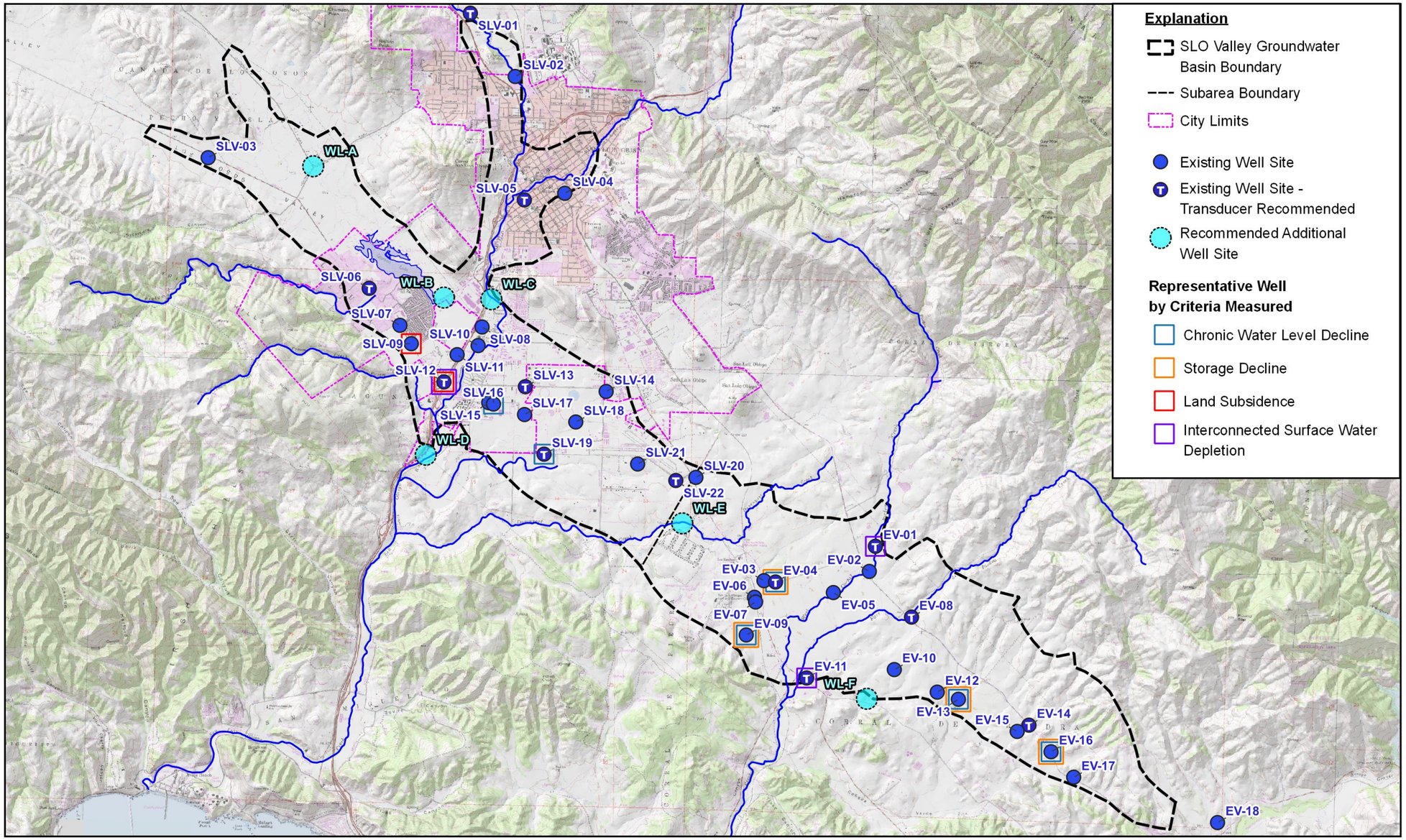
Table 7-1 presents the GSP groundwater level monitoring network wells. Table 7-2 presents additional areas recommended for groundwater level monitoring. Figure 7-1 shows the location of the existing groundwater level monitoring wells and the recommended additional monitoring areas.

Table 7-1
Groundwater Level Monitoring Network

Local ID[1]	TRS / **State ID**[2]	Well Depth (feet)	Screen Interval (feet)	RP Elev.[3] (feet AMSL)	First Data Year	Last Data Year	Data period (years)	Data Count	Aquifer[4]	Well Criteria[5]	Well Use[6]	GSA
SLV-01	30S/12E-23E	(pending)	(pending)	304			(pending)		Qa	GDE, T	MW	County
SLV-02	30S/12E-22G	(pending)	(pending)	276			(pending)		Qa		MW	City
SLV-03	30S/12E-30P			153					Qa		IRR-I	County
SLV-04	**30S/12E-35B1**	48	28-48	215.6	1991	2020	29	38	Qa		IRR-A	City
SLV-05	30S/12E-35D	52	32-52	187	1990	2018	28	7	Qa	GDE, T	IRR-A	City
SLV-06	31S/12E-04D	85	45-85	150	1989		1	1	Qa	T	MW	City
SLV-07	31S/12E-04K	125	55-125	139.5	1992	2000	8	46	Qpr		PS-I	City
SLV-08	31S/12E-03K	70	50-70	128	1988	2020	32	2	Qpr		IRR-A	City
SLV-09	**31S/12E-4R1**	130	40-130	129.5	1988	2020	32	48	Qa/Qpr	SUB	PS-I	City
SLV-10	31S/12E-3Q	48		131	2017	2020	3	82	Qa		MW	City
SLV-11	**31S/12E-3P1**	61		119	1990	2006	16	31	Qa		MW	City
SLV-12	**31S/12E-10D3**	175	50-90; 150-170	109.2	1992	2020	28	72	Qa/Qpr/Tps	ISW, SUB, T	IRR-A	City
SLV-13	31S/12E-11D	40	5-40	121.75	1996	2020	24	49	Qa	T, GDE	MW	City
SLV-14	31S/12E-12E	20	5-20	144.68	1990	2020	30	60	Qa		MW	County
SLV-15	**31S/12E-10G2**	190		122	1965	2020	55	90	Qpr		IRR-A	City
SLV-16	**31S/12E-10H3**	165	65-165	122	1984	2020	36	68	Qpr	WL	DOM-A	City
SLV-17	31S/12E-11M	100	60-100	119.78	1996	2020	24	73	Qpr		MW	County
SLV-18	31S/12E-11K	30	6-21	133.28	1990	2020	30	59	Qa		MW	County
SLV-19	**31S/12E-14C1**			128	1958	2020	62	98	Qpr	WL, GDE, T	IRR-A	County
SLV-20	31S/13E-18D			202					Qa		MW	County
SLV-21	31S/12E-13A	60	50-60	178.68	2018	2018	1		Qpr		MW	County
SLV-22	31S/12E-13C	100	11-100	178	2004	2020	16	2	Qpr/Kjf	T	IRR-I	County
EV-01	**31S/13E-16N1**	72		324	1958	2020	62	99	Qa	ISW, T	DOM-A	County
EV-02	31S/13E-20A	75		305					Qa	GDE	IRR-I	County
EV-03	**31S/13E-19H4**	250	178-250	254					Qpr/Tps		IRR-A	County
EV-04	**31S/13E-19H1**			262	1958	2020	62	100	Tps	WL, GWS, T	IRR-A	County
EV-05	31S/13E-20G	400	120-400	280					Tps		IRR-I	County
EV-06	**31S/13E-19J1**			251	1998	2020	22	44	Qpr		DOM-I	County
EV-07	**31S/13E-19J2**			250	1998	2020	22	45	Tps		DOM-A	County
EV-08	31S/13E-21L			350					Qa	GDE, T	IRR-A	County
EV-09	**31S/13E-19R3**	440	130-190; 290-430	239	1974	2020	46	45	Tps/Tm	WL, GWS	PS-A	County
EV-10	31S/13E-28F	340	200-330	344					Qpr/Tps		IRR-A	County
EV-11	**31S/13E-20F6**	150	55-150	230	2011	2020	9		Qpr/Tm	ISW, GDE, T	MW	County
EV-12	**31S/13E-28J3**	600		303	1993	2020	27	39	Qpr/Tps		IRR-A	County
EV-13	**31S/13E-27M3**	400	130-380	289	1993	2020	27	34	Qpr/Tps	WL, GWS	IRR-A	County
EV-14	31S/13E-27R	300	90-290	319	2017	2020	3	6	Qpr/Tps	T	MW	County
EV-15	31S/13E-27Q			307	1989	2020	31	9	Qpr/Tps		DOM-I	County
EV-16	31S/13E-35D	260	200-260	323	1988	2020	32	188	Tps	WL, GWS	PS-A	County
EV-17	31S/13E-35F	260	200-260	333	2014	2020	6	66	Tps/Kjf		PS-I	County
EV-18	**31S/13E-36R1**			327	1968	2020	52	99	(out of Basin)		IRR-A	County

Notes:

1- Representative Monitoring Sites are in **bold**. Wells with known State Well Completion Reports are underlined.
2- TRS = Township Range Section and ¼-¼ section listed, State Well ID bolded where applicable.
3- Reference Point elevations from various sources with variable accuracy.
4- Principal Aquifers are Quaternary Alluvium (Qa), Quaternary Paso Robles Formation (Qpr), and Tertiary Pismo Formation (Tps). Other bedrock aquifers (non-Basin sediments) are Tertiary Monterey Formation (Tm) and Cretaceous-Jurassic Franciscan Assemblage (KJf). Aquifers are inferred where construction information is not available.
5- Representative well criteria include Subsidence (SUB), Interconnected Surface Water Depletion (ISW), Chronic Water Level Decline (WL), and Groundwater Storage Decline (GSW). Other criteria are Transducer site (T), and Groundwater Dependent Ecosystem indicator evaluation site (GDE), which may be paired with nearby existing or proposed stream gage. Transducer installations are pending well owner authorization. Measurement frequency is semi-annual for all wells except Transducer sites (T), which are measured daily.
6- Well Use includes Monitoring Well (MW), Irrigation Well (IRR), Public Supply Well (PS), and Domestic Well (DOM). Modifiers are Active (A) or Inactive (I). Information for some wells inferred pending confirmation.



Prepared For:

COUNTY OF SAN LUIS OBISPO

Author: TK
Date: 11/19/2020

SAN LUIS OBISPO VALLEY BASIN GSP

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0 0.5 1 km

References:

1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hirozontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:

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Figure 7-1
Water Level Monitoring Network

Table 7-2
Recommended Groundwater Level Monitoring Network Additions

Water Level Data Gap ID	Location	Purpose
WL-A	Near Foothill Blvd. and O'Connor Way	Groundwater elevation contours and storage
WL-B	Madonna Road near Laguna Lake	GDE indicator evaluation
WL-C	Elks Lane south of SLO Creek Bridge	GDE indicator evaluation
WL-D	South Higuera near old Highway Bridge	GDE indicator evaluation
WL-E	Davenport Creek east of Crestmont Road	GDE indicator evaluation, groundwater elevation contours and storage
WL-F	Corbett Canyon Road near Canada Verde	GDE indicator evaluation

7.2.2 Groundwater Quality Monitoring Network

Groundwater quality monitoring refers to the periodic collection and chemical or physical analysis of groundwater from wells. As discussed in Chapter 5 (Section 5.9), the quality of groundwater in the Basin is generally good. Groundwater quality trends in the Basin are stable, with no significant trends of ongoing deterioration of groundwater quality based on the Central Coast Basin Plan.

Groundwater quality networks should be designed to demonstrate that the degraded groundwater quality sustainability indicator is being observed for the purposes of meeting the sustainability goal (DWR Monitoring Networks BMP, 2016). In other words, the main purpose of the groundwater quality monitoring network is to support the determination of whether the degradation of groundwater quality is occurring at the monitoring sites, based on the sustainability indicator constituents and minimum thresholds selected. This GSP groundwater quality network is also designed to use existing monitoring programs to the greatest degree possible (DWR Monitoring Networks BMP, 2016).

Sustainability indicator constituents selected for groundwater quality are Total Dissolved Solids (TDS), Nitrate, and Arsenic. These constituents were introduced in Chapter 5 (Section 5.9.3) as diffuse or naturally occurring in the Basin and are further discussed in relation to sustainability indicators in Section 7.3.4 and in Chapter 8. Two other water quality constituents associated with notable contaminant plumes in the South San Luis Obispo and Buckley Road areas (Figure 7-2 and Section 7.3.4) will also be monitored within the GSP water quality network, but not as sustainability indicators.

The groundwater quality network consists of nine sites (Figure 7-2), which are all are Public Water System supply wells. Water quality for these wells can be accessed using the GAMA Groundwater Information System. Wells in the Irrigated Lands Regulatory Program were evaluated for potential inclusion in the GSP monitoring program, however, the irrigation wells have not historically been sampled for groundwater quality at regular intervals, therefore no historical record of groundwater quality data exists. In addition, Agricultural Order 4.0 of the Irrigated Lands Regulatory Program is currently in draft form and under review. Selection of specific wells regulated under that program would not be recommended until the program is implemented and monitoring data is available for review. By comparison, the public water system wells have a history of groundwater quality data and specific wells are sampled at regular intervals for the three indicators recommended for groundwater quality monitoring in Chapter 8 – TDS, Nitrate, and Arsenic.

*7.2.2.1 **Groundwater Quality Monitoring Data Gaps***

Current groundwater quality monitoring within the Basin is sufficient to collect the spatial and historical data needed to determine groundwater quality trends for groundwater quality indicators. The GAMA database includes 120 wells within the Basin boundaries that have been monitored for groundwater quality in the last three years. The nine wells selected (Figure 7-2) provide representative Basin coverage but can be supplemented with other data if needed to support sustainability indicator evaluation. The water quality network wells will be used collectively to provide the metric for use with the groundwater quality degradation sustainability indicator (Chapter 8). No data gaps in groundwater quality monitoring are currently identified.

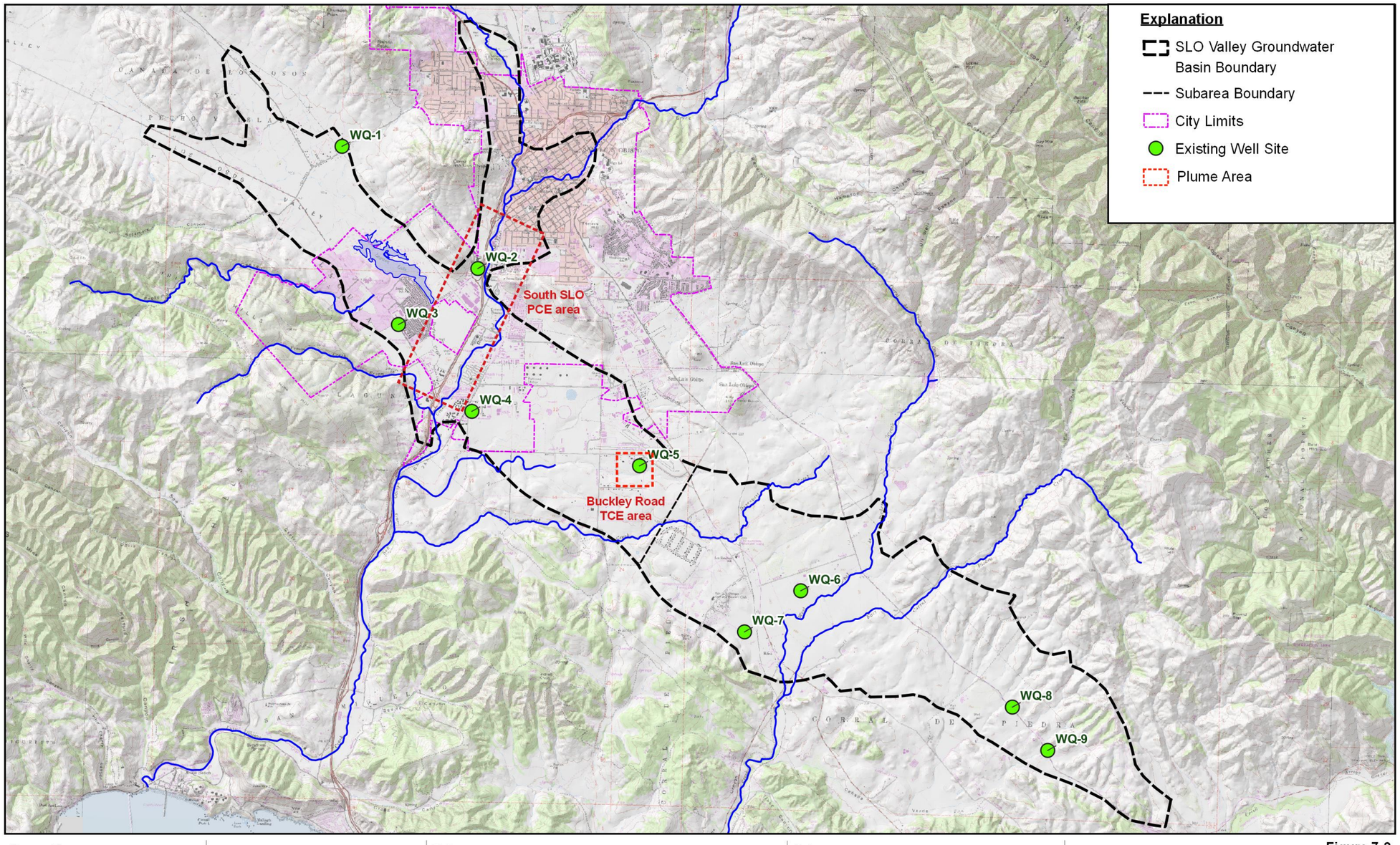
Table 7-3 presents the GSP groundwater quality monitoring network. Figures 7-2 show the locations of the groundwater quality monitoring wells.

Table 7-3
Groundwater Quality Monitoring Network

Local ID	State ID[1]	First Data Year	Last Data Year	Data period (years)	Data Count (TDS)[2]	Data Count (N)[3]	Data Count (As)[4]	GSA
WQ-1	4000206-003	2003	2019	16	4	12	5	County
WQ-2	4000780-001	2002	2019	17	5	21	6	City
WQ-3	4010009-004	1989	2019	30	8	42	8	City
WQ-4	4000604-001	2002	2020	18	6	69	6	City
WQ-5[5]	4000734-001	2004	2020	16	4	21	6	County
WQ-6	4000819-001	2017	2020	3	3	4	1	City
WQ-7	4010023-008	1992	2020	28	19	142	148	County
WQ-8	4000202-001	2003	2018	15	5	23	27	County
WQ-9	4000765-001	2002	2019	17	7	19	36	County

Notes: Data accessed on GAMA Groundwater Information System

1- State ID for public water system
2- TDS = Total Dissolved Solids – typically measured every three years
3- N = Nitrate-Nitrogen – typically measured every year or quarterly
4- As = Arsenic – variable from monthly to every three years
5- WQ-5 also used to track TCE (see Section 8.2.4)



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1. Coordinate System: State Plane California V FIPS 0405 Feet
2. Projection: Lambert Conformal Conic
3. Hirozontal Datum: NAD 83
4. Vertical Datum: NAVD 88
5. Basemap: USGS 7.5' Topographic Map

Notes:

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Figure 7-2
Water Quality Monitoring Network

7.2.3 Surface Water Flow Monitoring Network

Surface water flow monitoring can provide valuable information for the Basin model and for evaluating potential depletion of interconnected surface water for groundwater dependent ecosystems (GDEs), which is one of the sustainability indicators. The evaluation of surface water connectivity with the Basin and relevance to GDEs is described in a technical memorandum (Appendix 7A) that includes recommendations for the surface water flow monitoring sites identified in this chapter.

As summarized in Chapter 3, there are six permanent stream gages in or adjacent to the Basin, all within the San Luis Valley subarea watershed (Figure 7-3). The existing gaging stations only provide stage data, and not actual stream flow data. Stream stage is the height of water level in the stream above an arbitrary point, usually at or below the stream bed. Stage data can be useful for identifying flow and no-flow conditions, flood stage alerts, and analyzing the timing of precipitation and runoff in watersheds. Streamflow data is critical for quantifying Basin recharge from stream seepage as part of the water budget/model and for addressing sustainability indicators related to GDEs and depletion of interconnected surface water.

Stage data can be converted to streamflow through the use of a rating curve, which incorporates information that is specific to each site, including the cross-sectional area of the channel and the average surface water velocity for a given flow stage. A description of the methodology for monitoring surface water flow in natural channels is presented in Appendix 7B. There are partial rating curve approximations for three of the sites based on actual streamflow measurements (Section 3.6.1.3). A modeling approach to estimating rating curves was performed by Questa Engineering (2007), but the results of that study have not been validated with field measurements.

7.2.3.1 Surface Flow Monitoring Data Gaps

The existing gages are all in the San Luis Valley subarea watershed, where the majority of potential GDEs have been identified (Figure 5-15; Chapter 5). There are no surface flow monitoring sites in the Edna Valley subarea, which is the subarea subject to overdraft (Chapter 6). Data gaps for surface water flow monitoring with respect to interconnected surface water depletion, GDEs, and the water budget are identified on Stenner Creek near the upstream Basin boundary, on San Luis Obispo Creek near the downstream Basin boundary, and on Pismo Creek near the downstream Basin boundary (Appendix 7A). Three stream gages are recommended for installation to fill these data gaps adjacent to the Basin boundaries. In addition, two more stream gage sites are recommended on East Corral de Piedra Creek and West Corral de Piedra Creek at Orcutt Road to fill a data gap in the water budget in the Edna Valley. Stream gages on these two principal drainages, along with a gage downstream of their confluence on Pismo Creek, will provide important information on stream seepage in the Edan Valley for the water budget/Basin model, and will allow a direct comparison of streamflow between the two watersheds, one of which has a permitted reservoir upstream of Orcutt Road (Chapter 6, Section 6.3.3.1). Rating curve development is recommended for all stream gages to provide the stream flow information needed for the water budget/model and sustainability indicator evaluation.

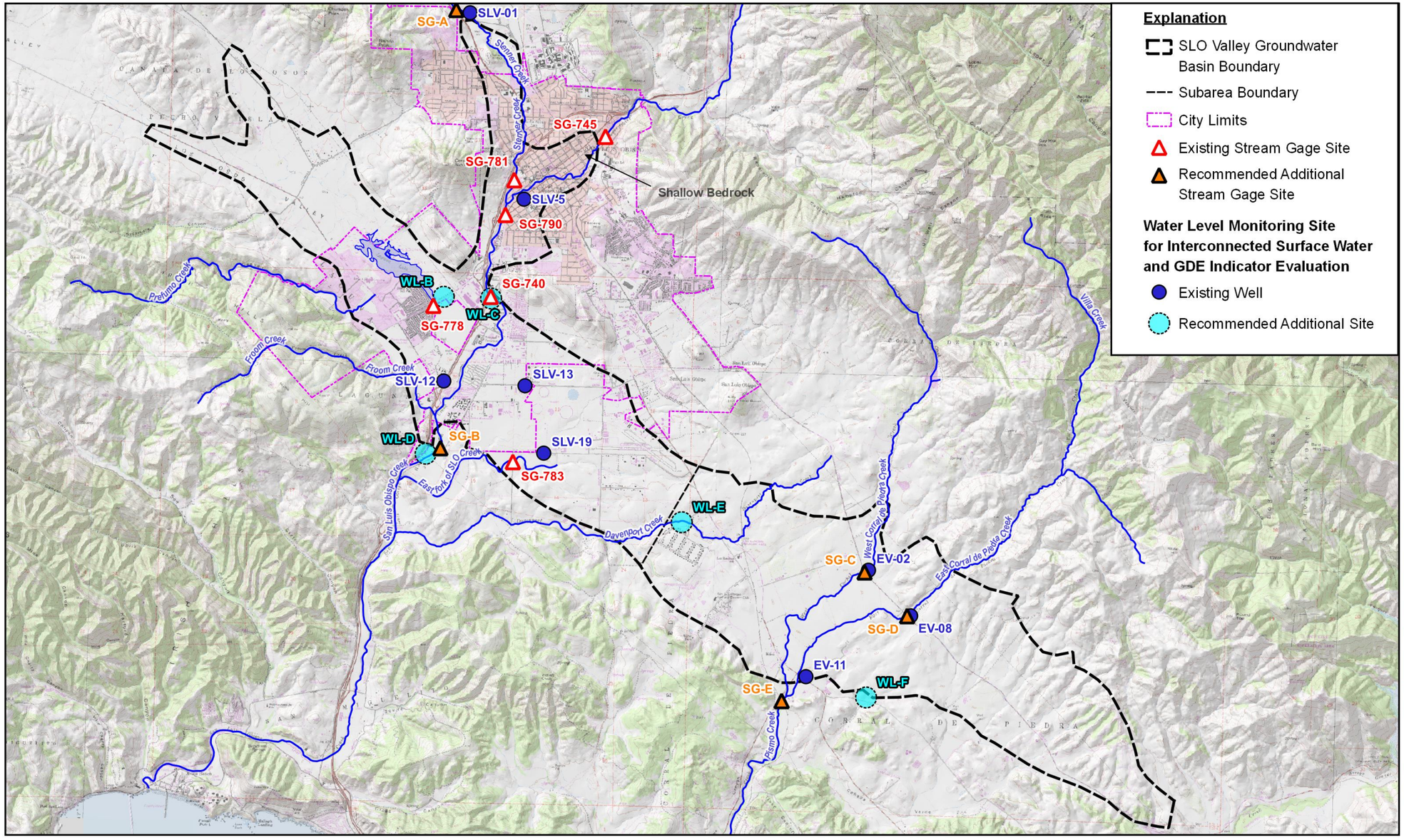
Table 7-4 presents the GSP surface water flow monitoring network. Table 7-5 presents recommended sites for additional stream gages. Figure 7-3 shows the locations of the existing gages, recommended gages, and the nearby groundwater level monitoring sites (both existing and recommended) that can be used to evaluate interconnected surface water depletion and GDE indicators (see Section 7.3.6 and Appendix 7A).

Table 7-4
Existing Surface Water Flow Monitoring Network

Local ID	Water Course	Location	First Data Year	Data Interval	Data period (years)	GSA
SG-745	San Luis Obispo Creek	Andrews St. Bridge	2006	15-minutes	14	City
SG-781	Stenner Creek	Nipomo Street	2005	15-minutes	15	City
SG-790	San Luis Obispo Creek	Marsh Street	2019	15-minutes	1	City
SG-740	San Luis Obispo Creek	Elks Lane	2005	15-minutes	15	City
SG-778	Prefumo Creek	Madonna Road	2005	15-minutes	15	City
SG-783	East Fork Creek	Jesperson Road	2005	15-minutes	15	County

Table 7-5
Recommended Surface Water Monitoring Network Additions

Surface Water Flow Gap ID	Location	Purpose
SG-A	Stenner Creek at Stenner Creek Road	Water Budget, Surface water connectivity, GDE indicator evaluation
SG-B	San Luis Obispo Creek at Old Highway Bridge	Water Budget, Surface water connectivity, GDE indicator evaluation
SG-C	West Corral de Piedra Creek at Orcutt Road	Water Budget
SG-D	East Corral de Piedra Creek at Orcutt Road	Water Budget
SG-E	Pismo Creek at Railroad Crossing	Water Budget, Surface water connectivity, GDE indicator evaluation



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Author: TK
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SAN LUIS OBISPO VALLEY BASIN GSP

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References:

1. Coordinate System: State Plane California V FIPS 0405 Feet
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5. Basemap: USGS 7.5' Topographic Map

Notes:

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Figure 7-3
Surface Water Flow Monitoring Network

7.3 SUSTAINABILITY INDICATOR MONITORING

Sustainability indicators are the effects caused by groundwater conditions occurring throughout the Basin that, when significant and unreasonable, become undesirable results. The SGMA sustainability indicators for GSP implementation are as follows:

- Chronic lowering of groundwater levels.
- Reduction in groundwater storage.
- Seawater Intrusion (this indicator is not applicable to Basin).
- Degraded groundwater quality.
- Land subsidence.
- Depletion of interconnected surface water (includes GDE sustainability).

7.3.1 Chronic Lowering of Groundwater Levels

Chronic lowering of groundwater levels can lead to a significant and unreasonable depletion of the water supply. All of the groundwater level monitoring network wells can be used for evaluating chronic lowering of groundwater levels, with a selected subset of six representative wells formally assigned to assess Minimum Thresholds and Measurable Objectives (Chapter 8). Groundwater monitoring network wells not included in the subset of representative wells are included in the network primarily for preparing groundwater level contour maps, which are used for evaluating hydraulic gradient and groundwater flow direction. Groundwater level contour maps can reveal groundwater pumping depressions that result from lowering of groundwater levels and can also be used to calculate change in groundwater storage. The area where chronic lowering of water levels has been occurring is in the Edna Valley (Chapter 5; Figure 5-11). Four of the six representative wells focus on this area (Figure 7-1).

Static groundwater level measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions. Historically, the semi-annual groundwater level program conducted by SLOFCWCD has measured groundwater levels in April and October of each year. This schedule will be maintained for the GSP.

In addition, 12 wells have been recommended (based on spatial distribution, equipment access, and interconnected surface water/GDE applications; Figure 7-1) for pressure transducer installation to automatically record groundwater levels on a daily basis, providing more detailed information on short-term trends, seasonal high and low conditions, and on potential GDEs and interconnected surface water depletion. Pressure transducers are instruments that record water levels automatically at pre-determined intervals. They are installed below the water surface in a well and use the pressure of the overlying water column to produce a depth to water measurement. Pressure transducers are a very efficient means of collecting groundwater level data at frequent intervals. The recommended transducer locations are listed in Table 7-1.

7.3.2 Reduction of Groundwater Storage

Groundwater storage and water levels are directly correlated, and chronic lowering of water levels also leads to a reduction of groundwater storage. Change in groundwater storage will be monitored using the overall monitoring network, while selected representative wells will track reduction of groundwater storage as the sustainability indicator.

The comprehensive 40-well monitoring network will be used to contour groundwater elevations for seasonal high conditions, from which annual spring groundwater storage estimates will be estimated and the annual change in storage reported as required for Annual Reports. Groundwater storage will be

calculated using the specific yield method, which is the product of total saturated Basin volume and average specific yield. The saturated Basin volume is the volume between a groundwater elevation contour map for a specific period (such as Spring 2019) and the base of permeable sediments (Chapter 6; Section 6.3.5). Representative wells that will be used for monitoring reductions in groundwater storage are listed in Table 7-1 and shown in Figure 7-1. Chapter 8 discusses the Minimum Thresholds and Measurable Objectives assigned to the representative wells.

7.3.3 Seawater Intrusion

The Basin is not susceptible to seawater intrusion and will not be monitored for that indicator.

7.3.4 Degraded Groundwater Quality

The significant and unreasonable degradation of water quality would be an undesirable result. As discussed in Section 7.2.2, groundwater quality constituents in the Basin that have been selected for groundwater quality indicator monitoring include TDS, Nitrate, and Arsenic. Selenium has been observed at concentrations that affect well operations at individual wells in the Basin, but it does not appear to be a widespread issue (Chapter 5; Section 5.9.3.5). The selected water quality indicators represent common constituents of concern in relation to groundwater production for domestic, municipal and agricultural use that will be assessed by the monitoring network. TDS is selected as a general indicator of groundwater quality in the Basin. Nitrate is a widespread contaminant in California groundwater and selected due to its presence across the Basin associated with agricultural activities, septic systems, landscape fertilizer and wastewater treatment facilities. Arsenic is selected to represent naturally occurring contaminants in the Basin. Other constituents of concern may be added to the list during GSP implementation. The sites currently best suited for evaluating trends over time are public supply wells. Sampling intervals vary by well and by constituent, ranging from every three years to monthly, but longer historical records are available, compared to other types of wells.

The significant and unreasonable degradation of water quality includes the migration of contaminant plumes that impair water supplies. There are two anthropogenic contaminant plumes that underly multiple properties and are under investigation within the Basin. These include a tetrachloroethylene (PCE) plume, also known as the South SLO PCE Plume, and a trichloroethylene (TCE) plume, also known as the Buckley Road Area plume (Figure 7-2).

7.3.4.1 South SLO PCE Plume

PCE is primarily used as a solvent at dry cleaning establishments and has a maximum contaminant level in drinking water of 5 micrograms per liter. Dissolved PCE in groundwater has been detected underlying portions of the City of San Luis Obispo, mainly south of the confluence of San Luis Obispo Creek and Stenner Creek. There have been several site investigations and documented PCE releases at various locations within the City. Historical site investigations date to the early 1990's, with regional investigations in 2005 (QPS, 2005) and 2013-2015 (URS, 2013), (URS, 2015). The Department of Toxic Substance Control (DTSC) and the Regional Water Quality Control Board (RWQCB) have provided most of the regulatory oversight related to site investigations and clean-up efforts since the early 1990's. Currently, the City has initiated a comprehensive PCE investigation, including monitoring well constructions, with Proposition 1 grant funding. Representative wells from the future PCE monitoring well network will be selected for inclusion with the GSP groundwater quality network specifically for tracking PCE in the Basin.

7.3.4.2 Buckley Road Area TCE Plume

TCE has a variety of uses, typically as an industrial solvent/degreaser. The maximum contaminant level for TCE in drinking water is 5 micrograms per liter. In 2013, the RWQCB initiated an investigation into the

source of TCE detected in two supply wells in the industrial area of Buckley Road and Thread Lane. County of San Luis Obispo Environmental Health Services also began a sampling program following TCE detection above the maximum contaminant level in groundwater from a residential supply well in 2015. Information from these and subsequent investigations, including investigation at the San Luis Obispo County Airport north of Buckley Road, indicated that the likely source of TCE was the industrial area of Buckley Road and Thread Lane. These investigations were summarized in a public notice from the RWQCB dated January 15, 2019. One of the supply wells selected for the groundwater quality network (WQ-5) is in the industrial area and both historically and currently reports TCE concentrations above the maximum contaminant level (24 micrograms per liter TCE reported in April 2020). Currently, the RWQCB is enforcing a replacement water program to provide treatment for wells impacted by the TCE plume. A web page has been established by the Water Board to provide the latest information to the public and can be accessed here: https://www.waterboards.ca.gov/centralcoast/water_issues/hot_topics/tce_pce_info/tce_pce_index.html. The TCE plume will be monitored for the GSP through tracking the concentration reported at WQ-5 and observing published plume maps over time. A general trend of decreasing TCE concentration, along with plume containment, would be measures of success in plume management.

7.3.5 Land Subsidence

Land subsidence can lead to undesirable results when it interferes with surface land uses. Land subsidence is frequently associated with groundwater pumping and has been documented in the San Luis Valley subarea (see Chapter 4; Section 4.7 and Chapter 6; Section 6.7.3). The purpose of land subsidence monitoring is to identify the rate and extent of land subsidence and to provide data for sustainability criteria thresholds. DWR maintains a land subsidence dataset derived from Interferometric Synthetic Aperture Radar (InSAR) data from satellite imagery. InSAR is a remote sensing method used to measure land-surface elevations over large areas, with accuracy on the order of centimeters to millimeters. InSAR uses satellites that emit and measure electromagnetic waves that reflect off of the earth's surface to produce synthetic aperture radar images with a spatial resolution of about 100 meters by 100 meters. Vertical displacement values associated with land subsidence can be estimated by comparing these images over time.

The DWR land subsidence dataset shows vertical displacement from 2015-2019 in California groundwater basins. The raster GIS dataset covers the entire Basin, with no data gaps. The dataset shows minimal vertical displacement of less than an inch from 2015-2019 throughout the Basin (Chapter 8). Continued evaluation of Basin land subsidence through monitoring the available InSAR data is planned. In addition, two representative monitoring site wells have been identified for land subsidence monitoring based on the historical area of land subsidence in the Basin (Chapter 4; Section 4.7) and are included in Table 7-2. Groundwater level can be a proxy for land subsidence because the process is typically not reversible, and maintaining groundwater levels above historic lows in areas susceptible to land subsidence can protect against future undesirable results (see Chapter 8).

7.3.6 Depletion of Interconnected Surface Water

Surface water provides beneficial uses, and depletion of interconnected surface water due to groundwater pumping can result in undesirable results by impacting these beneficial uses. The purpose of monitoring for depletion of interconnected surface water is to characterize the following:

- Flow conditions including surface water discharge, surface water head, and baseflow contribution.
- Identifying the approximate date and location where ephemeral or intermittent flowing streams cease to flow.
- Historical change in conditions due to variations in stream discharge and regional groundwater extraction.

- Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.

One of the beneficial uses of surface water is the environmental water demand which supports riverine, riparian, and wetland ecosystems. Locations where surface water is interconnected with groundwater have the potential for creating GDEs, which are ecological communities or species that depend on groundwater emerging from aquifers (rising into streams or lakes) or on groundwater occurring near ground surface where it may be used by riparian vegetation, wetland vegetation, or oak woodlands.

Depending on location and time of year, GDEs that overlie the Basin can be supported by a range of water sources including direct precipitation, surface runoff, shallow subsurface flow, and groundwater. Shallow subsurface flow can vary from short-term precipitation and runoff driven flow (e.g. bank storage and other macro-pores filled during a precipitation event that drain on the order of days to weeks) to flow that is directly connected to groundwater (e.g. baseflow as groundwater discharge into streams during the dry season). Because GDEs overlying the Basin are supported by a wider range of surface and groundwater hydrological processes in the wet season, monitoring of GDEs for sustainability indicators will focus on the late spring baseflow period and summer/early fall dry season. Primary groundwater dependence for GDEs is more likely during the late spring, summer, and early fall dry season, although in some reaches irrigation return flow may also be a factor. If the GDE indicators are met in the late spring and dry summer and fall seasons, sufficient groundwater is more likely also be available in the wet season to sustain GDEs (see Appendix 7A).

There are six existing County stream gages within, or adjacent to the SLO Valley Groundwater Basin (Table 7-4, Figure 7-3). The existing gages only report stage, as discussed in Section 7.2.3. An additional five stream gages are proposed, both for water budget and interconnected surface water flow data gaps (Table 7-5). Rating curves, which correlate stage with stream flows, should be developed for all 11 sites. In addition, groundwater level monitoring is recommended near the stream gages sites, and at additional sites for riparian and wetland/marsh GDE types (Figure 7-3). Table 7-6 shows the pairing between the stream gages and the nearby water level monitoring sites for interconnected surface water and GDE indicator evaluation (both existing and recommended).

Table 7-6
Interconnected Surface Water and Associated GDE indicator Monitoring Locations

Stream Gage	Monitoring Well	Area
SG-745	(none - bedrock)	SLO Creek near upstream Basin boundary
SG-781	SLV-5	Stenner Creek above SLO Creek confluence
SG-790	SLV-5	SLO Creek below Stenner Creek confluence
SG-740	WL-C	SLO Creek at Elks Lane
SG-778	WL-B	Prefumo Creek at Laguna Lake outlet
SG-783	SLV-19	East Fork SLO Creek at Jesperson Lane
SG-A	SLV-01	Stenner Creek near upstream Basin boundary
SG-B	WL-D	SLO Creek near downstream Basin boundary
SG-C	EV-2	West Corral de Piedra at Orcutt Road
SG-D	EV-8	East Corral de Piedra at Orcutt Road
SG-E	EV-11	Pismo Creek at downstream Basin boundary
(none)	SLV-12	Calle Joaquin
(none)	SLV-13	Tank Farm Road
(none)	WL-E	Davenport Creek near Crestmont Road
(none)	WL-F	Corbett Canyon Road near Canada Verde

The wells in Table 7-6 used for GDE monitoring need to be in locations that are representative of groundwater levels in the riparian zones. A few of the existing wells (SLV-5, SLV-19, EV-11) are not immediately adjacent to their paired stream gage, but may have a sufficient hydraulic connection to local riparian conditions to be useful for GDE indicator evaluation. The data for each paired monitoring well and stream gage would be supplemented with field surveys (discussed below), to evaluate the suitability of the GDE indicator monitoring sites.

In addition to streamflow and groundwater level monitoring, streamflow surveys are recommended across a range of seasons and water year types to identify losing and gaining reaches with the Basin. Identifying losing and gaining reaches is fundamental to understanding surface water-groundwater connectivity. Losing reaches occur in Basin recharge areas that are typically dry during the summer and late fall. Gaining reaches occur in Basin discharge areas where groundwater is contributing to surface water flow. Groundwater pumping that lowers groundwater levels in an aquifer beneath a creek channel may deplete surface water by either expanding a losing reach or contracting a gaining reach, depending on the depth of the water table and the permeability of the stream bed. The streamflow surveys characterize the extent of gaining and losing reaches and help evaluate depletion of interconnected streamflow. This type of data collection is conducted by measuring instream flow in multiple locations along a reach of creek in a short period of time and examining the loss or gain of stream flow rates along the length of the stream channel.

7.4 MONITORING TECHNICAL AND REPORTING STANDARDS

Monitoring technical and reporting standards include a description of the protocols, standards for monitoring sites, and data collection methods.

7.4.1 Groundwater Levels

Monitoring protocols and data collection methods for groundwater level monitoring and reporting are described in the attached Appendix 7C, and are based on SGMA monitoring protocols, standards and sites BMPs, USGS data collection methods, and practical experience. Wells used for monitoring program sites have been constructed according to applicable construction standards, although not all the information required under the BMPs is available for every site. Table 7-2 lists the pertinent information available for the monitoring sites.

7.4.2 Groundwater Quality

Monitoring protocols and standards for groundwater quality sampling sites are those required for public water systems from which the groundwater quality data is obtained. Sample collection and field tests shall be performed by appropriately trained personnel as required by California Code of Regulations Title 22, Section 64415. All wells used for public supply are expected to meet applicable construction standards.

7.4.3 Surface Water Flow

As previously discussed, the existing gaging stations only provide stage data, and not actual stream flow data. Stage data can be converted to streamflow through the use of a rating curve, which incorporates information that is specific to each site, including the cross-sectional area of the channel and the average surface water velocity for a given flow stage. These rating curves are developed using depth profiles and flow velocity measurements during storm-runoff events (Appendix 7B). Rating curves may need to be revised periodically as they can shift due to changes in channel geometry. Protocols and data collection methods will be based on applicable USGS standards and SLOFCWCD standards.

7.4.4 Monitoring Frequency

Monitoring frequency is the time interval between data collection. Seasonal fluctuations relating to groundwater levels or quality are typically on quarterly or semi-annual cycles, correlating with seasonal precipitation, recharge, groundwater levels, and well production. The monitoring schedule for groundwater levels collected under the GSP groundwater level monitoring program will coincide with seasonal groundwater level fluctuations, with higher levels (i.e. elevations) in April (Spring) and lower levels in October (Fall). A semi-annual monitoring frequency provides a measure of seasonal cycles, which can then be distinguishable from the long-term trends. At the transducer-monitored locations, groundwater level measurements will be recorded automatically on a daily basis and downloaded during the regular semi-annual groundwater level monitoring events. Daily measurements provide the same time-step as the Basin model, and will also allow direct correlation with daily stream flow data.

The monitoring frequency for groundwater quality sampling is variable and based on the schedule determined by the regulating agency (County Environmental Health Services for small public water systems and the State Division of Drinking Water for large public systems). TDS is typically monitored every three years, while nitrate and arsenic may be monitored annually, quarterly, or even monthly at vulnerable systems. The frequency selected for monitoring individual constituents at each system is sufficient to protect public health, and therefore considered sufficient for Basin management purposes.

Surface monitoring network frequency is a near-continuous record of flow stage, collected at 15-minute intervals. The stage data can then be converted to average daily flow (cubic feet per second) using a rating curve. Automatic gaging equipment (e.g. radar sensors or bubbler gages) at proposed flow monitoring locations will maintain the near-continuous monitoring frequency. Rating curves are needed at all gage sites, which requires manual flow measurements over a range of stream stages. New and existing wells listed in Table 7-6 used for interconnected surface water and GDE indicator evaluation may also be equipped with

groundwater level transducers, either upon construction (for network additions) or when the recommended nearby stream gage is installed.

7.5 DATA MANAGEMENT SYSTEM

SGMA requires development of a Data Management System (DMS). The DMS stores data relevant to development of a groundwater Basin's GSP as defined by the GSP Regulations (California Code of Regulations, Title 23, Division 2, Chapter 1.5, Subchapter 2). To comply with SGMA, the Basin DMS was developed in this GSP and will store data that is relevant to development and implementation of the GSP as well as for monitoring and reporting purposes. Appendix 7D describes the data management plan associated with the DMS.

