Groundwater Sustainability Commission
for the San Luis Obispo Valley Groundwater Basin

NOTICE OF MEETING

NOTICE IS HEREBY GIVEN that the Groundwater Sustainability Commission will hold a **Regular Meeting** at **3:00 P.M.** on **Monday, June 21, 2021.** Based on the threat of COVID-19 as reflected in the Proclamations of Emergency issued by both the Governor of the State of California and the San Luis Obispo County Emergency Services Director, as well as the Governor's Executive Order N-29-20 issued on March 17, 2020 relating to the convening of public meetings in response to the COVID-19 pandemic, this meeting will be conducted as a phone-in/web-based meeting only. There will be no physical meeting location for this GSC Meeting. Members of the public can participate via phone or by logging into the web-based meeting.

TO JOIN THE MEETING FROM YOUR COMPUTER, TABLET OR SMARTPHONE, GO TO:
https://zoom.us/j/99446100959?pwd=cUUrV3poWnJXL0xWR3RSZVhYUVNKUT09
Passcode: 688292
(This link will help connect both your browser and telephone to the call)

YOU CAN ALSO DIAL IN USING YOUR PHONE:
Dial +1 669 900 6833
Webinar ID: 994 4610 0959
Passcode: 688292

All persons desiring to speak during any Public Comment can submit a comment by:

- Email at dtzou@co.slo.ca.us by 5:00 PM on the day prior to the Commission meeting
- Teleconference meeting at link or phone number above
- Mail by 5:00 PM on the day prior to the Commission meeting to:
  County of San Luis Obispo Department of Public Works
  Attn: Dick Tzou
  County Government Center, Room 206
  San Luis Obispo, CA 93408
- Additional information on how to submit Public Comment is provided on page 3 of this Agenda

NOTE: The Groundwater Sustainability Commission reserves the right to limit each speaker to three (3) minutes per subject or topic. In compliance with the Americans with Disabilities Act and Executive Order N-29-20, all possible accommodations will be made for individuals with disabilities, so they may participate in the meeting. Persons who require accommodation for any audio, visual or other disability in order to participate in the meeting of the GSC are encouraged to request such accommodation 48 hours in advance of the meeting from Joey Steil at (805) 781-5252.

GROUNDWATER SUSTAINABILITY COMMISSION AGENDA

Dawn Ortiz-Legg, Member, County of San Luis Obispo
Bob Schiebelhut, Chair, EVGMWC
Dennis Fernandez, Member, ERMWC/VRMWC
Mark Zimmer, Vice Chair, GSWC
Andy Pease, Member, City of San Luis Obispo

Bruce Gibson, Alternate, County of San Luis Obispo
George Donati, Alternate, EVGMWC
James Lokey, Alternate, ERMWC/VRMWC
Toby Moore, Alternate, GSWC
Aaron Floyd, Alternate, City of San Luis Obispo

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1. **Call to Order** (Chair) **3:00**

2. **Roll Call** (City Staff: Mychal Boerman)

3. **Pledge of Allegiance** (Chair)

4. **Public Comment – Items not on Agenda** (Chair)

5. **Approval of Meeting Minutes** (Chair) **3:05 – 3:10 (5 mins)**
   a) May 20, 2021

6. **Response to Comments Received on GSP Chapter 8 – Sustainable Management Criteria** (WSC Consultant Team: Dave O'Rourke; County staff: Dick Tzou) **3:10 – 3: 25 (15 mins)**
   a) Discussions on responses to comments on GSP Chapter 8 and other general items.

7. **Draft GSP Chapter 9 and 10: Projects and Management Actions and Implementation Plan and Draft Technical Memorandum on Groundwater Dependent Ecosystem (GDE) for Review and Comment** (WSC Consultant Team: Michal Cruikshank and Dan Heimel) **3:25- 3:55 (30 mins)**
   Recommendation
   a) Consider recommending Draft GSP Chapter 9: Projects and Management Actions and Chapter 10 Implementation Plan to be received and filed by the GSAs and released for public comment.
   b) Consider recommending Draft Technical Memorandum on GDEs in the San Luis Obispo Valley Groundwater Basin to be received and filed by the GSAs and released for public comment.

8. **Future Items** (Chair) **3:55 - 4:00 (5 mins)**
   a) GSC Meeting (in-person) – August 11, 2021
   b) Admin Draft of the complete GSP

9. **Next Regular Meeting: August 11, 2021**

10. **Adjourn** (Chair)

Groundwater Sustainability Commission

for the San Luis Obispo Valley Groundwater Basin

NOTICE OF MEETING

CONFERENCE CALL/WEBINAR ONLY

Monday, June 21, 2021 at 3:00 p.m.

Important Notice Regarding COVID-19 Based on guidance from the California Department of Public Health and the California Governor's Officer, in order to minimize the spread of the COVID-19 virus, please note the following:

1. The meeting will only be held telephonically and via internet via the number and website link information provided on the agenda. After each item is presented, Commission Members will have the opportunity to ask questions. Participants on the phone will then be provided an opportunity to speak for 3 minutes as public comment prior to Commission deliberations and/or actions or moving on to the next item. The chat function on the webinar may also be used to submit comments and ask questions and will be verbalized by staff during the public comment period for each item. How to use the chat function will be demonstrated at the beginning of the meeting.

2. The Commission's agenda and staff reports are available at the following website: https://www.slowaterbasin.com

3. If you choose not to participate in the meeting and wish to make a written comment on any matter within the Commission's subject matter jurisdiction, regardless of whether it is on the agenda for the Commission's consideration or action, please submit your comment via email or U.S. Mail by 5:00 p.m. on the day prior to the Committee meeting. Please submit your comment to Dick Tzou at dtzou@co.slo.ca.us. Your comment will be placed into the administrative record of the meeting.

   Mailing Address:
   County of San Luis Obispo Department of Public Works
   Attn: Dick Tzou
   County Government Center, Room 206
   San Luis Obispo, CA 93408

4. If you choose not to participate in the meeting and wish to submit verbal comment, please call (805) 781-5252 and ask for Dick Tzou. If leaving a message, state and spell your name, mention the agenda item number you are calling about and leave your comment. The verbal comments must be received by no later than 9:00 a.m. on the morning of the noticed meeting and will be limited to 3 minutes. Every effort will be made to include your comment into the record, but some comments may not be included due to time limitations.