7.6 ASSESSMENT AND IMPROVEMENT OF MONITORING NETWORK

The current assessment of the monitoring networks has identified data gaps that will be filled during the implementation phase of the GSP and prior to the first five-year assessment. These data gaps, consisting of six groundwater level monitoring sites and five surface water flow monitoring sites, are listed in Tables 7-2 and 7-4 and shown in Figures 7-1 and 7-3.

As previously mentioned, obtaining well construction information for all monitoring network wells is not an immediate necessity or a requirement for Basin management purposes, provided the lack of information does not affect the usefulness of the monitoring results toward Basin management. Over time, wells for which construction information is not known will be inspected with a video camera to document construction, either within the next five years or at the earliest practical opportunity, such as when the well pump is being serviced. The monitoring networks will be re-evaluated at each five-year assessment.

7.7 ANNUAL REPORTS AND PERIODIC EVALUATION BY THE GSAS

Reporting requirements for the Annual Report and for periodic evaluation of the GSP are contained in Article 7 of the GSP regulations. The GSAs will submit an Annual Report that meets Article 7 regulations by April 1 of each year following adoption of the GSP, with the first Annual Report anticipated in 2022. Periodic evaluations of the GSP, including the monitoring networks, will be performed at least every five years and whenever the GSP is amended, with the first written evaluation anticipated no later than 2027.

REFERENCES

Balance Hydrologics. 2008. *Hydrology and Geology Assessment of the Pismo Creek Watershed, San Luis Obispo County, California.* 2008.
Blaney. 1963. *Utilization of the Water of the Santa Ynez River Basin in Southern Santa Barbara County California, United Stated Deparment of Agriculture.* 1963.
—. 1933. *Ventura County Investigation, Bulletin No. 46, California Deparment of Public Works, Division of Water Resources.* 1933.
Boyle Engineering. 1991. *City of San Luis Obispo Groundwater Basin Evaluation. January.* 1991.
Carollo. 2012. *San Luis Obispo County Master Water Report.* 2012.
CIMS. 2019. *Station 52, San Luis Obispo - Central Coast Valleys.* 2019.
City of San Luis Obispo. 2016. *2015 Urban Water Management Plan.* 2016.
—. 2018. *General Plan.* 2018.
—. 2015. *Water Resources Status Report.* 2015.
—. 2000. *Water Use Factors.* 2000.
Cleath & Associates, Inc. 2001. *Well Construction and Testing Report for Lewis Lane #4, Edna Valley, San Luis Obispo County. Prepared for Southern California Water Company. July.* 2001.
—. 2003. *Well Construction and Testing Report for Water Supply and Irrigation Wells, City of San Luis Obispo, Hayashi Irrigation Wells and Highway 101 Water Supply Well. March.* 2003.
Cleath-Harris Geologists. 2018. *Groundwater Flow Analysis, Recycled Water Recharge Project, San Luis Valley Subarea, San Luis Obispo Valley Groundwater Basin.* 2018.
—. 2019. *Optional Task 2.4B Geophysical Survey.* 2019.
Cleath-Harris Geologists, Inc. 2010. *Edna Valley Water System Groundwater Study. Prepared for Golden State Water Company. May.* 2010.
—. 2013. *Summary of Drilling,. Testing, and Destruction of the Golden State Water Company Country Club Test Well, Edna Road System, 6110 Lewis Lane, San Luis Obispo, California. Prepared for Golden State Water Company. June.* 2013.
—. 2013. *Summary of Exploration and Testing, 5061 Hacienda Avenue, San Luis Obispo, California. Prepared for Golden State Water Company. February.* 2013.
—. 2014. *Summary of Exploration and Testing, Blodgett parcel, Whiskey Run Lane, Country Club Area, San Luis Obispo, California. Prepared for Golden State Water Company. July.* 2014.
County of San Luis Obispo. 2014. *San Luis Obispo County Integrated Regional Water Management Plan (IRWMP).* 2014.
Cuesta Engineering Corporation. 2007. *San Luis Obispo Creek Watershed Calibration Study.* 2007.
Dibble, T.W. 2004. *Geologic Map of the Lopez Mountain Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2004. #DF-130.
Dibblee, T.W. 2006. *Geologic Map of the Arroyo Grande NE Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2006. #DF-211.
—. 2006. *Geologic Map of the Pismo Beach Quadrangle, San Luis Obispo County, California.* s.l. : Dibblee Geology Center Map, 2006. #DF-212.
—. 2004. *Geologic Map of the San Luis Obispo Quadrangle, San Luis Obispo County, California.* . s.l. : Dibble Geology Center Map, 2004. #DF-129.
DWR. 2003. *California's Groundwater: Bulletin 118 – Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2016. *California's Groundwater: Bulletin 118 - Interim Update 2016, Working Towards Sustainability.* 2016.
—. 2003. *California's Groundwater: Bulletin 118 - Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2015. *Consumptive Use Program Plus (CUP+) Model, in California Water Plan Update 2013, Volume 4. Reference Guide, Developed by DWR and UC Davis.* 2015.
—. 2014. DWR Atlas - Aglricultural Lang Use and Irrigated Areas. [Online] 2014. gis.water.ca.gov.

—. 1964. *San Luis Obispo and Santa Barbara Counties Land and Water Use Survey, 1959. .* s.l. : California Department of Water Resources (DWR), 1964.
—. 1958. *San Luis Obispo County Investigation. State Water Resources Board Bulletin No. 18. .* s.l. : California Department of Water Resources (DWR). May., 1958.
—. 1997. *San Luis-Edna Valley Groundwater Basin Study, Draft Report. .* s.l. : California Department of Water Resources (DWR)., 1997.
—. 1996. *South Central Coast Land Use Survey.* 1996.
—. 1987. *Southern Central Coast Land Use Survey, 1985. Morro Bay South 54-30 and San Luis Obispo 54-31 Survey Maps.* 1987.
—. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization - Process and Results Document.* 2019.
—. 2016. *Water Budget Best Management Practices for the Sustainable Management of Groundwater.* 2016.
—. 2002. *Water Resources of the Arroyo Grande - Nipomo Mesa Area.* 2002.
EPA. 2008. *Water Sense Factsheet - Indoor Water Use in the United States, EPA-832-F-06-004.* 2008.
ESA Consultants, Inc. 1994. *Hydrologic Investigation, Edna Valley Well Location Study. September.* 1994.
Fugro West and Cleath & Associates. 2002. *Paso Robles Groudnwater Study, Final Report.* 2002.
GSI Water Solutions. 2018. *San Luis Obispo Valley Basin Characterization and Monitoring Well Installation.* 2018.
Hall, C.A. 1979. *Geologic map of the San Luis Obispo – San Simeon Region, California.* s.l. : U.S. Geological Survey, 1979. Map I-1097.
—. 1973. *Geology of the Arroyo Grande Quadrangle, California. .* s.l. : California Division of Mines and Geology, 1973. Map Sheet 24.
ITRC. 2020. *Official Cal Poly Precipitation Data, Cal Poly/NOAA Station Rain Gage.* 2020.
Johnson, A.I. 1967. *Specific Yield - Compilation of Specific Yield for Various Materials, U.S. Geological Survey Water-Supply Paper 1662-D, prepared in cooperation with the California Deparment of Water Resources.* 1967.
National Land Cover Database. Multi-Resolution Land Characteristics Consortium. *2016.* Multi-Resolution Land Characteristics Consortium.
QPS. 2005. *DRAFT Background Study South San Luis Obispo Groundwater PCE Plume.* 2005.
Rosenberg, L.I. 2001. *Potential Aquifer Recharge Areas: Monterey County, California.* s.l. : Monterey County Planning Department, 2001.
San Luis Obispo County Deparment of Agriculture/Weights and Measures. 2019. *Crop Surveys for San Luis Obispo Valley Groundwater Basin 2013-2018.* 2019.
San Luis Obispo County Department of Public Works. 2020. *Andrews Street Bridge Stream Flow Gage 745.* 2020.
—. 2020. *Gas Company Rain Sensor 3099.* 2020.
San Luis Obispo County Engineering Department. 1974. *Hydrologic & Climatological Data, Seasons of 1970-71 & 1971-72.* 1974.
SLO-FCWCD. 2014. *CASGEM Monitoring Plan for High and Medium Priority Groundwater Basins in the San Luis Obispo County Flood Control & Water Conservation District. September.* s.l. : San Luis Obispo Flood Control & Water Conservation District, 2014.
Stillwater Sciences. 2015. *Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California. September.* 2015.
SWRCB. 1990. *Ernest Righetti & Sons Application 28883, Decision 1627.* 1990.
TEAM Engineering & Management. 2000. *Groundwater Yield Analysis. July.* 2000.
URS. 2013. *Final Investigation Report: San Luis Obispo PCE Groundwater Plume.* 2013.
—. 2015. *Investigation Report: San Luis Obispo PCE Groundwater Plume.* 2015.
USBR. 1955. *Reconnaissance Report San Luis Obispo County Basin, California. .* s.l. : U.S. Bureau of Reclamation, Region 2, Sacramento., 1955.

USDA-NRCS. 2007. *Soil Survey Geographic Database (SSURGO).* s.l. : U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), 2007.
WSC. 2018. *Salinas and Whale Rock Reserviors Safe Annual Yield TM.* 2018.

8 APPENDICES

APPENDIX 7A - GROUNDWATER-DEPENDENT ECOSYSTEMS IN THE SAN LUIS OBISPO VALLEY GROUNDWATER BASIN

(Will be included with the release of Chapter 8 – Sustainable Management Criteria)

APPENDIX 7B - GROUNDWATER LEVEL MEASUREMENT PROCEDURES FOR THE SAN LUIS OBISPO VALLEY GROUNDWATER BASIN GSP

Groundwater Level Measurement Procedures for the San Luis Obispo Valley Groundwater Basin GSP

Introduction

This document establishes procedures for measuring and recording groundwater levels for the SLO Basin Groundwater Monitoring Program, and describes various methods used for collecting meaningful groundwater data.

Static groundwater levels obtained for the groundwater monitoring program are determined by measuring the distance to water in a non-pumping well from a reference point that has been referenced to sea level. Subtracting the distance to water from the elevation of the reference point determines groundwater surface elevations above or below sea level. This is represented by the following equation:

$$E_{GW} = E_{RP} - D$$

Where:

E_{GW}	=	Elevation of groundwater above mean sea level (feet)
E_{RP}	=	Elevation above sea level at reference point (feet)
D	=	Depth to water (feet)

References

Procedures for obtaining and reporting water level data for the SLO Basin Groundwater Monitoring Program are based on a review of the following documents.

- State of California, Department of Water Resources, 2016, *Best Management Practices for the Sustainable Management of Groundwater: Monitoring Protocols, Standards, and Sites*, December 2016.
- State of California, Department of Water Resources, 2014, *Addendum to December 2010 Groundwater Elevation Monitoring Guidelines for the Department of Water Resources' California Statewide Groundwater Elevation Monitoring (CASGEM) Program,* October 2, 2014.
- State of California, Department of Water Resources, 2010, *Groundwater Elevation Monitoring Guidelines*, prepared for use in the California Statewide Groundwater Elevation Monitoring (CASGEM) program, December 2010.
- U.S. Geological Survey, 2011, *Groundwater Technical Procedures of the U.S. Geological Survey*, Techniques and Methods 1-A1, compiled by William L. Cunningham and Charles W. Schalk.
- U.S. Geological Survey, 1977, *National Handbook of Recommended Methods for Water-Data Acquisition*, a Unites States contribution to the International Hydrological Program.

Well Information

Table 1 below lists important well information to be maintained in a well file or in a field notebook. Additional information that should be available to the person collecting water level data include a description of access to the property and the well, the presence and depth of cascading water, or downhole obstructions that could interfere with a sounding cable.

Table 1
Well File Information

Well Completion Report	Hydrologic Information	Additional Information to be Recorded
Well name	Map showing basin boundaries and wells	Township, Range, Section and ¼-¼ Section
Well Owner	Name of groundwater basin	Latitude and Longitude (Decimal degrees)
Drilling Company	Description of aquifer	Assessor's Parcel Number
Location map or sketch	Confined, unconfined, or mixed aquifers	Description of well head and sounding access
Total depth	Pumping test data	Reference point elevations
Perforation interval	Hydrographs	Well use and pumping schedule if known
Casing diameter	Water quality data	Date monitoring began
Date of well completion	Property access instructions/codes	Land use

Reference Points and Reference Marks

Reference point (RP) elevations are the basis for determining groundwater elevations relative to sea level. The RP is generally a point on the well head that is the most convenient place to measure the water level in a well. In selecting an RP, an additional consideration is the ease of surveying either by Global Positioning System (GPS) or by leveling.

The RP must be clearly defined, well marked, and easily located. A description, sketch, and photograph of the point should be included in the well file. Additional Reference Marks (RMs) may be established near the wellhead on a permanent object. These additional RMs can serve as a benchmark by which the wellhead RP can be checked or re-surveyed if necessary. All RMs should be marked, sketched, photographed, and described in the well file.

All RPs for Groundwater Monitoring Program wells should be reported based on the same horizontal and vertical datum by a California licensed surveyor to the nearest tenth of one foot vertically, and the nearest one foot horizontally. The surveyor's report should be maintained in the project file.

In addition to the RP survey, the elevation of the ground surface adjacent to the well should also be measured and recorded in the well file. Because the ground surface adjacent to a well is rarely uniform, the average surface level should be estimated. This average ground surface elevation is referred to in the USGS Procedural Document (GWPD-1) and DWR guidelines as the Land Surface Datum.

Water Level Data Collection

Prior to beginning the field work, the field technician should review each well file to determine which well owners require notification of the upcoming site visit, or which well pumps need to be turned off to allow for sufficient water level recovery. Because groundwater elevations are used to construct groundwater contour maps and to determine hydraulic gradients, the field technician should coordinate water level measurements to be collected within as short a period of time as practical. Any significant changes in groundwater conditions during monitoring events should be noted in the Annual Monitoring Report. For an individual well, the same measuring method and the same equipment should be used during each sampling event where practical.

A static water level should represent stable, non-pumping conditions at the well. When there is doubt about whether water levels in a well are continuing to recover following a pumping cycle, repeated measurements should be made. If an electric sounder is being used, it is possible to hold the sounder level at one point slightly above the known water level and wait for a signal that would indicate rising water. If applicable, the general schedule of pump operation should be determined and noted for active wells. If the well is capped but not vented, remove the cap and wait several minutes before measurement to allow water levels to equilibrate to atmospheric pressure.

When lowering a graduated steel tape (chalked tape) or electric tape in a well without a sounding tube in an equipped well, the tape should be played out slowly by hand to minimize the chance of the tape end becoming caught in a downhole obstruction. The tape should be held in such a way that any change in tension will be felt. When withdrawing a sounding tape, it should also be brought up slowly so that if an obstruction is encountered, tension can be relaxed so that the tape can be lowered again before attempting to withdraw it around the obstruction.

Despite all precautions, there is a small risk of measuring tapes becoming stuck in equipped wells without dedicated sounding tubes. If a tape becomes stuck, the equipment should be left on-site and re-checked after the well has gone through a few cycles of pumping, which can free the tape due to movement/vibration of the pump column. If the tape remains stuck, a pumping contractor will be needed to retrieve the equipment. A dedicated sounding tube may be installed by the pumping contractor at that time.

All water level measurements should be made to an accuracy of 0.01 feet. The field technician should make at least two measurements. If measurements of static levels do not agree to within 0.02 feet of each other, the technician should continue measurements until the reason for the disparity is determined, or the measurements are within 0.02 feet.

Record Keeping in the Field

The information recorded in the field is typically the only available reference for the conditions at the time of the monitoring event. During each monitoring event it is important to record any conditions at a well site and its vicinity that may affect groundwater levels, or the field technician's ability to obtain groundwater levels. Table 2 lists important information to record, however, additional information should be included when appropriate.

Table 2
Information Recorded at Each Well Site

Well name	Changes in land use	Presence of pump lubricating oil in well
Name and organization of field technician	Changes in RP	Cascading water
Date & time	Nearby wells in use	Equipment problems
Measurement method used	Weather conditions	Physical changes in wellhead
Sounder used	Recent pumping info	Comments
Reference Point Description	Measurement correction(s)	Well status

An example of a field log sheet from DWR is attached.

Measurement Techniques

Four standard methods of obtaining water levels are discussed below. The chosen method depends on site and downhole conditions, and the equipment limitations. In all monitoring situations, the procedures and equipment used should be documented in the field notes and in final reporting. Additional detail on methods of water level measurement is included in the reference documents.

Graduated Steel Tape

This method uses a graduated steel tape with a brass or stainless steel weight attached to its end. The tape is graduated in feet. The approximate depth to water should be known prior to measurement.

- Estimate the anticipated static water level in the well from field conditions and historical information;
- Chalk the lower few feet of the tape by applying blue carpenter's chalk.
- Lower the tape to just below the estimated depth to water so that a few feet of the chalked portion of the tape is submerged. Be careful not to lower the tape beyond its chalked length.
- Hold the tape at the RP and record the tape position (this is the "hold" position and should be at an even foot);
- Withdraw the tape rapidly to the surface;
- Record the length of the wetted chalk mark on the graduated tape;
- Subtract the wetted chalk number from the "hold" position number and record this number in the "Depth to Water below RP" column;
- Perform a check by repeating the measurement using a different RP hold value;
- All data should be recorded to the nearest 0.01 foot;
- Disinfect the tape by wiping down the submerged portion of the tape with single-use, unscented disinfectant wipe, or let stand for one minute in a dilute chlorine bleach solution and dry with clean cloth.

The graduated steel tape is generally considered to be the most accurate method for measuring static water levels. Measuring water levels in wells with cascading water or with condensing water on the well casing causes potential errors, or can be impossible with a steel tape.

Electric Tape

An electric tape operates on the principle that an electric circuit is completed when two electrodes are submerged in water. Most electric tapes are mounted on a hand-cranked reel equipped with batteries and an ammeter, buzzer or light to indicate when the circuit is completed. Tapes are graduated in either one-foot intervals or in hundredths of feet depending on the manufacturer. Like graduated steel tapes, electric tapes are affixed with brass or stainless steel weights.

- Check the circuitry of the tape before lowering the probe into the well by dipping the probe into water and observe if the ammeter needle or buzzer/light signals that the circuit is completed;
- Lower the probe slowly and carefully into the well until the signal indicates that the water surface has been reached;
- Place a finger or thumb on the tape at the RP when the water surface is reached;
- If the tape is graduated in one-foot intervals, partially withdraw the tape and measure the distance from the RP mark to the nearest one-foot mark to obtain the depth to water below the RP. If the tape is graduated in hundredths of a foot, simply record the depth at the RP mark as the depth to water below the RP;
- Make all readings using the same needle deflection point on the ammeter scale (if equipped) so that water levels will be consistent between measurements;

- Make check measurements until agreement shows the results to be reliable;
- All data should be recorded to the nearest 0.01 foot;
- Disinfect the tape by wiping down the submerged portion of the tape with single-use, unscented disinfectant wipe, or let stand for one minute in a dilute chlorine bleach solution and dry with clean cloth;
- Periodically check the tape for breaks in the insulation. Breaks can allow water to enter into the insulation creating electrical shorts that could result in false depth readings.

The electric tape may give slightly less accurate results than the graduated steel tape. Errors can result from signal "noise" in cascading water, breaks in the tape insulation, tape stretch, or missing tape at the location of a splice. All electric tapes should be calibrated annually against a steel tape that is maintained in the office and used only for calibration.

Air Line

The air line method is usually used only in wells equipped with pumps. This method typically uses a 1/8 or 1/4-inch diameter, seamless copper tubing, brass tubing, stainless steel tubing, or galvanized pipe with a suitable pipe tee for connecting an altitude or pressure gage. Plastic (i.e. polyethylene) tubing may also be used, but is considered less desirable because it can develop leaks as it degrades. An air line must extend far enough below the water level that the lower end remains submerged during pumping of the well. The air line is connected to an altitude gage that reads directly in feet of water, or to a pressure gage that reads pressure in pounds per square inch (psi). The gage reading indicates the length of the submerged air line.

The formula for determining the depth to water below the RP is: **d = k – h** where d = depth to water; k = constant; and h = height of the water displaced from the air line. In wells where a pressure gage is used, h is equal to 2.31 ft/psi multiplied by the gage reading. The constant value for k is approximately equivalent to the length of the air line.

- Calibrate the air line by measuring an initial depth to water (d) below the RP with a graduated steel tape. Use a tire pump, air tank, or air compressor to pump compressed air into the air line until all the water is expelled from the line. When all the water is displaced from the line, record the stabilized gage reading (h). Add d to h to determine the constant value for k.
- To measure subsequent depths to water with the air line, expel all the water from the air line, subtract the gage reading (h) from the constant k, and record the result as depth to water (d) below the RP.

The air line method is not as accurate as a graduated steel tape or electric and is typically accurate to the nearest one foot at best. Errors can occur from leaky air lines, or when tubing becomes clogged with mineral deposits or bacterial growth. The air line method is not desirable for use in the Groundwater Monitoring Program.

Pressure Transducer

Electrical pressure transducers make it possible to collect frequent and long-term water level or pressure data from wells. These pressure-sensing devices, installed at a fixed depth in a well, sense the change in pressure against a membrane. The pressure changes occur in response to changes in the height of the water column in the well above the transducer membrane. To compensate for atmospheric changes, transducers may have vented cables or they can be used in conjunction with a barometric transducer that is installed in the same well or a nearby observation well above the water level.

Transducers are selected on the basis of expected water level fluctuation. The smallest range in water levels provides the greatest measurement resolution. Accuracy is generally 0.01 to 0.1 percent of the full scale range.

Retrieving data in the field is typically accomplished by downloading data through a USB connection to a portable computer or data logger. A site visit to retrieve data should involve several steps designed to safeguard the stored data and the continued useful operation of the transducer:

- Inspect the wellhead and check that the transducer cable has not moved or slipped (the cable can be marked with a reference point that can be used to identify movement);
- Ensure that the instrument is operating properly;
- Measure and record the depth to water with a graduated steel or electric tape;
- Document the site visit, including all measurements and any problems;
- Retrieve the data and document the process;
- Review the retrieved data by viewing the file or plotting the original data;
- Recheck the operation of the transducer prior to disconnecting from the computer.

A field notebook with a checklist of steps and measurements should be used to record all field observations and the current data from the transducer. It provides a historical record of field activities. In the office, maintain a binder with field information similar to that recorded in the field notebook so that a general historical record is available and can be referred to before and after a field trip.

Quality Control

The field technician should compare water level measurements collected at each well with the available historical information to identify and resolve anomalous and potentially erroneous measurements prior to moving to the next well location. Pertinent information, such as insufficient recovery of a pumping well, proximity to a pumping well, falling water in the casing, and changes in the measurement method, sounding equipment, reference point, or groundwater conditions should be noted. Office review of field notes and measurements should also be performed by a second staff member.

All field tapes (both steel and electric) used for the monitoring program should be calibrated annually against another acceptable steel tape. An acceptable steel tape is one that is maintained in the office for use only in calibrating the field tapes. Adjustments for tape calibration should be applied and noted.

STATE OF CALIFORNA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

STATE WELL NUMBER	COUNTY	REFERENCE POINT ELEV.	MEASURING AGENCY
			DWR

NO MEASUREMENT	QUESTIONABLE MEASUREMENT
0. Measurement discontinued 1. Pumping 2. Pump house locked 3. Tape hung up 4. Can't get tape in casing 5. Unable to locate well 6. Well has been destroyed 7. Special 8. Casing leaky or wet 9. Temporarily inaccessible	0. Caved or deepened 1. Pumping 2. Nearby pump operating 3. Casing leaky or wet 4. Pumped recently 5. Air or pressure gauge measurement 6. Other 7. Recharge operation at or nearby well 8. Oil in casing

DATE	NM	QM	TAPE AT RP	TAPE AT WS	RP to WS	OBSR VR	COMMENTS

APPENDIX 7C - STREAMFLOW MEASUREMENT IN NATURAL CHANNELS

Streamflow Measurement in Natural Channels

The most practical method for measuring streamflow in natural channels is the velocity-area method, which has the following computation[1]:

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

where:

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

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

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

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

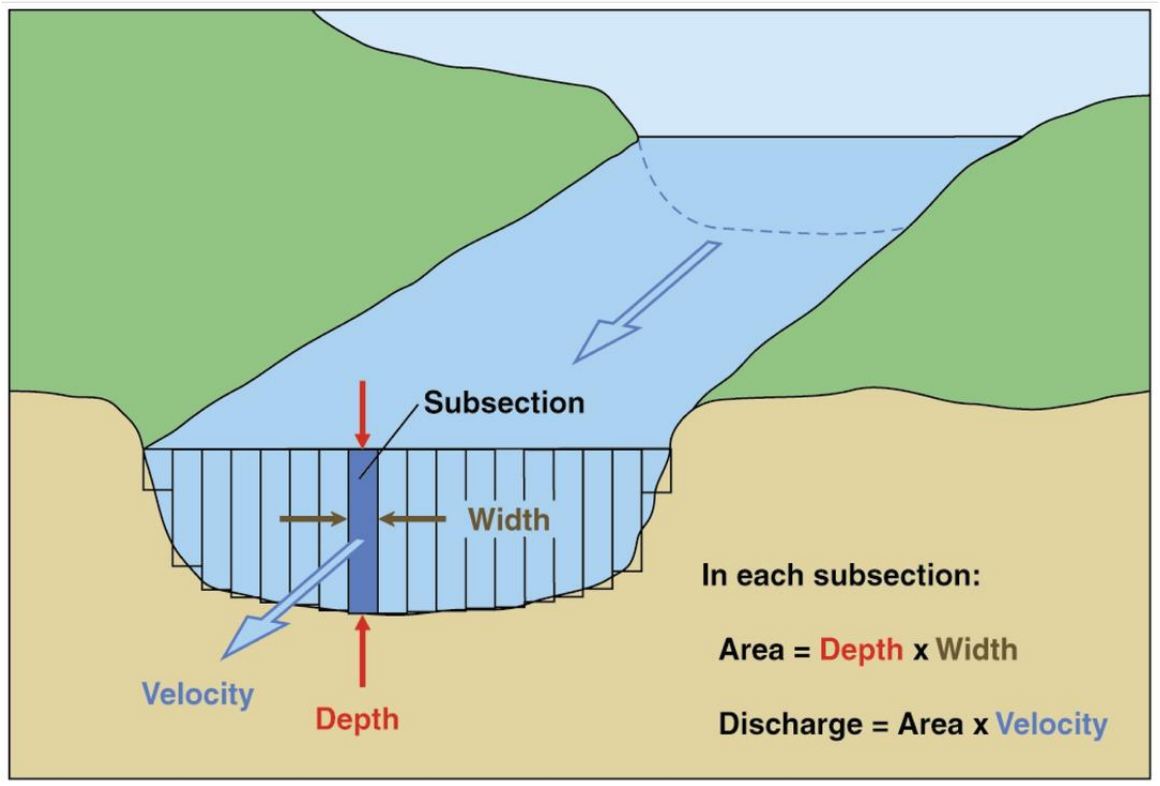

Diagram of Channel cross-section with segments for discharge computation (USGS)

In natural channels, stream gages are used to record stage (feet), which is the height of water in the stream above an arbitrary point, usually at or below the stream bed. The stage is then converted to streamflow through the use of a rating curve, or stage-discharge relation. A rating curve incorporates information collected that is specific to each site, including the cross-sectional area of

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

the channel and the average velocity for a given flow stage. These rating curves are developed using depth profiles and average flow velocity measurements during storm-runoff events. Rating curves may need to be revised periodically as they can shift due to changes in channel geometry. Measuring average flow velocity across a channel at different stream stages is the most challenging part of developing a rating curve.

APPENDIX 7D – DATA MANAGEMENT PLAN

(Draft Data Management Plan was released for public comment following the September 9th GSC Meeting and may be found at https://www.slowaterbasin.com/review-documents)

DRAFT

Chapter 8 - Sustainable Management Criteria

San Luis Obispo Valley Basin Groundwater Sustainability Plan

Available for viewing in the May 5, 2021 Agenda Packet:	**April 28, 2021**
Recommended the GSAs to receive and file for public comments:	**May 5, 2021**
Available for public comments on www.slowaterbasin.com:	**May 6, 2021**
Close of public comment period:	**June 6, 2021**

Per the GSC's recommendation on May 5, 2021, GSP Draft Chapter 8 - Sustainable Management Criteria will be distributed to the City and County GSAs to receive and file. This draft document is now posted on the web portal: www.slowaterbasin.com for public comments. Comments from the public are being collected using a comment form available at www.slowaterbasin.com by clicking on "Submit Comment". If you require a paper form to submit by postal mail, please contact your local Groundwater Sustainability Agency (GSA). All comments submitted will also be posted online for viewing.

DRAFT

Groundwater Sustainability Plan
Chapter 8 – Sustainable Management Criteria

for the

San Luis Obispo Valley Groundwater Basin
Groundwater Sustainability Agencies

Prepared by

WSC
Water Systems Consulting, Inc.
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4/28/2021

TABLE OF CONTENTS

Table of Contents i
List of Figures x
Tables xi
Appendices xii
List of Terms Used xiii
Executive Summary 1
1 Introduction to the SLO Basin GSP .....
1.1 Purpose of the Groundwater Sustainability Plan .....
1.2 Description of SLO Basin .....
1.3 Basin Prioritization .....
2 Agency Information (§ 354.6) .....
2.1 Agencies Names and Mailing Addresses .....
2.2 Agencies Organization and Management Structures .....
2.2.1 County of San Luis Obispo .....
2.2.2 City of San Luis Obispo .....
2.2.3 Other Participating Parties in the MOA .....
2.2.3.1 Edna Valley Growers Mutual Water Company .....
2.2.3.2 Varian Ranch Mutual Water Company .....
2.2.3.3 Edna Ranch Mutual Water Company .....
2.2.3.4 Golden State Water Company .....
2.3 Authority of Agencies .....
2.3.1 Groundwater Sustainability Agencies .....
2.3.1.1 County of San Luis Obispo .....
2.3.1.2 City of San Luis Obispo .....
2.3.2 Memorandum of Agreement .....
2.3.3 Coordination Agreements .....
2.4 Contact information for Plan Manager .....
3 Description of Plan Area (§ 354.8) .....
3.1 SLO Basin Introduction .....
3.2 Adjudicated Areas .....
3.3 Jurisdictional Areas .....
3.3.1 Federal Jurisdictions .....
3.3.2 Tribal Jurisdiction .....

3.3.3 State Jurisdictions
3.3.4 County Jurisdictions
3.3.5 City and Local Jurisdictions
3.3.6 Special Districts
3.4 Land Use
3.4.1 Water Source Types
3.4.2 Water Use Sectors
3.5 Density of Wells
3.6 Existing Monitoring and Management Programs
3.6.1 Groundwater Monitoring
3.6.1.1 Groundwater Level Monitoring
3.6.1.2 Groundwater Quality Monitoring
3.6.1.3 Surface Water Monitoring
3.6.1.4 Climate Monitoring
3.6.2 Existing Management Plans
3.6.2.1 SLO Basin Characterization and Monitoring Well Installation
3.6.2.2 San Luis Obispo County Master Water Report (2012)
3.6.2.3 San Luis Obispo County Integrated Regional Water Management Plan (2014)
3.6.2.4 City of San Luis Obispo 2015 Urban Water Management Plan (2016)
3.6.3 Existing Groundwater Regulatory Programs
3.6.3.1 Groundwater Export Ordinance (2015)
3.6.3.2 Well Ordinances, County and City
3.6.3.3 Countywide Water Conservation Program Resolution 2015-288 (2015)
3.6.3.4 Agricultural Order R3-2017-002 (2017)
3.6.3.5 Water Quality Control Plan for the Central Coast Basins (2017)
3.6.3.6 California DWR Well Standards (1991)
3.6.3.7 Requirements for New Wells (2017)
3.6.3.8 Title 22 Drinking Water Program (2018)
3.6.3.9 Waterway Management Plan – San Luis Obispo Creek Watershed (2003)
3.6.3.10 Incorporation Into GSP
3.6.3.11 Limits to Operational Flexibility
3.7 Conjunctive Use Programs
3.8 Land Use Plans
3.8.1 City of San Luis Obispo General Plan
3.8.2 County of San Luis Obispo General Plan

3.8.3 Los Ranchos/Edna Village Plan
3.8.4 Plan Implementation Effects on Existing Land Use
3.8.5 Plan Implementation Effects on Water Supply
3.8.6 Well Permitting
3.8.7 Land Use Plans Outside of Basin
3.9 Management Areas
3.9.1 Reason for Creation
3.10 Additional GSP Elements, if Applicable
4 Basin Setting (§ 354.14)
4.1 Basin Topography and Boundaries
4.2 Primary Users of Groundwater
4.3 Soils Infiltration Potential
4.4 Regional Geology
4.4.1 Regional Geologic Structures
4.4.2 Geologic Formations within the Basin
4.4.2.1 Alluvium
4.4.2.2 Paso Robles Formation
4.4.2.3 Pismo Formation
4.4.3 Geologic Formations Surrounding the Basin
4.4.3.1 Monterey Formation
4.4.3.2 Obispo Formation
4.4.3.3 Franciscan Assemblage
4.5 Principal Aquifers and Aquitards
4.5.1 Cross Sections
4.5.2 Aquifer Characteristics
4.5.3 Aquitards
4.6 Surface Water Bodies
4.7 Subsidence Potential
5 Groundwater Conditions (§ 354.16)
5.1 Groundwater Elevations and Intepretation
5.1.1 Fall 1954 Groundwater Elevations
5.1.2 Spring 1990 Groundwater Elevations
5.1.3 Modeled 1990s Groundwater Elevations
5.1.4 Spring 1997 Groundwater Elevations
5.1.5 Spring 2011 Groundwater Elevations

5.1.6 Spring 2015 Groundwater Elevations
5.1.7 Spring 2019 Groundwater Elevations
5.1.8 Fall 2019 Groundwater Elevations
5.1.9 Changes in Groundwater Elevation
5.1.10 Vertical Groundwater Gradients
5.2 Groundwater Elevation Hydrographs
5.3 Groundwater Recharge and Discharge Areas
5.3.1 Groundwater Recharge Areas
5.3.1.1 Infiltration of Precipitation
5.3.1.2 Subsurface Inflow
5.3.1.3 Percolation of Streamflow
5.3.1.4 Anthropogenic Recharge
5.3.2 Groundwater Discharge Areas
5.4 Change in Groundwater Storage
5.5 Seawater Intrusion
5.6 Subsidence
5.7 Interconnected Surface Water
5.7.1 Depletion of Interconnected Surface Water
5.8 Potential groundwater dependent ecosystems
5.8.1 Hydrology
5.8.1.1 Overview of GDE Relevant Surface and Groundwater Hydrology
5.8.1.2 Losing and Gaining Reaches
5.8.2 Vegetation and Wetland Groundwater Dependent Ecosystem Identification
5.8.3 Identification of Special-Status Species and Sensitive Natural Communities Associates with GDE's
5.9 Groundwater Quality Distribution and Trends
5.9.1 Groundwater Quality Suitability for Drinking Water
5.9.2 Distribution and Concentrations of Point Sources of Groundwater Constituents
5.9.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents
5.9.3.1 Total Dissolved Solids
5.9.3.2 Nitrate
5.9.3.3 Arsenic
5.9.3.4 Boron
5.9.3.5 Other Constituents

6 Water Budget (§ 354.18)
6.1 Climate
6.1.1 Historical Climate/Base Period
6.2 Water Budget Data Sources
6.3 Historical Water Budget
6.3.1 Historical Time Period
6.3.2 Historical Land Use
6.3.3 Historical Surface Water Budget
6.3.4 Historical Groundwater Budget
6.3.5 Total Groundwater in Storage
6.3.6 Change in Storage
6.3.7 Sustainable Yield
6.3.8 Quantification of Overdraft (Historical)
6.4 Current Water Budget
6.5 Projected Water Budget
6.5.1 Assumptions
6.5.2 Inflows
6.5.3 Outflows
6.5.4 Change In Storage

6.5 Projected Water Budget
6.5.1 Assumptions
6.5.2 Inflows
6.5.3 Outflows
6.5.4 Change In Storage
7 Monitoring Networks (§ 354.32 and § 354.34)
7.1 Monitoring Objectives
7.1.1 Management Areas
7.1.2 Representative Monitoring Sites
7.1.3 Scientific Rationale
7.1.4 Existing Monitoring Programs
7.2 MONITORING NETWORKS
7.2.1 Groundwater Level Monitoring Network
7.2.2 Groundwater Quality Monitoring Network
7.2.3 Surface Water Flow Monitoring Network

7.3 Sustainability Indicator Monitoring
7.3.1 Chronic Lowering of Groundwater Levels
7.3.2 Reduction of Groundwater Storage
7.3.3 Seawater Intrusion
7.3.4 Degraded Groundwater Quality
7.3.5 Land Subsidence
7.3.6 Depletion of Interconnected Surface Water
7.4 Monitoring Technical and Reporting Standards
7.4.1 Groundwater Levels
7.4.2 Groundwater Quality
7.4.3 Surface Water Flow
7.4.4 Monitoring Frequency
7.5 Data Management System
7.6 Assessment and Improvement of Monitoring Network
7.7 Annual Reports and Periodic Evaluation by the GSA_s
8 Sustainable Management Criteria (§ 354.22) 2
8.1 Definitions (§ 351) 3
8.2 Sustainability Goal (§ 354.24) 5
8.2.1 Description of Sustainability Goal 5
8.2.2 Sustainability Strategy 5
8.3 Generalized Process For Establishing Sustainable Management Criteria (§ 354.22-30) 6
8.4 Chronic Lowering Of Groundwater Levels Sustainability Indicator 7
8.4.1 Undesirable Results (§ 354.26) 7
8.4.1.1 Criteria for Establishing Undesirable Results §354.26(b)(2) 8
8.4.1.2 Potential Causes of Undesirable Results - §354.26(b)(1) 9
8.4.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses - §354.26 (b)(3) 9
8.4.2 Minimum Thresholds - §354.28(c)(1) 9
8.4.2.1 Information and Methods Used for Establishing Chronic Lowering of Groundwater Level Minimum Thresholds - §354.28(b)(1) 9
8.4.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators - §354.28(b)(2) 11
8.4.2.3 Effect of Minimum Thresholds on Neighboring Basins - §354.28(b)(3) 13
8.4.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses - §354.28(b)(4) 13
8.4.2.5 Relevant Federal, State, or Local Standards - §354.28(b)(5) 14
8.4.2.6 Method for Quantitative Measurement of Minimum Thresholds - §354.28(b)(6) 14

8.4.3 Measurable Objectives - §354.30(a)-(g) 14
8.4.3.1 Information and Methods Used for Establishing Chronic Lowering of Groundwater Level Measurable Objectives §354.30(b) 14
8.4.3.2 Interim Milestones §354.30(a)(e) 15
8.5 Reduction of Groundwater Storage Sustainability Indicator §354.28(c)(2) 16
8.5.1 Undesirable Results 16
8.5.1.1 Criteria for Establishing Undesirable Results §354.2(b)(2) 16
8.5.1.2 Potential Causes of Undesirable Results §354.2(b)(1) 16
8.5.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses §354.2(b)(3) 17
8.5.2 Minimum Thresholds §354.28(c)(2) 17
8.5.2.1 Information and Methods Used for Establishing Reduction of Storage Minimum Thresholds §354.28(b)(1) 18
8.5.2.2 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators §354.28(b)(2) 18
8.5.2.3 Effects of Minimum Thresholds on Neighboring Basins §354.28(b)(3) 18
8.5.2.4 Effects of Minimum Thresholds on Beneficial Uses and Users §354.28(b)(4) 19
8.5.2.5 Relation to State, Federal, or Local Standards §354.28(b)(5) 19
8.5.2.6 Methods for Quantitative Measurement of Minimum Threshold §354.28(b)(6) 20
8.5.3 Measurable Objectives §354.30(a)-(g) 20
8.5.3.1 Information and Methods Used for Establishing Reduction of Groundwater Storage Measurable Objectives §354.30(b) 20
8.5.3.2 Interim Milestones §354.30(a)(e) 20
8.6 Seawater Intrusion Sustainability Indicator §354.28(c)(3) 20
8.7 Degradation of Groundwater Quality Sustainability Indicator §354.28(c)(4) 20
8.7.1 Undesirable Results §354.26(a)-(d) 20
8.7.1.1 Criteria for Establishing Undesirable Results §354.26(b)(2) 21
8.7.1.2 Potential Causes of Undesirable Results §354.26(b)(1) 22
8.7.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses §354.26(b)(3) 22
8.7.2 Minimum Thresholds § 354.28(c)(4) 22
8.7.2.1 Information and Methods Used for Establishing Degradation of Water Quality Minimum Thresholds § 354.28 (b)(1) 22
8.7.2.2 Relation of Minimum Thresholds to Other Sustainability Indicators § 354.28(b)(2) 23
8.7.2.3 Effect of Minimum Thresholds on Neighboring Basins § 354.28(b)(3) 24
8.7.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses § 354.28(b)(4) 24
8.7.2.5 Relevant Federal, State, or Local Standards § 354.28(b)(5) 24
8.7.2.6 Method for Quantitative Measurement of Minimum Thresholds § 354.28(b)(6) 24

8.7.3 Measurable Objectives § 354.30(a)-(g) 24
8.7.3.1 Information and Methods Used for Establishing Degradation of Water Quality Measurable Objectives § 354.30(b) 25
8.7.3.2 Interim Milestones § 354.28(a)(e) 25
8.8 Land Subsidence Sustainability Indicator § 354.28(c)(5) 25
8.8.1 Undesirable Results § 354.26(a)-(d) 25
8.8.1.1 Criteria for Establishing Undesirable Results § 354.26(b)(2) 26
8.8.1.2 Potential Causes of Undesirable Results § 354.26(b)(1) 26
8.8.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses § 354.26(b)(3) 26
8.8.2 Minimum Thresholds § 354.28(c)(5) 26
8.8.2.1 Information and Methods Used for Establishing Land Subsidence Minimum Thresholds § 354.28(b)(1) 26
8.8.2.2 Relation of Minimum Thresholds to Other Sustainability Indicators § 354.28(b)(2) .. 27
8.8.2.3 Effect of Minimum Thresholds on Neighboring Basins § 354.28(b)(3) 27
8.8.2.4 Effects of Minimum Thresholds on Beneficial Users and Land Uses § 354.28(b)(4) .. 27
8.8.2.5 Relevant Federal, State, or Local Standard § 354.28(b)(5) 27
8.8.2.6 Method for Quantitative Measurement of Minimum Thresholds § 354.28(b)(6) 27
8.8.3 Measurable Objectives § 354.30(a)-(g) 28
8.8.3.1 Information and Methods Used for Establishing Land Subsidence Measurable Objectives 0§ 354.3(b) 28
8.8.3.2 Interim Milestones § 354.28(a)(e) 28
8.9 Depletion of interconnected surface water Sustainability Indicator § 354.28(c)(6) 28
8.9.1 Undesirable Results § 354.26(a)-(d) 28
8.9.1.1 Criteria for Establishing Undesirable Results § 354.26(b)(2) 29
8.9.1.2 Potential Causes of Undesirable Results § 354.26(b)(1) 29
8.9.1.3 Effects of Undesirable Results on Beneficial Users and Land Uses § 354.26(b)(3) 29
8.9.2 Minimum Thresholds 29
8.9.2.1 Information and Methods Used for Establishing Depletion of Interconnected Surface Water Minimum Thresholds 30
8.9.2.2 Relationship between Individual Minimum Thresholds and Other Sustainability Indicators 31
8.9.2.3 Effects of Minimum Thresholds on Neighboring Basins 31
8.9.2.4 Effects of Minimum Thresholds on Beneficial Uses and Users 32
8.9.2.5 Relation to State, Federal, or Local Standards 32
8.9.2.6 Methods for Quantitative Measurement of Minimum Threshold 32
8.9.3 Measurable Objectives 32

8.9.3.1 Method for Quantitative Measurement of Measurable Objectives 33
8.9.3.2 Interim Milestones 33
8.10 Management Areas 33
9 Projects and Management Actions (§ 354.44) .....
9.1 Projects .....
9.1.1 Project A .....
9.2 Management Actions .....
9.2.1 Management Action A .....
9.3 Projects Needed to Mitigate Overdraft .....
10 Implementation Plan .....
10.1 Cost of Implementation .....
10.2 Funding Alternatives .....
10.3 Implementation Schedule .....
10.4 GSP Annual Reporting .....
10.5 Periodic Evaluations of GSP .....
11 Notice and Communications (§ 354.10) .....
11.1 Communications and Engagement Plan .....
11.2 Nature of Consultations .....
11.3 Public Meetings .....
11.4 Incorporation of Feedback in Decision-Making Process .....
11.5 Comments Received .....
11.6 Responses to Comments .....
12 Interagency Agreements (§ 357.2-4) .....
12.1 Coordination Agreements .....
13 References .....
14 Appendices .....