NOTE: The Groundwater Sustainability Commission reserves the right to limit each speaker to three (3) minutes per subject or topic. In compliance with the Americans with Disabilities Act and Executive Order N-29-20, all possible accommodations will be made for individuals with disabilities, so they may participate in the meeting. Persons who require accommodation for any audio, visual or other disability in order to participate in the meeting of the GSC are encouraged to request such accommodation 48 hours in advance of the meeting from Joey Steil at (805) 781-5252.

Groundwater Sustainability Commission
Regular Meeting Minutes (DRAFT)
May 20, 2021

The following members were present:

Bob Schiebelhut, Chair, EVGMWC
Mark Zimmer, Vice Chair, GSWC
Dennis Fernandez, Member, ERMWC/VRMWC
Dawn Ortiz-Legg, Member, County of San Luis Obispo
Andy Pease, Member, City of San Luis Obispo

<table>
<tr><td>1. Call to Order

2. Roll Call

3. Pledge of Allegiance</td><td>Chair Schiebelhut: calls the meeting to order at 3:30 PM.

City Staff, Mychal Boerman: calls roll.

Chair Schiebelhut: leads the Pledge of Allegiance.</td></tr>
<tr><td>4. Public Comment – Items not on Agenda</td><td>Chair Schiebelhut: opens the floor for public comment.

None</td></tr>
<tr><td>5. Approval of Meeting Minutes:
May 5, 2021</td><td>Chair Schiebelhut: opens discussion for Agenda Item 5 - Approval of Meeting Minutes for the May 5, 2021, Groundwater Sustainability Commission meeting and asks for comments from the Commission; there are none.

Motion By: Member Pease
Second By: Member Vice Chair Zimmer
Motion: The Commission moves to approve the May 5, 2021, meeting minutes.

<table>
<tr><th>Members</th><th>Ayes</th><th>Noes</th><th>Abstain</th><th>Recuse</th></tr>
<tr><td>Bob Schiebelhut (Chair)</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Toby Moore (Vice Chair)</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Andy Pease (Member)</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td>Dennis Fernandez (Member)</td><td>X</td><td></td><td></td><td></td></tr>
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<tr><td>6. Continued Item (from May 5, 2021) Introduction to the Implementation Plan</td><td>WSC Consultant, Michael Cruikshank: presents on the Introduction to the Implementation Plan:
Chapter 10 Implementation Plan's attempt is to provide a roadmap or framework of things that will need to be done during the implementation phase of the GSP – a 20-year period. It will not include details on how projects will be funded, or how exactly any implementation of any demand management action. These things will be produced in the first years of the implementation plan. Outline of Chapter 10 is shared.
Annual Reporting Requirements. First annual report is due April 1, 2022, and will cover the period from October 1, 2020, to September 2021. First annual report will become template for future reports.</td></tr>
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	• Five Year Interim Evaluations of the GSP. More detail than annual reports, including basin evaluation. • Financing Plan Elements. Funding mechanism options will be looked at including a fee study. • Conceptual GSP Implementation Timeline shared that includes five-year updates. • Undesirable result thresholds and management actions. (Demand Management Plan) • Conceptual Implementation Scenarios: 1) No Demand Management and 2) Reducing Groundwater Production <u>Discussion:</u> Commission Members and staff discuss: • Supplemental Water Projects in graphic are conceptual at this time and not tied to specific projects. • If minimum threshold of 3300 ft is not met, still may not trigger need for reducing production. • Dry year/wet year scenarios: In annual reports and five-year updates, trends in levels can be reviewed and can develop an adaptive management plan that reacts to climate changes and levels. • Memorializing method for recognizing and documenting early investment in efficiencies: implement metering plan as previously discussed, documenting conservation efforts for future grant options. • Implementation plan will provide intentions to be included in any demand management plan that is created in the first couple of years. Chair Schiebelhut: opens the floor for public comment. Jean-Pierre Wolff: speaks.
7. Future Items	• GSC Meeting – June 16, 2021 • Draft Chapter 9 – Projects and Management Actions • Draft Chapter 10 – Implementation Plan **Due to conflict on June 16, 2021, next meeting will be moved to June 21, 2021.**
8. Next Meeting	June 21, 2021, at 3:00pm via Zoom
9. Adjourn	The Commission adjourns the meeting at 4:40 p.m.

DRAFTED BY: City Staff, Michelle Bulow

GROUNDWATER SUSTAINABILITY COMMISSION

for the San Luis Obispo Valley Groundwater Basin

June 21, 2021

Agenda Item 6 –Responses to Comments Received on GSP Chapter 8 – Sustainable Management Criteria (Presentation Item)

Recommendation

a) Discussions on responses to comments on GSP Chapter 8 and other general items.

Prepared by

Dave O'Rourke, GSI
Dick Tzou, County of San Luis Obispo

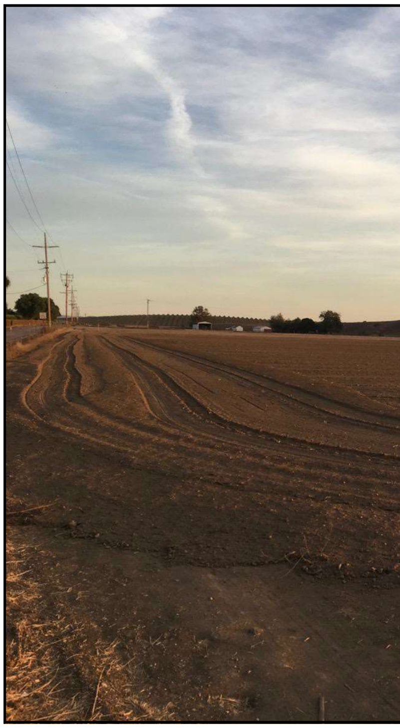
Discussion

The purpose of this item is to open the floor for the GSC members and public to discuss any pertinent comments received for draft Chapter 8 – Sustainable Management Criteria and/or any previous chapters and their associated initial responses to them. The comment period for draft GSP Chapter 8 closed on June 6, 2021. All comments received and their associated initial written responses will be published online and may be viewed at: https://www.slowaterbasin.com/review-documents. Public or GSA comments received during each draft GSP chapter/section's comment period will be considered and appropriate responses will be included when sections are compiled into a complete public draft GSP document, slated for further public review in late summer of 2021 before it is finalized for adoption.

The County GSAs have also received initial comments on the various deficiencies that DWR has identified in the Paso Robles Basin and Cuyama Basin GSPs. However, these initial concerns and potential corrective actions are only preliminary and final determination on GSP approval has not been made. Staff and Consultant Team are currently reviewing DWR's GSP evaluation comments to see if they are applicable to the SLO Basin GSP for any lessons learned.

Attachments:

1. Presentation
2. NMFS Comment Letter on Draft Chapter 8



Response to Comments on GSP Chapter 8 – Sustainable Management Criteria

Dave O'Rourke & Dick Tzou

Chapter 8 Comments and Other General Comments

- Received only one comment entry on Chapter 8 from National Marine and Fisheries Service (NMFS).
- County GSAs have also received comments from DWR's initial reviews of the Paso and Cuyama Basins GSPs.
  - Identified deficiencies and recommended corrective actions
  - The reviews are only preliminary. No final determinations have been made at this point on GSP approval.
- Consultant Team and staff are reviewing DWR's comments to better understand the concerns and any lessons learned.

5 | SLO GSC MEETING •June 21, 2021

Response to Chapter 8 Comments

- NMFS Questions/comments
  - Why two consecutive fall measurements of MTs?
  - Suggest pool depth as a measurement of undesired conditions.
  - Lack of discussion of MTs impacts with respect to fisheries.
  - MTs at historical lows will perpetuate undesirable conditions.
  - GSP has not established required correlation between water levels and streamflow depletion.
  - Oppose MTs lower than historical lows.

Some of these comments will be addressed with revised text.

Many will need to be addressed with the implementation of the monitoring network as outlined in Chapter 7 (Monitoring Network) and the Stillwater Sciences Technical Memorandum on GDEs to be included with GSP.

Groundwater-Dependent Ecosystems in the San Luis Obispo Valley Groundwater Basin – Technical Memorandum

- Summarizes known information about surface water hydrology relevant to GDEs.
- Identifies potential GDEs overlying and dependent upon the aquifer.
- Proposes a hydrologic monitoring network to track GDE indicators over time.
- Utilized to suggest expansions the monitoring network in Chapter 7.
- Relied upon to inform Sustainable Management Criteria in Chapter 8.

EXPANDED MONTIORING NETWORK
GW/SW INTERACTION / GDE MONTIORING NETWORK

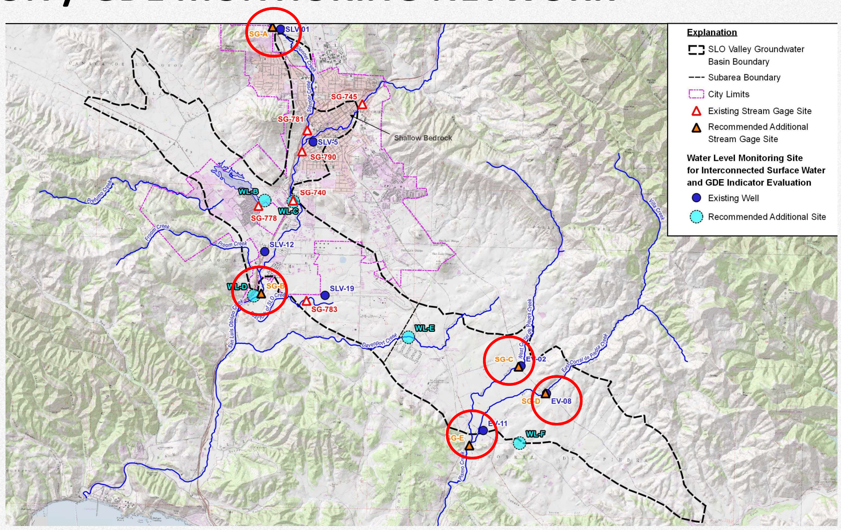
Existing Surface Water Monitoring Sites

6 active gages

Proposed Surface Water Monitoring Network includes

5 additional gages

5 additional wells



8 | SLO GSC MEETING • June 21, 2021

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

June 3, 2021

John Diodati
Interim Director, Public Works Department
County of San Luis Obispo
976 Osos St #207
San Luis Obispo, California 93408

Re: NOAA's National Marine Fisheries Service comments on the May 6, 2021, draft Groundwater Sustainability Plan for the San Luis Obispo Valley Groundwater Basin

Dear Mr. Diodati:

Enclosed with this letter are NOAA's National Marine Fisheries Service's (NMFS) comments on "Chapter 8: Groundwater Conditions" of the draft Groundwater Sustainability Plan (GSP) for the San Luis Obispo (SLO) Valley Groundwater Basin.

The GSP is intended to meet the requirements of the California Sustainability Groundwater Management Act (SGMA). The SMGA includes specific requirements to identify and consider impacts to Groundwater Dependent Ecosystems (GDE) that have significant and unreasonable adverse impacts on all recognized beneficial uses of groundwater and related surface waters (Water Section 10720), including fish and wildlife and botanical resources.

As explained more fully in the enclosed comments, the draft Chapter 8 does not adequately address the recognized instream beneficial uses of the SLO Valley Basin, which underlies San Luis Obispo Creek and Pismo Creek, or other GDE, potentially affected by the management of groundwater within the SLO Valley Basin. In particular, the draft Chapter 8 does not adequately analyze or identify Sustainable Management Criteria that have the potential to affect the federally threatened South-Central California Coast steelhead (*Oncorhynchus mykiss*). This information is necessary because management of the SLO Valley Basin has consequences for the amount and extent of surface flows in San Luis Obispo Creek and Pismo Creek, both of which support populations of threatened steelhead.

Our enclosed comments include recommendations for revisions that are intended to assist the County of San Luis Obispo develop a final GSP that meets the requirements of the SGMA. To this end, NMFS recommends that the revised draft Chapter 8 be re-circulated to give interested parties an opportunity to review and comment before it is finalized.

NMFS appreciates the opportunity to provide the enclosed comments on the draft Chapter 8. If you have a question regarding this letter or enclosure, please contact Mr. Mark H. Capelli in our Santa Barbara Office (805) 963-6478 or mark.capelli@noaa.gov, or Mr. Andres Ticlavilca in our Santa Rosa Office (707-575-6054) andres.ticlavilca@noaa.gov.