The grey highlighted sections in the Table of Contents (TOC) indicate that the section has been previously released (Chapters 1 through 7) or will be released in the future (Chapters 9 through 14). The complete list of the anticipated TOC is presented to give the reader context as to how Chapter 8 – Sustainable Management Criteria, connects with the complete Groundwater Sustainability Plan.

LIST OF FIGURES

Figure 8-1 HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-19. 34
Figure 8-2 HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-16. 34
Figure 8-3. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-09. ... 35
Figure 8-4. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-12. ... 35
Figure 8-5. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-12..... 36
Figure 8-6. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-04..... 36
Figure 8-7. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-09..... 37
Figure 8-8. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-16..... 37
Figure 8-9. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-01..... 38
Figure 8-10. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-11. .. 38

TABLES

No table of figures entries found.

APPENDICES

Appendix A - City of San Luis Obispo Resolution to form GSA
Appendix B - County of San Luis Obispo Resolution to form GSA
Appendix C - Memorandum of Agreement – Preparation of GSP
Appendix D Communications and Engagement Plan
Appendix E Surface Water/Groundwater Modeling Approach
Appendix F Stakeholder Workshop Summary – Building a Shared Vision for a "Sustainable SLO Basin"
Appendix G Sustainable Goal Setting Workshop
Appendix H Groundwater-Dependent Ecosystems in the San Luis Obispo Valley Groundwater Basin
Appendix I Groundwater Level Measurement Procedures for the San Luis Obispo Valley Groundwater Basin GSP
Appendix J Streamflow Measurement in Natural Channels
Appendix K Data Management Plan
Appendix L Response to Public Comments

LIST OF TERMS USED

Abbreviation	Definition
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
AMSL	Above Mean Sea Level
Basin Plan	Water Quality Control Plan for the Central Coast Basin
Cal Poly	California Polytechnic State University
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of San Luis Obispo
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CPWS-52	Cal Poly Weather Station 52
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ERMWC	Edna Ranch Mutual Water Company
ET_0	Evapotranspiration
EVGMWC	Edna Valley Growers Ranch Mutual Water Company
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet
MCL	Maximum Contaminant Level

Abbreviation	Definition
MG	Million Gallons
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCDC	National Climate Data Center
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLO Basin	San Luis Obispo Valley Groundwater Basin
SLOFCWCD	San Luis Obispo County Flood Control and Water Conservation District
SCML	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
VRMWC	Varian Ranch Mutual Water Company
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is complete.

8 SUSTAINABLE MANAGEMENT CRITERIA (§ 354.22)

This chapter defines the conditions specified at each of the Representative Monitoring Sites (RMSs) that constitute Sustainable Management Criteria (SMCs), discusses the process by which the GSAs in the Basin will characterize undesirable results, and establishes minimum thresholds and measurable objectives for each Sustainability Indicator. The chapter defines sustainability in the Basin for the purposes of managing groundwater in compliance with SGMA, and it addresses the regulatory requirements involved. The Measurable Objectives (MOs), Minimum Thresholds (MTs), and undesirable results presented in this chapter define the future sustainable conditions in the Basin and guide the GSAs in development of policies, implementation of projects, and promulgation of management actions that will achieve these future conditions.

Defining Sustainable Management Criteria (SMC) requires technical analysis of historical data, and input from the affected stakeholders in the Basin. This chapter presents the data and methods used to develop the SMC and demonstrate how they influence beneficial uses and users. The SMCs presented in this chapter are based on currently available data and application of the best available science. As noted in this GSP, data gaps exist in the hydrogeologic conceptual model. Uncertainty caused by these data gaps was considered when developing the SMC. Due to uncertainty in the hydrogeologic conceptual model, these SMCs are considered initial criteria and will be reevaluated and potentially modified in the future as new data become available.

The discussion of SMC in this chapter is organized by Sustainability Indicators. The following Sustainability Indicators are applicable in the Basin:

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

The sixth Sustainability Indicator, sea water intrusion, only applies to coastal basins, and is not applicable in the Basin.

To maintain an organized approach throughout the text, this chapter follows the same structure for each Sustainability Indicator. The description of each SMC contains all the information required by Section 354.22 et. seq of the SGMA regulations and outlined in the Sustainable Management Criteria BMP (DWR, 2017), including:

- How undesirable results were developed, including:
    - The criteria defining when and where the effects of the groundwater conditions that cause undesirable results based on a quantitative description of the combination of minimum threshold exceedances (§354.26 (b)(2))
    - The potential causes of undesirable results (§354.26 (b)(1))
    - The effects of these undesirable results on the beneficial users and uses (§354.26 (b)(3))
- How minimum thresholds were developed, including:
    - The information and methodology used to develop minimum thresholds (§354.28 (b)(1))
    - The relationship between minimum thresholds and the relationship of these minimum thresholds to other Sustainability Indicators (§354.28 (b)(2))
    - The effect of minimum thresholds on neighboring basins (§354.28 (b)(3))
    - The effect of minimum thresholds on beneficial uses and users (§354.28 (b)(4))

  - How minimum thresholds relate to relevant Federal, State, or local standards (§354.28 (b)(5))
  - The method for quantitatively measuring minimum thresholds (§354.28 (b)(6))
- How measurable objectives were developed, including:
  - The methodology for setting measurable objectives (§354.30)
  - Interim milestones (§354.30 (a), §354.30 (e), §354.34 (g)(3))

The SGMA regulations address minimum thresholds before measurable objectives. This order was maintained for the discussion of all applicable Sustainability Indicators.

8.1 DEFINITIONS (§ 351)

The SGMA legislation and regulations contain a number of new terms relevant to the SMCs. These terms are defined below using the definitions included in the SGMA regulations (§ 351, Article 2). Where appropriate, additional explanatory text is added in italics. This explanatory text is not part of the official definitions of these terms. To the extent possible, plain language, including limited use of overly technical terms and acronyms, was used so that a broad audience will understand the development process and implications of the SMCs.

1. Interconnected surface water (ISW) refers to surface water that is hydraulically connected at any point by a continuous saturated zone between the underlying aquifer and the overlying surface water. Interconnected surface waters are parts of streams, lakes, or wetlands where the groundwater table is at or near the ground surface and there is water in the lakes, streams, or wetlands.
2. Interim milestone (IM) refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan. Interim milestones are targets such as groundwater elevations that will be achieved every five years to demonstrate progress towards sustainability.
3. Management area refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.
4. Measurable objectives (MOs) refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin. Measurable objectives are goals that the GSP is designed to achieve.
5. Minimum thresholds (MTs) refer to numeric values for each Sustainability Indicator used to define undesirable results. Minimum thresholds are established at representative monitoring sites. Minimum thresholds are indicators of where an unreasonable condition might occur. For example, a particular groundwater elevation might be a minimum threshold if lower groundwater elevations would result in a significant and unreasonable reduction in groundwater storage.
6. Representative monitoring site (RMS) refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.
7. Sustainability Indicator refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x). The five Sustainability Indicators relevant to the Basin are listed in the introductory section of Chapter 8.
8. Uncertainty refers to a lack of understanding of the basin setting that significantly affects an Agency's ability to develop sustainable management criteria and appropriate projects and management actions in a Plan, or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.

9. Undesirable Result Section 10721 of the Sustainable Groundwater Management Act states that Undesirable result means one or more of the following effects caused by groundwater conditions occurring throughout the basin:
    a. 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.
    b. Significant and unreasonable reduction of groundwater storage.
    c. Significant and unreasonable seawater intrusion.
    d. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
    e. Significant and unreasonable land subsidence that substantially interferes with surface land uses.
    f. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.
10. Section § 354.26 of the SGMA regulations states that "The criteria used to define when and where the effects of the groundwater conditions cause undesirable results shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin."

8.2 SUSTAINABILITY GOAL (§ 354.24)

The sustainability goal for the San Luis Obispo Basin is a comprehensive statement that describes the important factors to be considered during the SGMA planning horizon. The sustainability goal was developed over a series of public meetings and public workshops with input from the City, County, and affected stakeholders. The June 10, 2020 Stakeholder Workshop, Groundwater Management Vision, was dedicated to obtaining information to be used to develop a sustainability goal for the Basin. In the workshop, stakeholders participated in an interactive visioning exercise where they helped populate a virtual white board to answer the question, "What is our shared vision of what a 'sustainable SLO Basin' means?" Stakeholders added ideas, perceptions, outcomes, and values onto the white board across the following categories:

- Available Groundwater Supply: What needs/uses does our groundwater supply always need to be able to serve?
- Available Groundwater Storage: What needs/uses does our stored groundwater need to serve or prepare us for?
- Groundwater Dependent Ecosystem Health: What outcomes do we want for surface water ecosystems and prevention of land subsidence?
- Cost to Users: If we achieve a "sustainable Basin," how does it look to ratepayers?
- Groundwater Quality: What is the quality of groundwater we aim to sustain?

During the September 9, 2020 GSC meeting, the results of the interactive exercise from the June workshop were presented in an organized fashion to stakeholders. Significant concepts from the visioning exercise are incorporated into the Sustainability Goal presented herein and are represented as guiding principles that underpin the Basin sustainability goal. The SGMA regulations require the sustainability goal to culminate in the absence of undesirable results within 20 years of the applicable statutory deadline. Per Section § 354.24 of the SGMA regulations the Sustainability goal has three parts:

- Description of the sustainability goal
- A discussion of the measures that will be implemented to ensure the Basin will be operated within sustainable yield, and
- An explanation of how the sustainability goal is likely to be achieved.

8.2.1 Description of Sustainability Goal

The sustainability goal for the Basin is to manage the Basin to ensure beneficial uses and basin users have access to a safe and reliable groundwater supply that meets current and future demand without causing undesirable results. Guiding principles of this goal are:

- Available groundwater supply supports diverse needs reliably and equitably.
- Stored groundwater equitably supports supply resilience and evolving needs.
- Groundwater levels support the sustained health of groundwater dependent ecosystems.
- Cost of maintaining sustainable groundwater levels is equitably distributed.
- Groundwater quality is maintained to a safe standard to meet diverse basin needs.

8.2.2 Sustainability Strategy

The sustainability strategy will be developed and discussed at the upcoming GSC meetings. This section will include a discussion of the measures that will be implemented to ensure the basin will be operated within the sustainable yield, ***to be completed after Chapter 9 -Projects and Management Actions is approved and will be included in the Public Draft of the GSP***, and an explanation of how the sustainability goal is likely to be achieved, ***to be completed after Chapter 10 -Implementation Plan is approved and will be included in the Public Draft of the GSP.***

8.3 GENERALIZED PROCESS FOR ESTABLISHING SUSTAINABLE MANAGEMENT CRITERIA (§ 354.22-30)

SMCs for the Basin were developed after technical analysis of hydrogeologic and geotechnical data by the consulting team, input from the GSC members, public input received in public meetings, written public comments in response to GSC meeting and workshop presentations, and meetings with GSA staff and GSC members. Public comments on alternative SMCs discussed during GSC meetings and responses to those comments are included in Appendix M. All presentations made at public meetings are available for review at the SLO Basin web site created for this GSP, www.slowaterbasin.com. The process further built on the Basin Groundwater Sustainability Agencies' history of involving interested parties – including the City, the County, environmental stakeholders, rural residents, agricultural stakeholders, water purveyors, and mutual water companies – in public meetings focused on groundwater resource planning.

The general process for establishing minimum thresholds and measurable objectives for the SMC and assessing significant and unreasonable conditions constituting undesirable results in the Basin was iterative and included the following:

- Evaluating historical data on groundwater elevations from wells monitored by the City and County.
- Evaluating water budget information presented in Chapter 6, including sustainable yield estimates and average deficits for the San Luis Valley and Edna Valley parts of the basin.
- Holding a series of public outreach meetings that outlined the GSP development process and introduced stakeholders to SMC, MOs, MTs, and other related information.
- Soliciting public comment and input on several alternative minimum threshold and measurable options based upon preliminary technical analysis presented at GSC meetings.
- Evaluating public comment to assess what are significant and unreasonable effects relevant to SMC. Public comments from outreach meetings was analyzed to assess if different areas in the Basin had different perspectives for what constitutes an undesirable result in the Basin and how minimum thresholds and measurable objectives are established.
- Combining public comment, outreach efforts, hydrogeologic data and considering the interests of beneficial uses and groundwater users, land uses, and property interests in the Basin to describe undesirable results and setting preliminary conceptual MTs and MOs.
- Performing groundwater model simulations that incorporate projects and management actions discussed in Chapter 9 to assess if the SMC are achievable.
- Conducting public meetings to present recommended preliminary conceptual minimum thresholds and measurable objectives and receiving additional public input. Presentations and discussion of SMCs occurred at eleven meetings in the Basin between March 2020 and May 2021.
- Reviewing and considering public and GSC input on recommended preliminary SMCs with GSA staff.
- GSC recommended final SMCs to GSAs for approval.

A number of alternative options for both MTs and MOs were considered for each RMS after evaluation of the historical record of groundwater elevations at each well, assessment of trends of groundwater elevation decline (where applicable), and input from stakeholders regarding their desired conditions.

Details regarding the specific SMCs for each Sustainability Indicator are included in the following sections of this chapter describing each indicator.

For all applicable Sustainability Indicators except for water quality (I.e., chronic lowering of groundwater levels, reduction of storage, land subsidence, and depletion of interconnected surface water), this GSP uses water levels as a proxy measurement metric to assess the SMCs for each indicator. Water levels are measured directly at each RMS. For the land subsidence Sustainability Indicator, direct measurement of changes in land surface elevation data (InSAR data) published by DWR define the SMCs, and water levels will be monitored in an RMS in the area of documented past subsidence to monitor groundwater conditions (SLV-09), and to manage such that water levels do not approach the levels observed in 1991-1992.

8.4 CHRONIC LOWERING OF GROUNDWATER LEVELS SUSTAINABILITY INDICATOR

This section of the GSP describes the SMC for the Chronic Lowering of Groundwater Levels Sustainability Indicator. The definition of Undesirable Results is presented, and MTs and MOs are presented for each RMS in the monitoring network.

8.4.1 Undesirable Results (§ 354.26)

The definition of undesired conditions for the Chronic Lowering of Groundwater Indicator for the purposes of this GSP is as follows:

> *The Basin will be considered to have undesirable results if two or more RMSs for water levels within a defined area of the Basin (i.e., San Luis Valley or Edna Valley) display exceedances of the minimum threshold groundwater elevation values for two consecutive fall measurements. Geographically isolated exceedances (i.e., conditions in a single well) will require investigation to determine if local or basin wide actions are required in response.*

Details addressing specific MTs and MOs are presented in the following sections. A summary of MTs and MOs used in the definition of Undesirable Conditions for the Chronic Lowering of Groundwater Sustainability Indicator are presented along with other indicators in Table 8-1.

Table 8-1 . Summary of MTs, MOs, and IMs for SLO Basin RMSs.

RMS	MT	MO	2020 WL	2027 IM	2032 IM	2037 IM	Sustainability Indicator
San Luis Valley							
SLV-09	102	110	119	110	110	110	Subsidence/Water Levels
SLV-16	70	100	111	100	100	100	Water Levels/Storage
SLV-19	80	110	123	110	110	110	Water Levels/Storage
SLV-12	85	100	107	100	100	100	SW-GW Interaction/Water Levels
Edna Valley							
EV-09	82	164	146	150	155	160	Water Levels/Storage
EV-04	160	247	209	219	229	239	Water Levels/Storage
EV-13	172	248	215	223	231	238	Water Levels/Storage
EV-16	150	190	180	175	180	185	Water Levels/Storage
EV-01	263	314	290	314	314	314	SW-GW Interaction /Water levels
EV-11	177	227	219	227	227	227	SW-GW Interaction /Water levels

Note: All water level and interim milestone measurements refer to fall measurements.

8.4.1.1 *Criteria for Establishing Undesirable Results §354.26(b)(2)*

Significant and unreasonable Chronic Lowering of Groundwater Levels in the Basin are those that:

- Reduce the ability of existing domestic wells of average depth to produce adequate water for domestic purposes (drought resilience).
- Cause significant financial burden to those who rely on the groundwater basin.
- Interfere with other SGMA Sustainability Indicators.

8.4.1.2 *Potential Causes of Undesirable Results - §354.26(b)(1)*

Conditions that could theoretically lead to an undesirable result include the following:

- Continuation of current levels of Edna Valley pumpage without development of additional water supply projects, or development of additional municipal or agricultural pumping at significantly higher rates than are currently practiced. Maintenance of current or additional non-de minimis pumping may result in continued decline in groundwater elevations and exceedance of the proxy minimum threshold.
- Expansion of de minimis pumping. Adding domestic de minimis pumpers in the areas of the Basin administered by the County may result in lower groundwater elevations, and an exceedance of the proxy minimum threshold.
- Extensive, unanticipated drought. Minimum thresholds are established based on reasonable anticipated future climatic conditions. Extensive, unanticipated droughts more severe than those on record may lead to excessively low groundwater recharge and unanticipated high pumping rates that could cause an exceedance of the proxy minimum threshold.

8.4.1.3 *Effects of Undesirable Results on Beneficial Users and Land Uses - §354.26 (b)(3)*

The primary effects on the beneficial users occurs from allowing multiple exceedances of the MTs in a small geographic area. Allowing two exceedances in a network of 10 RMS wells is reasonable if the exceedances are distributed throughout the Basin. If the exceedances are clustered in a limited area, it indicates that significant unreasonable effects are being experienced by a localized group of landowners. Any exceedances will require investigation to determine the significance and causes of the observed conditions.

8.4.2 Minimum Thresholds - §354.28(c)(1)

Section §354.28(c)(1) of the SGMA regulations states that "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".

After the 10 RMS had been selected and discussed at public meetings, numerous alternative draft MTs were developed based on the evaluation of historical groundwater elevations over the available period of record (including consideration of average water levels over various time periods, long term trends, response to the recent drought, etc.), consideration of likely future use of groundwater, well construction data, assessment of remaining available saturated thickness, and public input from stakeholders. The following sections present details on the development of MTs for specific RMSs in the Basin.

8.4.2.1 *Information and Methods Used for Establishing Chronic Lowering of Groundwater Level Minimum Thresholds - §354.28(b)(1)*

The primary source of data that was evaluated for the Sustainability Indicator of chronic lowering of groundwater levels is historical groundwater elevation data collected by the County. The information used for establishing the MOs and MTs for the chronic lowering of groundwater levels Sustainability Indicator included:

- Historical groundwater elevation data from wells monitored by the County of San Luis Obispo.
- Depths and locations of existing wells.
- Maps of current and historical groundwater elevation data.
- Input from stakeholders regarding significant and unreasonable conditions and desired current and future groundwater elevations communicated during public meetings and solicitation of public comment on various options of MTs and MOs presented in the public forum.
- Results of modeling of various project scenarios of future groundwater level conditions.

It is observed that historical trends of water levels are significantly different in the San Luis Valley and the Edna Valley. For this reason, the approach for setting MTs is different in the San Luis Valley than in the Edna Valley.

San Luis Valley

In the San Luis Valley, there have been no long-term water level declines in any of the monitoring wells or RMS (Figure 5-11). All four of the RMS hydrographs in San Luis Valley (SLV-09, SLV-12, SLV-16, and SLV-19) display a significant temporary decline in water levels in the early 1990s. This corresponds to the period when the City increased pumping from their wells during the drought of the late 1980s and early 1990s. After 1992-1993, the City reduced pumping and water levels have been in relative equilibrium since seasonal fluctuations continue, but water levels have been essentially stable. However, City staff and City GSA participants have communicated their desire to maintain flexibility to develop groundwater in the future to potentially augment their water supply portfolio to supply the public with drinking water in their service area. Therefore, the City wishes to avoid the definition of MTs that would prevent this. For this reason, MTs in the San Luis Valley are set 10 to 20 feet lower than previously observed low water levels, to allow for potential future groundwater development by the City. The GSAs will coordinate during GSP implementation to ensure such future development does not lead to undesirable results in the Basin. The GSAs considered historical groundwater elevations, available saturated thickness, proximity of nearby wells, and general hydrogeologic judgement when setting these MTs. Figure 7-1 displays the locations of representative wells in the Basin. MTs are presented in Table 8-1. Figures 8-1 through 8-4 present historically observed water levels in the four RMS in the San Luis Valley portion of the basin, and the MTs set at these wells.

Edna Valley

In Edna Valley, by contrast, four wells show water level declines over the past 20-30 years (EV-04, EV-09, EV-12, and EV-16). Various alternative approaches were considered to establish MTs including designation of current water levels, water levels higher than current water levels, historical low water levels (usually those that occurred in 2015 at the end of the recent drought), and levels lower than the historical low. Not all of the Edna Valley hydrographs show the same trends. Each hydrograph has unique characteristics depending on the local hydrogeologic setting in the immediate vicinity of the well, and this leads to the consideration of different definitions of MTs for different wells, as discussed below.

RMS EV-12, EV-04, and EV-09 display declining water levels over the past 20-25 years, with historical low elevations occurring around Fall 2015 at the end of the recent drought. The hydrographs for all three of these wells display recovery of water levels since then (Figures 8-5, 8-6, 8-7). Agricultural stakeholders in the Edna Valley communicated concern that setting the MT at the 2015 water levels in these wells would not provide them adequate operational flexibility to protect their long investments in the production of agriculture in the area. At the April 7, 2021 GSC meeting they requested consideration of an MT for these three RMSs to be defined 10 feet lower than 2015 drought water level. They communicated their desire for a slightly greater factor of safety for their operations and investments in the event of another drought during the planning horizon of SGMA activities. Members of the GSC were polled, and a majority of the GSC members agreed that this was a reasonable request to protect the significant investments in vineyard agriculture in the valley, and would not be considered an undesirable condition in this part of Edna Valley. Therefore, for these three wells, the MTs were defined to be 10 feet lower than the historical low groundwater elevation observed in 2015, at the height of the recent drought. (The measurement for EV-04 represents the Spring 2015 measurement; the Fall measurement was not collected. It is assumed that the Fall measurement would be lower than the Spring measurement, so the MT is set slightly lower than the Spring measurement.)

In order to assess the risk of having groundwater elevations lower than recent drought low levels, an analysis was performed to evaluate potential water level of MTs compared to the depths of private domestic wells identified in County data. The basin-wide Fall 2015 groundwater elevations were mapped and compared to the total depths of domestic wells in the County's well permitting database. Then the

2015 groundwater elevation arrays were reduced by 25 feet, and then 50 feet, to project conditions of lowered water levels. These revised lowered groundwater elevations were then compared to the total depths of the identified domestic wells. If in any of these comparison evaluations, the water level was below the total depth of a domestic well, that well was marked as "dry" in the analysis. The objective of this analysis is to assess the level of impact to domestic wells associated with water level reduction of these magnitudes. This is not intended to be a definitive analysis, given that depth and location data of the domestic wells are imperfect (many wells in the database are placed on the same point location, an artifact of the practice of assigning locations to the center of a section if better information is not available.) However, it is intended to provide a general indication of how many additional domestic wells might be impacted if water levels were decreased.

For the analysis of 2015 water levels, the data indicated 15 wells as "dry". (In reality, anecdotal information indicates knowledge of four known wells that needed to be replaced or stopped being used during the drought in Edna Valley). For water levels 25 feet lower than 2015 water levels, 29 wells were identified as "dry". For water levels 50 feet lower than 2015 water levels, 40 wells were identified as "dry". This evaluation was performed to give a relative idea as to the potential impact on domestic wells of lowered water levels. The conclusion of this analysis was that water levels 25 feet and 50 feet lower than the drought minimums would result in an unacceptable condition in which the number of domestic supply wells at risk of adverse operating conditions was too high. Afterward, an additional iteration of this analysis was performed in which water levels 10 feet lower than the 2015 water levels were assessed. At 10 feet of groundwater elevation reduction, no domestic wells in the County database were indicated as "dry", beyond those identified as dry using 2015 water levels. Therefore, the conclusion of this analysis is that lowering water levels 25 to 50 feet below 2015 conditions constitutes an unreasonable risk to domestic well owners, but that water levels 10 feet below the 2015 drought levels constitutes an acceptable level of risk for all stakeholders, and the definition of MTs for wells in this area 10 feet lower than 2015 levels does not constitute unreasonable or undesirable conditions.

RMS EV-16 displays a relatively steady decline in water levels of about 3.25 feet/year at the Varian Ranch Mutual Water Company (VRMWC) service area since the year 2000. The 2011-2015 drought is not apparent in this hydrograph as a period of historical low groundwater elevations. For this well, the MT was set at an elevation of 150 feet, lower than current groundwater elevations of about 180 feet, to allow for the various mutual water companies in the area to implement projects to slow and stabilize the observed water level declines (Figure 8-10). Consideration of the recent rate of groundwater elevation decline, amount of available saturated thickness, and hydrogeologic judgement regarding the amount of time likely required to mitigate this trend, were used in defining the MTs at this well. (VRMWC owns property and wells in the adjacent Arroyo Grande sub-basin of the Santa Maria Valley Groundwater Basin, which may be useful in reversing this trend, and will be discussed in Chapter 9.)

8.4.2.2 *Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators - §354.28(b)(2)*

Section 354.28 of the SGMA regulations requires that the description of all MTs include a discussion of the relationship between the MTs for each Sustainability Indicator. In the SMC Best Management Practices document (DWR, 2017), DWR has clarified this requirement. First, the GSP must describe the relationship between each Sustainability Indicator's MT by describing why or how a water level MT set at a particular RMS is similar to or different to water level thresholds in a nearby RMS. Second, the GSP must describe the relationship between the selected MT and MTs for other Sustainability Indicators; in other words, describe how (for example) a water level minimum threshold would not trigger an undesirable result for land subsidence.

Groundwater elevation MTs are derived from examination of the historical record reflected in hydrographs at the RMS. They were tested for achievability through model simulations (as described in Chapter 9). Because the MOs are largely based on observed historical groundwater conditions, the minimum thresholds derived from these objectives are not expected to conflict with each other. Groundwater elevation MTs can theoretically influence other Sustainability Indicators. Examples are listed below:

1. **Change in groundwater storage.** Changes in groundwater elevations are directly correlated to changes in the amount of stored groundwater. Pumping at or less than the sustainable yield will maintain or raise average groundwater elevations in the Basin. The groundwater elevation MTs are set to establish a minimum elevation that will not lead to undesirable conditions, and that are acceptable to the stakeholders in the area. Therefore, if the groundwater elevation MTs are met, they will not result in long term significant or unreasonable changes in groundwater storage.
2. **Subsidence.** A significant and unreasonable condition for subsidence is permanent pumping-induced subsidence that substantially interferes with surface land use. One cause for subsidence is dewatering and compaction of clay-or peat-rich sediments in response to lowered groundwater levels. As discussed in Chapter 5, significant subsidence was observed along Los Osos Valley Road in the early 1990s, which resulted in the City paying significant damages to affected local businesses. No observed subsidence has been reported in the Edna Valley. If MTs are maintained higher than the historically low water levels that were observed during the subsidence episode, this will minimize the risk of additional subsidence in the Basin. The groundwater elevation MT in RMS SLV-09 along Los Osos Valley Road is set 15 feet higher than the historically low groundwater elevation observed in the early 1990s. Therefore, if this MT is met, it should minimize the risk of further subsidence along Los Osos Valley Road. No subsidence MTs based on water levels are established in Edna Valley (the actual MTs for subsidence will be based on InSAR data provided annually by DWR, and are discussed later in this chapter). Should new subsidence be observed due to lower groundwater elevations, the groundwater elevation MTs will be raised to mitigate this subsidence and avoid future subsidence.
3. **Degraded water quality.** Protecting groundwater quality is critically important to all groundwater users in the Basin, particularly for drinking water and agricultural uses. Maintaining groundwater levels protects against degradation of water quality or exceeding regulatory limits for constituents of concern in supply wells due to actions proposed in the GSP. Water quality in the Basin could theoretically be affected through two processes:
    a. Low groundwater elevations in an area could theoretically cause deeper, poorer-quality groundwater to flow upward from bedrock into existing supply wells. Should groundwater quality degrade due to lowered groundwater elevations, the groundwater elevation MTs may be raised to avoid this degradation. However, since MTs are set to avoid significant declines of groundwater elevations below historically observed levels, and the historical low water levels did not result in water quality degradation, this is not expected to occur.
    b. Changes in groundwater elevation due to actions implemented to achieve sustainability could change groundwater gradients, which could cause poor quality groundwater to flow towards supply wells that would not have otherwise been impacted. However, MTs are established so as not to change the basin patterns or gradients of groundwater flow, so this is not expected to occur in the Basin.
4. **Depletion of Interconnected Surface Water.** Groundwater levels measured at representative monitoring wells (SLV-12, EV-01, EV-11) will serve as a proxy for depletion of interconnected surface water. In addition, stream flow gages along SLO Creek will continue to measure surface water conditions in San Luis Valley, and proposed stream gages along Corral de Piedras Creek will serve to generate information on surface water inflow and outflow in Edna Valley, allowing for direct measurement of surface water gains and losses to the groundwater systems based on future hydrologic and pumping conditions in the Basin. However, MTs along the Creeks are defined at

levels designed to avoid significant water declines in these areas, with the goal of minimizing any potential significant depletion of interconnected surface water flows.

5. **Seawater intrusion.** This Sustainability Indicator is not applicable to this Groundwater Basin.

8.4.2.3 *Effect of Minimum Thresholds on Neighboring Basins - §354.28(b)(3)*

Two neighboring groundwater basins share a boundary with the San Luis Obispo Basin; the Los Osos Basin to the northwest, and the Arroyo Grande Subbasin of the Santa Maria Valley Groundwater Basin to the southeast. The shared boundary with both of these basins is not extensive, and the Hydrogeologic Conceptual Model (HCM) posits that a groundwater divide separates the groundwater between those basins and the San Luis Obispo Basin. In the San Luis Valley there have been no trends indicating groundwater declines that would affect the Los Osos Basin. In Edna Valley the areas with observed declines are over two miles downgradient from the Arroyo Grande Subbasin boundary. It is not anticipated that actions associated with the GSP will have any significant impact on either the Los Osos Basin or the Arroyo Grande Subbasin.

Additionally, the SLO Basin GSAs have developed a cooperative working relationship with both the Los Osos Groundwater Basin – Basin Management Committee and the GSAs working in the Arroyo Grande Subbasin. Hydrogeologic conditions near the basin boundaries will be monitored, and any issues potentially affecting those basins will be communicated.

8.4.2.4 *Effects of Minimum Thresholds on Beneficial Users and Land Uses - §354.28(b)(4)*

Agricultural land uses and users

The agricultural stakeholders in the Edna Valley have maintained an active role during the development of this GSP. The groundwater elevation MTs place a practical limit on the acceptable lowering of groundwater levels in the Basin, thus conceptually restricting the current level of agriculture in the region without projects to supplement water supply to the Basin, or management actions to reduce current pumping. In the absence of other mitigating measures, this has been the practical effect of potentially limiting the amount of groundwater pumping in the Basin. Limiting the amount of groundwater pumping could limit the additional amount and type of crops that can be grown in the Basin, which could result in a reduction of economic viability for some properties. The groundwater elevation MTs could therefore limit the Basin's agricultural economy. This could have various effects on beneficial users and land uses:

- There could be an economic impact to agricultural employees and suppliers of agricultural production products and materials, as well as the tourism industry supported by the wineries in the Basin. Many parts of the local economy rely on a vibrant agricultural industry and they too will be hurt proportional to the losses imparted to agricultural businesses.
- Growth of city, county, and state tax rolls could be slowed or reduced due to the limitations imposed on agricultural growth and associated activities.

However, it should be noted that projects and management actions discussed in Chapter 9 will be pursued to allow for alternatives to reductions in agricultural pumping.

Urban land uses and users

The groundwater elevation MTs effectively limit the amount of groundwater pumping in the Basin. However, the MTs in the San Luis Valley are established below currently observed groundwater elevations to allow for reasonable future development of groundwater for potable supply to City residents. If groundwater elevations decline in the immediate vicinity of SLO Creek, this could potentially result in less groundwater discharge to the creek due to areas of interconnected groundwater and surface water.

Impacts to stream flows will be monitored with the augmentation of current data collection programs in San Luis Valley, and the addition of new stream gauges in the Basin.

Domestic land uses and users
The groundwater elevation MTs are established to protect as many domestic wells as possible. Therefore, the MTs will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells within the Edna Valley portion of the Basin. However, limited saturated thickness in some localized areas in the Basin of the shallowest domestic wells may require owners to drill deeper wells if water levels are decreased. Additionally, the groundwater elevation MTs may limit the increase of non-de minimis groundwater use in order to limit future declines in groundwater levels caused by non-de minimis domestic pumping.

Ecological land uses and users
Groundwater elevation MTs protect the groundwater resource and the existing ecological habitats that rely upon it because they are set to avoid long term declines in groundwater levels. As noted above, groundwater level MTs may limit increases in non-de minimis and agricultural groundwater uses. Ecological land uses and users may benefit by this reduction in non-de minimis and agricultural groundwater uses.

8.4.2.5 *Relevant Federal, State, or Local Standards - §354.28(b)(5)*
No Federal, State, or local standards exist for chronic lowering of groundwater elevations.

8.4.2.6 *Method for Quantitative Measurement of Minimum Thresholds - §354.28(b)(6)*
Conformance of Basin conditions to the established groundwater elevation MTs will be assessed through direct measurement of water levels from existing RMS. During planned 5-year revisions to this GSP, additional RMS may be stablished for the SMC evaluations, and direct water level measurements at these wells will be the method for quantitative measurement of MTs in the future. Groundwater level monitoring will be conducted in accordance with the monitoring plan outlined in Chapter 7 and will comply with the requirements of the technical and reporting standards included in SGMA regulations.

As noted in Chapter 7, the existing groundwater monitoring network in the Basin includes 12 wells. The GSP monitoring network developed in Chapter 7 increases the groundwater monitoring network to 40 wells to be used for water level measurements.

8.4.3 Measurable Objectives - §354.30(a)-(g)
The MOs for chronic lowering of groundwater levels represent target groundwater elevations that are established to achieve the sustainability goal by 2042. MOs are groundwater levels established at each RMS. MO groundwater levels are higher than MT groundwater levels, and provide operational flexibility above MTs to ensure that the Basin be sustainably managed over a range of climate and hydrologic variability. MOs are subject to change by the GSAs after GSP adoption as new information and hydrologic data become available.

8.4.3.1 *Information and Methods Used for Establishing Chronic Lowering of Groundwater Level Measurable Objectives §354.30(b)*
Preliminary MOs were established based on historical groundwater level data, along with input and desired future groundwater levels from domestic groundwater users, agricultural interests, environmental interests, and other Basin stakeholders. The input and desired conditions were used to formulate a range of alternative MO options, which were discussed by the GSAs and the GSC. Final MOs were voted on by the GSC members to recommend to the GSAs for approval as part of the full GSP.

Preliminary MOs were established based on historical groundwater level data and input regarding desired future groundwater levels from domestic groundwater users, agricultural interests, environmental

interests, and other public stakeholders. The input and desired conditions were used to formulate a range of conceptual MO scenarios. These scenarios were evaluated using the groundwater model developed during this GSP preparation to project the effects of future Basin operation and to select measurable objectives for the GSP.

As previously discussed in Chapter 5 and Section 8.4.2, groundwater conditions in San Luis Valley and Edna Valley are significantly different. Therefore, as with the MTs, the approach to the MOs is different in the two valleys.

San Luis Valley

In San Luis Valley, definition of MOs within the historically observed range of groundwater elevations, but about 20 feet lower than fall 2020 water levels, was considered to preserve the City's desired flexibility to pursue reasonable and managed groundwater development to augment its potable water supply portfolio to serve its customer base. MOs for SLV-09, SLV-16, SLV-19, and SLV-12 were set within the range of historical data, but lower than current water levels (Table 8-1) (Figures 8-1 through 8-4).

Edna Valley

In Edna Valley, if recovery from drought levels is evident (EV-04, EV-09, EV-12), MOs were set at the high-water levels observed immediately prior to the drought (Spring 2011, in most cases) (Figures 8-5 through 8-7). The rationale for this selection was that if the antecedent conditions before the recent drought are replicated, and no significant new groundwater pumping is occurring in the Basin, then the water level declines observed from 2012-2015 in the Basin will not be significantly exceeded in a similar drought. To the extent that groundwater elevations can recover to levels higher than the 2011 levels, the Basin will be more resilient to drought.

For the wells in Edna Valley to monitor surface water/groundwater conditions (EV-01, EV-11), MOs were set at approximately the average of seasonal high water levels over the period of record (Figures 8-8, 8-9). RMS EV-01 shows that similar high water levels occur with regularity during wet periods, going back to the late 1950s. Therefore, this level was selected for the MOs for these wells because they are the naturally occurring water levels that have been observed for decades.

The MO for RMS EV-16, located in the southeast area of Tiffany Ranch Road near the upgradient extent of the Basin, was set slightly below current water levels (Figure 8-7). This approach is to try to prevent further significant reductions in water levels at this location, since it does not appear to have experienced any recovery of water levels since 2015, and needs to maintain sufficient saturated thickness to sustain production for the service area.

Since there is data uncertainty due to significant data gaps, MTs and MOs will be reviewed every 5 years during GSP updates throughout the twenty-year SGMA planning horizon to assess if the RMSs and the assigned MOs and MTs remain protective of sustainable conditions in the Basin. MTs and MOs may be modified in the future as hydrogeologic conditions are monitored through the implementation phase of SGMA.

8.4.3.2 *Interim Milestones §354.30(a)(e)*

Interim milestones (IMs) are required to be included in the GSP. IMs at 5-year intervals for the MOs established at each RMS are included on Table 8-1.

Preliminary IMs were developed for the 10 RMS established for the basin. In San Luis Valley, because there have been no historic declines in water levels, IMs were simply defined as being numerically equivalent to the MO throughout the SGMA period. In Edna Valley, Interim milestones were generally selected to define

a smooth linear increase in water levels between the observed groundwater elevation at the RMS in 2020, and the MO as presented in Table 8-1.

IMs may be adjusted at any time during the SGMA timeline. It is expected that they will be reconsidered at 5-year intervals when the Basin GSP is revised and updated. The monitoring of basin conditions during the initial 5-year period will provide good indicators on if the IMs are close to being met. Failure to meet IMs is not in and of itself an indication of undesired conditions, but is meant to provide information determining whether the 20-year goals are on track to being achieved. Alternative projects and management actions may be considered or pursued if the IMs are not being met. Table 8-1 summarizes the interim milestones for the RMS.

8.5 REDUCTION OF GROUNDWATER STORAGE SUSTAINABILITY INDICATOR §354.28(C)(2)

8.5.1 Undesirable Results

As per §354.26 of the SGMA regulations, locally defined significant and unreasonable conditions were assessed based on review of historical groundwater data and stakeholder input during numerous public meetings, analysis of available data, and discussions with GSA staff. It is recognized based on well-established hydrogeologic principles that the Reduction of Groundwater Storage Sustainability Indicator is directly correlated to the lowering of water level Sustainability Indicator. Significant and unreasonable changes in groundwater storage in the Basin are those that:

- Lead to long-term reduction in groundwater storage.
- Interfere with other Sustainability Indicators.

Assessment of groundwater in storage will initially be evaluated with the same RMS and associated water level MTs and MOs as the chronic lowering of groundwater levels sustainability criteria. As additional data is collected in the monitoring network described in Chapter 7, new RMS may be established, and appropriate SMCs determined by the GSAs.

For the purposes of this GSP, the definition of undesired conditions for the Reduction of Groundwater Storage Sustainability Indicator is as follows:

> *The Basin will be considered to have undesirable results if two or more than two RMS for groundwater storage within a defined area of the Basin (I.e., San Luis Valley or Edna Valley) display exceedances of the MTs for two consecutive Fall measurements. Geographically isolated exceedances will require investigation to determine if local or basin wide actions are required in response.*

8.5.1.1 *Criteria for Establishing Undesirable Results §354.2(b)(2)*

Significant and unreasonable Reduction of Groundwater Storage in the Basin are those that:

- Reduce the ability of existing domestic wells of average depth to produce adequate water for domestic purposes (drought resilience).
- Cause significant financial burden to those who rely on the groundwater basin.
- Interfere with other SGMA Sustainability Indicators.

8.5.1.2 *Potential Causes of Undesirable Results §354.2(b)(1)*

Conditions that could theoretically lead to an undesirable result include the following:

- Continuation of current levels of Edna Valley pumpage without development of additional water supply projects, or development of additional municipal or agricultural pumping at significantly higher rates than are currently practiced. Maintenance of current or additional non-de minimis pumping may result in continued decline in groundwater elevations and exceedance of the proxy minimum threshold..
- Expansion of de minimis pumping. Adding domestic de minimis pumpers in the areas of the Basin administered by the County may result in lower groundwater elevations, and an exceedance of the proxy minimum threshold.
- Extensive, unanticipated drought. Minimum thresholds are established based on reasonable anticipated future climatic conditions. Extensive, unanticipated droughts more severe than those on record may lead to excessively low groundwater recharge and unanticipated high pumping rates that could cause an exceedance of the proxy minimum threshold.

8.5.1.3 *Effects of Undesirable Results on Beneficial Users and Land Uses §354.2(b)(3)*

The effects of these undesirable results on the beneficial users and uses are the same effects as those discussed for the Chronic Lowering of Groundwater Levels Sustainability Indicator.
The primary effects on the beneficial users (§354.26 (b)(3)) occurs from allowing multiple exceedances of the MTs in a small geographic are. Allowing a minimum of two exceedances in a network of 10 RMS wells is reasonable if the exceedances are distributed throughout the Basin. If the exceedances are clustered in a limited area, it indicates that significant unreasonable effects are being experienced by a localized group of landowners. Any exceedances will require investigation to determine the significance and causes of the observed conditions.

8.5.2 Minimum Thresholds §354.28(c)(2)

Section §354.28(c)(2) of the SGMA regulations states that "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."

This GSP will monitor changes in groundwater level at the RMSs as a proxy for the change in groundwater storage metric. As allowed in §354.36(b)(1) of the SGMA regulations, groundwater elevation data at the RMS will be reported annually as a proxy to track changes in the amount of groundwater in storage.

Based on well-established hydrogeologic principles, stable groundwater elevations maintained above the MTs will limit depletion of groundwater from storage. Therefore, using groundwater elevations as a proxy, the MT is that the groundwater surface elevation averaged across all the wells in the groundwater level monitoring network will remain stable above the MT for chronic lowering of groundwater levels.

In accordance with the SGMA regulation cited above, GSAs have the option of defining the MT metric as a calculated volume of groundwater in storage. As discussed in Chapter 6, separate estimates for total groundwater in storage were generated for the San Luis Valley and Edna Valley using methodology described in Chapter 6. Figure 6-21 presents these estimates. After the monitoring network described in Chapter 7 is established, and several years of water level data have been collected, a robust and repeatable method for directly quantifying groundwater in storage using the monitoring network may be developed and finalized. It is possible that in future versions of the GSP, the MT may be changed to be defined as the directly calculated amount of groundwater in storage. However, for the current 5-year planning horizon, water levels at the RMS will be used as a proxy for the groundwater in storage Sustainability Indicator.

8.5.2.1 *Information and Methods Used for Establishing Reduction of Storage Minimum Thresholds §354.28(b)(1)*

As with the chronic reduction of groundwater levels Sustainability Indicator, the primary source of data that was evaluated for the Sustainability Indicator of reduction of groundwater storage is historical groundwater elevation data maintained by the County. The information used for establishing the MOs and MTs for the chronic lowering of groundwater levels Sustainability Indicator included:

- Historical groundwater elevation data from wells monitored by the County of San Luis Obispo.
- Depths and locations of existing wells.
- Maps of current and historical groundwater elevation data.
- Input from stakeholders regarding significant and unreasonable conditions and desired current and future groundwater elevations communicated during public meetings and solicitation of public comment on various options of MTs and MOs presented in the public forum.
- Results of modeling various project scenarios of future groundwater level conditions.

Storage MTs will be measured by collecting water level measurements at the RMS sites in the monitoring network. The monitoring network and protocols used to measure groundwater elevations at the RMS are presented in Chapter 7. The Water Level Monitoring Network is presented in Figure 7-1. This data will be used to monitor groundwater elevations and assess changes in groundwater storage.