Sincerely,

Anthony P. Spina
Chief, Southern California Branch
California Coastal Office

cc:

Natalie Stork, Chief, DWR, Groundwater Management Program
James Nachbaur, SWRCB
Annette Tenneboe, Region 4, CDFW
Julie Vance, Regional Manager, Region 4, CDFW
Steve Slack, CDFW
Kristal Davis-Fadtke, Water Branch, CDFW
Dennis Michniuk, District Fisheries Biologist, Region 4, CDFW
Annee Ferranti, Environmental Program Manager Resource Conservation, CDFW
Suzanne De Leon, Region 4, CDFW
Don Baldwin, Region 4, CDFW
Christopher Diel, Ventura Field Office, USFWS
Ronnie Glick, CDP&R
Fred Otte, City of San Luis Obispo

Enclosure

NOAA's National Marine Fisheries Service's Comments on the draft Groundwater Sustainability Plan (Chapter 8: Sustainable Management Criteria) for the San Luis Obispo Valley Groundwater Basin (May 6, 2021)

June 3, 2021

Background

NOAA's National Marine Fisheries Service (NMFS) is responsible for protecting and conserving anadromous fish species listed under the U.S. Endangered Species Act (ESA), including the federally threatened South-Central California Coast (SCCC) Distinct Population Segment (DPS) of Steelhead (*Oncorhynchus mykiss*), which utilize San Luis Obispo Creek and Pismo Creek. NMFS listed SCCC, including the populations in the San Luis Obispo Creek and Pismo Creek watersheds (which overlies a portion of the SLO Valley Basin), as "threatened" in 1997 (62 FR 43937), and reaffirmed the threatened status of the species in 2006 (71 FR 5248).

On March 12, 2020, the California Department of Water Resources (DWR) designated the SLO Valley Basin a "Medium" priority for groundwater management, requiring the development of a final Groundwater Sustainability Plan (GSP) by January 31, 2022, pursuant to the 2014 SGMA. Several watercourses that overlie portions of the SLO Valley Basin, including San Luis Obispo Creek and the headwaters of Pismo Creek, support federally threatened steelhead.

The available information establishes that surface water and groundwater are hydraulically linked in the SLO Valley Basin, and this linkage is critically important in creating seasonal habitat for threatened SCCC steelhead. Where the groundwater aquifer supplements streamflow, the influx of cold, clean water is essential for maintaining suitable water temperature and surface flow (Brunke and Gosmer 1997). Pumping from these aquifer-stream complexes can adversely affect freshwater rearing areas for juvenile steelhead by lowering groundwater levels and interrupting the hyporheic flow between the aquifer and the stream, particularly during summer and fall months when streamflow is already low. Thus, groundwater extraction in the SLO Valley Basin has the potential to adversely affect threatened SCCC steelhead through a reduction in the amount and extent of freshwater rearing sites for this species.

NMFS has previously commented on Chapter 5: Groundwater Conditions of the SLO Valley Basin GSP and provided background information on steelhead life history habitat requirements, and the role of both Pismo Creek and San Luis Obispo Creek in NMFS' South-Central Steelhead Recovery Plan (2013). See NMFS' May 29, 2020 letter to John Diodati, Interim Director, Public Works Department County of San Luis Obispo County).

Specific Comments

Page 29: The draft Chapter 8 indicates the basin will be considered to have experienced undesirable results if any of the monitoring wells exceed the minimum threshold for two consecutive fall measurements. The standard of failing two consecutive fall measurements is not explained, and thus appears arbitrarily. Steelhead migration, spawning and rearing (beneficial uses of surface water as set by the Regional Water Quality Control Board[1]) are biological processes that can be impacted by a single streamflow depletion event. SGMA regulations require a minimum threshold be used to define an undesirable result, in this case streamflow depletion resulting in significant and unreasonable impact to beneficial uses of surface water. For a beneficial use such as steelhead rearing, a depletion of adequate streamflow can result in steelhead mortality, and is therefore irreversible. We therefore recommend that the standard for determining undesirable results be expressed in terms of minimum pool depth and/or surface flow during the summer and fall base flow periods.

Page 29: Groundwater elevations may be necessary as a proxy for streamflow depletion due to a lack of data gathered to this point. However, there appears to be no attempt at correlating groundwater elevation thresholds with impacts to beneficial uses of surface water. In fact, many of the groundwater elevation minimum thresholds are set at the lowest (or below the lowest) groundwater elevations ever recorded within the basin. These thresholds are likely associated with severe groundwater over-pumping during dry periods, when groundwater depletion was greatest, and surface water discharge the lowest. Managing streamflow depletion conditions comparable with the severest drought conditions is not protective of surface water beneficial uses that support ESA-listed steelhead, and likely would result in adversely affecting steelhead and its identified critical habitat (see enclosed steelhead critical habitat and intrinsic potential maps for San Luis Obispo Creek and Pismo Creek). If the GSAs uses groundwater levels as a proxy for streamflow depletion, it should explain how the chosen minimum thresholds and measurable objectives adequately avoid adversely impacting surface water beneficial uses that support steelhead survival throughout the SLO Basin. If that effort proves problematic due to a lack of data at the present time, the GSAs should follow guidance by the California Department of Fish and Wildlife that recommends a conservative approach to groundwater dependent ecosystem protection in those situations (CDFW 2019).

Page 29, Section 8.9.2: The draft includes the following statement:

> *To avoid management conditions that allow for lower groundwater elevations than those historically observed, MTs* [Minimum Thresholds]f*or 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).*

As noted above, managing to perpetuate historically low groundwater elevations is not appropriate as a management threshold, since it does not adequately define the undesirable result of streamflow depletion on aquatic biological resources such as federally threatened South-Central Coast steelhead. Based upon fundamental hydrogeologic principles where the depletion rate is proportional to the difference between the water table and surface water, the amount of streamflow depletion associated with the proposed minimum thresholds would be the greatest on record (Sophocleous 2002, Bruner *et al*. 2011, Barlow and Leake 2012). This level of streamflow depletion would likely impact surface water beneficial uses to the extent that threatened steelhead would experience "harm" under the ESA as well as result in adverse impacts to Groundwater Dependent Ecosystems (GDE) supporting a variety of native aquatic species.