8.5.2.2 *Relationship between Individual Minimum Thresholds and Other Sustainability Indicators §354.28(b)(2)*

The MTs for reduction in groundwater storage is a single value of average groundwater elevation over the entire Basin. Therefore, the concept of potential conflict between MTs at different locations in the Basin is not applicable. The reduction in groundwater storage MT could influence other Sustainability Indicators. The reduction in groundwater storage MT was selected to avoid undesirable results for other Sustainability Indicators, as outlined below:

- **Chronic lowering of groundwater levels.** Because groundwater elevations will be used as a proxy for estimating groundwater pumping and changes in groundwater storage, the reduction in groundwater storage would not cause undesirable results for this Sustainability Indicator.
- **Seawater intrusion.** This Sustainability Indicator is not applicable to this Basin.
- **Degraded water quality.** The minimum threshold proxy of stable groundwater levels is not expected to lead to a degradation of groundwater quality.
- **Subsidence.** Because future average groundwater levels will be stable, they will not induce any additional subsidence.
- **Depletion of interconnected surface waters.** Groundwater levels measured at representative monitoring wells (SLV-12, EV-01, EV-11) will serve as a proxy for depletion of interconnected surface water. In addition, stream flow gages along SLO Creek will continue to measure surface water conditions in San Luis Valley, and proposed stream gages along Corral de Piedras Creek will serve to generate information on surface water inflow and outflow in Edna Valley, allowing for direct measurement of surface water gains and losses to the groundwater systems based on future hydrologic and pumping conditions in the Basin. However, MTs along the creeks are defined to avoid significant water declines in these areas, with the goal of minimizing any potential significant depletion of interconnected surface water flows.

8.5.2.3 *Effects of Minimum Thresholds on Neighboring Basins §354.28(b)(3)*

Two neighboring groundwater basins share a boundary with the SLO Basin; the Los Osos Basin to the northwest, and the Arroyo Grande sub-basin of the Santa Maria Valley Groundwater Basin to the southeast. Neither of these shared boundaries are extensive, and the HCM posits that a groundwater divide separates the groundwater between them and the SLO Basin. In the San Luis Valley there have been no

trends indicating groundwater declines that would affect the Los Osos Basin. In Edna Valley the areas with observed declines are one to two miles from the Arroyo Grande Basin boundary in a downgradient direction. It is not anticipated that actions associated with the GSP will have any significant impact on either the Los Osos Basin or the Arroyo Grande Basin.

The SLO Basin GSAs have developed a cooperative working relationship with the Los Osos Groundwater Basin – Basin Management Committee and the GSAs working in the Arroyo Grande Subbasin. Groundwater conditions near the borders with these basins will be monitored and shared.

8.5.2.4 *Effects of Minimum Thresholds on Beneficial Uses and Users §354.28(b)(4)*

The MT for reduction in groundwater storage will maintain stable average groundwater elevations, but may require a reduction in the amount of groundwater pumping in the Basin, or development of sources of supplemental water as discussed in Chapter 9. Reducing pumping may impact the beneficial uses and users of groundwater in the Basin.

The practical effect of this GSP for protecting against the reduction in groundwater storage undesirable result is that it encourages minimal long-term net change in groundwater elevations and storage. Seasonal and drought cycle variations are expected, but during average conditions and over the long-term, beneficial users will have access to adequate volumes of water from the aquifer to service the needs of all water use sectors. The beneficial users of groundwater are protected from undesirable results.

Agricultural Land Uses and Users

The MT for reduction in groundwater storage may limit or reduce non-de minimis production in the Basin by reducing the amount of available water. The practical effect of these MTs on agricultural users is that current levels of agricultural pumping may not be sustainable without development of additional sources of water to the Basin. Owners of undeveloped agricultural lands that are currently not irrigated may be particularly impacted because the additional groundwater pumping needed to irrigate these lands could increase the Basin pumping beyond the sustainable yield, violating the MT. Existing agricultural operations may also be limited in their use of more water-intensive crops, expansion of existing irrigated lands, and by periods of extended drought that decrease the quantity of water naturally returning to the basin.

Urban Land Uses and Users

Potential future increases of groundwater pumping in the City of San Luis Obispo could decrease the cost of water for municipal users in the City, because groundwater may be the cheapest water supply alternative. However, in order to avoid undesirable results, the City is unlikely to pursue groundwater pumping in the quantity that it did during the 1980s-90s drought without the use of groundwater recharge.

Domestic Land Uses and Users

Existing domestic groundwater users may generally benefit from this MT. Many domestic groundwater users are de-minimis users whose pumping may not be restricted by the projects and management actions adopted in this GSP. By restricting the amount of groundwater that is pumped from the Basin, the de-minimis users would be protected from overdraft that could impact their ability to pump groundwater or require them to drill deeper wells.

Ecological Land Uses and Users.

Groundwater dependent ecosystems would generally benefit from this MT. Maintaining groundwater levels close to current levels keeps groundwater supplies near present levels, which will continue to support groundwater dependent ecosystems.

8.5.2.5 *Relation to State, Federal, or Local Standards §354.28(b)(5)*

No federal, state, or local standards exist for reductions in groundwater storage.

8.5.2.6 *Methods for Quantitative Measurement of Minimum Threshold §354.28(b)(6)*

The quantitative metric for assessing compliance with the reduction in groundwater storage MT is monitoring groundwater elevations. The approach for quantitatively evaluating compliance with the MT for reduction in groundwater storage will be based on evaluating groundwater elevations semi-annually. All groundwater elevations collected from the groundwater level monitoring network will be analyzed and averaged.

In the future, after the monitoring network is established and multiple years of data are available for analysis, a robust and repeatable method for calculating groundwater in storage utilizing the monitoring well network may be developed and finalized. At that time, the metric for defining the SMC of reduction of groundwater in storage may possibly be changed to direct calculation of groundwater in storage for the two areas of the basin, but this will be reviewed after additional data has been collected during the implementation phase of the GSP.

8.5.3 Measurable Objectives §354.30(a)-(g)

The change in storage Sustainability Indicator uses groundwater levels as a proxy for direct calculation of groundwater in storage. The same MTs and MOs are used as are defined in the chronic lowering of groundwater level indicator to protect against significant and unreasonable reduction in groundwater storage.

8.5.3.1 *Information and Methods Used for Establishing Reduction of Groundwater Storage Measurable Objectives §354.30(b)*

Input from stakeholders suggested that they would prefer more groundwater in storage to maintain resiliency against future droughts. Therefore, the conservative approach of simply maintaining stable groundwater levels was adopted for the MO. MOs for the RMS are identical to the MOs for the chronic lowering of groundwater elevations MOs (Table 8-1).

8.5.3.2 *Interim Milestones §354.30(a)(e)*

Interim milestones for groundwater storage are the same as those established for chronic lowering of groundwater elevations. Achieving the groundwater elevation interim milestones will also eliminate long term reductions in groundwater in storage. Interim milestones are included on Table 8-1.

8.6 SEAWATER INTRUSION SUSTAINABILITY INDICATOR §354.28(C)(3)

This Sustainability Indicator does not apply to the Basin since the Basin is not a coastal basin.

8.7 DEGRADATION OF GROUNDWATER QUALITY SUSTAINABILITY INDICATOR §354.28(C)(4)

The purpose of the Degraded Water Quality Indicator in SGMA is to prevent any degradation in groundwater quality as a result of groundwater management under the GSP. SGMA is not intended to serve as impetus to improve water quality within the Basin. The Basin's current water quality is not considered degraded. For these reasons, the SMC in this section are set to maintain current conditions in the Basin, protecting from potential degradation as a result of groundwater management under this GSP.

8.7.1 Undesirable Results §354.26(a)-(d)

Section §354.28(c)(2) of the SGMA regulations states that "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."

By SGMA regulations, the Degraded Groundwater Quality undesirable result is a quantitative combination of groundwater quality minimum threshold exceedances. The undesirable results for the Degraded Water Quality Sustainability Indicator as defined for the purposes of this GSP are as follows:

> *The Basin will be considered to have Undesirable Results if, for any year, an increase in groundwater quality minimum threshold exceedances are observed at 20 percent or more of the representative monitoring sites in the Basin, in relation to 2015 Basin conditions, as a result of groundwater management implemented as part of the GSP.*

The undesirable conditions for degraded water quality in the Basin are based on the goal of fewer than 20% of the RMSs for water quality exceedances that can occur as a result of GSP groundwater management activities over the next 5-year management period. Based on the current number of wells in the existing water quality monitoring network described in Chapter 7, the percentage defined equates to a maximum of two wells that can exceed the minimum thresholds.

Specifics regarding the definition of the MTs used in defining the Undesirable Results are detailed in the following sections. A summary of the MTs defined for the Degradation of Water Quality Sustainability Indicator are presented in Table 8.2.

Table 8-2. San Luis Obispo Basin Groundwater Basin Water Quality Minimum Thresholds

SLO Groundwater Basin				
ID	TDS MT (ppm)	NO3 MT (ppm)	Arsenic MT (ppb)	TCE, PCE (ppb)
WQ-1	900	10	10	5
WQ-2	900	10	10	5
WQ-3	900	10	10	5
WQ-4	900	10	10	5
WQ-5	900	10	10	5
WQ-6	900	10	10	5
WQ-7	900	10	10	5
WQ-8	900	10	10	5
WQ-9	900	10	10	5

8.7.1.1 *Criteria for Establishing Undesirable Results §354.26(b)(2)*

Criteria used to establish the Undesirable Results for Degraded Water Quality Sustainability Indicator are observed water quality data and trends that:

- Reduce capacity of public water supply systems or unreasonably increase costs for public or private water supply.
- Reduce crop production.
- Result in constituent concentrations above regulatory primary drinking water standards at supply wells.
- Results in constituent concentrations above the RWQCB Basin Objectives for secondary standards (TDS)

8.7.1.2 *Potential Causes of Undesirable Results §354.26(b)(1)*

Conditions that may lead to an undesirable result include the following:

- Changes to Basin Pumping: If the location and rates of groundwater pumping change as a result of projects implemented under the GSP, these changes could cause movement of one of the constituents of concern towards a supply well at concentrations that exceed relevant water quality standards.
- Groundwater Recharge: Active recharge with imported water or captured runoff could cause movement of one of the constituents of concern towards a supply well in concentrations that exceed relevant water quality standards.
- Recharge of Poor-Quality Water: Recharging the Basin with water that exceeds a primary or secondary MCL or concentration that reduces crop production could lead to an undesirable result. However, permitting requirements generally preclude this circumstance.

8.7.1.3 *Effects of Undesirable Results on Beneficial Users and Land Uses §354.26(b)(3)*

As defined in this GSP, undesirable results are established to prevent degradation of water quality within the Basin prior to the implementation of any actions inherent in the management of groundwater in the Basin. This limits the potential impacts of undesirable water quality on beneficial users in the Basin. However, potential effects of undesirable results include:

- Increased water treatment costs for public or private supply wells
- Reduced agricultural production

8.7.2 Minimum Thresholds § 354.28(c)(4)

8.7.2.1 *Information and Methods Used for Establishing Degradation of Water Quality Minimum Thresholds § 354.28 (b)(1)*

Locally defined significant and unreasonable conditions were assessed based on federal and state mandated drinking water and groundwater quality regulations, the Sustainable Management Criteria survey, public meetings, and discussions with GSA staff. Significant and unreasonable changes in groundwater quality in the Basin are increases in a chemical constituent that either:

- Result in groundwater concentrations in a public supply well above an established primary or secondary MCL, or
- Lead to reduced crop production.

The information used for establishing the degraded groundwater quality minimum thresholds included:

- Historical groundwater quality data from production wells in the Basin
- Federal and state primary drinking water quality standards
- RWQCB Basin objectives for groundwater quality (2019) for TDS
- Feedback about significant and unreasonable conditions from GSC members, GSA staff members, and public stakeholders

The historical groundwater quality data used to evaluate groundwater quality minimum thresholds are presented in Chapter 5 (Figures 5-16 through 5-18).

As stated in Section 8.7.1, the SGMA regulations allow three options to develop an approach for setting degraded water quality minimum thresholds (number of wells, volume of water, or location of concentration isocontour). In the Basin, degraded water quality minimum thresholds are based on EPA-published water quality standards (EPA, 2018) for constituents of concern with a primary or secondary MCL is to avoid degrading the existing water quality with respect to these constituents in the Basin. (Primary standards refer to chemical constituents in groundwater with a potential impact on human health; secondary standards refer to constituents that may affect taste or odor of drinking water.)

As noted in Section 354.28 (c)(4) of the SGMA regulations, minimum thresholds are based on a degradation of groundwater quality, not an improvement of groundwater quality. Therefore, this GSP was developed to avoid taking actions that may inadvertently move groundwater constituents that have already been identified in the Basin in such a way that they have a significant and unreasonable impact that would not otherwise occur.

Based on the review of groundwater quality in Chapter 5, water quality in the basin is generally good. The primary constituents of concern that exist for both agricultural wells and public supply wells are:

- Total Dissolved Solids (TDS)
- Nitrate
- Arsenic
- Volatile Organic Compounds (PCE and TCE)

As noted in Section 5.6.3, based on available information there are two known groundwater contamination plumes in the Basin: The TCE plume along Buckley Road south of the airport, and a PCE plume within the City. Both of these cases are under active investigation with oversight by the RWQCB.

The MTs for the constituents of concern are presented in Table 8-2.

8.7.2.2 *Relation of Minimum Thresholds to Other Sustainability Indicators § 354.28(b)(2)*

The groundwater quality minimum thresholds were set for each of four constituents previously discussed. These minimum thresholds were derived from existing data measured at individual wells and applicable regulatory criteria. There are no conflicts between the existing groundwater quality data. Because the underlying groundwater quality distribution is reasonable and realistic, there is no conflict that prevents the Basin from simultaneously achieving all minimum thresholds.

No actions regarding the MTs for Water Quality will directly influence other Sustainability Indicators. However, preventing migration of poor groundwater quality (for example, actions required to prevent additional migration of contaminant plumes) could theoretically limit activities needed to achieve minimum thresholds for other Sustainability Indicators, as discussed below:

- **Change in groundwater levels.** Groundwater quality minimum thresholds could influence groundwater level minimum thresholds by limiting the types of water that can be used for recharge to raise groundwater levels or locations where it could be recharged. Water used for recharge cannot exceed any of the groundwater quality minimum thresholds.
- **Change in groundwater storage.** Nothing in the groundwater quality minimum thresholds promotes pumping in excess of the sustainable yield. The groundwater quality minimum thresholds will not result in an exceedance of the groundwater storage minimum threshold.
- **Seawater intrusion.** This Sustainability Indicator is not applicable to this basin.
- **Subsidence.** Nothing in the groundwater quality minimum thresholds promotes a condition that will lead to additional subsidence and therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable level of subsidence.
- **Depletion of interconnected surface waters.** Nothing in the groundwater quality minimum thresholds promotes additional pumping or lower groundwater elevations in areas where interconnected surface waters may exist. Therefore, the groundwater quality minimum thresholds will not result in a significant or unreasonable depletion of interconnected surface waters.

8.7.2.3 *Effect of Minimum Thresholds on Neighboring Basins § 354.28(b)(3)*

Because there is a groundwater divide between the SLO Basin and the adjacent Los Osos Basin and Arroyo Grande sub-basin, there is no anticipated effect of the degraded groundwater quality minimum thresholds on each of the two neighboring Basins.

8.7.2.4 *Effects of Minimum Thresholds on Beneficial Users and Land Uses § 354.28(b)(4)*

The practical effect of the MTs for the Degraded Groundwater Quality Sustainability Indicator is that it deters any significant long-term changes to groundwater quality in the Basin. Therefore, Basin management that prevents the undesirable results from occurring will not constrain the use of groundwater, nor have a negative effect on the beneficial users and uses of groundwater.

Agricultural land uses and users. The degraded groundwater quality minimum thresholds generally benefit the agricultural water users in the Basin by maintaining groundwater quality suitable for use in agriculture. For example, limiting the number of additional agricultural supply wells that may exceed constituent of concern concentrations (for example, TDS) that could reduce crop production ensures that a supply of usable groundwater will exist for beneficial agricultural use.

Urban land uses and users. The degraded groundwater quality minimum thresholds generally benefit the urban water users in the Basin. Limiting the number of additional wells where constituents of concern could exceed primary or secondary MCLs ensures an adequate supply of quality groundwater for municipal use. Management of the Basin to prevent occurrences of these MTs may also result in lowered costs for water treatment. Existing State, Federal, Public Health or Municipal regulations may require that a well not be used if MCLs are exceeded and may supersede any actions related to SGMA-related MT exceedances. Wells in violation of federal, state, and local water quality regulations will have to comply with the specific regulations.

Domestic land uses and users. The degraded groundwater quality minimum thresholds generally benefit the domestic water users in the Basin by maintaining current and acceptable water quality.

Ecological land uses and users. Although the groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degraded groundwater quality minimum thresholds generally benefit the ecological water uses in the Basin. Preventing constituents of concern from migrating will prevent unwanted contaminants from impacting ecological groundwater supply.

8.7.2.5 *Relevant Federal, State, or Local Standards § 354.28(b)(5)*

The Degraded Groundwater Quality minimum thresholds specifically incorporate federal and state drinking water standards.

8.7.2.6 *Method for Quantitative Measurement of Minimum Thresholds § 354.28(b)(6)*

The Degraded Groundwater Quality minimum thresholds will be directly measured using analytical laboratory results of sampling conducted at the RMSs of the Water Quality Monitoring Network presented in Chapter 7. Groundwater quality will initially be measured using existing monitoring programs.

- Exceedances of primary or secondary MCLs will be monitored by reviewing water quality reports submitted to the California Division of Drinking Water by municipalities and small water systems for the wells that are included in the Water Quality Monitoring Network.

8.7.3 Measurable Objectives § 354.30(a)-(g)

Groundwater quality should not be degraded due to actions taken under this GSP and, therefore, the measurable objectives are defined as zero exceedances as a result of groundwater management, in samples from the Water Quality Monitoring Network wells over the 20-year SGMA planning horizon.

8.7.3.1 *Information and Methods Used for Establishing Degradation of Water Quality Measurable Objectives § 354.30(b)*

Because protecting groundwater quality is important to the beneficial users and uses of the resource, the measurable objective for the Degradation of Water Quality Sustainability Indicator is defined as zero exceedances of the MTs over the 20-year SGMA planning horizon. Any exceedance will be reviewed by the GSAs to determine its significance and potential responses.

8.7.3.2 *Interim Milestones § 354.28(a)(e)*

Interim milestones show how the GSAs anticipate moving from current conditions to meeting the measurable objectives. For water quality, measurable objectives are set at the current number of water quality exceedances, which in this case is zero. Interim milestones are set for each five-year interval following GSP adoption. The interim milestones for degraded groundwater quality are defined as zero exceedances of the MT for each constituent of concern for 5, 10 and 15 years after GSP adoption.

8.8 LAND SUBSIDENCE SUSTAINABILITY INDICATOR § 354.28(C)(5)

8.8.1 Undesirable Results § 354.26(a)-(d)

Locally defined significant and unreasonable conditions for the Land Subsidence Sustainability Indicator were assessed based on public meetings and discussions with GSA staff. Significant and unreasonable rates of land subsidence in the Basin are those that lead to a permanent subsidence of land surface elevations that impact infrastructure. For clarity, this Sustainable Management Criterion references two related concepts:

- Land Subsidence is a gradual settling of the land surface caused by, among other processes, compaction of subsurface materials due to lowering of groundwater elevations from groundwater pumping. Land subsidence from dewatering subsurface clay layers can be an inelastic process, and the potential decline in land surface could be permanent.

- Land Surface Fluctuation is the periodic or annual measurement of the ground surface elevation. Land surface may rise or fall in any one year. Declining land surface fluctuation may or may not indicate long-term permanent subsidence.

Subsidence was documented in the Los Osos Valley in the early 1990s. Currently, InSAR data provided by DWR shows that significant land subsidence did not occur in the Basin during the period between June 2015 and June 2018.

By regulation, the ground surface Land Subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the Basin, no long-term subsidence that impacts infrastructure (including commercial buildings, homes, utility infrastructure, etc.) is acceptable. The Undesirable Results for the land subsidence Sustainability Indicator as defined for the purposes of this GSP are as follows:

> *The Basin will be considered to have Undesirable Results if measured subsidence using InSAR data, between June of one year and June of the subsequent year is greater than 0.1 foot in any 1-year, or a cumulative 0.5 foot in any 5-year period, as a result of groundwater management under the GSP, or any long-term permanent subsidence is attributable to groundwater management.*

Should potential subsidence be observed, the GSAs will first assess whether the subsidence may be due to elastic processes. If the subsidence is not elastic, the GSAs will undertake a program to correlate the observed subsidence with measured groundwater levels.

8.8.1.1 *Criteria for Establishing Undesirable Results § 354.26(b)(2)*
Criteria used to establish the Undesirable Results for Land Subsidence Sustainability Indicator are satellite-measured subsidence data (InSAR data) collected by DWR.

8.8.1.2 *Potential Causes of Undesirable Results § 354.26(b)(1)*
Conditions that may lead to an undesirable result include:

- A shift in pumping locations, which could lead to a substantial decline in groundwater levels.
- Shifting a significant amount of pumping and causing groundwater levels to fall in an area that is susceptible to subsidence, such as certain areas underlaying the City, could trigger subsidence in excess of the minimum threshold.

8.8.1.3 *Effects of Undesirable Results on Beneficial Users and Land Uses § 354.26(b)(3)*
The effects of these undesirable results on the beneficial users and uses (§354.26 (b)(3)) include the damage of critical infrastructure, and the damage of private or commercial structures that would adversely affect their uses. Staying above the minimum threshold will avoid the subsidence undesirable conditions.

8.8.2 Minimum Thresholds § 354.28(c)(5)
Section 354.28(c)(5) of the SGMA regulations states that "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."

Based on an analysis of potential errors in the InSAR data, as discussed in the following section, the subsidence minimum threshold is: The InSAR measured subsidence between June of one year and June of the subsequent year shall be no more than 0.1 foot in any single year and a cumulative 0.5 foot in any five-year period, resulting in no long-term permanent subsidence.

Although InSAR data is the official minimum threshold value for the land subsidence Sustainability Indicator, the GSAs have included one well to monitor for water levels as a proxy for potential subsidence. Regular data collection from this well could alert the GSAs to conditions that may lead to subsidence before InSAR data are available. RMS SLV-09 along Los Osos Valley Road is in the area of the basin that experienced significant subsidence in the early 1990s. Therefore, this well has been selected to monitor for conditions that could lead to subsidence. The minimum threshold for this well is set at 102 feet, 15 feet higher than the observed low water level in the early 1990s.

8.8.2.1 *Information and Methods Used for Establishing Land Subsidence Minimum Thresholds § 354.28(b)(1)*
Minimum thresholds were established to protect groundwater supply, land uses and property interests from substantial subsidence that may lead to undesirable results. Changes in surface elevation are measured using InSAR data available from DWR. The general minimum threshold is the absence of long-term land subsidence due to pumping in the Basin. The InSAR data provided by DWR, however, are subject to measurement error. DWR has stated that, on a statewide level, for the total vertical displacement measurements between June 2015 and June 2018, the errors are as follows (GSP, Paso Robles Basin, 2020):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95% confidence level.
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95% confidence level.

For the purposes of this GSP, the errors for InSAR data is considered the sum of errors 1 and 2, combined total error of 0.1 foot. Thus, measured land surface change of greater than 0.1 feet will be assessed as potential subsidence. As discussed previously, land surface elevations can fluctuate naturally. Therefore, subsidence will be monitored at the same time each year to reduce the effect of general fluctuations of elevation on observed data. Additionally, if subsidence is observed, a correlation to lowered groundwater elevations at RMS SLV-09 must exist for the minimum threshold to be exceeded.

Locally defined significant and unreasonable conditions are assessed based on historically observed water levels in areas of known past land subsidence, satellite-based measurements of land subsidence provided by DWR, public meetings, and discussions with GSA staff.

8.8.2.2 *Relation of Minimum Thresholds to Other Sustainability Indicators § 354.28(b)(2)*
Land Subsidence minimum thresholds have little or no impact on other minimum thresholds, as described below:

- **Chronic lowering of groundwater elevations.** The Land Subsidence minimum thresholds will not result in significant or unreasonable groundwater elevations.
- **Change in groundwater storage.** The Land Subsidence minimum thresholds will not change the amount of pumping, and will not result in a significant or unreasonable change in groundwater storage.
- **Seawater intrusion.** This Sustainability Indicator is not applicable in the Basin.
- **Degraded water quality.** The Land Subsidence minimum thresholds will not change the groundwater flow directions or rates, and therefore and will not result in a significant or unreasonable change in groundwater quality.
- **Depletion of interconnected surface waters.** The Land Subsidence minimum thresholds will not change the amount or location of pumping and will not result in a significant or unreasonable depletion of interconnected surface waters.

8.8.2.3 *Effect of Minimum Thresholds on Neighboring Basins § 354.28(b)(3)*
The ground surface subsidence minimum thresholds are set to prevent any long-term subsidence that could harm infrastructure. Therefore, the subsidence minimum thresholds will not prevent the Los Osos Basin or the Arroyo Grande Basin from achieving sustainability.

8.8.2.4 *Effects of Minimum Thresholds on Beneficial Users and Land Uses § 354.28(b)(4)*
The Land Subsidence minimum thresholds are set to prevent subsidence that could harm infrastructure. Available data indicate that there is currently no subsidence occurring in the Basin that affects infrastructure, and reductions in pumping are already required by the reduction in groundwater storage Sustainability Indicator. Therefore, the Land Subsidence minimum thresholds do not require any additional reductions in pumping. However, in general the amount of pumping in the Los Osos Valley Road area must be kept at levels significantly lower than implemented in the 1990s.

Staying above the minimum threshold will avoid the Land Subsidence undesirable result and protect the beneficial uses and users from impacts to infrastructure and interference with surface land uses.

8.8.2.5 *Relevant Federal, State, or Local Standard § 354.28(b)(5)*
There are no federal, state, or local regulations related to subsidence.

8.8.2.6 *Method for Quantitative Measurement of Minimum Thresholds § 354.28(b)(6)*
Minimum thresholds will be assessed using DWR-supplied InSAR data.

8.8.3 Measurable Objectives § 354.30(a)-(g)

The measurable objectives for subsidence represent target subsidence rates in the Basin. Long-term ground surface elevation data do not suggest the occurrence of permanent subsidence in the Basin. Therefore, the measurable objective for subsidence is maintenance of current ground surface elevations.

8.8.3.1 *Information and Methods Used for Establishing Land Subsidence Measurable Objectives 0§ 354.3(b)*

The measurable objectives are set based on maintaining current conditions and changes are measured by DWR-supplied InSAR data.

8.8.3.2 *Interim Milestones § 354.28(a)(e)*

Interim milestones show how the GSAs anticipate moving from current conditions to meeting the measurable objectives. Interim milestones are set for each five-year interval following GSP adoption. Land Subsidence measurable objectives are set at current conditions of no long-term subsidence. There is no change between current conditions and sustainable conditions. Therefore, the interim milestones are identical to the minimum thresholds and measurable objectives.

8.9 DEPLETION OF INTERCONNECTED SURFACE WATER SUSTAINABILITY INDICATOR § 354.28(C)(6)

Natural hydraulic connections can exist between shallow groundwater systems and some surface water bodies. These surface water bodies can be gaining (receiving discharge from the alluvial aquifer) or losing (discharging water to the alluvial aquifer). These relationships may change in magnitude and direction across wet and dry cycles, and in response to changes in surface water operations or groundwater management practices.

Depletions of interconnected surface water occurs when there are decreased gains or increased losses in volumes of streamflow caused by lowered groundwater elevations associated with groundwater use. At certain levels, depletions may have adverse impacts on beneficial uses of the surface water and may lead to undesirable results.

Direct measurement of flux between an aquifer and an interconnected stream is not feasible using currently available data. A number of proposals to improve the collection of surface water and interconnected groundwater data are discussed in Chapter 7 (Monitoring Networks), and proposed details for these tasks are discussed in Chapter 10 (Implementation Plan). Until immediately adjacent such time as this data is available, this GSP uses water level measurements in representative wells located immediately adjacent to Basin creeks as the SMCs for the Depletion of Interconnected Surface Water Sustainability Indicator.

8.9.1 Undesirable Results § 354.26(a)-(d)

The undesirable result for Depletions of Interconnected Surface Water is a result that causes significant and unreasonable adverse effects on beneficial uses of interconnected surface water within the Basin over the planning and implementation horizon of this GSP. As discussed in Section 8.9, measurement of the fluxes between the aquifer and Basin creeks is not feasible with currently available data. Therefore, water level measurements at the RMSs designated for the Depletion of Interconnected Surface Water Sustainability Indicator will be used as the basis MTs and Undesirable Results until better data becomes available under future monitoring activities.

The statement defining undesirable results for the Depletion of Interconnected Surface Water for this GSP is as follows:

The Basin will be considered to have undesirable results if any of the representative wells monitoring groundwater/surface water interaction display exceedances of the minimum threshold values for two consecutive Fall measurements.

8.9.1.1 *Criteria for Establishing Undesirable Results § 354.26(b)(2)*

Criteria used to define undesired conditions for this Sustainability Indicator are those that:

- Impact the ability of the stream system to meet instream flow requirements and maintain groundwater dependent ecosystems (GDEs)
- Impact the ability to provide surface water supplies to direct diverters
- Interfere with other SGMA Sustainability Indicators.

The information used for establishing the criteria for undesirable results for the Depletion of Interconnected Surface Water Sustainability Indicator is water levels data collected from three RMS wells (i.e., SLV-12 and EV-01, and EV-11) that are located immediately adjacent to San Luis Obispo and Corral de Piedras Creek systems. For the present, water levels in these wells will be used as a proxy indicator of undesirable results.

8.9.1.2 *Potential Causes of Undesirable Results § 354.26(b)(1)*

Potential causes of undesirable results include increases in pumping in the proximity of a Basin creeks, or instream projects that could alter the natural flow regimes of the creeks.

8.9.1.3 *Effects of Undesirable Results on Beneficial Users and Land Uses § 354.26(b)(3)*

If depletions of interconnected surface water were to reach undesirable results, adverse effects could include the reduced ability of the stream flows to meet instream flow requirements for local fisheries and critical habitat, or reduced ability to deliver surface water supplies to direct users of surface water in the Basin.

8.9.2 Minimum Thresholds

Section 354.28(c)(6) of the SGMA regulations states that "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."

Current data are insufficient to determine the rate or volume of surface water deletions in the creeks. Therefore, groundwater elevations in the RMSs intended to monitor surface water/groundwater interaction (SLV-12, EV-01, EV-11) are used as a proxy for the Depletion of Interconnected Surface Water Sustainability Indicator. If in the future, data from a more comprehensive monitoring program (as discussed in chapter 7 and Chapter 10) succeed in quantifying surface water depletions, those data may be used to re-define minimum thresholds for areas of interconnection. Minimum thresholds for these representative wells are presented in Table 8-1 and Figures 8-4, 8-98, and 8-10.

RMS EV-01 is located along West Corral de Piedras Creek just where it enters the Basin, and EV-11 (Greengate) is located near the junction of East and West Corral de Piedras, near the outlet of the Basin. These wells are screened at least partially in the alluvial sediments associated with the creek, and therefore, reflect groundwater conditions in the alluvial sediments. Hydrographs for these wells display seasonal fluctuation of about 50 feet, which occur during wet and dry climatic periods. To avoid management conditions that allow for lower groundwater elevations than those historically observed, MTs for these wells were set at the historic low water levels indicated on the hydrographs, which occur with regularity during every extended dry period evident in the record (Figures 8-9, 8-10).

San Luis Obispo Creek is a significant feature in the Basin. It is an unregulated (I.e., undammed) creek. Some reaches of San Luis Obispo Creek in the Basin have been observed to maintain flow year-round, and some reaches go dry in the summer. A more extensive description and quantification of the stream/aquifer interaction is included in Chapter 5 – Groundwater Conditions and Chapter 6 – Water Budget. The water budget shows that flow conditions in the creek are highly variable depending on rainfall events and the hydrologic year type. In wetter years, when flows in the San Luis Obispo Creek are high there is greater amounts of discharge from the creek to the groundwater system. In drier years, when flows in the San Luis Obispo Creek are low, there is less stream recharge to the groundwater system. In both cases the amount of flux between the surface water and the groundwater system is small compared to the volume of water flowing down the creek. Inspection of hydrographs for RMS SLV-12, intended to monitor conditions along near San Luis Obispo Creek (Figure 8-4) do not indicate any significant declines of water levels since the drought of the early 1990s. Therefore, this data suggests that the mechanisms of surface water/groundwater interaction at this location have not been negatively impacted since the early 1990s.

East and West Corral de Piedras Creeks meet to form Pismo Creek just south of the basin boundary in Edna Valley. Corral de Piedras Creeks are significant features in the Edna Valley portion of the SLO Basin. West Corral de Piedras is affected by a private dam that impounds water at the Righetti Reservoir upstream from the basin. To the extent that captured flows impounded in Righetti Reservoir do not naturally flow downstream, the amount of stream flow is reduced and ancillary basin recharge via streamflow percolation is less than it would be under natural (I.e., undammed) conditions in the Edna Valley. East and West Corral de Piedras Creeks in the Basin are not observed to maintain flow year-round in most of the Basin. Inspection of hydrographs for RMS EV-01, intended to monitor conditions near West Corral de Piedras Creeks where it enters the Basin (Figure 8-9, 8-10) indicate highly seasonal groundwater conditions which fluctuate between well-established high points near ground surface and low points significantly deeper than the assumed creek bed elevation, and do not reflect any significant long-term declines of water levels in the observed period of record dating back to the late 1950s. This hydrograph pattern indicates that surface water in Corral de Piedras Creeks recharges the underlying aquifer when the creek is flowing, and is disconnected from the underlying aquifer system when the creek is dry.

As described in Chapter 4, Hydrogeologic Conceptual Model and Chapter 5, Groundwater Conditions, there are insufficient data to quantitatively assess the extent of the connection between surface water and groundwater in the Basin. As described in Chapter 7, Monitoring Networks, a more expansive monitoring network will be developed during GSP implementation to improve understanding of interconnection between surface water and groundwater in the Basin. Chapter 10 (Implementation Plan) addresses details of the plan to accumulate better data for this Sustainability Indicator. If in the future, better data are generated to quantify the connection between surface water and groundwater, undesirable results may be revised to reflect this data. However, for this GSP, groundwater elevations in SLV-12, EV-01, and EV-11 will be used as a proxy for the Depletion of Interconnected Surface Water Sustainability Indicator.

8.9.2.1 *Information and Methods Used for Establishing Depletion of Interconnected Surface Water Minimum Thresholds*

As with the other Sustainability Indicators, the primary methods for development of SMCs for this Sustainability Indicator is monitoring of groundwater elevations in the three RMSs established for the purpose of monitoring hydrogeologic conditions in the adjacent creeks.

As with the chronic reduction of groundwater levels Sustainability Indicator, the primary source of data that was evaluated for the Depletion of Interconnected Surface Water Sustainability Indicator is historical groundwater elevation data maintained by the GSAs. The information used for establishing the MOs and MTs for the chronic lowering of groundwater levels Sustainability Indicator included:

- Historical groundwater elevation data from wells monitored by the County of San Luis Obispo.
- Construction details of RMS wells
- Long-term trends displayed in hydrographs of the RMS wells identified for this Sustainability Indicator.

The use of groundwater elevation as a proxy metric for the Depletion of Interconnected Surface Water Sustainability Indicator is adopted given the challenges and cost of direct monitoring of depletions of interconnected surface water. The depletion of interconnected surface water is driven by the gradient between water surface elevation in the surface water body and groundwater elevations in the connected, shallow groundwater system. By defining minimum thresholds in terms of groundwater elevations in shallow groundwater wells near surface water, the GSAs will monitor and manage this gradient, and in turn, manage potential changes in depletions of interconnected surface.

8.9.2.2 *Relationship between Individual Minimum Thresholds and Other Sustainability Indicators*

The MTs for the Depletion of Interconnected Surface Water Sustainability Indicator are defined as the lowest water levels observed in the period of record for each of the three RMSs. Therefore, the concept of potential conflict between MTs at different locations in the Basin is not applicable. The Depletion of Interconnected Surface Water Sustainability Indicator could influence other Sustainability Indicators. The Depletion of Interconnected Surface Water Sustainability Indicator MTs was selected to avoid undesirable results for other Sustainability Indicators, as outlined below:

- **Chronic lowering of groundwater levels.** Because groundwater elevations will be used as a proxy for estimating Depletion of Interconnected Surface Water Sustainability Indicator, and the definitions of the MTs are set at historically observed conditions, the MTs will not cause undesirable results for this Sustainability Indicator.
- **Depletion of Groundwater Storage.** Because groundwater elevations will be used as a proxy for estimating Depletion of Interconnected Surface Water Sustainability Indicator, and the definitions of the MTs are set at historically observed conditions, the MTs will not cause undesirable results for this Sustainability Indicator.
- **Seawater intrusion.** This Sustainability Indicator is not applicable to this Basin.
- **Degraded water quality.** The minimum threshold proxy of stable groundwater levels is not expected to lead to a degradation of groundwater quality.
- **Subsidence.** Because future groundwater levels will be above historically observed conditions, they will not induce any additional subsidence.

8.9.2.3 *Effects of Minimum Thresholds on Neighboring Basins*

Two neighboring groundwater basins share a boundary with the SLO Basin; the Los Osos Basin to the northwest, and the Arroyo Grande Subbasin of the Santa Maria Valley Groundwater Basin to the southeast. Neither of these shared boundaries are extensive, and the HCM posits that a groundwater divide separates the groundwater between them and the SLO Basin. In addition, the Basin streams are relatively far from the Basin boundaries shared with the neighboring basins. In the San Luis Valley there have been no trends indicating groundwater declines that would affect the Los Osos Basin. In Edna Valley the areas with observed declines are one to two miles from the Arroyo Grande Basin boundary in a downgradient direction. It is not anticipated that actions associated with the GSP will have any significant impact on either the Los Osos Basin or the Arroyo Grande Subbasin.

The SLO Basin GSAs have developed a cooperative working relationship with the Los Osos Groundwater Basin – Basin Management Committee and the GSAs working in the Arroyo Grande Subbasin. Groundwater conditions near the borders with these basins will be monitored and shared.

8.9.2.4 *Effects of Minimum Thresholds on Beneficial Uses and Users*

The MT for Depletion of Interconnected Surface Water is defined to maintain historically observed groundwater elevations.

The practical effect of this GSP for protecting against the Depletion of Interconnected Surface Water MTs is that it encourages minimal long-term net change in groundwater elevations in the vicinity of the Basin streams. Seasonal and drought cycle variations are expected, but during average conditions and over the long-term, beneficial users will have access to adequate volumes of water from the aquifer to service the needs of all water use sectors. The beneficial users of groundwater are protected from undesirable results.

Agricultural Land Uses and Users

The water levels set as MTs are within the historical range of data, implying that surface water/groundwater interaction will be within historical norms. Therefore, existing agricultural operations are not expected to be affected by the Depletion of Interconnected Surface Water MTs.

Urban Land Uses and Users

Development of real estate along streams and creeks is generally constrained by prohibiting development in mapped floodplains in the Basin. Therefore, the Depletion of Interconnected Surface Water MTs are not anticipated to affect urban land users in the Basin.

Domestic Land Uses and Users

Development of real estate along streams and creeks is generally constrained by prohibiting development in mapped floodplains in the Basin. Therefore, the Depletion of Interconnected Surface Water MTs are not anticipated to affect urban land users in the Basin.

Ecological Land Uses and Users.

Groundwater dependent ecosystems would generally benefit from this MT. Maintaining groundwater levels close to within historically observed ranges will continue to support groundwater dependent ecosystems. More detailed mapping of GDEs, installation of gages in Edna Valley, and development of discharge rating curves for the San Luis Creek gages, all will clarify the effects of these MTs on ecological uses.

8.9.2.5 *Relation to State, Federal, or Local Standards*

Agreements with NOAA mandate a minimum delivery for environmental flows of 1.6 MGD of effluent flow from the City Wastewater Treatment Plant located along San Luis Obispo Creek near the outlet of the Basin in San Luis Valley.

SWRCB permit requirements with respect to outflow from Righetti Reservoir may impact flow conditions along West Corral de Piedras Creek.

8.9.2.6 *Methods for Quantitative Measurement of Minimum Threshold*

The quantitative metric for assessing compliance with the Depletion of Interconnected Surface Water MTs is monitoring groundwater elevations at the three RMSs designated for this Sustainability Indicator (SLV-12, EV-01, EV-11). The approach for quantitatively evaluating compliance with the MT for reduction in groundwater storage will be based on evaluating groundwater elevations semi-annually. All groundwater elevations collected from the groundwater level monitoring network will be analyzed and averaged.

8.9.3 Measurable Objectives

Similar to minimum thresholds, measurable objectives were defined using water level data based on the historical water level data observed in RMSs intended to monitor streamflow conditions. Measurable objectives for these wells are presented in Table 8-1 and Figures 8-4, 8-9, and 8-10. If future data from a

more comprehensive surface water monitoring program documents quantitative estimates of stream flow depletion, those data may be used to re-define the measurable objectives for areas of interconnection.

8.9.3.1 *Method for Quantitative Measurement of Measurable Objectives*
The measurable objectives are set based on maintaining current conditions of seasonal high water level elevations observed in the RMS wells during rainy periods. The quantitative method for assessing compliance with the MOs is monitoring of groundwater elevations at the selected RMSs.

8.9.3.2 *Interim Milestones*
Interim milestones show how the GSAs anticipate moving from current conditions to meeting the measurable objectives. Interim milestones are set for each five-year interval following GSP adoption. MOs for the Depletion of Interconnected Surface Water are set at historically observed conditions of high groundwater elevations during wet climatic periods. Therefore, the interim milestones are defined to be identical to the water levels associated with the MOs.

8.10 MANAGEMENT AREAS
Management areas are not established in the Basin. The GSAs and GSC members did not find it necessary to sub-divide the Basin into smaller management areas with specific administrative requirements.

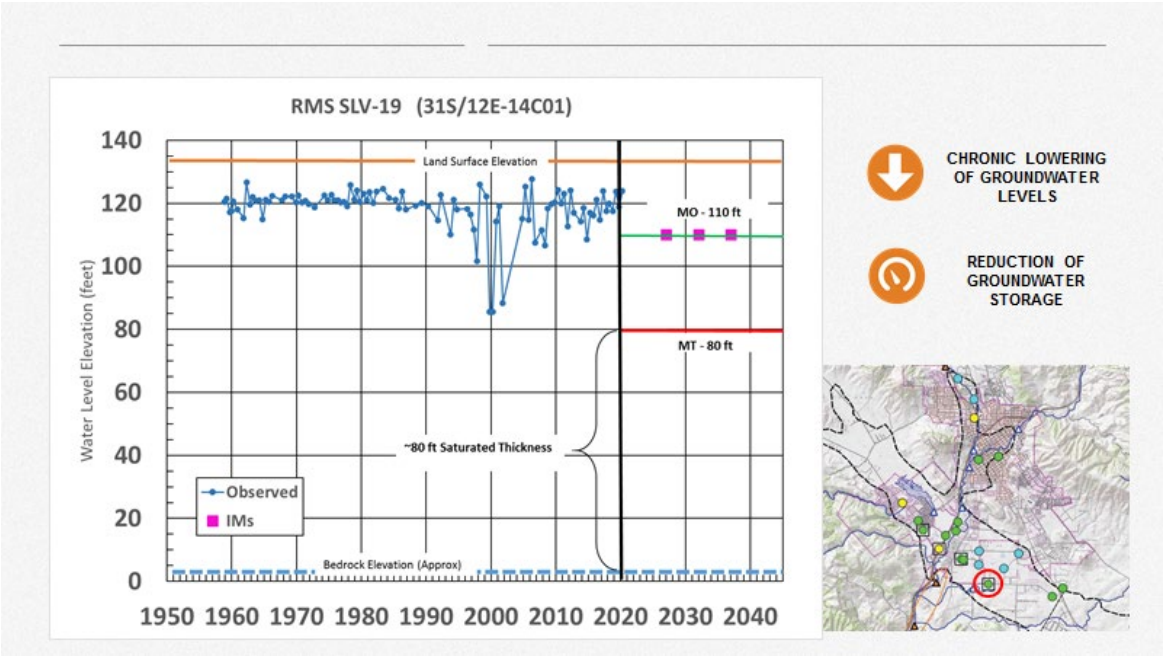

Figure 8-1 HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-19.

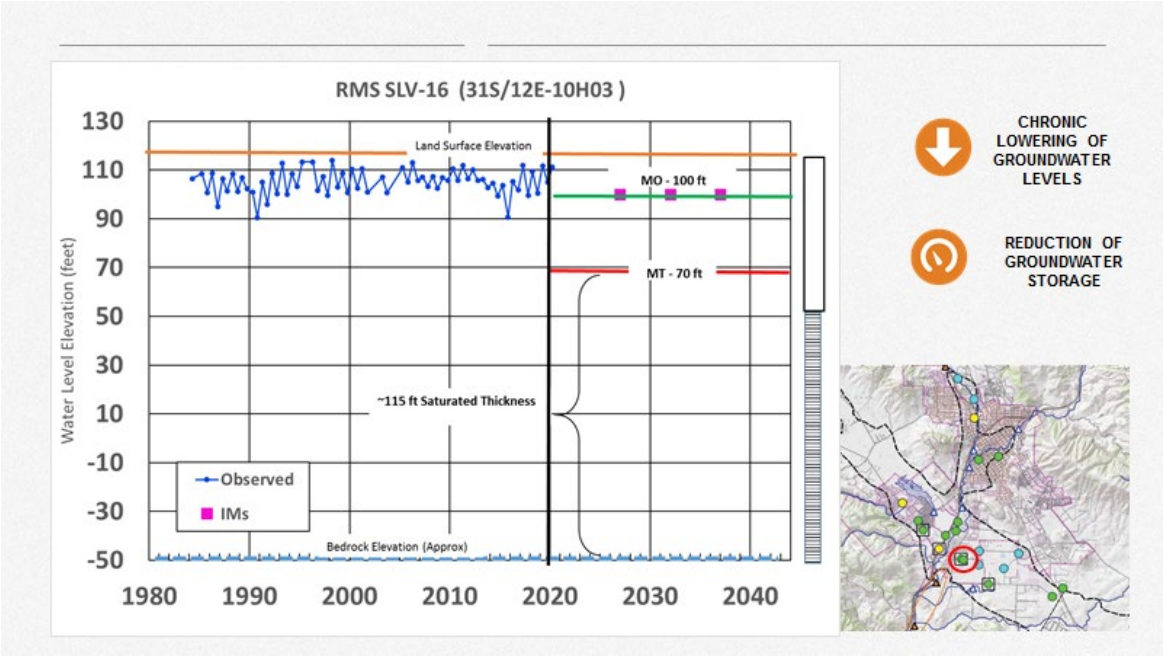

Figure 8-2 HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-16.

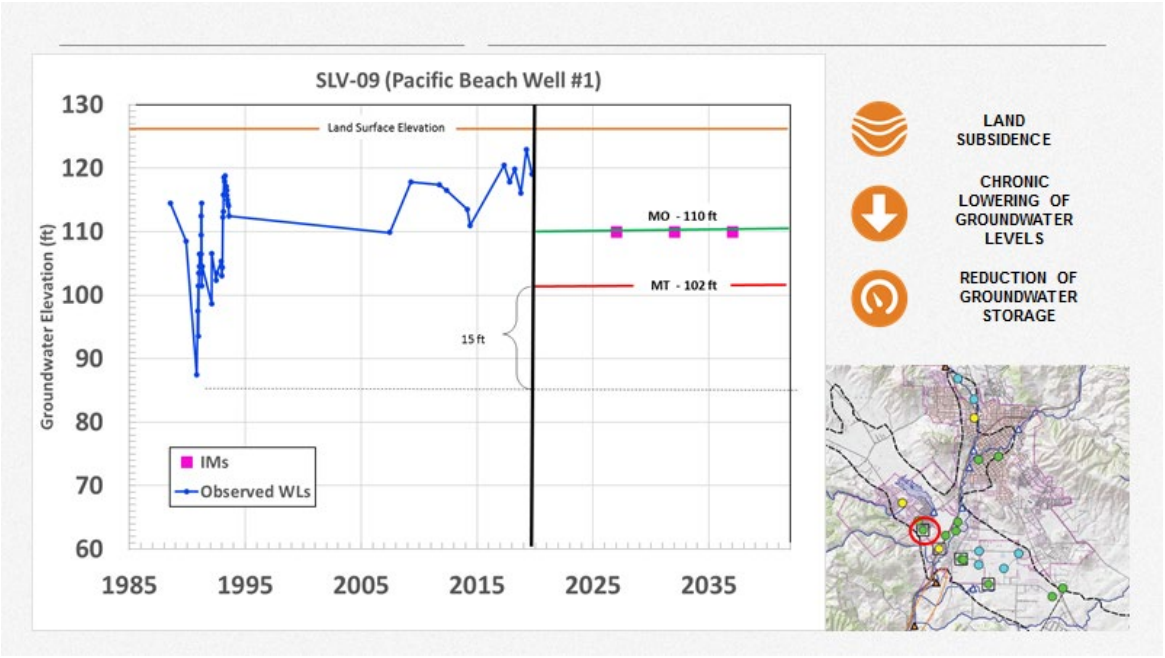

Figure 8-3. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-09.

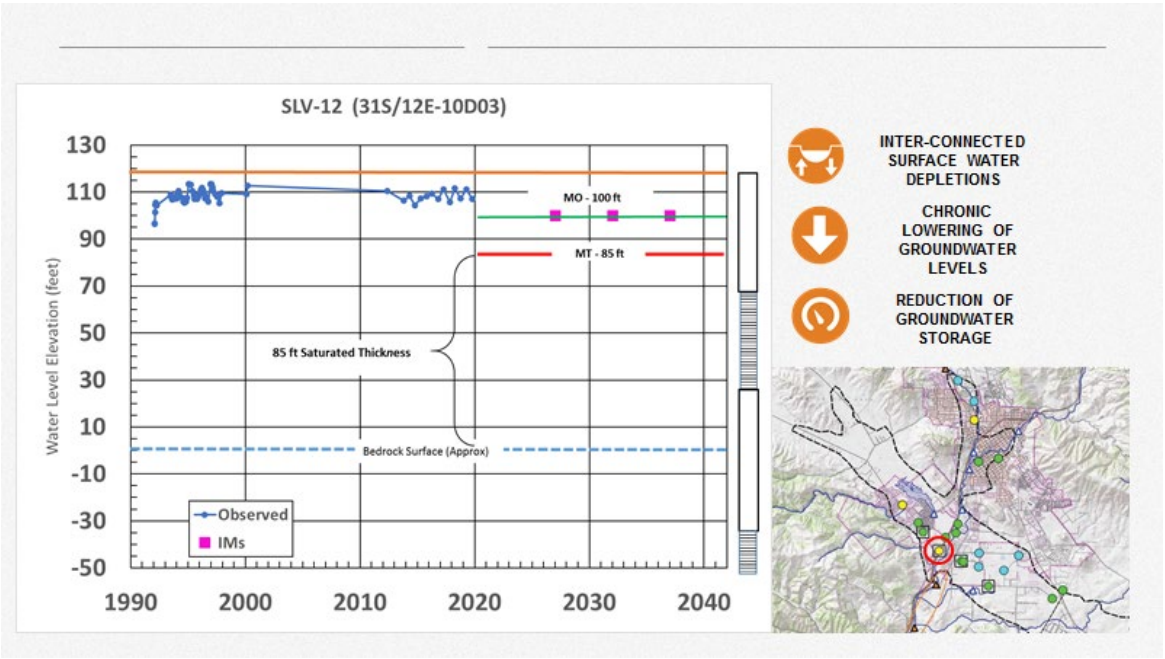

Figure 8-4. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS SLV-12.

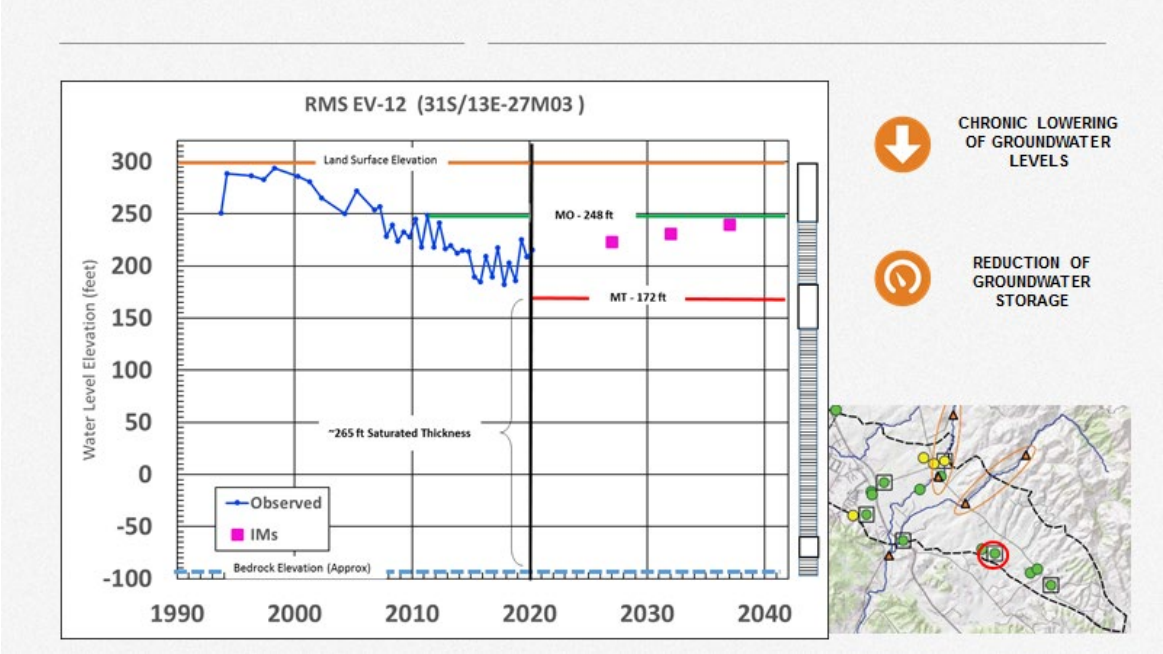

Figure 8-5. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-12.

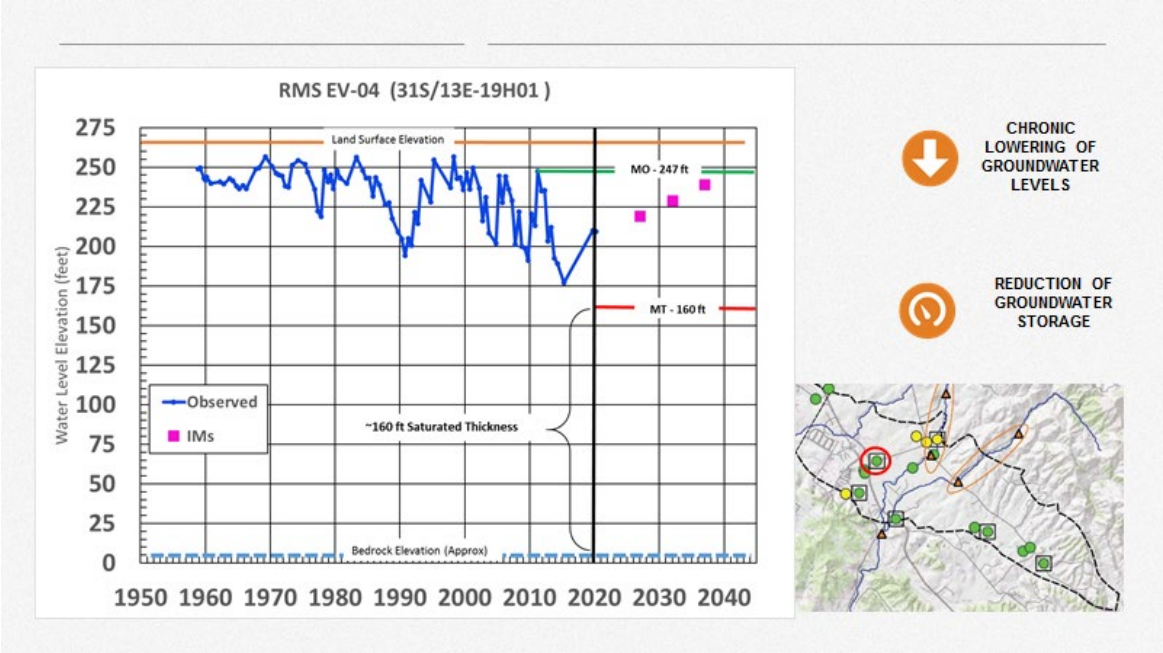

Figure 8-6. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-04

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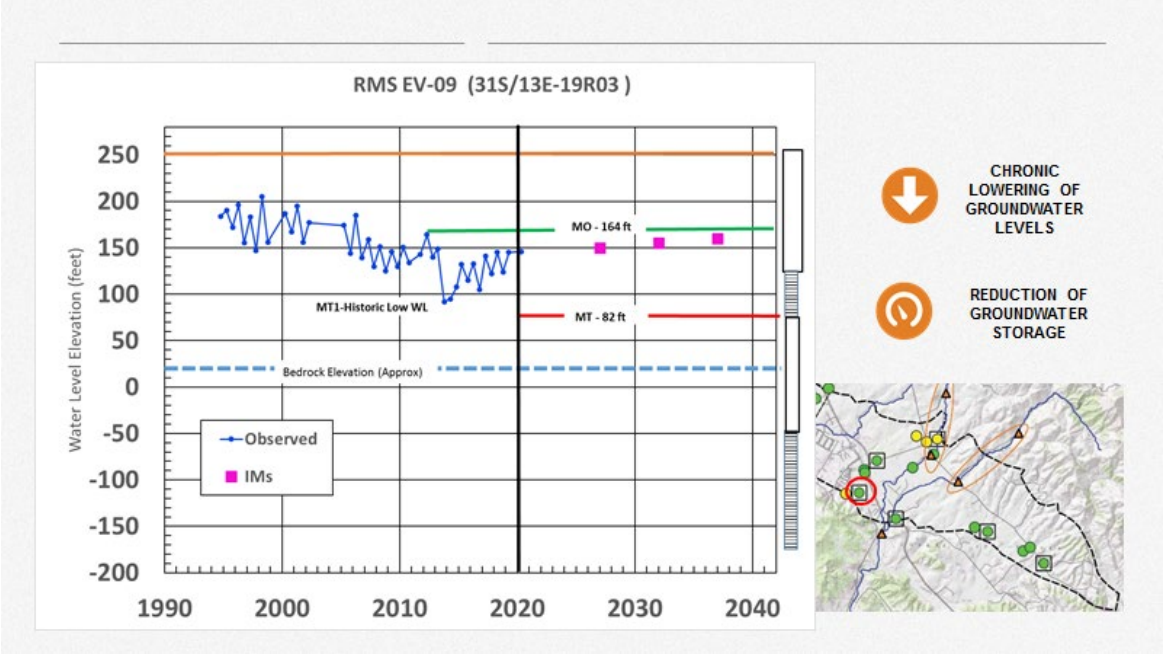

Figure 8-7. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-09.

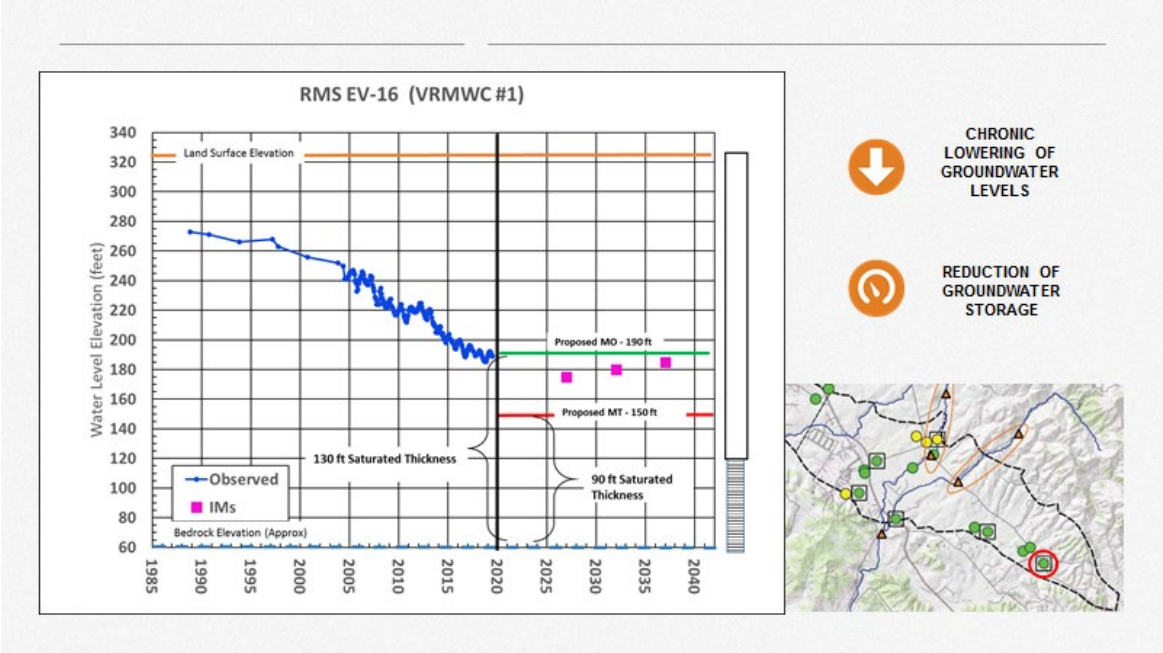

Figure 8-8. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-16.

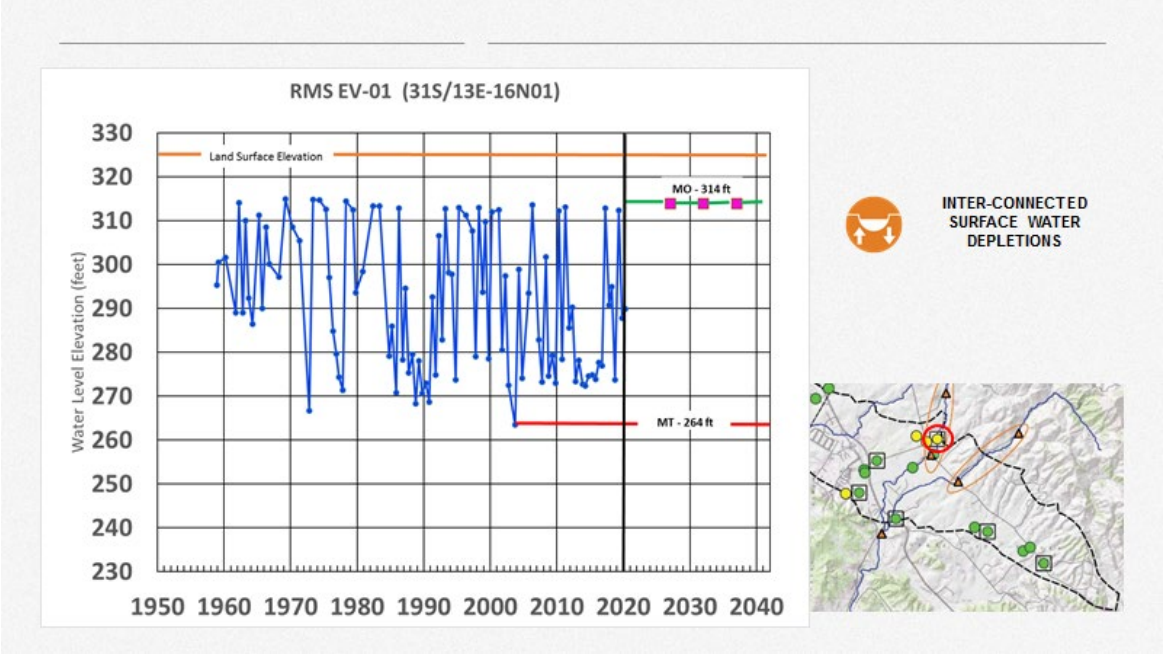

Figure 8-9. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-01.

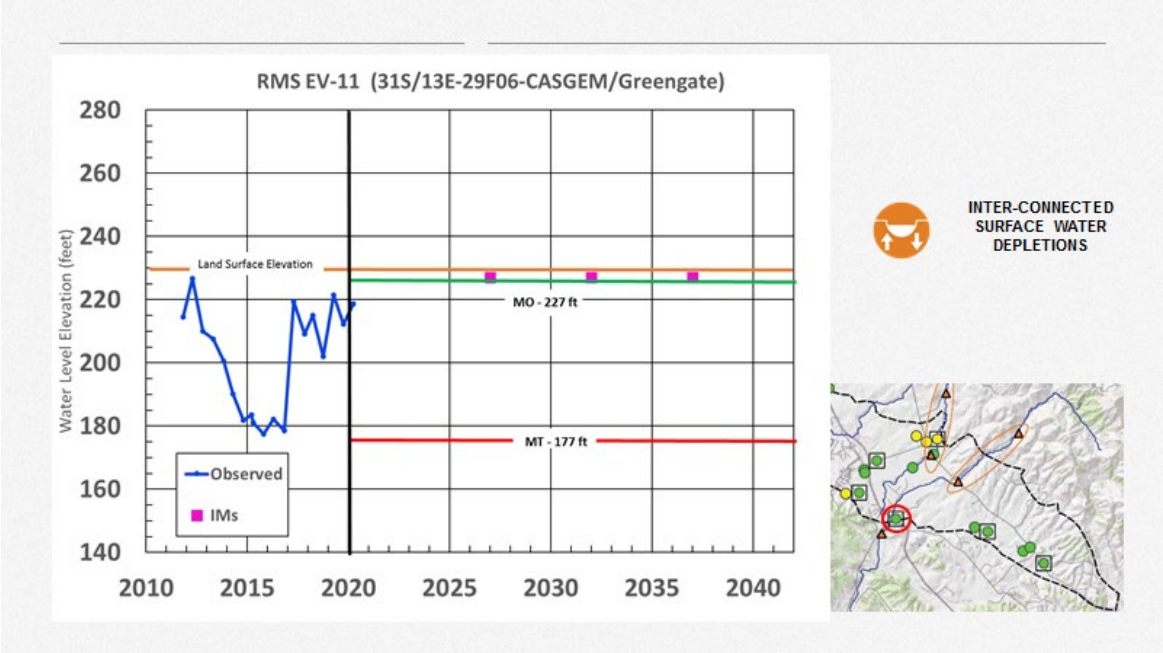

Figure 8-10. HYDROGRAPH, MINIMUM THRESHOLD, AND MEASURABLE OBJECTIVE FOR RMS EV-11.

REFERENCES

Balance Hydrologics. 2008. *Hydrology and Geology Assessment of the Pismo Creek Watershed, San Luis Obispo County, California.* 2008.
Blaney. 1963. *Utilization of the Water of the Santa Ynez River Basin in Southern Santa Barbara County California, United Stated Deparment of Agriculture.* 1963.
—. 1933. *Ventura County Investigation, Bulletin No. 46, California Deparment of Public Works, Division of Water Resources.* 1933.
Boyle Engineering. 1991. *City of San Luis Obispo Groundwater Basin Evaluation. January.* 1991.
Carollo. 2012. *San Luis Obispo County Master Water Report.* 2012.
CIMS. 2019. *Station 52, San Luis Obispo - Central Coast Valleys.* 2019.
City of San Luis Obispo. 2016. *2015 Urban Water Management Plan.* 2016.
—. 2018. *General Plan.* 2018.
—. 2015. *Water Resources Status Report.* 2015.
—. 2000. *Water Use Factors.* 2000.
Cleath & Associates, Inc. 2001. *Well Construction and Testing Report for Lewis Lane #4, Edna Valley, San Luis Obispo County. Prepared for Southern California Water Company. July.* 2001.
—. 2003. *Well Construction and Testing Report for Water Supply and Irrigation Wells, City of San Luis Obispo, Hayashi Irrigation Wells and Highway 101 Water Supply Well. March.* 2003.
Cleath-Harris Geologists. 2018. *Groundwater Flow Analysis, Recycled Water Recharge Project, San Luis Valley Subarea, San Luis Obispo Valley Groundwater Basin.* 2018.
—. 2019. *Optional Task 2.4B Geophysical Survey.* 2019.
Cleath-Harris Geologists, Inc. 2010. *Edna Valley Water System Groundwater Study. Prepared for Golden State Water Company. May.* 2010.
—. 2013. *Summary of Drilling,. Testing, and Destruction of the Golden State Water Company Country Club Test Well, Edna Road System, 6110 Lewis Lane, San Luis Obispo, California. Prepared for Golden State Water Company. June.* 2013.
—. 2013. *Summary of Exploration and Testing, 5061 Hacienda Avenue, San Luis Obispo, California. Prepared for Golden State Water Company. February.* 2013.
—. 2014. *Summary of Exploration and Testing, Blodgett parcel, Whiskey Run Lane, Country Club Area, San Luis Obispo, California. Prepared for Golden State Water Company. July.* 2014.
County of San Luis Obispo. 2014. *San Luis Obispo County Integrated Regional Water Management Plan (IRWMP).* 2014.
Cuesta Engineering Corporation. 2007. *San Luis Obispo Creek Watershed Calibration Study.* 2007.
Dibble, T.W. 2004. *Geologic Map of the Lopez Mountain Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2004. #DF-130.
Dibblee, T.W. 2006. *Geologic Map of the Arroyo Grande NE Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2006. #DF-211.
—. 2006. *Geologic Map of the Pismo Beach Quadrangle, San Luis Obispo County, California.* s.l. : Dibblee Geology Center Map, 2006. #DF-212.
—. 2004. *Geologic Map of the San Luis Obispo Quadrangle, San Luis Obispo County, California. .* s.l. : Dibble Geology Center Map, 2004. #DF-129.
DWR. 2003. *California's Groundwater: Bulletin 118 – Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2016. *California's Groundwater: Bulletin 118 - Interim Update 2016, Working Towards Sustainability.* 2016.
—. 2003. *California's Groundwater: Bulletin 118 - Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2015. *Consumptive Use Program Plus (CUP+) Model, in California Water Plan Update 2013, Volume 4. Reference Guide, Developed by DWR and UC Davis.* 2015.
—. 2014. DWR Atlas - Aglricultural Lang Use and Irrigated Areas. [Online] 2014. gis.water.ca.gov.

—. 1964. *San Luis Obispo and Santa Barbara Counties Land and Water Use Survey, 1959. .* s.l. : California Department of Water Resources (DWR), 1964.
—. 1958. *San Luis Obispo County Investigation. State Water Resources Board Bulletin No. 18. .* s.l. : California Department of Water Resources (DWR). May., 1958.
—. 1997. *San Luis-Edna Valley Groundwater Basin Study, Draft Report. .* s.l. : California Department of Water Resources (DWR)., 1997.
—. 1996. *South Central Coast Land Use Survey.* 1996.
—. 1987. *Southern Central Coast Land Use Survey, 1985. Morro Bay South 54-30 and San Luis Obispo 54-31 Survey Maps.* 1987.
—. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization - Process and Results Document.* 2019.
—. 2016. *Water Budget Best Management Practices for the Sustainable Management of Groundwater.* 2016.
—. 2002. *Water Resources of the Arroyo Grande - Nipomo Mesa Area.* 2002.
EPA. 2008. *Water Sense Factsheet - Indoor Water Use in the United States, EPA-832-F-06-004.* 2008.
ESA Consultants, Inc. 1994. *Hydrologic Investigation, Edna Valley Well Location Study. September.* 1994.
Fugro West and Cleath & Associates. 2002. *Paso Robles Groudnwater Study, Final Report.* 2002.
GSI Water Solutions. 2018. *San Luis Obispo Valley Basin Characterization and Monitoring Well Installation.* 2018.
Hall, C.A. 1979. *Geologic map of the San Luis Obispo – San Simeon Region, California.* s.l. : U.S. Geological Survey, 1979. Map I-1097.
—. 1973. *Geology of the Arroyo Grande Quadrangle, California. .* s.l. : California Division of Mines and Geology, 1973. Map Sheet 24.
ITRC. 2020. *Official Cal Poly Precipitation Data, Cal Poly/NOAA Station Rain Gage.* 2020.
Johnson, A.I. 1967. *Specific Yield - Compilation of Specific Yield for Various Materials, U.S. Geological Survey Water-Supply Paper 1662-D, prepared in cooperation with the California Deparment of Water Resources.* 1967.
National Land Cover Database. Multi-Resolution Land Characteristics Consortium. *2016.* Multi-Resolution Land Characteristics Consortium.
Rosenberg, L.I. 2001. *Potential Aquifer Recharge Areas: Monterey County, California.* s.l. : Monterey County Planning Department, 2001.
San Luis Obispo County Deparment of Agriculture/Weights and Measures. 2019. *Crop Surveys for San Luis Obispo Valley Groundwater Basin 2013-2018.* 2019.
San Luis Obispo County Department of Public Works. 2020. *Andrews Street Bridge Stream Flow Gage 745.* 2020.
—. 2020. *Gas Company Rain Sensor 3099.* 2020.
San Luis Obispo County Engineering Department. 1974. *Hydrologic & Climatological Data, Seasons of 1970-71 & 1971-72.* 1974.
SLO-FCWCD. 2014. *CASGEM Monitoring Plan for High and Medium Priority Groundwater Basins in the San Luis Obispo County Flood Control & Water Conservation District. September.* s.l. : San Luis Obispo Flood Control & Water Conservation District, 2014.
Stillwater Sciences. 2015. *Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California. September.* 2015.
SWRCB. 1990. *Ernest Righetti & Sons Application 28883, Decision 1627.* 1990.
TEAM Engineering & Management. 2000. *Groundwater Yield Analysis. July.* 2000.
USBR. 1955. *Reconnaissance Report San Luis Obispo County Basin, California. .* s.l. : U.S. Bureau of Reclamation, Region 2, Sacramento., 1955.
USDA-NRCS. 2007. *Soil Survey Geographic Database (SSURGO).* s.l. : U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), 2007.
WSC. 2018. *Salinas and Whale Rock Reserviors Safe Annual Yield TM.* 2018.

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Chapter 9 - Projects and Management Actions

Chapter 10 - Implementation Plan

San Luis Obispo Valley Basin Groundwater Sustainability Plan

Available for viewing in the June 21, 2021 Agenda Packet:	**June 16, 2021**
Recommended the GSAs to receive and file for public comments:	**June 21, 2021**
Available for public comments on www.slowaterbasin.com:	**June 22, 2021**
Close of public comment period:	**July 22, 2021**

Per the GSC's recommendation on June 21, 2021, GSP Draft Chapter 9 - Projects and Management Actions and Chapter 10 Implementation Plan will be distributed to the City and County GSAs to receive and file. This draft document is now posted on the web portal: www.slowaterbasin.com for public comments. Comments from the public are being collected using a comment form available at www.slowaterbasin.com by clicking on "Submit Comment". If you require a paper form to submit by postal mail, please contact your local Groundwater Sustainability Agency (GSA). All comments submitted will also be posted online for viewing.

Draft

Groundwater Sustainability Plan
Chapter 9 and 10 – Projects and Management Actions and Implementation Plan

for the

San Luis Obispo Valley Groundwater Basin
Groundwater Sustainability Agencies

Prepared by

6/14/2021

TABLE OF CONTENTS

Table of Contents i
List of Figures v
Tables vi
Appendices vii
List of Terms Used viii
Executive Summary 1
9 Projects and Management Actions (§ 354.44) 2
9.1 Introduction 2
9.2 Overview of Potential Projects and Management Actions 3
9.2.1 Project and Management Actions Development 3
9.2.1.1 Screening and Ranking of Projects 3
9.2.1.2 Summary of Projects 3
9.2.2 Addressing Sustainability Indicators (§ 354.44 (1)) 9
9.2.3 Overdraft Mitigation (§ 354.44 (2)) 9
9.3 Integrated Surface Water and Groundwater Modeling 9
9.4 Projects 11
9.4.1 State Water Project for Agricultural Irrigation 11
9.4.1.1 Project Benefits (§ 354.44.5) 12
9.4.1.2 Supply Reliability (§ 354.44.6) 12
9.4.1.3 Project Costs (§ 354.44.8) 13
9.4.1.4 Project Implementation (§ 354.44.4) 13
9.4.1.5 Basin Uncertainty (§ 354.44.9d) 13
9.4.1.6 Legal Authority (§ 354.44.7) 14
9.4.1.7 Permitting and Regulatory Processes (§ 354.44.3) 14
9.4.1.8 Public Notice and Outreach (§ 354.44B) 14
9.4.2 City of SLO Recycled Water for Agricultural Irrigation 16
9.4.2.1 Project Benefits (§ 354.44.5) 16
9.4.2.2 Supply Reliability (§ 354.44.6) 16
9.4.2.3 Project Costs (§ 354.44.8) 17
9.4.2.4 Project Implementation (§ 354.44.4) 17
9.4.2.5 Basin Uncertainty (§ 354.44.9d) 18
9.4.2.6 Legal Authority (§ 354.44.7) 18
9.4.2.7 Permitting and Regulatory Processes (§ 354.44.3) 18

9.4.2.8 Public Notice and Outreach (§ 354.44B) 18
9.4.3 State Water Project Recharge Basin 18
9.4.3.1 Project Benefits (§ 354.44.5) 19
9.4.3.2 Supply Reliability (§ 354.44.6) 19
9.4.3.3 Project Costs (§ 354.44.8) 19
9.4.3.4 Project Implementation (§ 354.44.4) 19
9.4.3.5 Basin Uncertainty (§ 354.44.9d) 20
9.4.3.6 Legal Authority (§ 354.44.7) 20
9.4.3.7 Permitting and Regulatory Processes (§ 354.44.3) 22
9.4.3.8 Public Notice and Outreach (§ 354.44B) 22
9.4.4 State Water Project to Golden State Water Company 22
9.4.4.1 Project Benefits (§ 354.44.5) 22
9.4.4.2 Supply Reliability (§ 354.44.6) 23
9.4.4.3 Project Costs (§ 354.44.8) 23
9.4.4.4 Project Implementation (§ 354.44.4) 23
9.4.4.5 Basin Uncertainty (§ 354.44.9d) 23
9.4.4.6 Legal Authority (§ 354.44.7) 23
9.4.4.7 Permitting and Regulatory Processes (§ 354.44.3) 23
9.4.4.8 Public Notice and Outreach (§ 354.44B) 23
9.4.5 City of SLO Potable Water to Golden State Water Company 25
9.4.5.1 Project Benefits (§ 354.44.5) 25
9.4.5.2 Supply Reliability (§ 354.44.6) 25
9.4.5.3 Project Costs (§ 354.44.8) 25
9.4.5.4 Project Implementation (§ 354.44.4) 25
9.4.5.5 Basin Uncertainty (§ 354.44.9d) 26
9.4.5.6 Legal Authority (§ 354.44.7) 26
9.4.5.7 Permitting and Regulatory Processes (§ 354.44.3) 26
9.4.5.8 Public Notice and Outreach (§ 354.44B) 26
9.4.6 Varian Ranch Mutual Water Company Arroyo Grande Subbasin Wells 26
9.4.6.1 Project Benefits (§ 354.44.5) 27
9.4.6.2 Supply Reliability (§ 354.44.6) 27
9.4.6.3 Project Costs (§ 354.44.8) 27
9.4.6.4 Project Implementation (§ 354.44.4) 27
9.4.6.5 Basin Uncertainty (§ 354.44.9d) 27
9.4.6.6 Legal Authority (§ 354.44.7) 27

9.4.6.7 Permitting and Regulatory Processes (§ 354.44.3) 28
9.4.6.8 Public Notice and Outreach (§ 354.44B) 28
9.4.7 State Water Project to the Mutual Water Companies 28
9.4.7.1 Project Benefits (§ 354.44.5) 28
9.4.7.2 Supply Reliability (§ 354.44.6) 28
9.4.7.3 Project Costs (§ 354.44.8) 28
9.4.7.4 Project Implementation (§ 354.44.4) 28
9.4.7.5 Basin Uncertainty (§ 354.44.9d) 29
9.4.7.6 Legal Authority (§ 354.44.7) 29
9.4.7.7 Permitting and Regulatory Processes (§ 354.44.3) 29
9.4.7.8 Public Notice and Outreach (§ 354.44.B) 29
9.4.8 Price Canyon Discharge Relocation 29
9.4.8.1 Project Benefits (§ 354.44.5) 30
9.4.8.2 Supply Reliability (§ 354.44.6) 30
9.4.8.3 Project Costs (§ 354.44.8) 30
9.4.8.4 Project Implementation (§ 354.44.4) 30
9.4.8.5 Basin Uncertainty (§ 354.44.9d) 30
9.4.8.6 Legal Authority (§ 354.44.7) 31
9.4.8.7 Permitting and Regulatory Processes (§ 354.44.3) 31
9.4.8.8 Public Notice and Outreach (§ 354.44.B) 31
9.4.9 Modeling of Multiple Projects 33
9.5 Management Actions 35
9.5.1 Expand Monitoring Network 35
9.5.2 Groundwater Extraction Metering and Reporting Plan 35
9.5.2.1 De Minimis Self-Certification 35
9.5.2.2 Non-De Minimis Extraction and Reporting Program 36
9.5.3 Demand Management Plan 36
9.5.3.1 Water Conservation Measures 36
9.5.3.2 Irrigation Efficiency Improvements 37
9.5.3.3 Volunteer Water Efficient Crop Conversion 39
9.5.3.4 Volunteer Land Fallowing 39
9.5.3.5 Pumping Reductions 39
9.6 Adaptive Management (§ 354.44A) 40
10 Implementation Plan 41
10.1 GSP Implementation, Administration, and Management 41

10.1.1 Administrative Approach/Governance Structure 41
10.1.2 Implementation Schedule 41
10.1.3 Implementation Costs 43
10.1.3.1 Administration and Finance 43
10.1.3.2 Monitoring Network Implementation 43
10.1.3.3 Project Implementation 43
10.1.3.4 Reporting 44
10.1.4 Outreach and Communication 44
10.2 Funding 44
10.2.1 GSP Implementation Funds 44
10.2.2 Fee Study 44
10.2.3 Grant/Low Interest Financing 44
10.3 Reporting 45
10.3.1 Annual Reports 45
10.3.1.1 General Information 45
10.3.1.2 Basin Conditions 45
10.3.1.3 Implementation Progress 45
10.3.2 Five-Year Evaluation Reports 47
10.3.2.1 Sustainability Evaluation 47
10.3.2.2 Plan Implementation Progress 47
10.3.2.3 Reconsideration of GSP Elements 47
10.3.2.4 Monitoring Network Description 47
10.3.2.5 New Information 47
10.3.2.6 Regulations or Ordinances 48
10.3.2.7 Legal or Enforcement Actions 48
10.3.2.8 Plan Amendments 48
10.3.2.9 Coordination 48
10.3.2.10 Reporting to Stakeholders and the Public 48

11 References .....
12 Appendices .....

LIST OF FIGURES

Figure 9-1. Project Location Map 8
Figure 9-2 Anticipated Future Availability of District SWP Supplies Based on the Historic Hydrologic Period (1922-2003) 13
Figure 9-3 SWP with In-Lieu Agricultural Pumping Reduction - 1,000 AFY – Project Scenario 1 15
Figure 9-4. SWP Recharge Basin – 500 AFY – Project Scenario 2 21
Figure 9-5 SWP Purveyor In-Lieu Pumping Reduction – GSWC = 200 AFY, VRMWC & ERMWC = 50 AFY – Project Scenario 3 24
Figure 9-6. Relocation of Price Canyon Discharge Point – 500 AFY 32
Figure 9-7Model Results from the Combined Modeled Project Scenarios – Project Scenario 5 34
Figure 10-1. SLO Basin GSP Implementation Schedule 42

TABLES

Table 9-1. Initial Project Screening Evaluation Criteria 5
Table 9-2. Project Evaluation Scoring Results 6
Table 9-3 Projects and Management Actions Strategies 7
Table 9-4 Summary of Project and Management Action Benefits and Impacts on Sustainability Indicators. 9
Table 9-5. Consumptive Use of Applied Water and Total Irrigated Acreage by Land Use/Land Cover Type 39
Table 10-1 GSP Implementation Costs (2022-2027) 46

APPENDICES

Appendix A - City of San Luis Obispo Resolution to form GSA
Appendix B - County of San Luis Obispo Resolution to form GSA
Appendix C - Memorandum of Agreement – Preparation of GSP
Appendix D Communications and Engagement Plan
Appendix E Surface Water/Groundwater Modeling Approach
Appendix F Stakeholder Workshop Summary – Building a Shared Vision for a "Sustainable SLO Basin"
Appendix G Sustainable Goal Setting Workshop
Appendix H Groundwater-Dependent Ecosystems in the San Luis Obispo Valley Groundwater Basin
Appendix I Groundwater Level Measurement Procedures for the San Luis Obispo Valley Groundwater Basin GSP
Appendix J Streamflow Measurement in Natural Channels
Appendix K Data Management Plan
Appendix L Response to Public Comments

LIST OF TERMS USED

Abbreviation	Definition
AB	Assembly Bill
ADD	Average Day Demand
AF	Acre Feet
AFY	Acre Feet per Year
AMSL	Above Mean Sea Level
Basin Plan	Water Quality Control Plan for the Central Coast Basin
Cal Poly	California Polytechnic State University
CASGEM	California State Groundwater Elevation Monitoring program
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCF	One hundred cubic feet
CCGC	Central Coast Groundwater Coalition
CDFM	Cumulative departure from the mean
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
City	City of San Luis Obispo
County	County of San Luis Obispo
CPUC	California Public Utilities Commission
CPWS-52	Cal Poly Weather Station 52
CRWQCB	California Regional Water Quality Control Board
CWC	California Water Code
DDW	Division of Drinking Water
Du/ac	Dwelling Units per Acre
DWR	Department of Water Resources
EPA	Environmental Protection Agency
ERMWC	Edna Ranch Mutual Water Company
ET_0	Evapotranspiration
EVGMWC	Edna Valley Growers Ranch Mutual Water Company
°F	Degrees Fahrenheit
FAR	Floor Area Ratio
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment program
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
GPM	Gallons per Minute
GSA	Groundwater Sustainability Agency
GSC	Groundwater Sustainability Commission
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
IRWMP	San Luis Obispo County Integrated Regional Water Management Plan
kWh	Kilowatt-Hour
LUCE	Land Use and Circulation Element
LUFTs	Leaky Underground Fuel Tanks
MAF	Million Acre Feet

Abbreviation	Definition
MCL	Maximum Contaminant Level
MG	Million Gallons
MGD	Million Gallons per Day
Mg/L	Milligrams per Liter
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MWR	Master Water Report
NCDC	National Climate Data Center
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
O&M	Operations and Maintenance
PPWTP	Polonio Pass Water Treatment Plant
RW	Recycled Water
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act
SGMP	Sustainable Groundwater Management Planning
SGWP	Sustainable Groundwater Planning
SLO Basin	San Luis Obispo Valley Groundwater Basin
SLOFCWCD	San Luis Obispo Flood Control and Water Conservation District
SCML	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SNMP	Salt and Nutrient Management Plan
SWP	State Water Project
SWRCB	California State Water Resources Control Board
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
USTs	Underground Storage Tanks
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
UWMP Guidebook	Department of Water Resources 2015 Urban Water Management Plan Guidebook
VRMWC	Varian Ranch Mutual Water Company
WCS	Water Code Section
WMP	Water Master Plan
WPA	Water Planning Areas
WRF	Water Reclamation Facility
WRCC	Western Regional Climate Center
WRRF	Water Resource Recovery Facility
WSA	Water Supply Assessment
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This section to be completed after GSP is completed

9 PROJECTS AND MANAGEMENT ACTIONS (§ 354.44)

9.1 INTRODUCTION

This chapter describes the Projects, Management Actions and Adaptive Management information that satisfies Sections 354.42 and 354.44 of the SGMA regulations. These projects, actions, and their benefits are intended to help achieve sustainable management goals in the Basin.