Page 30: Following the discussion on the relation between flow conditions in San Luis Obispo Creek and the underlying aquifer, the draft Chapter 8 asserts, "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." The point of this statement is unclear but seems to suggest that groundwater levels are not significantly influenced by the volume (including duration) of stream flow. However, this implication is contradicted by the statement, "In wetter years, when flows in the San Luis Obispo Creek are high there is [sic] greater amounts of discharge from the creek to the groundwater system." In general, higher and longer the duration flows in SLO Creek will increase the area of wetted stream bottom (i.e., the area of infiltration) as well as the duration of the infiltration of surface flows to the underlying groundwater basin. Furthermore, the assertion that stable groundwater levels at a specific well "suggest that the mechanisms of surface water/groundwater interaction have not been negatively impacted since the early 1990's" does not address the question of whether these stable conditions have had and are resulting in streamflow depletion impacts as defined under SGMA. Currently stable groundwater levels are not an indicator of sustainable groundwater conditions, or, more specifically, avoidance of significant and unreasonable effects on streamflow. The revised draft Chapter 8 should address this issue and clearly indicate how existing stable groundwater conditions are protective of GDE, such as rearing habitat for juvenile steelhead.

Page 31: The draft Chapter 8 states that, "by defining minimum thresholds in terms of groundwater elevations….the GSA will….manage potential changes in depletion of interconnected surface (sic [flows?])." The draft Chapter 8, however, has not established the required correlation between groundwater elevations and surface flows that would justify groundwater levels as a proxy for streamflow depletion, and has not quantified what level of streamflow depletion represents significant and unreasonable impacts to GDE, including but not limited to rearing habitat for juvenile steelhead. The draft Chapter 8 should identify the data needed to analyze the relationship of groundwater levels, streamflow depletion rates, and impacts to GDE, specifically spawning, rearing and migration of ESA-listed steelhead.

Page 31: The draft Chapter 8 establishes minimum thresholds for streamflow depletions as "the lowest water levels observed in the period of record" for the chosen monitoring wells. As noted earlier, according to SGMA regulations a minimum threshold is used to define an undesirable result, in this case streamflow depletion resulting in significant and unreasonable impact to GDE, including, but not limited to rearing juvenile steelhead. The use of a streamflow depletion thresholds associated with the lowest recorded groundwater levels are inappropriate because they will not avoid significant and unreasonable impacts to GDE. The thresholds are inappropriate for avoiding impacts to ESA-listed steelhead resulting from streamflow depletion. To be consistent with the requirements of SGMA, the GSAs must develop thresholds that are likely to avoid adversely impacting steelhead, as well as other GDE.

Page 32: The draft Chapter 8 includes no information or analysis that supports the assertion that "maintaining groundwater levels close to historically observed ranges will continue to support groundwater dependent ecosystems." As noted above, there is an assumption embedded within the assertion that current groundwater levels support groundwater dependent ecosystems; this has not been supported by any data or analysis because such information is not presented in the draft document. Managing groundwater levels at historical lows is likely to adversely affect ESA-listed steelhead, and designated critical habitat for this species. To be consistent with the requirements of SGMA, the GSAs must develop minimum thresholds that are likely to avoid adversely impacting steelhead, as well as other GDE.

Finally, it is unclear if the reference in the draft Chapter 8 to the Water Budget is to Chapter 5 and/or Chapter 6. If the draft Chapter 8 is referring to Table 6-20 (Current Water Budget – Basin Total), the comparison between the annual groundwater/ surface water interaction with an annual outflow volume of the watershed does not provide an indication of aquatic habitat conditions during low flow periods. We would note that intermittent stream reaches can provide seasonally important rearing habitat for juvenile steelhead. Reaches that temporarily lose surface flow through the natural seasonal reduction in groundwater levels can be re-occupied by fish rearing in other parts of the stream system as groundwater levels rebound and surface flows are reinitiated in the temporarily desiccated reaches (Boughton *et al.* 2009). However, artificially reduced groundwater levels can accelerate the temporary cessation of surface flows, and then delay the re-initiation of surface flows, thus reducing the amount and quality of rearing habitat with the stream system and adversely affect GDE.

References

Brunke, M. and T. Gosner. 1977. The Ecological Significance of Exchange Processes between Rivers and Groundwater. *Freshwater Biology* 37(1977): 1-33.

Barlow, P.M., and Leake, S.A. 2012. Streamflow depletion by wells—Understanding and managing the effects of groundwater pumping on streamflow: U.S. Geological Survey Circular 1376. Available at: http://pubs.usgs.gov/circ/1376/).

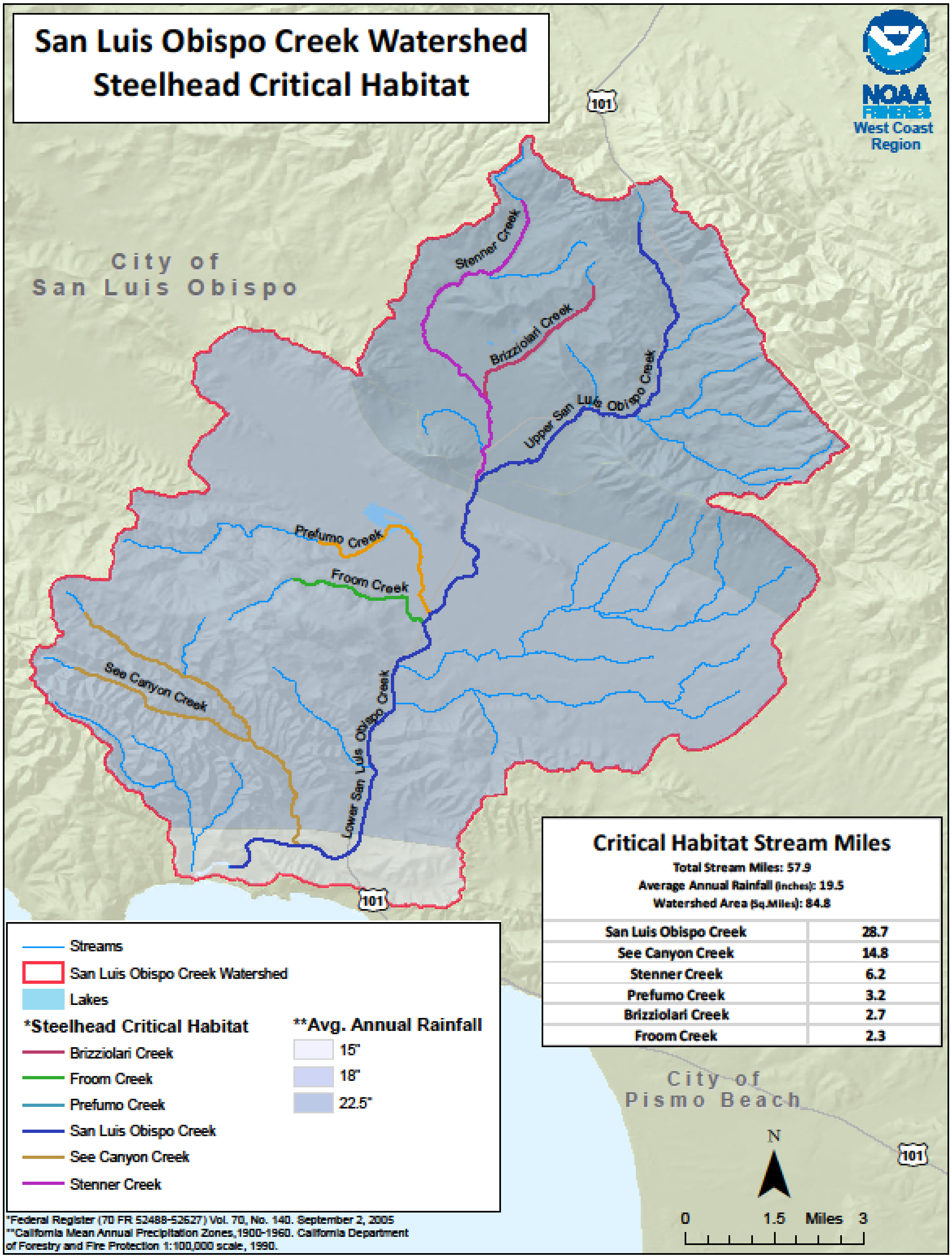
Boughton, D. H., H. Fish, J. Pope, and G. Holt. 2009. Spatial patterning of habitat for *Oncorhynchus mykiss* in a system of intermittent and perennial stream. *Ecology of Freshwater Fishes* 18: 92-105.