Under the Regulations, § 354.44, the Groundwater Sustainability Plan (GSP, Plan) is to include the following:

- *Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.*

- *Each Plan shall include a description of the projects and management actions that include the following:*
    - *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:*
        - *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*
        - *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.*
    - *If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.*
    - *A summary of the permitting and regulatory process required for each project and management action.*
    - *The status of each project and management action, including a timetable for expected initiation and completion, and the accrual of expected benefits.*
    - *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*
    - *An explanation of 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.*
    - *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*
    - *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*
    - *A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.*

- *Projects and management actions shall be supported by best available information and best available science.*
- *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

9.2 OVERVIEW OF POTENTIAL PROJECTS AND MANAGEMENT ACTIONS

9.2.1 Project and Management Actions Development

The projects and management actions concepts were developed over a series of working sessions with GSA staff, meetings with GSC members and in six public GSC meetings between December 9, 2020 and June 21, 2021. The projects and management actions are focused in the Edna Valley (Figure 9-1) where the overdraft was documented in Chapter 6 Water Budget. The effectiveness of the projects and management actions will be assessed by the ability to mitigate undesirable results such as groundwater level declines in the Edna Valley Representative Monitoring Sites (RMS) described in Chapter 8 Sustainable Management Criteria.

9.2.1.1 Screening and Ranking of Projects

An initial screening of the projects was performed using the evaluation criteria shown in Table 9-1. The Evaluation Criteria developed collaboratively with the GSC members were applied to the list of projects deliberated by the GSA Staff, GSC members, and the public. The results of the initial screening and ranking are displayed in Table 9-2. The scoring of each project was weighted to better represent the ease/likelihood of implementation and the impacts of the project on the sustainability goals described in Chapter 8.

9.2.1.2 Summary of Projects

Table 9-3 provides a summary of the projects and management actions considered in this GSP. The table shows the status, timing for implementation (years), capital costs ($), annual Operations and Maintenance (O&M) ($/Year), quantity of water delivered (AFY), and the unit cost ($/AFY) for each project and management action. The projects discussed in this GSP are centered around supplemental water sources that could be brought into the SLO Basin to mitigate the overdraft. The projects considered supplemental water from three sources all of which have existing conveyance infrastructure within or in close proximity to the Basin; State Water Project, City of SLO recycled water, and Price Canyon discharge.

The project costs included in this GSP were prepared in conformance with industry practice and, as planning level cost opinions, and ranked as a Class 4 Conceptual Opinion of Probable Construction Cost as developed by the Association for the Advancement of Cost Engineering (Association for the Advancement of Cost Engineering, 2011). The AACE classification system is intended to classify the expected accuracy of planning level cost opinions and is not a reflection on the effort or accuracy of the actual cost opinions prepared for the GSP. According to AACE, a Class 4 Estimate is intended to provide a planning level conceptual effort with an accuracy that will range from -30% to +50% and includes an appropriate contingency for planning and feasibility studies. The conceptual nature of the projects and associated costs presented in this Chapter are based upon limited design information available at this current stage of the projects.

At this planning-level stage, two percentages were applied to the estimated construction costs, 30% for construction contingency and 25% for implementation costs (which incorporates anticipated Design, Construction Management, and Environmental and Construction Engineering costs). In order to estimate annual payments, a loan period of 30 years at a 5% interest rate was assumed. The $/AFY values were calculated using the total annual cost, which include capital repayment and operations and maintenance costs, divided by the estimated yield from each project, see Section 9.4 for further detail. It is important to

note that the cost estimates shown in Table 9-3 do not include the cost of the water as the costs to purchase the water are subject to negotiation between the supplier and the purchasing party.

The projects were further evaluated with the integrated model to quantify the benefit of the projects respect to the SMCs in the Edna Valley. Model results are described in more detail in Section 9.4.

Table 9-1. Initial Project Screening Evaluation Criteria

Criteria	Scoring
Quantity of Water	1- <250 AFY 2- 250-500 AFY 3- 500-750 AFY 4- 750-1000 AFY 5- > 1,000 AFY
Capital Cost	1->$5M 3- $2,500,000 5- $0
Water Cost	1- >$4,000/AFY 2- $3,000 - $4,000/AFY 3- $2,000 - $3,000/AFY 4- $1,000 - $2,000/AFY 5- < $1,000/AFY
O&M Cost	1- >$2,000/AFY 2- $1,000 - $2,000/AFY 3- $500 - $1,000/AFY 4- $100 - $500/AFY 5- < $100/AFY
GW Water Quality Impact	1- Higher TDS to ambient groundwater 3- Equivalent TDS than ambient groundwater 5- Lower TDS than ambient groundwater
Reliability/Resiliency	1- Highly variable 3- Moderately reliable 5- Highly reliable
Timeline to Implement	1- > 10 years 2- 7 years 3- 5 years 4- 3 years 5- < 1 year
Feasibility/Complexity	1- Significant regulatory, environmental, political, or social challenges 2- 3- Potential significant regulatory, environmental, political, or social challenges 4- 5- Limited regulatory, environmental, political, or social challenges
Environmental Impacts	1- Detrimental Environmental impacts 3- Neutral Environmental impacts 5- Beneficial Environmental impacts
Socioeconomic Impacts	1- Detrimental Socioeconomic impacts 3- Neutral Socioeconomic impacts 5- Beneficial Socioeconomic impacts
Eligible for Grant Funding	1- Limited grant funding opportunities 3- Moderate grant funding opportunities 5- Significant grant funding opportunities
Groundwater Level Benefit	1- Minimal Effect on Groundwater Levels 3- Average Effect on Groundwater Levels 5- Highest Effect Groundwater Levels

Table 9-2. Project Evaluation Scoring Results

Projects and Management Actions	Description	Quantity of Water (AFY)	Quantity of Water	Capital Cost	Water Cost	O&M Cost	GW Water Quality Benefits	Reliability/Resiliency	Timeline to Implement	Feasibility/Complexity	Environmental Impacts	Socioeconomic Impacts	Eligibility for Grant Funds	Groundwater Level Benefit	Total Score
Weighting Factor			3	2	2	2	1	1	1	2	1	1	1	4	
SWP to Ag Irrigation	Connection to SWP to offset Ag groundwater pumping through direct delivery of SWP Water	1000	5	2	3	4	5	3	3	3	3	4	4	3	**73**
SWP Recharge	Connection to SWP to provide water for groundwater recharge	500	3	2	3	4	5	3	3	3	3	4	4	4	**71**
City of SLO Potable Water to GSWC	Connection to City of SLO potable water system to offset Golden State Water Company groundwater pumping through direct delivery	400	2	4	1	4	5	5	4	3	4	3	3	4	**70**
City of SLO Recycled Water to Ag Irrigation	Connection to City of SLO Recycled Water System to offset Ag groundwater pumping through direct delivery	500-700	3	3	1	4	4	5	4	4	3	4	4	3	**69**
SWP to GSWC	Connection to SWP project to offset GSWC groundwater pumping through direct delivery of SWP Water	400	2	2	3	4	5	3	4	3	3	4	4	4	**69**
Price Canyon Discharge Relocation	Relocation of Sentinel Peak Produced Water Discharge location to upper Corral de Piedra Creek or direct delivery to agriculture	500	2	2	5	4	5	5	4	2	4	3	4	3	**69**
Varian Ranch MWC AG Subbasin Wells	Connection to Varian Ranch MWC wells in Arroyo Grande Subbasin to offset Varian Ranch groundwater pumping through direct delivery of imported groundwater	35	1	3	5	4	3	4	4	3	3	4	4	3	**67**
SWP to Mutual Water Companies	Connection to SWP to offset Edna and Varian Ranch MWC groundwater pumping through direct delivery of SWP Water	200	1	4	3	4	5	3	3	3	3	4	4	3	**65**
East Corral de Piedra Stormwater Capture and Recharge	Capture of high flow stormwater in East Corral de Piedra Creek and percolation in a recharge basin	50	1	3	5	4	5	1	4	3	5	3	5	2	**64**

Table 9-3 Projects and Management Actions Strategies

Projects and Management Actions	Status	Implementation Timing	Capital Cost	Annual Capital Payment	Annual O&M	Total Annual Payment	Quantity of Water (AF)	Unit Cost ($/AF)[1]
SWP to Ag Irrigation	Not begun yet	Feasibility study: 0 to 1 years Design/Construction: 1 to 5 years	$ 890,000	$ 58,000	$ 5,000	$ 63,000	1,000	$ 60
City of SLO Recycled Water to Ag Irrigation	Evaluated as part of the City of SLO Recycled Water Study (2017)	Feasibility study: 0 to 1 years Design/Construction: 1 to 3 years	$ 1,004,000	$ 65,000	$ 88,000	$153,000	600	$ 260
SWP Recharge	Not begun yet	Feasibility study: 0 to 1 years Design/Construction: 1 to 5 years	$ 3,624,000	$ 236,000	$ 101,000	$ 337,000	500	$ 670
SWP to GSWC	Not begun yet	Feasibility study: 0 to 1 years Design/Construction: 1 to 5 years	$ 2,685,000	$ 175,000	$ 17,000	$ 192,000	200	$ 960
City of SLO Potable Water to GSWC	Not begun yet	Feasibility study: 0 to 1 years Design/Construction: 1 to 3 years	$ 1,739,000	$ 127,000	$ 14,000	$ 127,000	200	$ 640
Varian Ranch MWC AG Subbasin Wells	Not begun yet	Feasibility study: 0 to 1 years Design/Construction: 1 to 3 years	$ 2,701,000	$ 176,000	$ 34,000	$ 210,000	50	$ 4,200
SWP to Mutual Water Companies	Not begun yet	Feasibility study: 0 to 1 years Design/Construction: 1 to 5 years	$ 835,000	$ 54,000	$ 5,000	$ 59,000	50	$ 1,180
Price Canyon Discharge Relocation	Mitigated Negative Dec Completed in 2015	Feasibility study: 0 to 1 years Design/Construction: 1 to 3 years	$ 4,909,000	$ 319,000	$ 56,000	$ 375,000	500[2]	$ 750
East Corral de Piedra Stormwater Capture and Recharge	Not begun yet	Feasibility study: 0 to 1 years Design/Construction: 1 to 3 years	$ 3,169,000	$ 206,000	$ 101,000	$ 307,000	50	$ 6,140
Groundwater Extraction Metering Plan	Not begun yet	1 year						
Demand Management Strategies	Not begun yet	As needed						

1. Does not include the cost of the water.
2. Quantity of water at the discharge point.

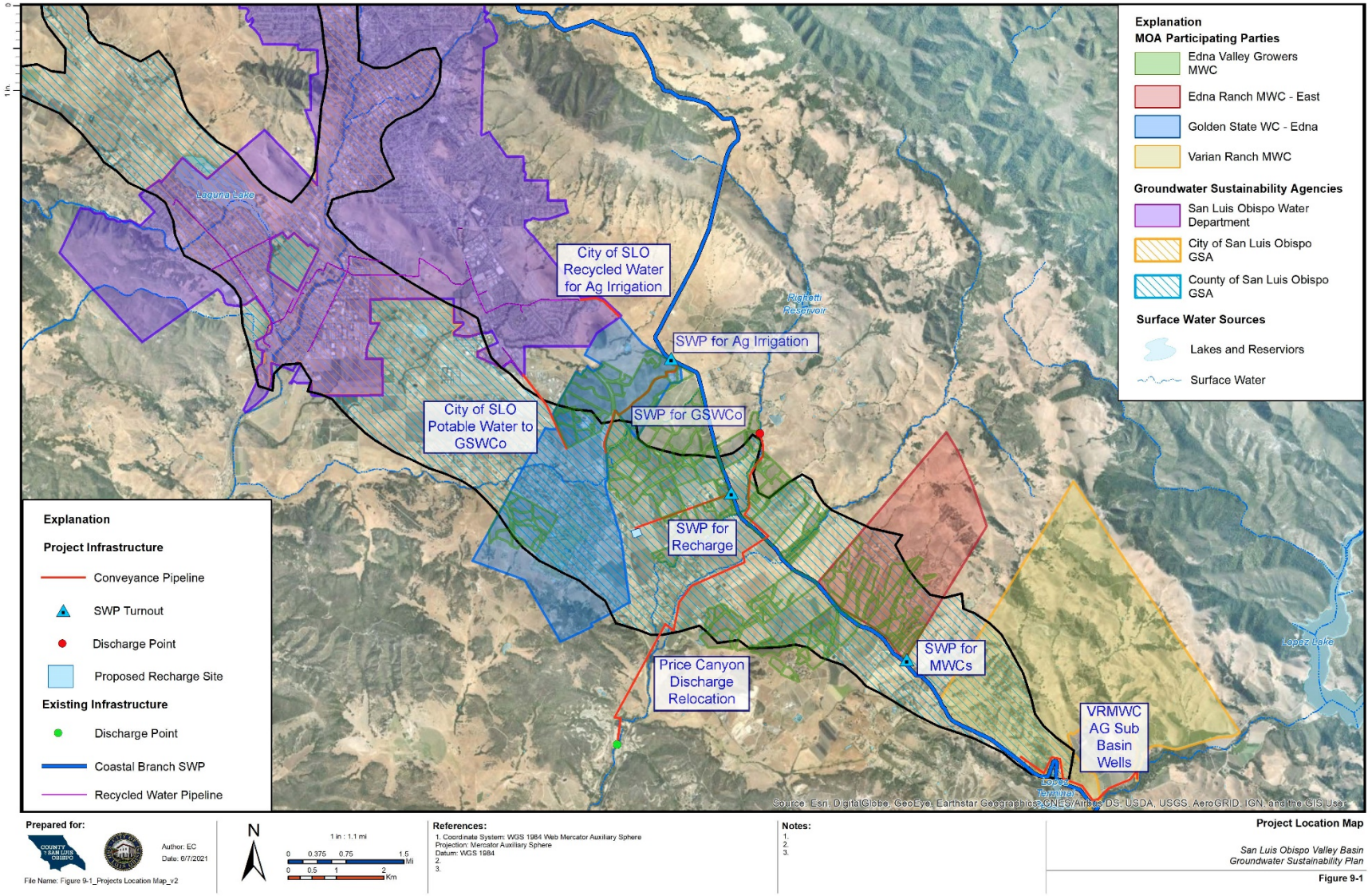


Figure 9-1. Project Location Map

9.2.2 Addressing Sustainability Indicators (§ 354.44 (1))

Table 9-4 shows the project and management action benefits and impacts on specific sustainability indicators and associated measurable objectives and minimum thresholds.

Table 9-4 Summary of Project and Management Action Benefits and Impacts on Sustainability Indicators.

Projects and Management Actions	Benefits	Measurable Objective	Exceedance of Minimum Thresholds
SWP to Ag Irrigation	Increases water levels in the Edna Valley to avoid minimum thresholds		Yes
City of SLO Recycled Water to Ag Irrigation	Increases water levels in the Edna Valley to avoid minimum thresholds Supplemental Water to Edna Valley		Yes
SWP Recharge	Increases water levels in the Edna Valley to avoid minimum thresholds		Yes
SWP to GSWC	Reduces localized groundwater production Supplemental Water to the Edna Valley		Yes
City of SLO Potable Water to GSWC	Reduces localized groundwater production Supplemental Water to the Edna Valley		Yes
Varian Ranch MWC AG Subbasin Wells	Reduces localized groundwater production Supplemental Water to the Edna Valley		Yes
SWP to Mutual Water Companies	Reduces localized groundwater production Supplemental Water to the Edna Valley		Yes
Price Canyon Discharge Relocation	Increases recharge to the Edna Valley Increases streamflow in West Corral de Piedras for Steelhead		Yes
East Corral de Piedra Stormwater Capture and Recharge	Increased Recharge to the Edna Valley		Yes
Groundwater Extraction Metering Plan	Improve understanding of the Basin Ability to manage the Basin		No
Voluntary Fallowing of Agricultural Land	Reduces groundwater production in the Edna Valley		Yes
Improved Irrigation Efficiency	Reduces groundwater production in the Edna Valley		Limited

Notes:

Chronic Lowering of Groundwater Levels

Reduction of Groundwater Storage

Depletion of Interconnected Surface Water

Degradation of Groundwater Quality

9.2.3 Overdraft Mitigation (§ 354.44 (2))

The proposed projects and management actions are intended to maintain groundwater levels above minimum thresholds through in-lieu pumping reductions or increased recharge. Overdraft is caused when pumping exceeds recharge and inflows in the Basin over a long period of time. Improving the management of groundwater in the Basin will help to mitigate overdraft.

9.3 INTEGRATED SURFACE WATER AND GROUNDWATER MODELING

As part of the development of this GSP, the GSAs incorporated the development of an integrated groundwater-surface water model of the Basin. A brief overview of the development and application of the model is presented herein. This discussion is not intended to be complete; more detailed documentation of the model is included in Appendix E, Surface Water/Groundwater Modeling Documentation.

The integrated model was developed using GSFLOW, a modeling code developed and maintained by the United States Geological Survey (USGS). GSFLOW incorporates two existing USGS modeling codes under a single structure. The first is the Precipitation Runoff Modeling System (PRMS), which models rainfall, plant

uptake, evapotranspiration, and runoff to streams, using a water budget approach applied to a gridded domain of the model area. The second is MODFLOW, which simulates groundwater flow and surface water/groundwater interaction in the aquifers of the model area. GSFLOW operates by first running PRMS, using climatological input and daily time steps to calculate the movement of rainfall that falls onto the Basin area through plant canopy, root zone, runoff to streams, and deep percolation to the groundwater environment. GSFLOW then transmits necessary data to MODFLOW (e.g., streamflow, deep percolation, etc.) at times and locations significant to the simulation of groundwater flow for the completion of the GSFLOW run.

The areal model grid was established utilizing 500-foot square model grid cells that cover the entire contributing watershed of the Basin. The vertical grid was discretized into three layers to correspond to the three water bearing formations in the Basin (Alluvium, Paso Robles Formation, and Pismo Formation). The bedrock in the contributing watershed area was also discretized into three layers so that lateral hydraulic communication could be simulated between the bedrock and all three formations in the Basin.

A historical calibration period from water years 1987 through 2019 was selected to correspond to the period of the historical water budget analysis documented in Chapter 6 of this GSP. The pumping estimates developed in the water budget analysis were used in the model calibration runs. Surface water flow data is unavailable for creeks in either the San Luis Valley or Edna Valley, but flow estimates were made for San Luis Obispo Creek based on flow stage or height data from the City's gages. The PRMS model was calibrated to achieve acceptable results for peak flow and flow volume on San Luis Obispo Creek. The MODFLOW model was calibrated to achieve acceptable results for groundwater elevations at wells in the Basin. The model calibration was found to meet industry criteria of a relative error of less than 10% (relative error is the mean error divided by the range of observed groundwater elevations). Therefore, the model was judged to be appropriate to perform predictive simulations to assess the impacts of proposed projects and management actions on water levels at RMS in the Basin.

The model was applied to evaluate the GSP projects and management actions using the following methodology. To maintain continuity of results between the historical calibration period and the predictive period, each simulation was run continuously from the historical calibration period through the end of the predictive simulation period, from water years 1987 through 2045. (The SGMA planning ends in 2042, but the model was run through 2045 to make sure model results were stable at the end of the predictive period; model results are presented for the end of the SGMA planning period). The 1995-2019 pumping time series that was developed in the water budget analysis and used in the MODFLOW historical calibration was repeated for the predictive simulation period. Likewise, the climatological time series data used as input for PRMS historical calibration was also repeated for the predictive simulation period. Thus, the pumping and climatological conditions for the predictive simulations replicated the observed conditions from 1995-2019, including the recent drought period. It is assumed that there will be no significant increase in agricultural pumping or acreage during this time period.

In order to assess the effect that a simulated project would have on groundwater elevations in the Basin, the following methodology was used. A baseline scenario was simulated in which no projects or management actions occurred. Pumping and climate conditions were repeated for the recent time series as previously discussed. Then a project scenario was incorporated in which a specific project or management action was represented in the model, either through reduction of pumping or introduction of a new source of recharge, as appropriate. The modeled RMS hydrographs for the baseline scenario and the project

scenario are then plotted on the same chart, so the effect of the project can be assessed by the difference in water levels between the baseline and project scenario over the predictive period of the project implementation. The projects discussed herein were represented with only the project under consideration represented in the model, in order to quantify the effect of the individual project discussed. It is likely that more than one of these projects will be required to achieve sustainability, which will be evaluated later in this Chapter.

Four separate project scenarios were modeled. However, some of these project model scenarios are intended to represent multiple projects as described in the following sections, but with different options for source water. It is assumed that the groundwater pumping reductions in the modeled project scenarios are offset by supplemental water supplies. For example, one of the project scenarios simulates a 1,000 AFY reduction in agricultural pumping. This reduction could conceivably be offset through import of State Water Project (SWP) water, short-term delivery of City of San Luis Obispo recycled water, or direct transfer of future Sentinel Peak effluent water to agriculture. So, this single model simulation could potentially represent the effects of more than one project, or a combination of projects, depending on the ultimate disposition and feasibility of obtaining the various possible sources of water or implementation of management actions. When this is the case, it will be noted in the text of the specific project descriptions. Additionally, a final project scenario was run in which four projects are represented simultaneously.

9.4 PROJECTS

9.4.1 State Water Project for Agricultural Irrigation

The Coastal Branch of the SWP conveys water from the California Aqueduct to San Luis Obispo and Santa Barbara Counties (Figure 9-1). The California Aqueduct is operated by the California Department of Water Resources (DWR). The Coastal Branch provides water to two SWP Contractors: the Santa Barbara County Flood Control and Water Conservation District (via the Central Coast Water Authority (CCWA), a Joint Powers Authority) and the San Luis Obispo County Flood Control and Water Conservation District (District). The CCWA owns, operates, and maintains the Polonio Pass Water Treatment Plant (PPWTP) and operates the portion of the Coastal Branch that is downstream of Polonio Pass.

The Coastal Branch transects the Edna Valley subarea and runs along Orcutt Road as shown in Figure 9-1. This project includes the construction of a new turnout to the Coastal Branch along Orcutt Rd south of the Energy Dissipation Valve and 200 feet of 10-inch pipeline to connect to the existing Edna Valley Growers Mutual Water Company distribution system. The project would allow for approximately 1,000 AFY of SWP water based on the availability and cost of SWP water, and will offset an equivalent amount of the irrigation demands currently met by groundwater. The SWP water is a treated water supply and may require dechlorination before being used for agricultural purposes.

SWP water for the SLO Basin could be purchased from 1) District subcontractors that receive their SWP water through Lopez and Chorro Valley pipelines, 2) Santa Barbara County Participants or 3) a portion of the District's unsubscribed Table A amount (14,463 AFY). In the first two scenarios the purchaser would hold a sub-agreement with an existing subcontractor and not have a direct relationship with District. The third scenario would require the purchaser to become a new subcontractor to the District. The recent adoption of the Water Management Tools Amendment to the SWP Contracts by the District and the Santa Barbara County Flood Control and Water Conservation District (SBCWCFCD) presents new opportunities for obtaining SWP water supply and delivery capacity to Edna Valley.

9.4.1.1 Project Benefits (§ 354.44.5)

In order to assess this project's benefits to water levels in the aquifer and effect on sustainability of the Basin, a project scenario was simulated using the integrated GSFLOW model developed as part of the GSP efforts. A baseline simulation was performed in which agricultural pumping and climatological conditions for the predictive time period 2021-2045 was defined as a repetition of the time series used for 1995-2020. As a reminder, agricultural pumping in Edna Valley ranged from about 2,700 AFY to 4,200 AFY during this period.

The model was run continuously for the time period from water years 1987 through 2045. Annual agricultural pumping estimates for San Luis Valley and Edna Valley developed during the preparation of the water budget (Chapter 6) were used, and the amounts were distributed among agricultural wells identified from County records. This project simulation assumes that 1,000 AFY of SWP water is available for agriculture to offset irrigation supply currently supplied by groundwater.

For the predictive time period, agricultural pumping was reduced by 1,000 AFY in Edna Valley for the period starting in 2026. (These reductions were not applied to San Luis Valley, because no water level declines have been observed in that area.) This assumes it will take five years to implement the project or combination of projects required to make up the water for the pumping reduction. The 1,000 AFY in-lieu pumping reduction was distributed equally among all identified agricultural wells starting in 2026.

Figure 9-3 displays the baseline and Project Scenario 1 hydrographs for this project for the four Edna Valley wells identified as the RMS for the Chronic Lowering of Groundwater Levels Sustainability Indicator. This figure indicates that the increase in water levels over the baseline scenario in year 2042 at these wells ranges from 5 feet at EV-04 to 31 feet at EV-16. (It should be noted that it is recognized that some model results in the vicinity of RMS EV-04 seem anomalous; the well at this location is relatively insensitive to changes in pumping, and the magnitude of the seasonal and drought water level fluctuations is not fully captured. This was identified in the model documentation as an area where the model may be improved, but in general the model results are instructive. In addition, earlier model runs prior to the final calibration displayed less improvement of water levels at EV-16; some re-distribution of agricultural pumping locations was incorporated in the final calibration run, which had an impact on model results at this RMS.

9.4.1.2 Supply Reliability (§ 354.44.6)

The latest estimates of anticipated SWP availability under future conditions are included in the Department of Water Resources 2019 SWP Delivery Capability Report (DWR, 2019). The 2019 DCR anticipates approximately 58% of the District's and 59% of the SBCFCWCD's Table A and other contract amounts will be available on average under anticipated future conditions. These estimates are based on outputs from the CALSIM-2 Operations model (DWR, 2019). However, the availability of these SWP water supplies will be variable year by year based on hydrologic conditions. The historical delivery of Annual Allocation from the SWP ranges from 5% to 100% of the contracted amount. The anticipated amounts of SWP available to the District on an annual basis from the recent Water Management Tools study (CCWA, 2021) are shown in Figure 9-2. The CALSIM-2 Model projects future SWP supply availability under current operating conditions and constraints over the historic hydrologic period from 1922 to 2003. Carry-over water represents SWP water not used the previous year that is made available for use the following year by a SWP Contractor. Article 21 Water represents water above a Contractor's Table A allocation that could be available in a given year.

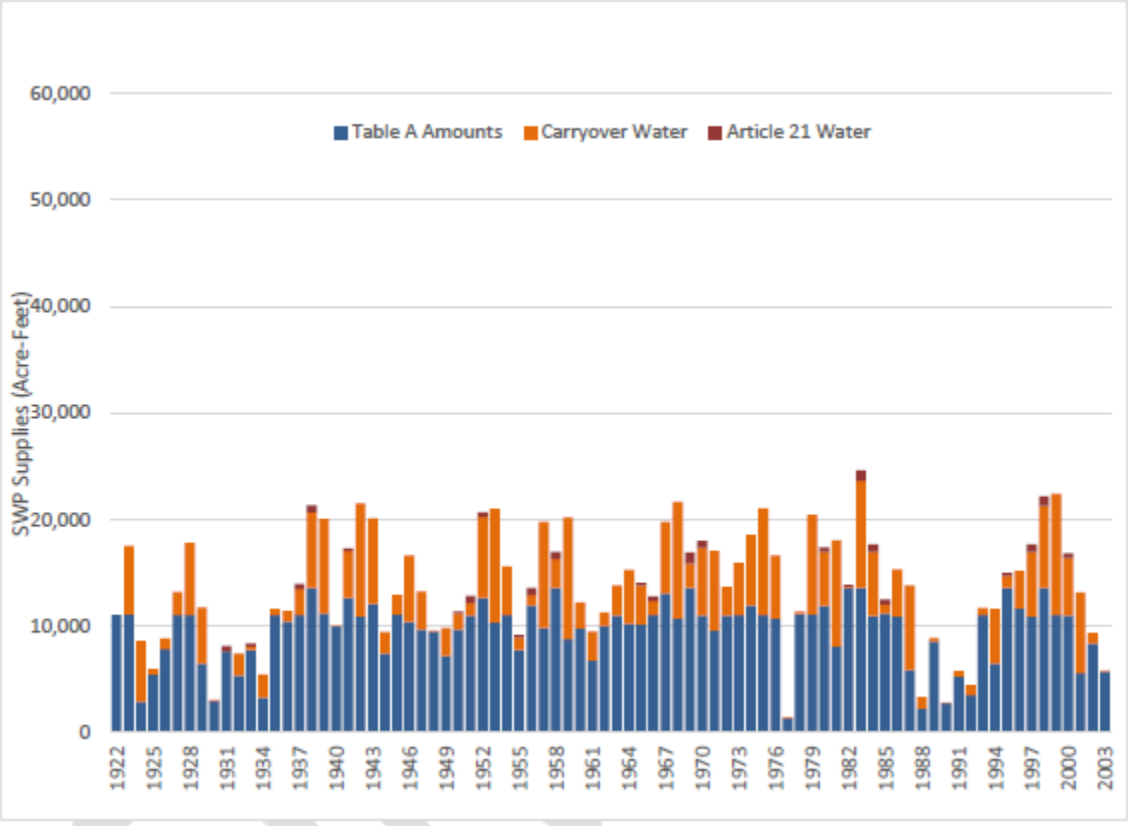


Figure 9-2 Anticipated Future Availability of District SWP Supplies Based on the Historic Hydrologic Period (1922-2003)

Given the variable availability of SWP supplies, a project to deliver 1,000 AFY of SWP water to Edna Valley would likely need to be sized to accommodate greater than 1,000 AFY during wet years to balance out lower delivery amounts during dry years. Alternatively, contracts for the purchase of SWP could be structured to ensure a minimum delivery of 1,000 AFY of SWP water (e.g., purchasing Drought Buffer or more Table A Allocation or supply than delivery capacity) to provide a higher level of reliability for the SWP. However, to incorporate this enhanced reliability would likely increase the costs of the SWP supplies. For the purposes of the initial project level evaluation include in this GSP the capacity to deliver and availability of water were assumed to be a constant 1,000 AFY.

9.4.1.3 Project Costs (§ 354.44.8)

The estimated capital cost to construct a turnout off from the Coastal Branch Pipeline and infrastructure to connect to the existing Edna Valley Growers Mutual Water Company distribution system is approximately $890,000 equating to an annual payment of $63,000 and a unit cost of $60/AF. These costs do not include the cost to purchase SWP or the work required to negotiate a contract with the District or District subcontractors.

9.4.1.4 Project Implementation (§ 354.44.4)

Investigating the use of SWP as a supplemental water source would occur within the first year of implementation. Following the recommendations of the feasibility study, negotiations to acquire SWP from the identified sellers could take up to 5 years. The design and construction of the turnout and pipeline could occur concurrent with the negotiations and occur within 5 years.

9.4.1.5 Basin Uncertainty (§ 354.44.9d)

The benefits from the projects in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the

modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model Calibration TM (Appendix E) identifies uncertainty and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.1.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water, and privileges. The GSAs have the legal authority to conduct a feasibility study into the use of SWP as a supplemental water supply for the SLO Basin. Following the recommendation from the feasibility study the project could be implemented by the GSAs, GSC members or other parties.

9.4.1.7 Permitting and Regulatory Processes (§ 354.44.3)

No permits or regulatory processes would be necessary for development of the feasibility study. However, implementation of this project will likely require a California Environmental Quality Act (CEQA) environmental review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation. A new connection or turnout infrastructure requires coordination and agreements with the District, CCWA, and DWR.

9.4.1.8 Public Notice and Outreach (§ 354.44B)

The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

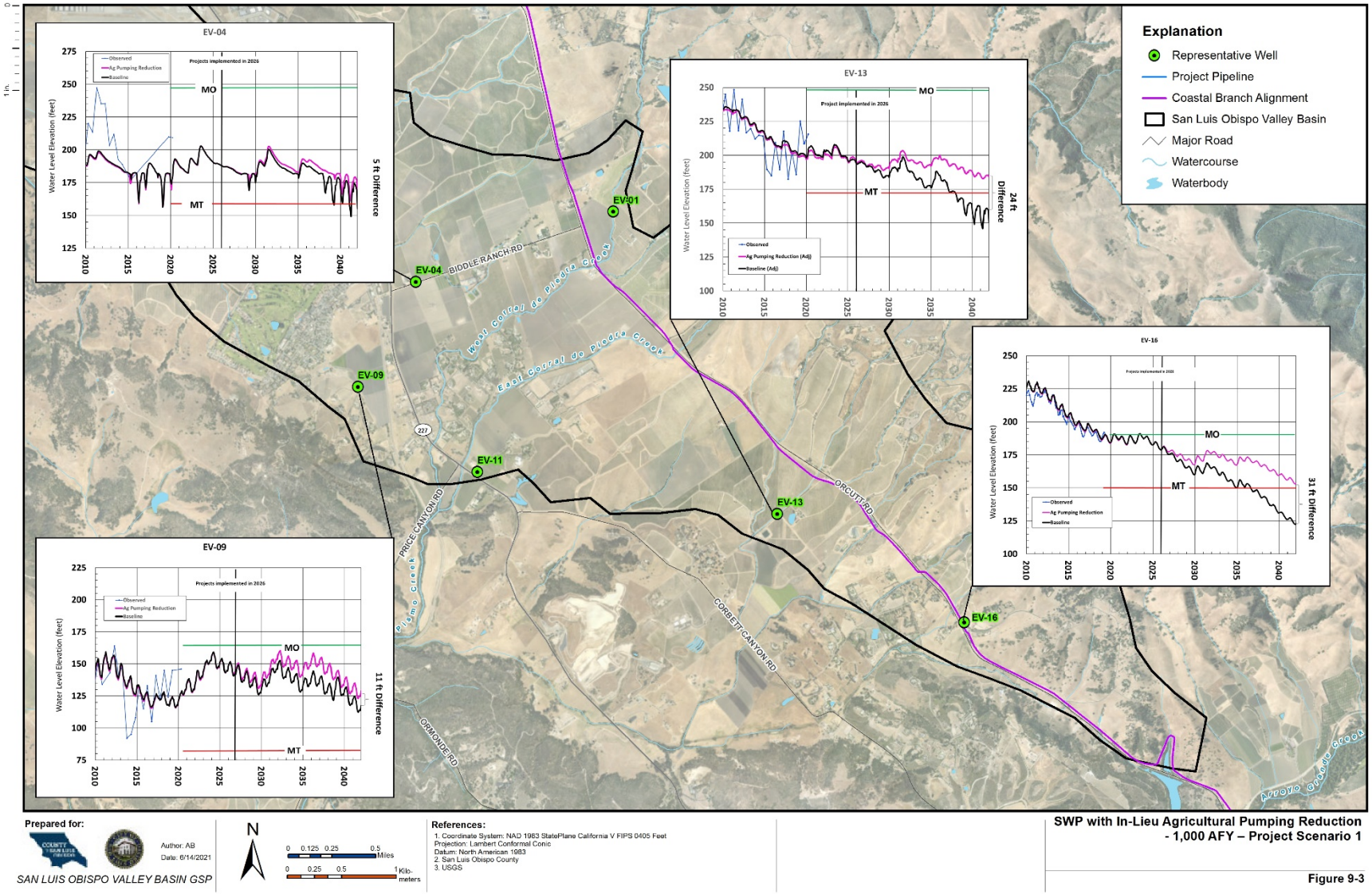


Figure 9-3 SWP with In-Lieu Agricultural Pumping Reduction - 1,000 AFY – Project Scenario 1

9.4.2 City of SLO Recycled Water for Agricultural Irrigation

The City owns and operates a Water Resource Recovery Facility (WRRF) that treats municipal wastewater from the City, California Polytechnic State University, San Luis Obispo (Cal Poly), and the San Luis Obispo County Airport. Tertiary treated and disinfected effluent is either distributed for landscape irrigation and construction uses, or/and dechlorinated and discharged to San Luis Obispo Creek. The WRRF is required to maintain a minimum daily average year-round discharge of 2.5 cubic feet per second (cfs) of treated effluent to San Luis Obispo Creek, which equals approximately 1.6 MGD or 1,800 AFY, for protection of downstream biological resources as required by the National Oceanic Atmospheric Association, National Marine Fisheries Service (NOAA NMFS).

The City of San Luis Obispo has been utilizing recycled water as a component of its multi-source water supply since 2006. The City's goal is to use this water source to the highest and most beneficial use. The City is committed to the expansion of its non-potable recycled water programs and to the development of a potable reuse program to supplement groundwater and/or surface water supplies. The delivery of the City's recycled water to parties within the Edna Valley area has been identified as a potential short-term augmentation project to offset further lowering of groundwater levels within the Edna Valley.

With current in-City recycled water demands and influent, it is anticipated that the City could provide 500-800 acre-feet of recycled water annually with quantities decreasing as new in-City users come online, indoor water conservation is increased as a result of statewide water efficiency mandates, and as the City develops potable reuse projects to supplement its water supplies. In-City groundwater basin augmentation efforts, new regulations, drought, additional in-City customers, and the like could reduce the quantity available to outside users by several hundred acre-feet per year in the foreseeable future.

The project includes the construction of 2,600 feet of 8-inch pipeline, a pumpstation, and a turnout to connect to the existing Edna Valley Growers Mutual Water Company distribution system. The project would allow for approximately 100 AF in the winter months with minimal amounts available during summer months, and will replace some of the irrigation demands currently met by groundwater.

9.4.2.1 Project Benefits (§ 354.44.5)

This project is considered to be one of the various projects that may provide portions of the water supply needed to reduce Edna Valley agricultural pumping by 1,000 AFY. As such, it is considered conceptually to be part of the same model scenario (i.e., Project Scenario 1) as described in Section 9.4.1 State Project Water to Agriculture Irrigation. Because of the uncertainty of the supply, no model runs were dedicated specifically to this project. It is one of the sources that would provide benefits to Basin water levels as described in Section 9.4.1.1.

9.4.2.2 Supply Reliability (§ 354.44.6)

The quantity of recycled water available for use to City customers is dependent on the quantity of untreated wastewater flowing into the City's WRRF. Unlike most cities that experience relatively uniform recycled water availability throughout the year, the City of San Luis Obispo's recycled water availability is drastically impacted by the students from Cal Poly vacating the community during the summer months and thus decreasing the wastewater influent into the WRRF. This decrease in wastewater influent occurs during the summer months when the City's 50+ recycled water accounts increase irrigation to combat the warm, dry conditions. This decrease in availability, coupled with a substantial increase in demand, abnormally limits the recycled water available during the summer months.

Long-Term Versus Short-Term Availability

While there is currently surplus recycled water available year-round, with over 150 acre-feet per month available in some winter and spring months, it is anticipated that the City will not have a significant volume of recycled water supply available to sell to any outside users from June-October once the internal City demands increase to support new residential and commercial developments. Recycled water demands from Avila Ranch, San Luis Ranch, Righetti Ranch, and other future in-City developments are expected to result in increased recycled water demand of roughly 400-500 acre-feet per year with most of this demand occurring during the summer. These developments are currently being constructed with many of the Orcutt Area developments already receiving recycled water deliveries. The City continues to update its recycled delivery projections as any amounts obligated for delivery beyond availability would need to be made up by use of City potable water supplies. This concern will continue to increase as both in-City and Cal Poly users continue to improve in their indoor water use efficiency.

As the City continues to develop its groundwater pumping program, it has been identified that there is significant recharge potential (upwards of 400 acre-feet per year) within the City's portion of the SLO Valley Groundwater Basin adjacent to the WRRF. Recharge projects in other areas of the City have not yet been studied but are anticipated to increase the amount of water that could be recharged within the Basin. As the City resumes its groundwater pumping, additional capacity will likely be created within the Basin, increasing the City's need for recycled water for recharge projects that may ultimately be used for a potable reuse project. As surface water supplies are adversely impacted by climate change, augmentation of the Basin will be the City's major water supply expansion strategy and will limit water availability for outside-City interests as augmentation projects come online. Potable reuse through storage in the Basin may also address the issues with seasonal availability by creating a prolonged time lag between highly treated wastewater injection/percolation and its withdrawal for use.

Physical Delivery Constraints

The City's recycled water storage and distribution system was designed to provide intermittent in-City deliveries within the southern half of the City. The City's storage tank, pumps, telemetry, and pipelines were not designed to provide recycled water to outside-City customers and may require upgrades in order to accommodate continuous 24/7 delivery. Additionally, the two potential pipeline alignments that could be utilized to deliver water to the Edna Valley area are undersized and limit the ability to deliver recycled water during the winter and spring months when it is most abundantly available. One pipeline located along Broad Street near the Airport is 6-inch diameter C900 pipe. The other, located along Tank Farm Road, is 8-inch diameter ductile iron pipe. It is estimated that the larger of the two pipelines could deliver approximately 100 acre-feet of recycled water per month if operated 24-hours per day for a full month. This undersized pipelines constrain the amount of water that could be delivered to outside City customers during the winter and spring months when it is available in its highest quantities.

9.4.2.3 Project Costs (§ 354.44.8)

The estimated capital cost to connect the City's recycled water distribution to the existing Edna Valley Growers Mutual Water Company distribution system is approximately $1,004,000 equating to an annual payment of $153,000 and a unit cost of $260/AF. These costs do not include the cost of the water that will be purchased from the City. The City's recycled water is approved to be sold within City limits for approximately $4,000/AF.

9.4.2.4 Project Implementation (§ 354.44.4)

The circumstance for implementation of this project is driven by the Basin overdraft conditions in the Edna Valley. The City and representatives from the Edna Valley have been discussing the feasibility of the project during the development of this GSP. It is estimated that the design and construction of the pipeline could occur within 1 to 3 years of the GSP Implementation.

9.4.2.5 Basin Uncertainty (§ 354.44.9d)

The addition of recycled water as a supplemental water supply source would help address the uncertainty of the estimated overdraft described in Chapter 6 - Water Budget in the Edna Valley portion of the Basin. The benefits from the project in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model Calibration TM (Appendix E) identifies the uncertainties and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.2.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. The GSAs have the legal authority to conduct a feasibility study into the use of SWP as a supplemental water supply for the SLO Basin. Following the recommendation from the feasibility study the project could be implemented by the GSAs, GSC members or other parties. The City owns its recycled water and has the legal authority to sell its recycled water.

9.4.2.7 Permitting and Regulatory Processes (§ 354.44.3)

This project would require review and approval by the SLO City Council. The project may require a CEQA environmental review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation.

Delivery of recycled water to the Edna Valley may require analysis to confirm that the large-scale, ongoing application of recycled water does not result in recycled water recharging the groundwater basin and thus constituting a potable reuse project. Direct application of recycled water at agronomic rates is allowable under the City's existing recycled water delivery permit.

While the City has policy language that allows for the sale of recycled water outside of City limits. Specific findings must be made for this to be permitted. Examples of these findings include requirements for receiving properties to record a conservation, open space, Williamson Act, or other easement instrument to maintain the area being served in agriculture and open space, assurance that recycled water will not be used to increase development potential of the property being served, and that recycled water will not be further treated to make it potable. Contract negotiations related to the sale price of recycled water, term of delivery, etc. would require approval of the San Luis Obispo City Council.

9.4.2.8 Public Notice and Outreach (§ 354.44B)

The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

9.4.3 State Water Project Recharge Basin

To enhance recharge in the Edna Valley, a groundwater recharge basin could be constructed to percolate SWP water. A groundwater recharge basin is a bermed basin structure designed for the purpose of efficiently allowing water collected in the basin to infiltrate through the ground surface, percolate through the vadose zone, and ultimately recharge the underlying aquifer. The concept of this project is to construct a recharge basin in the Edna Valley and supply it with water obtained from the SWP to recharge the aquifer.

The conceptual location selected for this project is near the southeast corner of Biddle Ranch Road and State Highway 227 (aka, Edna Road, Figure 9-4). This area is classified as having high recharge potential in the Stillwater Percolation zone Study discussed in Chapter 4. This land is currently utilized for agriculture, and it is assumed that a parcel of land adequate to build the recharge basin could be purchased. Water would be conveyed via a 6,000 foot 6-inch pipeline from the SWP pipeline, along Biddle Ranch Rd, to a newly constructed recharge basin on approximately 5 acres of land along Orcutt Road.

9.4.3.1 Project Benefits (§ 354.44.5)

In order to assess this project's benefits to the aquifer and effect on sustainability of the Basin in terms of expected water levels, Project Scenario 2 was simulated using the integrated GSFLOW model developed as part of the GSP effort. The project was defined to represent 500 AFY of supplemental water provided from the SWP made available to a newly constructed recharge basin to be located in Edna Valley. Benefits of recharge basins versus direct delivery to offset pumping include the potential to deliver water during seasonal periods when there is less demand for SWP water supplies and capacity in the SWP conveyance systems.

A baseline simulation was performed as previously described. The recharge basin is assumed to be less than 500 feet by 500 feet in area, and is simulated in a single cell in the model. Recharge is input as a flux in MODFLOW (feet/day), so a flux rate equivalent to 500 AFY percolating into a 500 ft by 500 ft cell was input into model cell on a constant basis. The project was defined as beginning in 2026, allowing five years for project design and implementation.

Figure 9-4 displays the baseline and Project Scenario 2 hydrographs for this project for the four Edna Valley wells identified as RMS for the Chronic Lowering of Groundwater Levels Sustainability Indicator. This figure indicates that the increase in water levels over the baseline scenario in year 2042 at these wells ranges from 2 feet at EV-16 to 52 feet at EV-04, which is the closest RMS to the recharge basin location. The water level increase in the SWP recharge basin scenario over baseline was 21 feet at EV-09, and 4 feet at EV-13

9.4.3.2 Supply Reliability (§ 354.44.6)

The supply reliability of the SWP is discussed in detail in Section 9.4.1.2 and is applicable to this project. This project assumes a total of 500 AFY would be purchased and recharged in the Edna Valley. If both the SWP for Agricultural Irrigation and the SWP Recharge Basin projects were to be implemented the total capacity of SWP would be 1,500 AFY and contracts would need to be negotiated accordingly.

9.4.3.3 Project Costs (§ 354.44.8)

The estimated capital cost to construct a turnout off from the Coastal Branch Pipeline and infrastructure to connect to a newly constructed recharge basin is approximately $3,624,000 which equates to annual payment of $337,000 and a unit cost of $670/AF. If multiple SWP groundwater recharge projects are implemented, the cost of the turnout and other infrastructure can be shared. These costs do not include the cost to purchase SWP or the work required to negotiate a contract with the District or District subcontractors.

9.4.3.4 Project Implementation (§ 354.44.4)

The circumstance for implementation of this project is driven by the overdraft conditions in the Edna Valley. The feasibility study evaluation of the use of the SWP as a supplemental water source to recharge groundwater within the Edna Valley could occur within the first year of implementation. Following the recommendations of the feasibility study, negotiations to acquire SWP from the identified sellers could take up to 5 years. The design and construction of the turnout and pipeline could occur concurrent with the negotiations and be completed within 5 years.

9.4.3.5 Basin Uncertainty (§ 354.44.9d)

The addition of SWP as a supplemental water supply source would help address the uncertainty of the estimated overdraft described in Chapter 6 - Water Budget in the Edna Valley portion of the Basin. The benefits from the projects in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model Calibration TM (Appendix E) identifies uncertainty and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.3.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water, and privileges. The GSAs have the legal authority to conduct a feasibility study into the recharge of SWP as a supplemental water supply for the SLO Basin. Following the recommendation from the feasibility study the project could be implemented by the GSAs, GSC members or other parties.

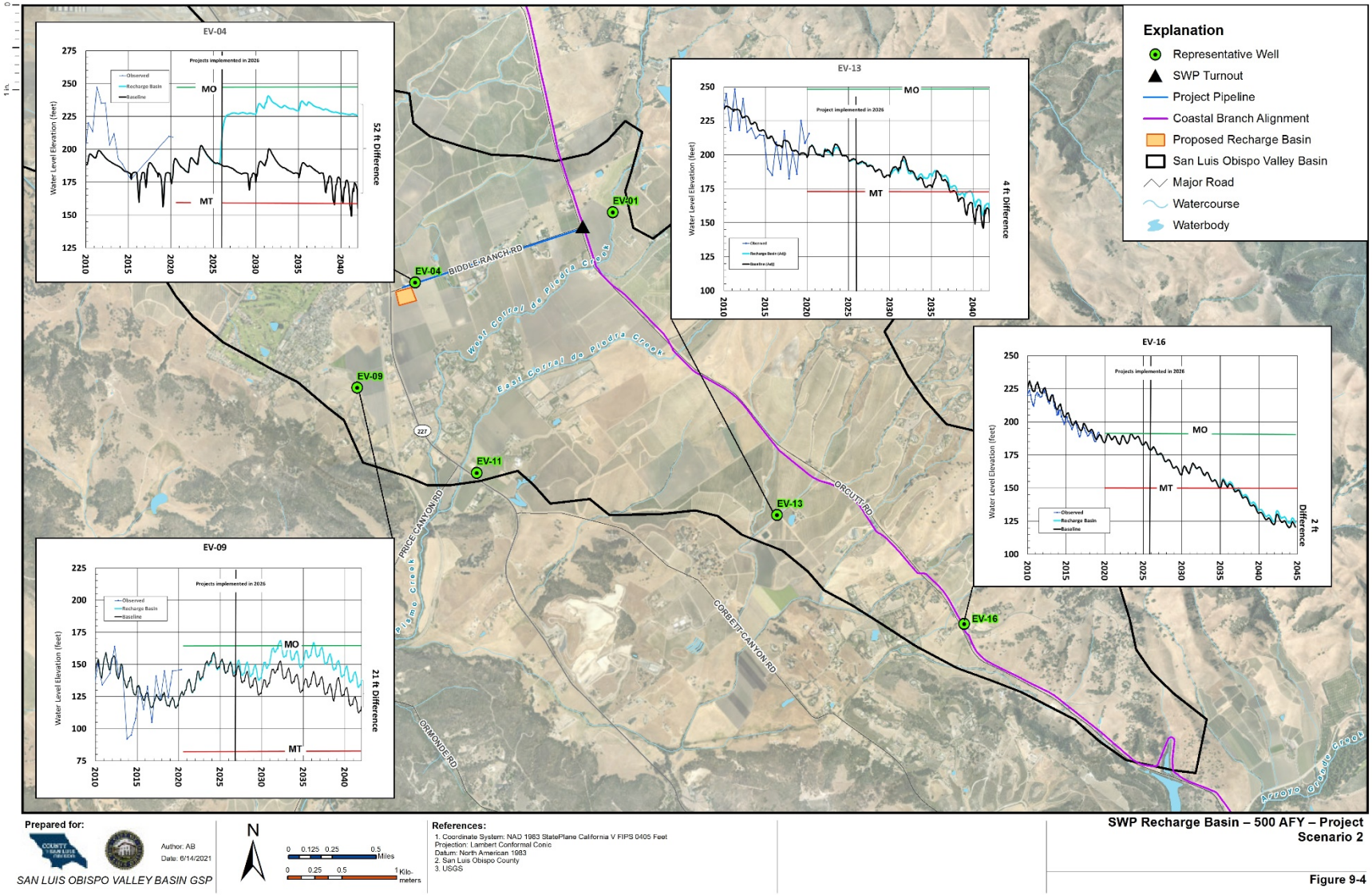


Figure 9-4. SWP Recharge Basin – 500 AFY – Project Scenario 2

9.4.3.7 Permitting and Regulatory Processes (§ 354.44.3)

No permits or regulatory processes would be necessary for development of the feasibility study. However, implementation of this project will likely require a CEQA environmental review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation.
A new connection or turnout infrastructure requires coordination and agreements with the District, CCWA, and DWR.

9.4.3.8 Public Notice and Outreach (§ 354.44B)

The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

9.4.4 State Water Project to Golden State Water Company

Golden State Water Company (GSWC) currently provides water to a small service area of County administered land in the central part of the Basin, near the boundary of Edna Valley and San Luis Valley. GSWC obtains its supply from groundwater wells within their service area. The recent drought resulted in significant constraints on GSWC's groundwater supplies. Because their service area is relatively small, their ability to site new wells to expand their source locations is limited. For this reason, the conceptual project of obtaining SWP water to augment GSWC's current supplies is evaluated.

This project assumes a SWP delivery of 200 AFY to GSWC, representing about 50% of it's long term demand. To implement this project, a turnout to the SWP pipeline along Orcutt Road will be required. From the corner of Orcutt Road and Biddle Ranch Road, approximately 8,000 feet of pipeline along Biddle Ranch Road will be required to convey the water from the SWP pipeline to the edge of the GSWC service area. Infrastructure improvements internal to GSWC's system are not included in this project evaluation.

9.4.4.1 Project Benefits (§ 354.44.5)

In order to assess this project's benefits to the aquifer and effect on sustainability of the Basin in terms of expected water levels, Project Scenario 3 was simulated using the integrated GSFLOW model developed as part of the GSP effort. This project assumes a 200 AFY reduction in pumping by GSWC. Edna Ranch MWC and Varian Ranch MWC pumping was also reduced, but these water companies are distant enough that results from one are not expected to have a significant impact on the other. As with the scenarios for agricultural pumping reduction, the water to offset this pumping reduction may come from this project or another source; in this case, additional water for GSWC may come from the SWP or/and City of SLO water (Section 9.4.5).

Modeled pumping for GSWC was reduced by 50% from recent annual pumping volumes at their operating wells. It is assumed that the remaining demand for GSWC's service area would be met through supplemental water from the SWP.

Figure 9-5 displays the baseline and project scenario hydrographs for this project for the four Edna Valley wells identified as RMS for the Chronic Lowering of Groundwater Levels Sustainability Indicator (EV-04, EV-09, EV-13, and EV-16). This figure indicates that the increase in water levels over the baseline scenario in year 2042 at these wells ranges from 3 feet at EV-13 to 15 feet at EV-09, which is a GSWC well.

9.4.4.2 Supply Reliability (§ 354.44.6)

The supply reliability of the SWP is discussed in detail in Section 9.4.1.2 and is applicable to this project. This project assumes a total of 200 AFY would be purchased and delivered to GSWC.

9.4.4.3 Project Costs (§ 354.44.8)

The estimated capital cost to construct a turnout off from the Coastal Branch Pipeline, infrastructure to connect to the GSWC is approximately $2,685,000 which equates to annual payment of $192,000 and a unit cost of $960/AF. If multiple projects which require SWP water are implemented, the cost of the turnout and other infrastructure can be shared. These costs do not include the cost to purchase SWP or the work required to negotiate a contract with the District or District subcontractors.

9.4.4.4 Project Implementation (§ 354.44.4)

The circumstance for implementation of this project is driven by the overdraft conditions in the Edna Valley The feasibility study into the use of the SWP as a supplemental water source to GSWC would occur within the first year of implementation. Following the recommendations of the feasibility study, negotiations to acquire SWP from the identified sellers could take up to 5 years. The design and construction of the turnout and pipeline could occur concurrent with the negotiations and occur within 5 years.

9.4.4.5 Basin Uncertainty (§ 354.44.9d)

The addition of SWP as a supplemental water supply source to GSWC would help address the uncertainty of the estimated overdraft described in Chapter 6 - Water Budget in the Edna Valley portion of the Basin. The benefits from the projects in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model Calibration TM (Appendix E) identifies uncertainty and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.4.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. The GSAs have the legal authority to conduct a feasibility study into the obtaining SWP as a supplemental water supply for the SLO Basin. Following the recommendation from the feasibility study the project could be implemented by the GSAs, GSC members or other parties.

9.4.4.7 Permitting and Regulatory Processes (§ 354.44.3)

No permits or regulatory processes would be necessary for development of the feasibility study. However, implementation of this project will likely require a CEQA environmental review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation.

A new connection or turnout infrastructure requires coordination and agreements with the District, CCWA, and DWR.

9.4.4.8 Public Notice and Outreach (§ 354.44B)

The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

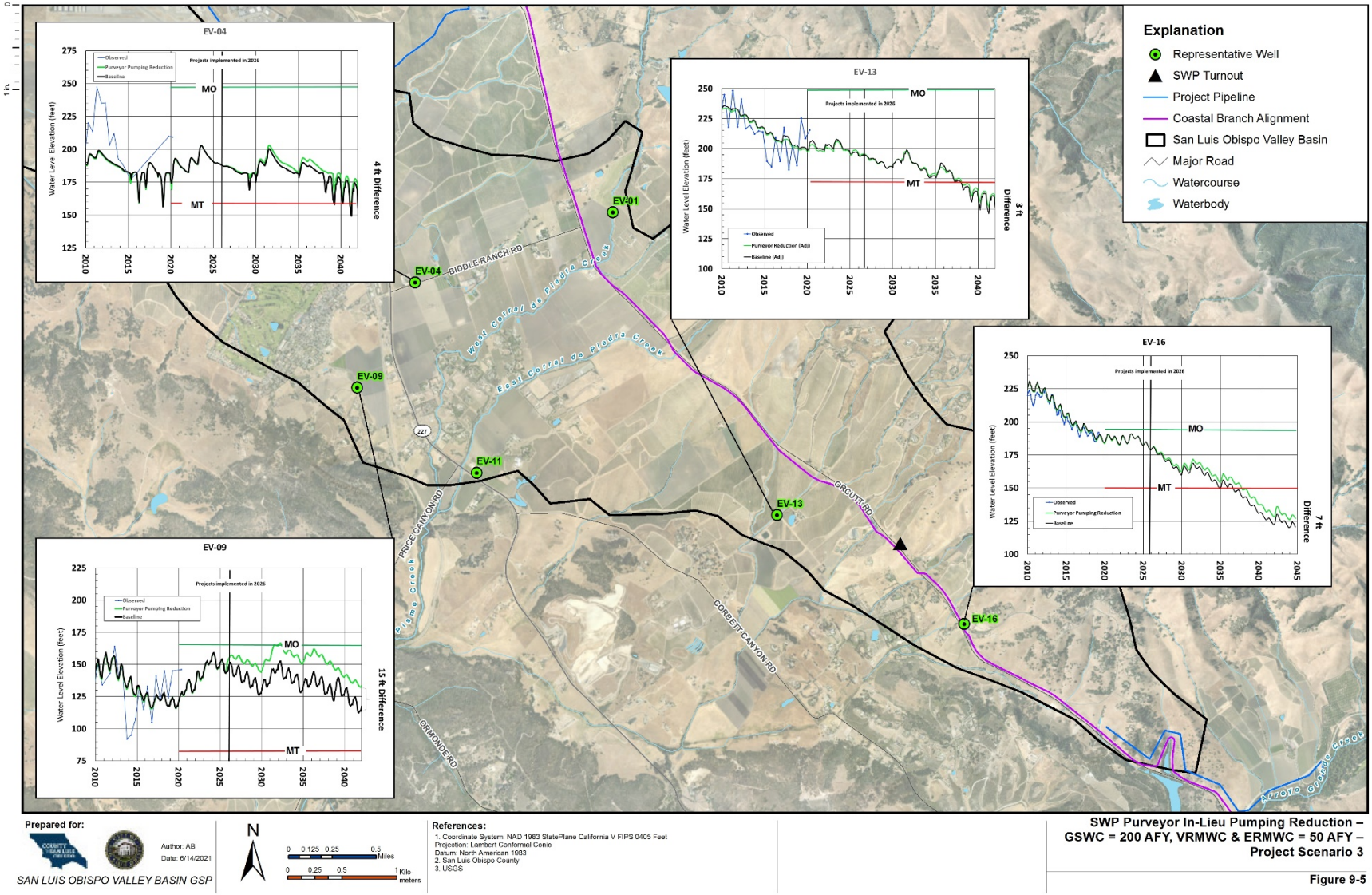


Figure 9-5 SWP Purveyor In-Lieu Pumping Reduction – GSWC = 200 AFY, VRMWC & ERMWC = 50 AFY – Project Scenario 3

9.4.5 City of SLO Potable Water to Golden State Water Company

The concept of this project is that GSWC would purchase treated drinking water from the City of SLO on an interruptible basis to augment their current supply from wells within their service area. This project would require construction of approximately 4,850 feet of 6-inch pipeline and a pump station to connect the City's existing potable water pipelines along Buckley Road to GSWC's service area. The City of San Luis Obispo has longstanding policy that only allows for non-potable and recycled water to be sold outside of City limits. Policy does not exist to support the sale of potable water outside of City limits. Analysis of this project is included in the GSP so that some basic analysis of cost and feasibility is documented in the event that there was a change in the City's policy regarding the sale of potable water supplies.

9.4.5.1 Project Benefits (§ 354.44.5)

This project is considered to be one of the various projects that may provide supply to reduce pumping by the water purveyors in Edna Valley. As such it is considered conceptually similar to the same model scenario as described in 9.4.4, State Project Water to GSWC.

Modeled pumping for GSWC was reduced by 50% from recent annual pumping volumes at their operating wells. It is assumed that the remaining demand for GSWC's service area would to be met through supplemental water from the City of SLO.

Figure 9-5 displays the baseline and project scenario hydrographs for this project for the four Edna Valley wells identified as RMS for the Chronic Lowering of Groundwater Levels Sustainability Indicator (EV-04, EV-09, EV-13, and EV-16). This figure indicates that the increase in water levels over the baseline scenario in year 2042 at these wells ranges from 3 feet at EV-13 to 15 feet at EV-09, which is a GSWC well. The water level increase over baseline was 4 feet at EV-04, and 7 feet at EV-16 (a MWC well).

9.4.5.2 Supply Reliability (§ 354.44.6)

The City of San Luis Obispo's potable water supplies have proven to be reliable in meeting the City's water needs and are projected to safely meet the City's General Plan buildout needs. Analysis of the ability for the City's supplies to continually deliver up to 200 AFY to GSWC, have not been examined and cannot be confirmed.

9.4.5.3 Project Costs (§ 354.44.8)

The estimated capital cost to construct a connection from the City of SLO to GSWC is approximately $1,739,000 which equates to annual payment of $127,000 and a unit cost of $640/AF. Because existing policy does not allow for the sale of potable water outside of City limits, the City does not have standard rates adopted for sales to new outside-City customers. However, the City does have a few outside-City accounts that are served water as part of long-standing agreements dating back to the early 1900s. These properties pay twice the City's in-City water rates for potable water, which equal approximately $8,200/AF.

The delivery of potable water to GSWC could require upgrades to City's water distribution system (pipelines, storage tanks, pump stations, etc.) in order to safely and effectively deliver potable water to GSWC's service area. Costs for all required infrastructure upgrades would be paid in full by GSWC and are not included in the construction costs referenced above. Additionally, connection to the City's potable water system may require the payment of capacity and connection fees, also commonly known as impact fees, depending on the details of the water sales agreement. These fees have not been included in the construction costs referenced above.

9.4.5.4 Project Implementation (§ 354.44.4)

The circumstance for implementation of this project is driven by the overdraft conditions in the Edna Valley specifically in and around the GSWC service area. As the City's current policies effectively prohibit the sale

of potable water outside of City limits, a timeline for the policy changes required for the sale of potable water supplies is unknown. Distribution system infrastructure upgrades that could be triggered by the sale of potable water outside of City limits could take 5 years or longer to construct, depending on the magnitude of required improvements.

9.4.5.5 Basin Uncertainty (§ 354.44.9d)

The addition of the City of SLO potable water as a supplemental water supply source to GSWC would help address the uncertainty of the estimated overdraft described in Chapter 6 - Water Budget in the Edna Valley portion of the Basin. The benefits from the projects in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model Calibration TM (Appendix E) identifies uncertainty and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.5.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. The GSAs have the legal authority to conduct a feasibility study into the delivering the City of SLO potable water as a supplemental water supply for the Edna Valley portion of the SLO Basin.

9.4.5.7 Permitting and Regulatory Processes (§ 354.44.3)

This project may require a CEQA environmental review process, and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation. This project would require amendments to the City's General Plan to allow for the sale of potable water outside of City limits, even on a short term or interruptible basis, and would require Local Agency Formation Commission (LAFCO) review and approval.

9.4.5.8 Public Notice and Outreach (§ 354.44B)

The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

9.4.6 Varian Ranch Mutual Water Company Arroyo Grande Subbasin Wells

The Varian Ranch MWC (VRMWC) is located in the southeastern extent of the Basin and currently supplies its service area from wells within the Basin. However, its service area extends into the neighboring Arroyo Grande Subbasin of the Santa Maria River Valley Groundwater Basin (SMRVGB). Twenty-two of their fifty-one parcels are located outside of the Basin in the adjacent Arroyo Grande Creek watershed. VRMWC owns an existing well, located on its property in the Arroyo Grande Subbasin that has been tested and found to be suitable for use as a domestic supply source for its service area.

The concept of this project is to build a conveyance pipeline to deliver approximately 50 AFY of water from the well that VRMWC owns in the Arroyo Grande Subbasin to an interconnection point within its current distribution system in the Basin. The project would also evaluate a connection with the adjacent Edna Ranch MWC (ERMWC). It is estimated that this pipeline will be 6 inches in diameter and approximately 10,850 feet long. The project also includes well pump and well site improvements. Utilization of this well to supply a portion of VRMWC and ERMWC's demand would reduce the pumping required of their wells in the Basin, and would benefit water levels in the area.

9.4.6.1 Project Benefits (§ 354.44.5)

This project is considered to be one of the various projects that may provide supply to reduce pumping by the small water purveyors in Edna Valley. As such it is considered conceptually to be part of the same scenario as described in Section 9.4.4, SWP to GSWC. Because of the uncertainty of the supply, no model runs were dedicated specifically to this project.

Modeled pumping for both ERMWC and VRMWC wells in the Edna Valley were reduced by 50 AFY and is offset by groundwater pumped from the Arroyo Grande Subbasin.

Figure 9-5 displays the baseline and project scenario hydrographs for this project for the four Edna Valley wells identified as RMS for the Chronic Lowering of Groundwater Levels Sustainability Indicator (EV-04, EV-09, EV-13, and EV-16). This figure indicates that the increase in water levels over the baseline scenario in year 2042 is about 7 feet at EV-16 (a MWC well).

9.4.6.2 Supply Reliability (§ 354.44.6)

The water source for this project is groundwater from the Arroyo Grande Subbasin. The County and City of Arroyo Grande are currently developing a GSP for the Arroyo Grande Subbasin and will be developing a detailed water budget which will provide information regarding the reliability of the groundwater source.

9.4.6.3 Project Costs (§ 354.44.8)

The estimated capital cost to convey groundwater from the Arroyo Grande Subbasin to the Varian Ranch distribution system is approximately $2,701,000 equating to an annual payment of $176,000 and a unit cost of $4,200/AF. These costs do not include any costs to purchase the water since the VRMWC currently owns the well.

9.4.6.4 Project Implementation (§ 354.44.4)

The circumstance for implementation of this project is driven by the overdraft conditions in the southeastern portion of Edna Valley. The feasibility study into the use of VRWMC wells in Arroyo Grande Subbasin as a supplemental water source to both VRMWC and ERMWC would occur within the first year of implementation. Following the recommendations of the feasibility study the design and construction of the turnout and pipeline could occur concurrent with the negotiations and occur within 3 years.

9.4.6.5 Basin Uncertainty (§ 354.44.9d)

The addition of the Arroyo Grande Varian Ranch MWC wells as a supplemental water supply source to VRMWC and Edna Ranch MWC would help address the uncertainty of the estimated overdraft described in Chapter 6 - Water Budget in the Edna Valley portion of the Basin. The benefits from the projects in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model Calibration TM (Appendix E) identifies uncertainty and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.6.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. The GSAs have the legal authority to conduct a feasibility study into the utilizing the Arroyo Grande Subbasin as a supplemental water supply for the southeastern portion of Edna Valley.

San Luis Obispo County Code Chapter 8.95 currently requires that a permit be obtained for any export of groundwater greater than 0.5 AFY from a Bulletin 118 defined groundwater basin within the County. The ordinance requires that the export permit only be approved if the Director of Public Works finds that the

proposed export will not cause or contribute to significant detrimental impacts to groundwater resources, including such impacts to health, safety and welfare of overlying property owners.

9.4.6.7 Permitting and Regulatory Processes (§ 354.44.3)
This project may require a CEQA environmental review process, and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation.

9.4.6.8 Public Notice and Outreach (§ 354.44B)
The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

9.4.7 State Water Project to the Mutual Water Companies
The VRMWC and ERMWC located in the southeastern extent of the Basin, currently provides water supply to their service areas from wells within the Basin. The recent drought resulted in significant constraints on their supplies.

To implement this project, a turnout to the SWP pipeline along Orcutt Road will be required. From the corner of Orcutt Road and Biddle Ranch Road, approximately 8,000 feet of pipeline along Biddle Ranch Road will be required to convey the water from the SWP pipeline to the edge of the ERMWC service area. Infrastructure internal to ERMWC and VRMWC's system is not included in this project evaluation.

9.4.7.1 Project Benefits (§ 354.44.5)
This project is considered to be one of the various projects that may provide water supply to reduce pumping by the water purveyors in Edna Valley. As such it is considered conceptually to be part of the same scenario as described in 9.4.4, SWP to GSWC. Because of the uncertainty of the supply, no model runs were dedicated specifically to this project. It is one of the sources that would provide the benefits to Basin water levels described in Section 9.4.4.

9.4.7.2 Supply Reliability (§ 354.44.6)
The supply reliability of the SWP is discussed in detail in Section 9.4.1.2 and is applicable to this project. This project assumes a total of 50 AFY would be purchased and served to ERMWC and VRMWC.

9.4.7.3 Project Costs (§ 354.44.8)
The estimated capital cost to construct a turnout off from the Coastal Branch Pipeline, infrastructure to connect to the ERMWC and VRMWC is approximately $835,000 which equates to annual payment of $59,000 and a unit cost of $1,180/AF. If multiple projects which require SWP water are implemented, the cost of the turnout and other infrastructure can be shared. These costs do not include the cost to purchase SWP or the work required to negotiate a contract with the District or District subcontractors.

9.4.7.4 Project Implementation (§ 354.44.4)
The circumstance for implementation of this project is driven by the overdraft conditions in the Edna Valley The feasibility study into the use of the SWP as a supplemental water source to ERMWC and VRMWC would occur within the first year of implementation. Following the recommendations of the feasibility study, negotiations to acquire SWP from the identified sellers could take up to 5 years. The design and construction of the turnout and pipeline could occur concurrent with the negotiations and occur within 5 years.

9.4.7.5 Basin Uncertainty (§ 354.44.9d)

The addition of SWP as a supplemental water supply source to ERMWC and VRMWC would help address the uncertainty of the estimated overdraft described in Chapter 6 - Water Budget in the Edna Valley portion of the Basin. The benefits from the projects in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model Calibration TM (Appendix E) identifies uncertainty and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.7.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. The GSAs have the legal authority to conduct a feasibility study into the obtaining SWP as a supplemental water supply for the SLO Basin. Following the recommendation from the feasibility study the project could be implemented by the GSAs, GSC members or other parties.

9.4.7.7 Permitting and Regulatory Processes (§ 354.44.3)

No permits or regulatory processes would be necessary for development of the feasibility study. However, implementation of this project will likely require a CEQA environmental review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation.
A new connection or turnout infrastructure requires coordination and agreements with the District, CCWA, and DWR.

9.4.7.8 Public Notice and Outreach (§ 354.44.B)

The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

9.4.8 **Price Canyon Discharge Relocation**

Sentinel Peak Resources LLC (Sentinel Peak) is an energy company that operates a well field that extracts petroleum hydrocarbons from an area approximately 1-2 miles southwest of Edna Valley in Price Canyon. Sentinel Peak owns and operates a water reclamation facility that treats water to (CSLRCD, 2014) tertiary standards and has an NPDES permit to discharge into Pismo Creek about 1 mile southwest of Highway 227 near Price Canyon Road. The discharge permit is primarily provided for increased flow in Pismo Creek and wildlife propagation with a secondary benefit to agriculture.

The proposed project would change the current point of discharge by about 3.5 miles to the upper portion of West Corral de Piedras Creek in the Edna Valley. The new discharge point would be approximately 1 mile east of Orcutt Road. The project would provide increased benefit to fisheries from increased streamflow, and also benefit Edna Valley agriculture by increasing streamflow percolation to the underlying aquifers. For the purpose of this analysis, it is assumed that 500 AFY of water will be available to deliver to the new discharge location, resulting in approximately 350 acre-feet of recharge to the Basin.

It is anticipated that a 6-inch diameter 17,760 foot long PVC pipeline would convey the water to the new discharge point. A booster pump would move the water through this pipeline to the new discharge location. The pipeline would cross approximately 6 agricultural properties, whose owners have already expressed their willingness to participate in the project, 4 creek crossings and 1 railroad crossing.

9.4.8.1 Project Benefits (§ 354.44.5)

In order to assess this project's benefits to the aquifer and effects on the sustainability of the Basin, Project Scenario 4 was simulated using the integrated GSFLOW model developed as part of the GSP efforts.

This project assumes a transfer of the 500 AFY of tertiary treated water that is currently discharged from Sentinel Peak's treatment plant to Pismo Creek downstream of the Basin to a new discharge point on West Corral de Piedra Creek near the northern edge of the Basin. Therefore, 500 AFY (0.7 cubic feet per second) was added as inflow to the MODFLOW Stream Flow Routing package in the first model cell representing West Corral de Piedras Creek that is in the Basin. It should be noted that adding this inflow to the stream segment is not equivalent to adding recharge directly to the aquifer. The additional streamflow from the project discharge will be routed downstream in the model, and will ultimately result in an increased amount of streamflow percolation to the aquifer. However, this amount of additional streamflow percolation, which would be additional recharge to the aquifer that will benefit the groundwater users in the Basin, is not directly defined by the model user. It is calculated by the model based on the parameters defined in the SFR package. Evaluation of the model water budget results from the baseline and project scenarios indicates that an average of approximately 350 AFY of the 500 AFY project stream inflow associated with this project ultimately percolates to the aquifer to increase storage in the Basin.

Figure 9-6 displays the baseline and project scenario hydrographs for this project for the four Edna Valley wells identified as RMS for the Chronic Lowering of Groundwater Levels Sustainability Indicator (EV-04, EV-09, EV-13, and EV-16). This figure indicates that the increase in water levels over the baseline scenario in year 2042 at these wells ranges from 6 feet at EV-16 and EV-13, to 8 feet at EV-04 and EV-09. Inspection of comparative water levels along West Corral de Piedras Creek indicate a water level increase of over 30 vertical feet along the creek itself.

9.4.8.2 Supply Reliability (§ 354.44.6)

The supply reliability of the Price Canyon discharge is tied to the operations related to the extraction of petroleum hydrocarbons from the Price Canyon and the associated permits. The long-term availability of this water source is uncertain.

9.4.8.3 Project Costs (§ 354.44.8)

The estimated capital cost to relocate the discharge point approximately 3.5 miles to West Corral de Piedras Creek is $4,909,000 equating to an annual payment of $375,000 and a unit cost of $750/AF. These costs do not include the cost of the water that will be purchased from Sentinel Peak.

9.4.8.4 Project Implementation (§ 354.44.4)

The circumstance for implementation of this project is driven by the overdraft conditions in the Edna Valley A mitigated negative declaration/initial study was performed in July 2014 by the Coastal San Luis Resource Conservation District as the lead agency. The feasibility study into the relocation of the Price Canyon discharge point would occur within the first year of implementation. Negotiations between Sentinel Peak and representatives from the Edna Valley Growers MWC have been ongoing throughout the development of this GSP. The design and construction of the turnout and pipeline could occur concurrent with the negotiations and occur within 3 years.

9.4.8.5 Basin Uncertainty (§ 354.44.9d)

The increased recharge to the Edna Valley as the result of the relocation of the Price Canyon discharge point would help address the uncertainty of the estimated overdraft described in Chapter 6 - Water Budget in the Edna Valley portion of the Basin. The benefits from the projects in terms of improved water levels in the Basin are evaluated using the integrated GSFLOW model. It should be understood that there is uncertainty that is inherent in the modeling process, including uncertainty with respect to parameters describing the subsurface environment, historical volumes of pumping, etc. The Integrated Model

Calibration TM (Appendix E) identifies uncertainty and the need for additional data collection in the conceptual model, model parameters, and calibration.

9.4.8.6 Legal Authority (§ 354.44.7)

California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges.

9.4.8.7 Permitting and Regulatory Processes (§ 354.44.3)

This project may require a CEQA environmental review process and an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require NEPA documentation.

In addition, permits from the following government organizations that may be required to relocate the Price Canyon Discharge Point include:

- United States Army Corps of Engineers (USACE) – A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- California Department of Fish and Wildlife (CDFW) – A Standard Agreement is required if the project could impact a species of concern.
- Environmental Protection Agency (EPA) Region 9 – National Environmental Policy Act (NEPA) documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.
- National Marine Fisheries Service (NMFS) – A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- California Department of Transportation (Caltrans) – An Encroachment Permit is required if any state highway will be obstructed

9.4.8.8 Public Notice and Outreach (§ 354.44.B)

The public notice and outreach associated with this project would occur through GSA, GSC and/or future governance structure public meetings. If CEQA is required, the project will follow the public noticing requirements required by CEQA.

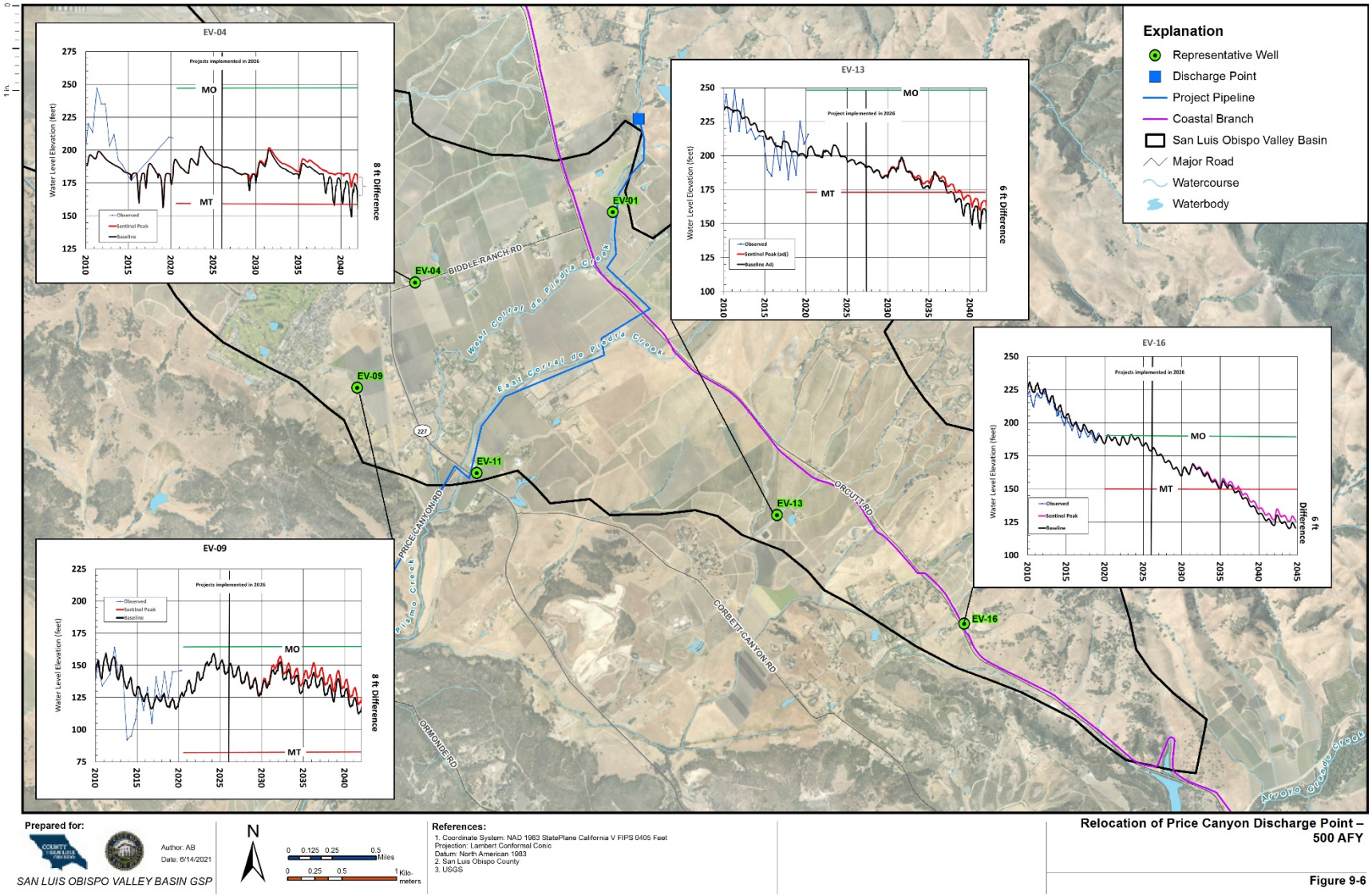


Figure 9-6. Relocation of Price Canyon Discharge Point – 500 AFY

9.4.9 Modeling of Multiple Projects

Basin groundwater modeling results for each of the projects previously discussed has represented the project described exclusively, and does not model other projects concurrently. The model results indicate that it is unlikely that any single project presented will, by itself, maintain water levels above the defined MTs at the RMSs. Therefore, an additional model scenario was developed in which multiple projects were represented simultaneously, to demonstrate potential results of a multi-project approach. Technical details of each of the individual projects are presented in the original chapter sections and are not represented here. The projects that are modeled in this multiple-projects scenario are:

- Reduction of agricultural pumping by 1,000 AFY (Sections 9.4.1, 9.4.2)
- Reduction of Edna Valley water purveyor pumping by 250 AFY (Sections 9.4.4, 9.4.5, 9.4.6, 9.4.7)
- State Water Project Recharge Basin – 500 AFY (Section 9.4.3)
- Relocation of Sentinel Peak WRF discharge –350AFY (Section 9.4.8)

As with the individual modeled project scenarios, all projects are represented as beginning in the year 2026.

Figure 9-7 displays the baseline and Project Scenario 5 hydrographs for the combined projects for the four Edna Valley wells identified as RMS for the Chronic Lowering of Groundwater Levels Sustainability Indicator (EV-04, EV-09, EV-13, and EV-16). This figure indicates that the increase in water levels over the baseline scenario in year 2042 at these wells ranges from 39 feet at EV-16 to 63 feet at EV-EV-09. The projected water level increase over baseline was 46 feet at EV-16, and 62 feet at EV-04.

This scenario indicates that with all the projects presented incorporated into the management of the Basin, the benefit to water levels is more than required to achieve sustainability. So just as it has been stated previously that no one single project will likely bring the basin into sustainability, this scenario indicates that all of the projects presented are not required to achieve this goal.

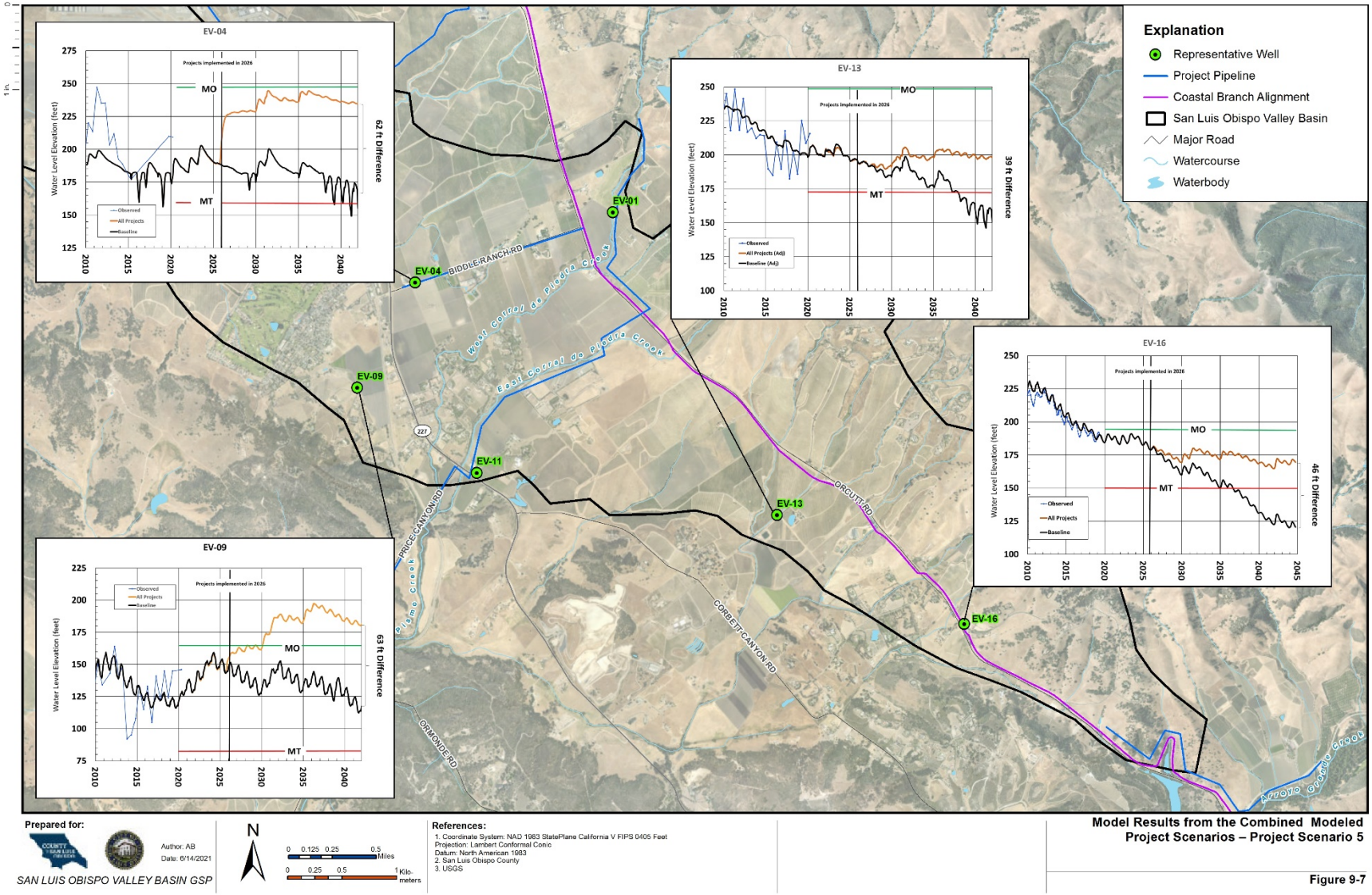


Figure 9-7Model Results from the Combined Modeled Project Scenarios – Project Scenario 5

9.5 MANAGEMENT ACTIONS

The management actions in this plan include the expansion of the monitoring network, development and implementation of a groundwater extraction metering and reporting plan, and the development of a demand management plan.

9.5.1 Expand Monitoring Network

This management action expands the monitoring network from the current County monitoring network of 12 wells to the new network of 40 monitoring wells as presented in Chapter 7 within the first two years of the GSP implementation. Chapter 7 describes a proposed monitoring network that has adequate spatial resolution to properly monitor changes to groundwater and surface water conditions relative to SMCs within the Basin. The network will provide data with sufficient temporal resolution to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions. Included in the chapter are recommendations for additional monitoring sites to better understand the groundwater and surface water interactions which include five surface water gages which will be paired with five monitoring wells (Appendix H).

9.5.2 Groundwater Extraction Metering and Reporting Plan

As described in Chapter 6 – Water Budget, groundwater extraction from wells is the primary component of outflow within the groundwater budget. Estimates for historical pumping were derived from various sources, including purveyor records, land use data and water duty factors, and daily soil-moisture budgets. The total estimated groundwater production in the SLO Basin during the water budget period of 2016 to 2019 was approximately 6,000 AFY. Of the 6,000 AFY, only about 5% or 300 AFY is metered. Groundwater purveyor meter records were provided by the City of San Luis Obispo, Golden State Water Company, Edna Ranch MWC, and Varian Ranch MWC. A groundwater extraction metering and reporting plan is a foundational component of the GSP that will facilitate the reporting of groundwater extraction data and the development of a groundwater accounting framework. The collection and reporting of this data will enable the GSAs to adaptively manage the groundwater resources. The location and quantity of agricultural pumping was identified as a significant data gap during the development of the water budget and integrated model. The collection of metered groundwater pumping data will provide a key metric to evaluate the effectiveness of the demand management strategies that will be included in the Demand Management Plan. The Groundwater Extraction Metering and Reporting Plan will include a de minimis self-certification and non de minimis extraction and reporting program.

SGMA provides the authority of a GSA to meter groundwater production:

> ***10725.8. MEASUREMENT DEVICES AND REPORTING; INAPPLICABILITY OF SECTION TO DE MINIMIS EXTRACTORS***
> *(a) A groundwater sustainability agency may require through its groundwater sustainability plan that the use of every groundwater extraction facility within the management area of the groundwater sustainability agency be measured by a water-measuring device satisfactory to the groundwater sustainability agency*

Under California Water Code §10725.8(e) Measurement Devices and Reporting, SGMA exempts de minimis extractors from metering requirements.

9.5.2.1 De Minimis Self-Certification

De minimis extractor means a person who extracts, for domestic purposes, two acre-feet or less per year (CWC 10721). The GSAs will consider developing an approach and process to allow de minimis basin extractors to self-certify that they extract two (2) acre-feet or less per year for domestic purposes.