Brunner, P., Cook, P., and C. Simmons. 2011. Disconnected surface water and groundwater: from theory to practice. *Ground Water* 49(4): 460-467.

California Department of Fish and Wildlife. 2019. Fish & Wildlife Groundwater Planning Considerations. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=170185&inline

National Marine Fisheries Service. 2013. South-Central California Steelhead Recovery Plan. California Coastal Area Office. Long Beach, CA.

Sophocleous, M. 2002. Interactions between Groundwater and Surface Science. *Hydrogeology Journal* 10.1 (2002): 52-67.


San Luis Obispo Creek Watershed
Steelhead Critical Habitat
NOAA FISHERIES
West Coast Region
City of San Luis Obispo
City of Pismo Beach
101
Stenner Creek
Brizziolari Creek
Upper San Luis Obispo Creek
Prefumo Creek
Froom Creek
See Canyon Creek
Lower San Luis Obispo Creek
Critical Habitat Stream Miles
Total Stream Miles: 57.9
Average Annual Rainfall (inches): 19.5
Watershed Area (Sq.Miles): 84.8
San Luis Obispo Creek 28.7
See Canyon Creek 14.8
Stenner Creek 6.2
Prefumo Creek 3.2
Brizziolari Creek 2.7
Froom Creek 2.3
Streams
San Luis Obispo Creek Watershed
Lakes
*Steelhead Critical Habitat
Brizziolari Creek
Froom Creek
Prefumo Creek
San Luis Obispo Creek
See Canyon Creek
Stenner Creek
**Avg. Annual Rainfall
15"
18"
22.5"
N
0 1.5 Miles 3
*Federal Register (70 FR 52488-52627) Vol. 70, No. 140. September 2, 2005
**California Mean Annual Precipitation Zones,1900-1960. California Department of Forestry and Fire Protection 1:100,000 scale, 1990.