> *§ 1030 g) **"Domestic purposes"** has the same meaning as **"domestic uses"** as defined in section 660 of Division 3 of Title 23 of the California Code of Regulations for the purposes of identifying if an extractor is a de minimis extractor*
> *§ 660. Domestic Uses. Domestic use means the use of water in homes, resorts, motels, organization camps, camp grounds, etc., including the incidental watering of domestic stock for family sustenance or enjoyment and the irrigation of not to exceed one-half acre in lawn, ornamental shrubbery, or gardens at any single establishments. The use of water at a camp ground or resort for human consumption, cooking or sanitary purposes is a domestic use.*

De-minimis groundwater extractors will not be regulated under this GSP. Growth of de minimis groundwater extractors could warrant regulated use in this GSP in the future. Growth will be monitored and reevaluated periodically. Estimated groundwater extractions from de-minimis users will be documented in the annual reports.

9.5.2.2 Non-De Minimis Extraction and Reporting Program

During the first five years of implementation, the Groundwater Extraction Metering and Reporting Plan will be developed for non deminimis users to report extractions using metering devices or other suitable methods. Water Code § 10725.8 provides GSAs the power through their GSPs to measure the use of groundwater extraction facilities for non de minimis extractions.

9.5.3 Demand Management Plan

A demand management plan will be developed and will include the documentation of water conservation measures taken by the purveyors, documentation of irrigation efficiencies of the agricultural fields, water efficient crop conversion, volunteer crop fallowing and pumping reductions. It is intended that the Demand Management Plan will recognize measures already taken by purveyors to increase water conservation or water use efficiency prior to the adoption of the GSP.

9.5.3.1 Water Conservation Measures

The purveyors in SLO Basin have implemented significant water conservation measures during the most recent drought. The following sections summarize the water conservation measures that the metered purveyors (City of SLO, GSWC, VRMWC, ERMWC) have taken to reduce their water use and will be described in more detail in the demand management plan.

9.5.3.1.1 City of SLO

The City of San Luis Obispo has had a defined water conservation program since the 1970s. As an original signatory to the California Urban Water Conservation Council, the City has not maintained effective water conservation programs for several decades. In an effort to preserve groundwater supplies, the City has made significant investments in three surface water reservoirs and a recycled water program.

Today the City's per-capita water use is amongst the lowest in the state and is approximately half of what it was in the late 1980s. The City's current GPCD water demand is approximately 92 and has seen virtually no increase since the end of the 2012-2015 drought. City staff anticipate that GPCD water use within the City will continue to decrease as the State of California adopts enhanced conservation and water use efficiency mandates.

9.5.3.1.2 Mutual Water Companies

Edna Ranch East and Varian Ranch MWCs have implemented water conservation measures in response to Basin conditions and the drought since 2014. The MWC's presented a technical memorandum at the December 9, 2020 GSC Meeting which documented the conservation measures taken by the MWC's and is summarized below (Wallace Group, 2020):

- New monitoring technology, combined with conservation policies, have resulted in well water production of 35% compared to the 2013 baseline year, and 26% compared to the 10 year period of 2005 through 2014.
- The combined groundwater production of the MWC's (75 AFY on average over the last 5 years) and represents approximately 2% of the total production in the Edna Valley.

9.5.3.1.3 Golden State Water Company

In response to the Governor's Executive Order (B-29-15) the State Water Resources Control Board (Water Board) imposed restrictions to achieve a statewide 25% reduction in potable urban water usage through February 28, 2016. These restrictions will require water consumers to reduce usage as compared to the amount they used in 2013. (GSWC, 2015). A Staged Mandatory Conservation and Ration Plan was developed and implemented in 2015. GSWC's Edna System is currently in Stage 2 which includes the following conservation measures:

- Stage 1: Outdoor irrigation limited to two days per week, before 8 AM or after 7 PM; even addresses on Sunday and Wednesday, odd addresses on Tuesday and Saturday
- Stage 2: Irrigation restrictions from Stage 1; $2.50 emergency surcharge per CCF over allocation

GSWC has reduced the groundwater production from about 318 AFY in 2013 to approximately 210 AFY in 2019.

9.5.3.2 Irrigation Efficiency Improvements

Many of the agricultural users of groundwater in the Basin have implemented efficient irrigation methods and more is envisioned by agricultural operations to improve the irrigation efficiencies. There are potential irrigation efficiency benefits to the Basin that can be realized by changing the irrigation methods for some types of crops. Irrigation efficiency refers to the ratio of the amount of water consumed by the crop to the amount of water supplied through irrigation. Some irrigation water may be lost to evaporation, to surface runoff, or to deep percolation past the plant root zone. However, some of the deep percolation water may return to the underlying aquifer as illustrated later in this section. Irrigation methods vary in how efficient they utilize water, thus leaving an opportunity for modification in irrigation methods to result in reductions in water use. For example, flood irrigation is less efficient than spray irrigation, which is less efficient than drip irrigation applied at the surface, which is less efficient than drip irrigation applied directly to the root zone. Other on-farm water conservation measures may be implemented to improve irrigation efficiencies such as irrigation water management practices and measurement of pump flows. If a large enough area of agricultural fields convert to more efficient methods of irrigation, there may be a net benefit to the Basin that could offset needs for direct pumping reductions. A key component to understanding the net benefit (gain) in water savings is the concept of irrigation return flow, i,e, the amount of water that percolates past the root zone, to ultimately reach and recharge the underlying aquifer. The following analysis demonstrates an example of this concept.

Figure 9-8 uses data that are approximately representative of conditions in Edna Valley. If it is assumed that the consumptive demand of a specified area of crops is 3,520 AFY, the amount of required water and calculated irrigation return flow to the aquifer under varying assumptions of irrigation efficiency may be significantly different. Figure 9-8 presents a visual presentation of this analysis and documents how improvements to irrigation efficiency can result in recovery of groundwater levels.

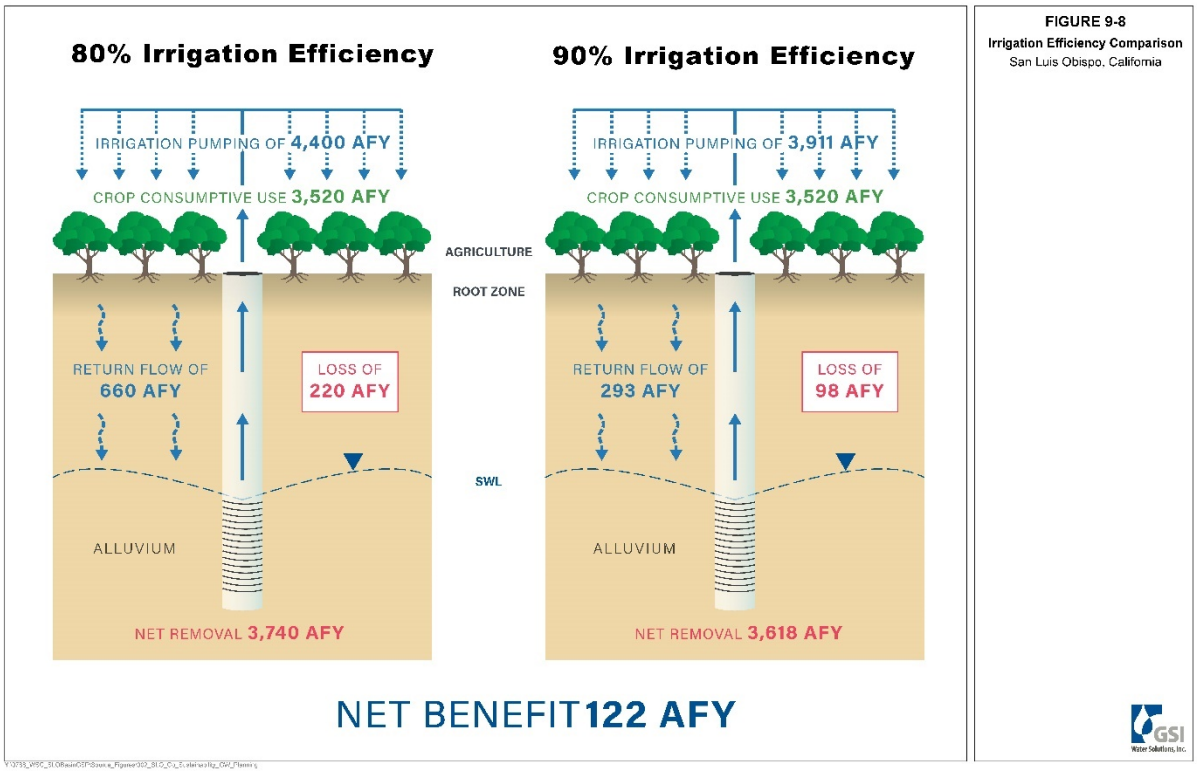


Figure 9-8 Irrigation Efficiency Comparison

Under the assumption of 80% irrigation efficiency, groundwater pumping of 4,400 AFY is required to provide the crop consumptive demand of 3,520 AFY (i.e., 3520/4400 = 80%). This results in 880 AFY of pumped water that is not directly up taken by the crop. For this analysis the assumption used in water budget calculations (Chapter 6) is that 75% of the unused water reaches to the aquifer as return flow. (It is assumed the remainder is lost to evaporation or permanent entrapment in the vadose zone pore space). Therefore, 660 AFY reaches the aquifer as return flow. Thus the net removal from the aquifer in this example is 3,740 AFY (4,400 AFY pumped reduced by 660 AFY of return flow).

If it is assumed that conversion to more efficient irrigation methods results in overall irrigation efficiency of 90%, groundwater pumping of 3,911 AFY is required to provide the crop consumptive demand of 3,520 AFY (i.e., 3520/3911= 90%). This results in 391 AFY of pumped water that is not directly up taken by the crop. Under the same assumptions as previously discussed, 293 AFY reaches the aquifer as return flow and 98 AFY is lost. Thus, the net removal from the aquifer in this example is 3,618 AFY (3,911 AFY pumped reduced by 293 AFY of return flow).

The difference in net removal from the aquifer under the assumptions of improved irrigation efficiency, displayed on Figure 9-8, is 122 AFY. This, then, is the net benefit to the aquifer of improving irrigation efficiency from 80% to 90%.

It is acknowledged that this example calculation is conceptual. Although groundwater pumping is easily measured, it is very difficult to accurately measure irrigation return flow, or the evaporative losses of applied irrigation. However, the hydrologic assumptions behind this analysis are well founded and commonly accepted in the industry. Therefore, this analysis demonstrates that conceptually there will be a net benefit to the aquifer if irrigation efficiency is improved basin wide. 122 AFY of water is approximately

10% of the Edna Valley overdraft calculated in Chapter 6. This indicates that overall improved irrigation efficiency can be a significant contributor to bringing the Basin into sustainability.

With the implementation of the Groundwater Extraction and Metering plan, the agricultural entities that implement improved irrigation methods will be able to document the improvements with reported meter readings.

9.5.3.3 Volunteer Water Efficient Crop Conversion

Chapter 6 - Water Budget describes the applied water demand by crops within the SLO Basin. These crop types included citrus, deciduous (non-vineyard), pasture, vegetable, vineyard, and turfgrass. Estimates of per-acre annual water demand are shown in the table below:

Table 9-5. Consumptive Use of Applied Water and Total Irrigated Acreage by Land Use/Land Cover Type

Land Use/ Land Cover	Acre-feet per acre per year			Acreage
	Low	Med	High	2018
Citrus	1.1	1.6	2.2	256
Deciduous	1.8	2.2	2.5	20
Pasture	2.6	3.1	3.7	41
Vegetables[1]	1.4	1.6	2	768
Vineyard	0.5	0.6	0.8	2410
Turfgrass[2]	2	2.6	4.1	164

[1]60 percent of ET applied water to account for fallow fields

[2]Turfgrass represents irrigated turf i.e. lawns, golf courses, etc…

As shown above, crop types use different quantities of water per year and the conversion from a less efficient crop would reduce the overall groundwater demand. This voluntary water efficient crop conversion program will be included in the Demand Management Plan.

9.5.3.4 Volunteer Land Fallowing

The Voluntary Fallowing Program will create a process to convert high water use irrigated agricultural lands to low water use open space or other less water intensive land use on a voluntary basis. The program would be similar to the volunteer water efficient crop conversion program and the resulting benefit would depend on the initial crop type. This voluntary fallowing program will be included in the Demand Management Plan.

9.5.3.5 Pumping Reductions

The projects and management actions described above are developed to maintain groundwater levels above minimum thresholds through in-lieu pumping reductions or increased recharge. The Demand Management Plan prioritizes the development of water conservation measures, irrigation efficiencies, volunteer water efficient crop conversion and the volunteer fallowing of crops to avoid mandatory direct pumping reductions. Mandatory pumping reductions may be required if the criteria for undesirable results for the sustainability indicators as described in Chapter 8 is met. The implementation of the mandatory direct pumping reductions will be addressed in the Demand Management Plan.

9.6 ADAPTIVE MANAGEMENT (§ 354.44A)

Adaptive management allows the GSAs to react to the success or lack of success of actions and projects implemented in the Basin and to make management decisions to redirect efforts in the Basin to more effectively achieve sustainability goals. The GSP process under SGMA requires annual reporting and updates to the GSP at minimum every 5 years. These requirements provide opportunities for the GSAs to evaluate progress towards meeting its sustainability goals and avoiding undesirable results.

Adaptive management triggers are thresholds that, if reached, initiate the process for considering implementation of adaptive management actions or projects. For SLO Bain, the trigger for adaptive management is the following:

- If analytical or modeled projections anticipate that future conditions will exceed the undesirable result thresholds, then the preparation for implementation of additional projects and management actions would begin.
- If actual conditions exceed the undesirable result thresholds, then additional projects and management actions will be implemented.

10 IMPLEMENTATION PLAN

This section is intended to serve as a conceptual roadmap for each Groundwater Sustainability Agency (GSA) to start implementing the Groundwater Sustainability Plan (GSP) over the first five years and discusses implementation effects in accordance with the Sustainable Groundwater Management Act (SGMA) regulations sections 354.8(f)(2) and (3). A general schedule showing the major tasks and estimated timeline for the GSP implementation is provided in Figure 10-1.

The implementation plan provided in this chapter is based on current understanding of SLO Basin (Basin) conditions and includes consideration of the projects and management actions included in Chapter 9, as well as other actions that are needed to successfully implement the GSP including the following:

- GSP implementation, administration, and management
- Funding
- Reporting, including annual reports and 5-year evaluations and updates

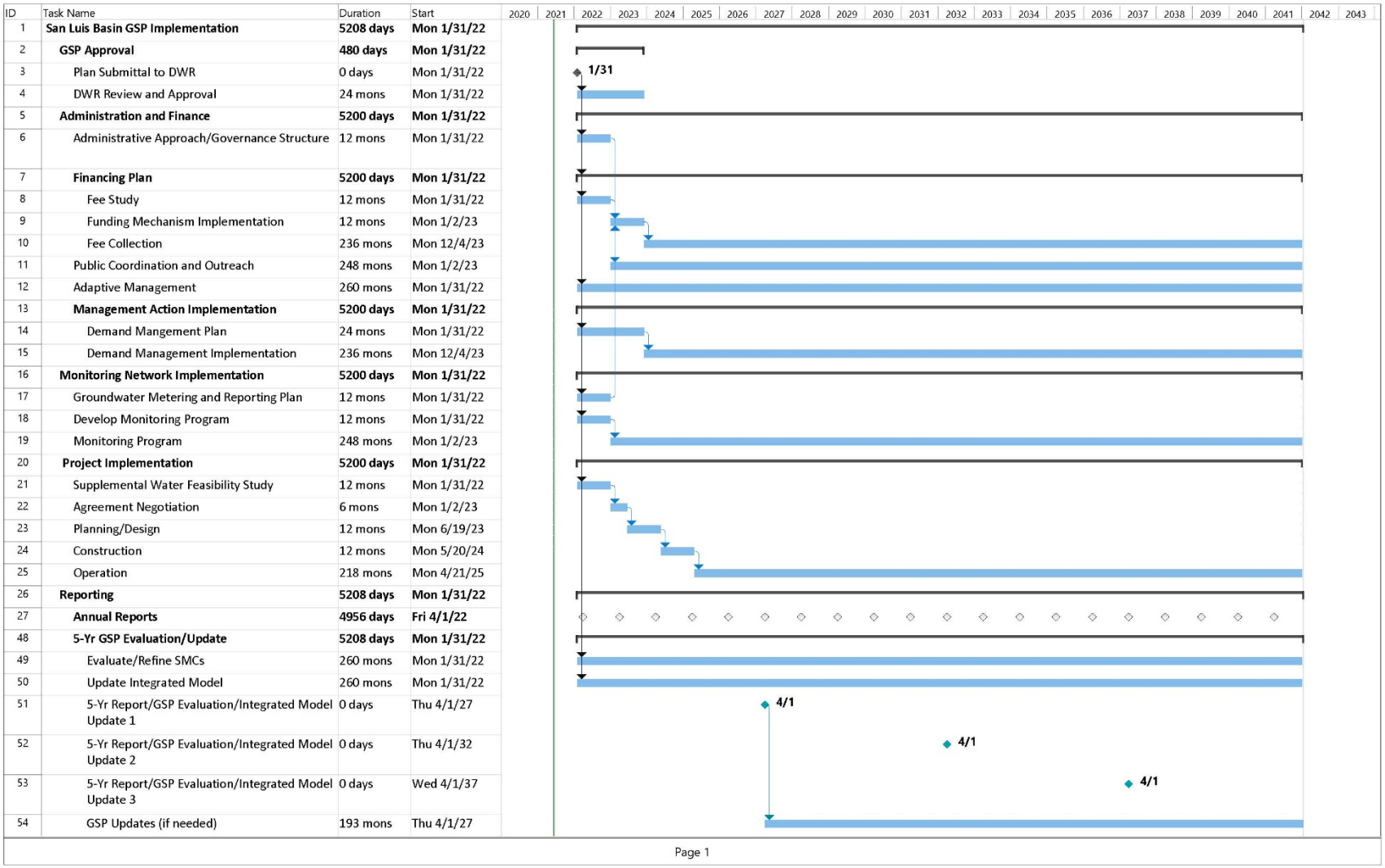
10.1 GSP IMPLEMENTATION, ADMINISTRATION, AND MANAGEMENT

10.1.1 Administrative Approach/Governance Structure

The City and County (GSAs) and the participating parties will continue to operate under the existing MOA, including the existing governance structure, until actions are taken amending/revising the existing MOA or developing new agreements (e.g., joint power agreement). The existing MOA is included in Appendix A and will automatically terminate upon DWR's approval of the GSP for the Basin. During DWR's GSP review process, the GSAs intend to update the governance structure before the GSP is approved to better serve the implementation of the GSP. For example, the updated governance structure could be established through a new agreement between the GSAs that supersedes the existing MOA. The agreement would outline details and responsibilities for GSP administration and implementation among the participating entities and may include provisions to establish other advisory bodies to advise the GSAs on GSP implementation, updates, etc.

10.1.2 Implementation Schedule

Figure 10-1 illustrates the GSP implementation schedule. Included in the chart are activities necessary for ongoing GSP monitoring and updates, as well as tentative schedules for the development of projects and management actions. Additional details about the activities included in the schedule are provided in these activities' respective sections of this GSP. Adaptive management and mandatory demand management would only be implemented if triggering events are reached, as described in Chapter 9, and are shown as ongoing in the schedule.



ID	Task Name	Duration	Start
1	**San Luis Basin GSP Implementation**	**5208 days**	**Mon 1/31/22**
2	**GSP Approval**	**480 days**	**Mon 1/31/22**
3	Plan Submittal to DWR	0 days	Mon 1/31/22
4	DWR Review and Approval	24 mons	Mon 1/31/22
5	**Administration and Finance**	**5200 days**	**Mon 1/31/22**
6	Administrative Approach/Governance Structure	12 mons	Mon 1/31/22
7	**Financing Plan**	**5200 days**	**Mon 1/31/22**
8	Fee Study	12 mons	Mon 1/31/22
9	Funding Mechanism Implementation	12 mons	Mon 1/2/23
10	Fee Collection	236 mons	Mon 12/4/23
11	Public Coordination and Outreach	248 mons	Mon 1/2/23
12	Adaptive Management	260 mons	Mon 1/31/22
13	**Management Action Implementation**	**5200 days**	**Mon 1/31/22**
14	Demand Mangement Plan	24 mons	Mon 1/31/22
15	Demand Management Implementation	236 mons	Mon 12/4/23
16	**Monitoring Network Implementation**	**5200 days**	**Mon 1/31/22**
17	Groundwater Metering and Reporting Plan	12 mons	Mon 1/31/22
18	Develop Monitoring Program	12 mons	Mon 1/31/22
19	Monitoring Program	248 mons	Mon 1/2/23
20	**Project Implementation**	**5200 days**	**Mon 1/31/22**
21	Supplemental Water Feasibility Study	12 mons	Mon 1/31/22
22	Agreement Negotiation	6 mons	Mon 1/2/23
23	Planning/Design	12 mons	Mon 6/19/23
24	Construction	12 mons	Mon 5/20/24
25	Operation	218 mons	Mon 4/21/25
26	**Reporting**	**5208 days**	**Mon 1/31/22**
27	**Annual Reports**	**4956 days**	**Fri 4/1/22**
48	**5-Yr GSP Evaluation/Update**	**5208 days**	**Mon 1/31/22**
49	Evaluate/Refine SMCs	260 mons	Mon 1/31/22
50	Update Integrated Model	260 mons	Mon 1/31/22
51	5-Yr Report/GSP Evaluation/Integrated Model Update 1	0 days	Thu 4/1/27
52	5-Yr Report/GSP Evaluation/Integrated Model Update 2	0 days	Thu 4/1/32
53	5-Yr Report/GSP Evaluation/Integrated Model Update 3	0 days	Wed 4/1/37
54	GSP Updates (if needed)	193 mons	Thu 4/1/27

Figure 10-1. SLO Basin GSP Implementation Schedule

10.1.3 Implementation Costs

Implementation of this GSP is estimated to cost approximately $965,000 per year for the first five years of implementation, excluding the development of the specific projects listed in Chapter 9. Costs related to the various activities anticipated for the first five years are shown in Table 10-1. Estimates of future annual implementation costs (Years 6 through 20) will be developed during future updates of the GSP, which will include the development of the various anticipated projects. The costs of specific projects and management actions will like vary year by year, based in part on needed adaptive management activities.

10.1.3.1 Administration and Finance

The Administration and Finance implementation activities include the following: GSP Administration Development, Ongoing GSP Implementation, Fee Study, Funding Mechanism Implementation, Demand Management Plan. The total estimated cost during the initial five years of the GSP implementation is approximately $2,850,000 and is shown in Table 10-1. It is anticipated that the Administrative and Finance Costs will be paid for by regulatory fees and will be analyzed as part of the fee study as described in Section 10.2.2.

10.1.3.2 Monitoring Network Implementation

The Monitoring Network Implementation includes the development of a groundwater metering and reporting plan, development of a monitoring program, and conducting annual monitoring. The Groundwater Metering and Reporting Plan is described in detail in Section 9.5 Management Actions and will provide a key metric to evaluate the effectiveness of the demand management strategies and enable the GSAs to adaptively manage the Basin. The monitoring program is described in detail in Chapter 7-Monitoring Network and the expansion of the monitoring network is targeted to monitor changes to groundwater and surface water conditions relative to SMCs within the Basin. The annual monitoring is the execution of the data collection required to complete the Annual Reports. The total estimated cost during the initial five years of the GSP implementation is approximately $875,000 as shown in Table 10-1. It is anticipated that the Monitoring Network Implementation will be paid for by regulatory fees and will be analyzed as part of the fee study as described in Section 10.2.2.

10.1.3.3 Project Implementation

Project implementation is anticipated to include the following steps: Supplemental Water Feasibility Study; Planning and Design; Construction and Operation. The initial step for project implementation is anticipated to include completion a Supplemental Water Feasibility Study to further evaluate the different supplemental water supply options (e.g. SWP, Recycled Water, Price Canyon Discharge Water, etc.) described in Chapter 9. This evaluation will include a more granular analysis of the parameters associated with each of the different supplemental supply options available to address the overdraft in the basin, including assessment of seasonal supply availability and demand patterns, hydraulic capacity, costs of supplemental water, environmental/permitting requirements, and updated infrastructure and operation & maintenance costs. The feasibility study will also include additional groundwater model scenario analysis to further determine beneficiaries of the individual projects to assist in developing equitable project cost sharing mechanisms.

The findings from the Supplemental Water Feasibility Study will be utilized to inform agreement negotiations and planning/design of the preferred supplemental water supply projects for the basin. It is anticipated that the Projects will be paid for by project proponents/beneficiaries and costs associated with project implementation is not included in the GSP Implementation Budget estimate shown in Table 10-1. Specific details regarding the cost share mechanisms are anticipated to be determined after the preferred supplemental water projects are identified and further defined. Additionally, it is anticipated that grant funding would be available to assist with project implementation, see Section 10.2.3.

10.1.3.4 Reporting

SGMA regulations require the GSAs to submit annual reports to DWR on the status of GSP implementation. The reporting requirements are presented in Section 10.3.1. SGMA regulations require the GSAs to evaluate the GSP at least every 5 years and whenever the Plan is amended. The reporting requirements for the periodic evaluation are presented in Section 10.3.2. The initial 5-year GSP evaluation is due for submission to DWR in April 2027. The estimated cost to prepare an annual report is $100,000/year and the cost for the initial Five Year GSP update is estimated to be $500,000, equating to a total of $1,000,000 over the initial five years of the GSP implementation. It is anticipated that the Reporting Costs will be paid for by regulatory fees and will be analyzed as part of the fee study as described in Section 10.2.2.

10.1.4 Outreach and Communication

To meet the requirements of SGMA, implementation of the GSP will require additional communication and outreach efforts and coordination among the City and County GSAs and stakeholder groups. The GSP calls for GSAs to routinely provide information to the public about GSP implementation and ongoing sustainable management of the Basin. The GSP calls for a website to be maintained as a communication tool for posting data, reports, and meeting information. The website may also include forms for on-line reporting of information needed by the GSAs (e.g., annual pumping a shown in mounts) and an interactive mapping function for viewing Basin features and monitoring information.

10.2 FUNDING

The budget information included in Section 10.1.3 will be used to conduct a fee study which could include development of funding mechanisms to cover the costs of implementing the regulatory programs described in the GSP. This fee could include costs related to monitoring and reporting, hydrogeologic studies, pumping reduction enforcement if necessary, public outreach, and other related costs. Project implementation costs are anticipated to be covered by the project proponents and the associated beneficiaries. Project implementation costs will be evaluated as part of the Supplemental Water Feasibility Study.

10.2.1 GSP Implementation Funds

Development of this GSP was partially funded through a Proposition 1 Sustainable Groundwater Planning Grant from DWR, along with in-kind contributions from the GSAs and GSC members. Although ongoing implementation of the GSP could include contributions from its member agencies, which are ultimately funded through customer fees or other public funds, additional funding would be required to implement the GSP. Included in the GSP implementation is a Fee Study that will evaluate multiple approaches for funding the ongoing administration and implementation of the GSP.

10.2.2 Fee Study

The GSAs plan to perform a fee study to evaluate and provide recommendations for developing GSP implementation funding mechanisms. This study will include focused public outreach and meetings to educate and solicit input on the potential fee structures/funding mechanisms (i.e. pumping fees, assessments, or a combination of both). California Water Code Sections 10730 and 10730.2 provide GSAs with the authority to impose certain fees, including fees on groundwater pumping. Any imposition of fees, taxes or other charges would need to follow the applicable protocols outlined in the above referenced water code sections and all applicable Constitutional requirements based on the nature of the fee. It is anticipated that the fee study will cover the costs associated with the Administrative and Finance, Monitoring Network Implementation, and Reporting. The Fee Study is not anticipated to cover the costs associated with project implementation.

10.2.3 Grant/Low Interest Financing

The GSAs will pursue grants and low-interest financing to help pay for GSP implementation costs to the extent possible. If grants or low-interest financing is obtained for GSP implementation it could be utilized to

offset costs for the GSAs and basin pumpers. However, as mentioned previously external funding/financing may only be eligible for project and management action implementation and not ongoing GSP administrative expenses.

10.3 REPORTING

As part of GSP implementation, SGMA Regulation §356.2 requires the GSAs to develop annual reports and more detailed five-year evaluations, which could lead to updates of the GSP. The following sections describe the reporting requirements for both the annual reports and five-year evaluations.

10.3.1 Annual Reports

Annual reports will be developed to address current needs in the Basin and the legal requirements of SGMA. As defined by DWR, annual reports must be submitted for DWR review by April 1st of each year following the GSP adoption, except in years when five-year or periodic assessments are submitted. Annual reports are anticipated to include three key sections: General Information, Basin Conditions, and Implementation Progress. The GSAs will compile information relevant to annual reports and the Basin Point of Contact will coordinate collection of information and submit a single annual report for the Basin to DWR.

10.3.1.1 General Information

The General Information section will include an executive summary that highlights the key content of the annual report. This section will include a map of the Basin, a description of the sustainability goals, a description of GSP projects and their progress, as well as an annual update to the GSP implementation schedule.

10.3.1.2 Basin Conditions

Basin conditions will describe the current groundwater conditions and monitoring results in the Basin. This section will include an evaluation of how conditions have changed over the previous year and will compare groundwater data for the water year to historical groundwater data. Pumping data, effects of project implementation (if applicable), surface water deliveries, total water use, and groundwater storage data will be included. Key required components include:

- Groundwater level data from the monitoring network, including contour maps of seasonal high and seasonal low water level maps
- Hydrographs of groundwater elevation data at RMS
- Groundwater extraction data by water use sector
- Groundwater Quality at RMS
- Surface water supply availability and use data by water use sector and source
- Streamflow
- Total water use data
- Change in groundwater in storage, including maps for the aquifer
- Subsidence rates and associated survey data

10.3.1.3 Implementation Progress

Progress toward GSP implementation will be included in the annual report. This section of the annual report will describe the progress made toward achieving interim milestones as well as implementation of projects and management actions. Key required components include:

- GSP implementation progress, including proposed changes to the GSP
- Progress toward achieving the Basin sustainability goals

Table 10-1 GSP Implementation Costs (2022-2027)

GSP Implementation Activity	Description	Estimated Cost	Unit	Anticipated Timeframe	Estimated Costs (2022 -2027)
Administrative and Finance					
GSP Administration Development	Develop Administrative Approach/Governance Structure for GSP Implementation	$100,000	Lump Sum	Q1-4, 2022	$100,000
Ongoing GSP Implementation	Routine GSP Administration (including staffing, overhead expenses, equipment, outreach and communication, etc.)	$500,000	Annual	2021 - 2025	$2,500,000
Fee Study	Prepare a fee study to evaluate and provide recommendations for GSP implementation funding mechanisms	$150,000	Lump Sum	Q1-4, 2022	$150,000
Funding Mechanism Implementation	Implement and begin collecting GSP Implementation fees	$100,000	Lump Sum	Q1-4, 2023	$100,000
Demand Management Plan	The demand management plan will include the documentation of water conservation measures, and develop programs for volunteer water efficient crop conversion, volunteer fallowing of crops, and pumping reductions, etc. in a stakeholder driven process.	$100,000	Lump Sum	2022 - 2023	$100,000
Monitoring Network Implementation					
Groundwater Metering and Reporting Plan	Develop a plan to establish and maintain a groundwater pumping, metering, and reporting plan (does not include meters and installation)	$150,000	Lump Sum	Q1-4, 2022	$150,000
Monitoring Program	Conduct survey of proposed monitoring well network to verify locations and elevations, and video logging if applicable	$100,000	Lump Sum	Q1-4, 2022	$100,000
	Construction of 5 new monitoring wells and 5 surface water gages for GDEs and GW/SW interaction, transducers and surveying	$500,000	Lump Sum	Q1-4, 2022	$500,000
Annual Monitoring	Complete annual monitoring (Field work)	$25,000	Annual	Q1-4, 2022	$125,000
Project Implementation					
Supplemental Water Feasibility Study		Costs estimates for the Supplemental Water Feasibility Study, Planning/Design and Construction of Supplemental Water Projects not included in the initial 5-Yr budget.			
Planning/Design					
Construction					
Reporting					
Annual Reports	Compile data and prepare GSP Annual Report	$100,000	Annual	2021 - 2025	$500,000
5-Yr GSP Updates	Compile data and prepare 5-yr GSP Updates, including Integrated Model updates	$500,000	Lump Sum	Q2, 2026 - Q1, 2027	$500,000

Total Estimated Costs (2022 - 2027)	$4,825,000
Average Annual Estimated Cost (2022 - 2027)	$965,000

Development of an annual report will begin following the end of the water year, September 30, and will include an assessment of the previous water year. The annual report will be submitted to DWR before April 1st of the following year. The 2021 annual report covering water year 2021 will be submitted by the GSAs by April 1, 2022. Five annual reports for the Basin will be submitted to DWR between 2022 and 2026, prior to the first five-year assessment of this GSP, which is to be submitted to DWR in January 2027.

10.3.2 Five-Year Evaluation Reports

As required by SGMA regulations, an evaluation of the GSP and the progress toward meeting the approved sustainable management criteria and the sustainability goal will occur at least every five years and with every amendment to the GSP. A written five-year evaluation report (or periodic evaluation report) will be prepared and submitted to DWR. The information to be included in the evaluation reports is provided in the sections below.

10.3.2.1 Sustainability Evaluation

A Sustainability Evaluation will contain a description of current groundwater conditions for each applicable sustainability indicator and will include a discussion of overall sustainability in the Basin. Progress toward achieving interim milestones and measurable objectives will be included, along with an evaluation of status relative to minimum thresholds. If any of the adaptive management triggers are found to be met during this evaluation, a plan for implementing adaptive management as described in Section 9.6 of this GSP will be included.

10.3.2.2 Plan Implementation Progress

A Plan Implementation Progress section will describe the current status of project and management action implementation and whether any adaptive management actions have been implemented since the previous report. An updated project implementation schedule will be included, along with any new projects identified that support the sustainability goals of the GSP and a description of any projects that are no longer included in the GSP. The benefits of projects and management actions that have been implemented will be described and updates on projects and management actions that are underway at the time of the report will be documented.

10.3.2.3 Reconsideration of GSP Elements

As additional monitoring data are collected, land uses and community characteristics change, and GSP projects and management actions are implemented, it may become necessary to reconsider elements of this GSP and revise the GSP as appropriate. GSP elements to be reassessed may include basin setting, management areas, undesirable results, minimum thresholds, and measurable objectives. If appropriate, a revised GSP, completed at the end of the five-year assessment period, will include revisions informed by findings from the monitoring program and changes in the Basin, including changes to groundwater uses, demands, or supplies, and results of project and management action implementation.

10.3.2.4 Monitoring Network Description

A description of the monitoring network will be provided. An assessment of the monitoring network's function will be included, along with an analysis of data collected to date. If data gaps are identified, the GSP will be revised to include a method for addressing these data gaps, along with an implementation schedule for addressing gaps and a description of how the GSA will incorporate updated data into the GSP.

10.3.2.5 New Information

New information available since the last five-year evaluation or GSP amendment will be described and evaluated. If the new information should warrant a change to the GSP, this will also be included, as described previously in Reconsideration of GSP Elements.

10.3.2.6 Regulations or Ordinances

A summary of the regulations or ordinances related to the GSP that have been implemented by DWR or others since the previous report will be provided. The report will include a discussion of any required updates to the GSP.

10.3.2.7 Legal or Enforcement Actions

Legal or enforcement actions taken by the GSA in relation to the GSP will be summarized, including an explanation of how such actions support sustainability in the Basin.

10.3.2.8 Plan Amendments

A description of amendments to the GSP will be provided in the five-year evaluation report, including adopted amendments, recommended amendments for future updates, and amendments that are underway.

10.3.2.9 Coordination

Ongoing coordination will be required among the GSA, members of the GSC, and the public. The five-year evaluation report will describe coordination activities between these entities such as meetings, joint projects, data collection and sharing, and groundwater modeling efforts.

10.3.2.10 Reporting to Stakeholders and the Public

Outreach activities associated with the GSP implementation, assessment, and GSP updates will be documented in the five-year evaluation report.

REFERENCES

Association for the Advancement of Cost Engineering, Inc. 2011. *ACE International Recommended PracticeNo. 17R-97; Cost Estimate Classification System; TCM Framework: 7.3 - Cost Estimating and Budgeting.* 2011.

Balance Hydrologics. 2008. *Hydrology and Geology Assessment of the Pismo Creek Watershed, San Luis Obispo County, California.* 2008.

Blaney. 1963. *Utilization of the Water of the Santa Ynez River Basin in Southern Santa Barbara County California, United Stated Deparment of Agriculture.* 1963.

—. 1933. *Ventura County Investigation, Bulletin No. 46, California Deparment of Public Works, Division of Water Resources.* 1933.

Boyle Engineering. 1991. *City of San Luis Obispo Groundwater Basin Evaluation. January.* 1991.

Carollo. 2012. *San Luis Obispo County Master Water Report.* 2012.

CCWA. 2021. *Water Management Strategy.* 2021.

CIMS. 2019. *Station 52, San Luis Obispo - Central Coast Valleys.* 2019.

City of San Luis Obispo. 2016. *2015 Urban Water Management Plan.* 2016.

—. 2018. *General Plan.* 2018.

—. 2015. *Water Resources Status Report.* 2015.

—. 2000. *Water Use Factors.* 2000.

Cleath & Associates, Inc. 2001. *Well Construction and Testing Report for Lewis Lane #4, Edna Valley, San Luis Obispo County. Prepared for Southern California Water Company. July.* 2001.

—. 2003. *Well Construction and Testing Report for Water Supply and Irrigation Wells, City of San Luis Obispo, Hayashi Irrigation Wells and Highway 101 Water Supply Well. March.* 2003.

Cleath-Harris Geologists. 2018. *Groundwater Flow Analysis, Recycled Water Recharge Project, San Luis Valley Subarea, San Luis Obispo Valley Groundwater Basin.* 2018.

—. 2019. *Optional Task 2.4B Geophysical Survey.* 2019.

Cleath-Harris Geologists, Inc. 2010. *Edna Valley Water System Groundwater Study. Prepared for Golden State Water Company. May.* 2010.

—. 2013. *Summary of Drilling,. Testing, and Destruction of the Golden State Water Company Country Club Test Well, Edna Road System, 6110 Lewis Lane, San Luis Obispo, California. Prepared for Golden State Water Company. June.* 2013.

—. 2013. *Summary of Exploration and Testing, 5061 Hacienda Avenue, San Luis Obispo, California. Prepared for Golden State Water Company. February.* 2013.

—. 2014. *Summary of Exploration and Testing, Blodgett parcel, Whiskey Run Lane, Country Club Area, San Luis Obispo, California. Prepared for Golden State Water Company. July.* 2014.

County of San Luis Obispo. 2014. *San Luis Obispo County Integrated Regional Water Management Plan (IRWMP).* 2014.

CSLRCD, Coastal San Luis Resource Conservation District. 2014. *Mitigated Negative Declaration/Initial Study Edna Valley Groundwater Basin Recharge and Steehead Habitat Enhancement Project.* 2014.

Cuesta Engineering Corporation. 2007. *San Luis Obispo Creek Watershed Calibration Study.* 2007.

Dibble, T.W. 2004. *Geologic Map of the Lopez Mountain Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2004. #DF-130.

Dibblee, T.W. 2006. *Geologic Map of the Arroyo Grande NE Quadrangle, San Luis Obispo County, California.* s.l. : Dibble Geology Center Map, 2006. #DF-211.

—. 2006. *Geologic Map of the Pismo Beach Quadrangle, San Luis Obispo County, California.* s.l. : Dibblee Geology Center Map, 2006. #DF-212.

—. 2004. *Geologic Map of the San Luis Obispo Quadrangle, San Luis Obispo County, California. .* s.l. : Dibble Geology Center Map, 2004. #DF-129.

DWR. 2003. *California's Groundwater: Bulletin 118 – Update 2003, Groundwater Basin Descriptions.* 2003.

—. 2016. *California's Groundwater: Bulletin 118 - Interim Update 2016, Working Towards Sustainability.* 2016.
—. 2003. *California's Groundwater: Bulletin 118 - Update 2003, Groundwater Basin Descriptions.* 2003.
—. 2015. *Consumptive Use Program Plus (CUP+) Model, in California Water Plan Update 2013, Volume 4. Reference Guide, Developed by DWR and UC Davis.* 2015.
—. 2014. DWR Atlas - Aglricultural Lang Use and Irrigated Areas. [Online] 2014. gis.water.ca.gov.
—. 1964. *San Luis Obispo and Santa Barbara Counties Land and Water Use Survey, 1959. .* s.l. : California Department of Water Resources (DWR), 1964.
—. 1958. *San Luis Obispo County Investigation. State Water Resources Board Bulletin No. 18. .* s.l. : California Department of Water Resources (DWR). May., 1958.
—. 1997. *San Luis-Edna Valley Groundwater Basin Study, Draft Report. .* s.l. : California Department of Water Resources (DWR)., 1997.
—. 1996. *South Central Coast Land Use Survey.* 1996.
—. 1987. *Southern Central Coast Land Use Survey, 1985. Morro Bay South 54-30 and San Luis Obispo 54-31 Survey Maps.* 1987.
—. 2019. *Sustainable Groundwater Management Act 2019 Basin Prioritization - Process and Results Document.* 2019.
—. 2016. *Water Budget Best Management Practices for the Sustainable Management of Groundwater.* 2016.
—. 2002. *Water Resources of the Arroyo Grande - Nipomo Mesa Area.* 2002.
DWR, California Department of Water Resources. 2019. *Delivery Capability Report and Studies 2019.* 2019.
EPA. 2008. *Water Sense Factsheet - Indoor Water Use in the United States, EPA-832-F-06-004.* 2008.
ESA Consultants, Inc. 1994. *Hydrologic Investigation, Edna Valley Well Location Study. September.* 1994.
Fugro West and Cleath & Associates. 2002. *Paso Robles Groudnwater Study, Final Report.* 2002.
GSI Water Solutions. 2018. *San Luis Obispo Valley Basin Characterization and Monitoring Well Installation.* 2018.
GSWC. 2015. *Staged Mandatory Conservation and Rationing Plan.* 2015.
Hall, C.A. 1979. *Geologic map of the San Luis Obispo – San Simeon Region, California.* s.l. : U.S. Geological Survey, 1979. Map I-1097.
—. 1973. *Geology of the Arroyo Grande Quadrangle, California. .* s.l. : California Division of Mines and Geology, 1973. Map Sheet 24.
ITRC. 2020. *Official Cal Poly Precipitation Data, Cal Poly/NOAA Station Rain Gage.* 2020.
Johnson, A.I. 1967. *Specific Yield - Compilation of Specific Yield for Various Materials, U.S. Geological Survey Water-Supply Paper 1662-D, prepared in cooperation with the California Deparment of Water Resources.* 1967.
National Land Cover Database. Multi-Resolution Land Characteristics Consortium. *2016.* Multi-Resolution Land Characteristics Consortium.
Rosenberg, L.I. 2001. *Potential Aquifer Recharge Areas: Monterey County, California.* s.l. : Monterey County Planning Department, 2001.
San Luis Obispo County Deparment of Agriculture/Weights and Measures. 2019. *Crop Surveys for San Luis Obispo Valley Groundwater Basin 2013-2018.* 2019.
San Luis Obispo County Department of Public Works. 2020. *Andrews Street Bridge Stream Flow Gage 745.* 2020.
—. 2020. *Gas Company Rain Sensor 3099.* 2020.
San Luis Obispo County Engineering Department. 1974. *Hydrologic & Climatological Data, Seasons of 1970-71 & 1971-72.* 1974.
SLO-FCWCD. 2014. *CASGEM Monitoring Plan for High and Medium Priority Groundwater Basins in the San Luis Obispo County Flood Control & Water Conservation District. September.* s.l. : San Luis Obispo Flood Control & Water Conservation District, 2014.

Stillwater Sciences. 2015. *Percolation Zone Study of Pilot-Study Groundwater Basins in San Luis Obispo County, California. September.* 2015.
SWRCB. 1990. *Ernest Righetti & Sons Application 28883, Decision 1627.* 1990.
TEAM Engineering & Management. 2000. *Groundwater Yield Analysis. July.* 2000.
USBR. 1955. *Reconnaissance Report San Luis Obispo County Basin, California. .* s.l. : U.S. Bureau of Reclamation, Region 2, Sacramento., 1955.
USDA-NRCS. 2007. *Soil Survey Geographic Database (SSURGO).* s.l. : U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), 2007.
Wallace Group. 2020. *Policy Considerations for Groundwater Sustainability Plan.* 2020.
WSC. 2018. *Salinas and Whale Rock Reserviors Safe Annual Yield TM.* 2018.