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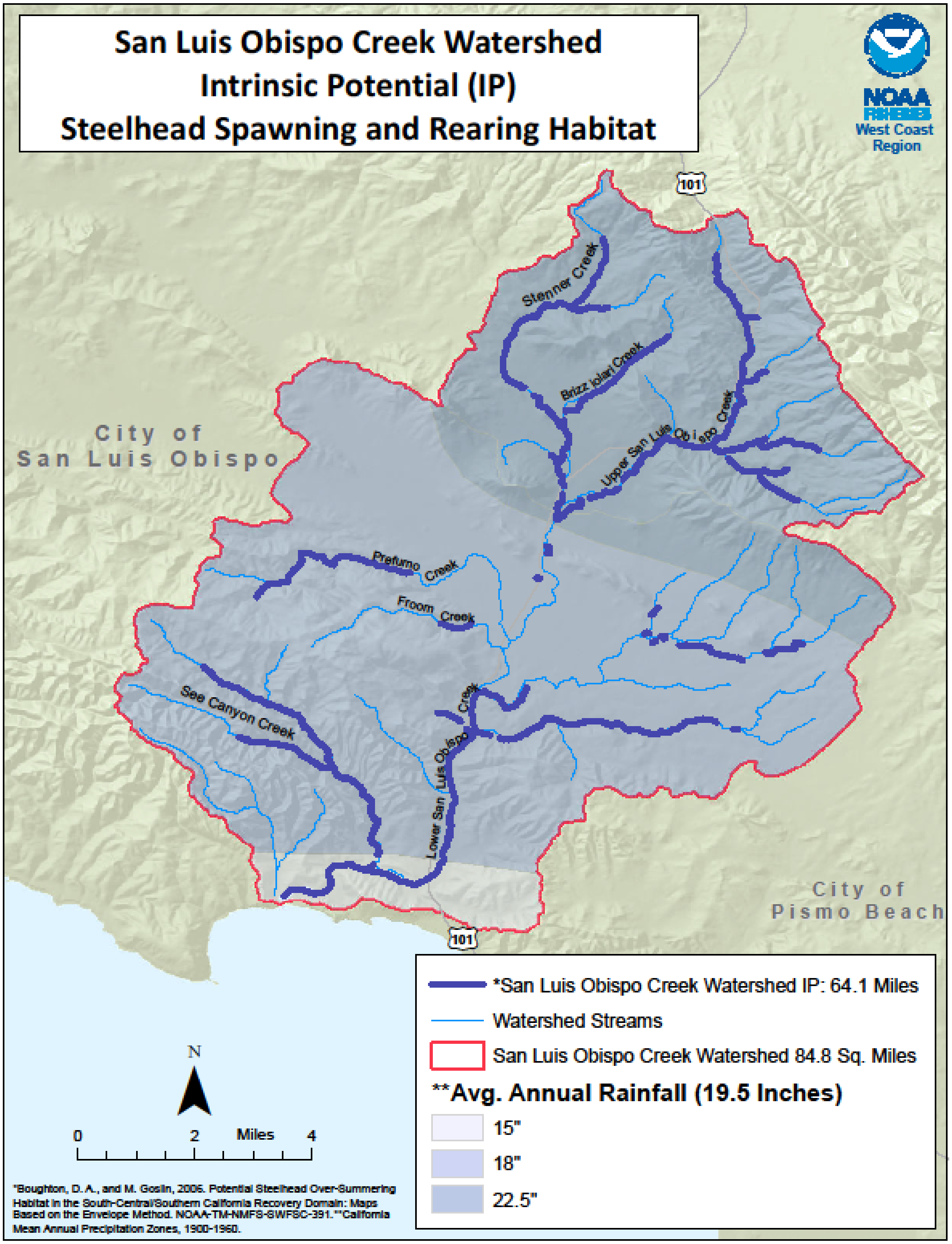
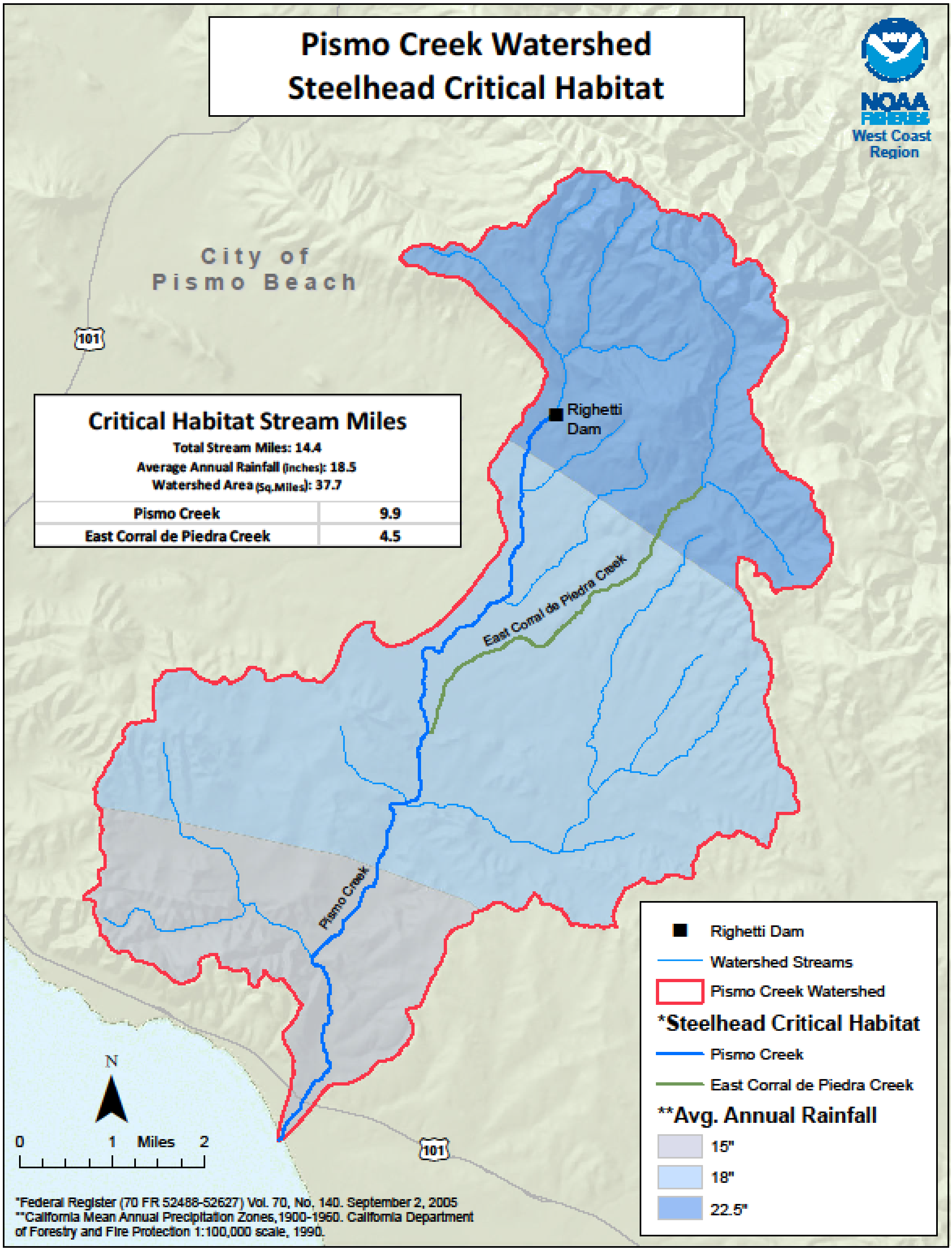
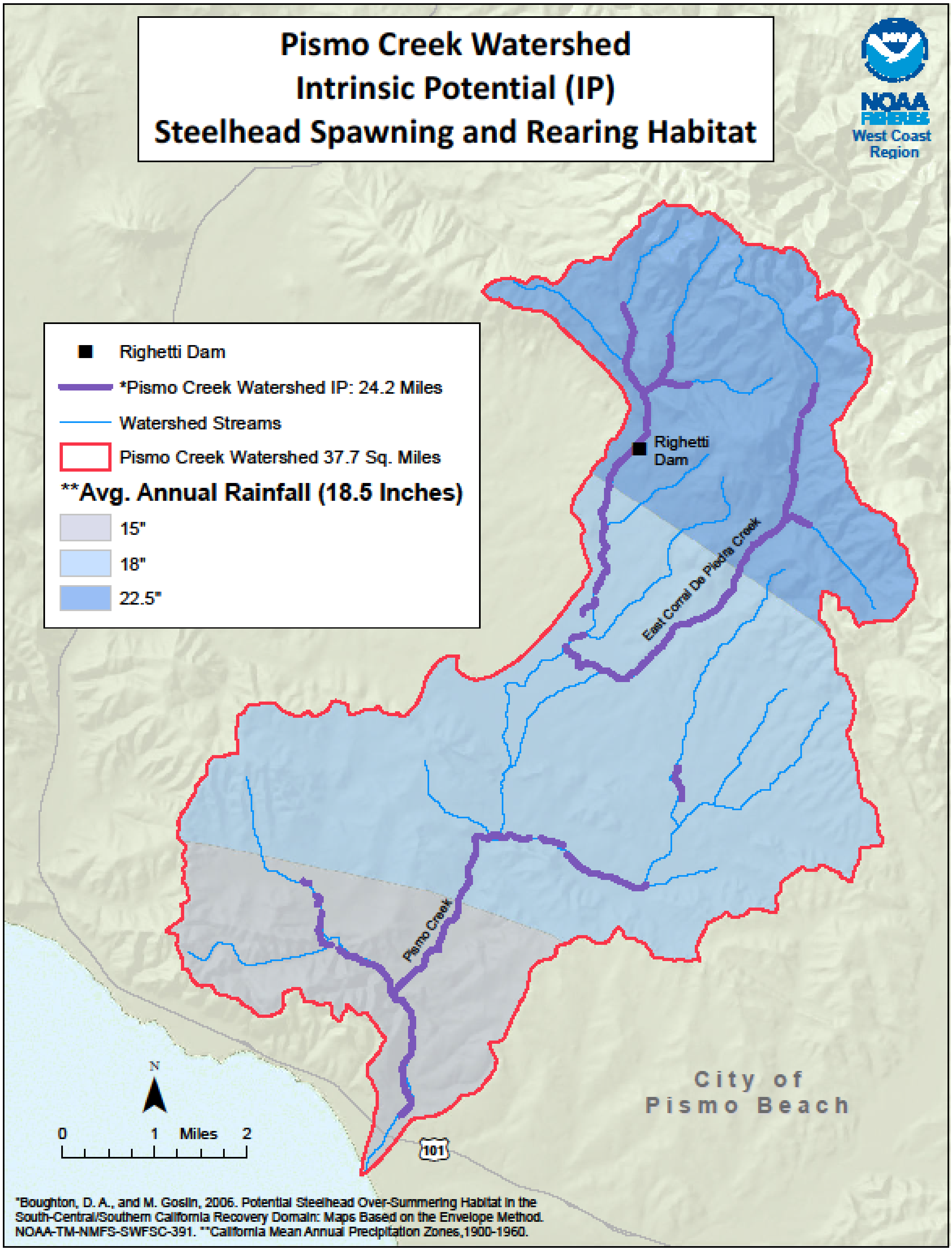

San Luis Obispo Creek Watershed
Intrinsic Potential (IP)
Steelhead Spawning and Rearing Habitat
NOAA FISHERIES
West Coast Region
City of San Luis Obispo
City of Pismo Beach
101
Stenner Creek
Brizziolari Creek
Upper San Luis Obispo Creek
Prefumo Creek
Froom Creek
See Canyon Creek
Lower San Luis Obispo Creek
*San Luis Obispo Creek Watershed IP: 64.1 Miles
Watershed Streams
San Luis Obispo Creek Watershed 84.8 Sq. Miles
**Avg. Annual Rainfall (19.5 Inches)
15"
18"
22.5"
N
0
2
Miles
4
*Boughton, D. A., and M. Goslin, 2006. Potential Steelhead Over-Summering Habitat in the South-Central/Southern California Recovery Domain: Maps Based on the Envelope Method. NOAA-TM-NMFS-SWFSC-391. **California Mean Annual Precipitation Zones, 1900-1960.

9


Pismo Creek Watershed
Steelhead Critical Habitat
NOAA FISHERIES
West Coast Region
City of Pismo Beach
101
Critical Habitat Stream Miles
Total Stream Miles: 14.4
Average Annual Rainfall (inches): 18.5
Watershed Area (Sq.Miles): 37.7
Pismo Creek 9.9
East Corral de Piedra Creek 4.5
Righetti Dam
East Corral de Piedra Creek
Pismo Creek
N
0 1 Miles 2
101
Righetti Dam
Watershed Streams
Pismo Creek Watershed
*Steelhead Critical Habitat
Pismo Creek
East Corral de Piedra Creek
**Avg. Annual Rainfall
15"
18"
22.5"
*Federal Register (70 FR 52488-52627) Vol. 70, No. 140. September 2, 2005
**California Mean Annual Precipitation Zones,1900-1960. California Department of Forestry and Fire Protection 1:100,000 scale, 1990.

10


Pismo Creek Watershed
Intrinsic Potential (IP)
Steelhead Spawning and Rearing Habitat
NOAA FISHERIES
West Coast Region
Righetti Dam
*Pismo Creek Watershed IP: 24.2 Miles
Watershed Streams
Pismo Creek Watershed 37.7 Sq. Miles
**Avg. Annual Rainfall (18.5 Inches)
15"
18"
22.5"
Righetti Dam
East Corral De Piedra Creek
Pismo Creek
City of Pismo Beach
101
N
0 1 Miles 2
*Boughton, D. A., and M. Goslin, 2006. Potential Steelhead Over-Summering Habitat in the South-Central/Southern California Recovery Domain: Maps Based on the Envelope Method. NOAA-TM-NMFS-SWFSC-391. **California Mean Annual Precipitation Zones,1900-1960.

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GROUNDWATER SUSTAINABILITY COMMISSION
for the San Luis Obispo Valley Groundwater Basin
June 21, 2021

Agenda Item 7 – Draft GSP Chapter 9: Projects and Management Actions and Chapter 10: Implementation Plan and Draft Technical Memorandum on Groundwater Dependent Ecosystem (GDE) for Review and Comment
(Action Item)

Recommendation

a) Consider recommending Draft GSP Chapter 9: Projects and Management Actions and Chapter 10: Implementation Plan to be received and filed by the Groundwater Sustainability Agencies (GSAs) and released for public comment.
b) Consider recommending Draft Technical Memorandum on GDE in the San Luis Obispo Valley Groundwater Basin to be received and filed by the GSAs and released for public comment.

Prepared by

Michael Cruikshank, WSC
Dan Heimel, WSC

Discussion

The WSC Team, has been tasked with the preparation of the Groundwater Sustainability Plan (GSP) for the SLO Basin to meet the requirements of SGMA. Chapter 9 – Projects and Management Actions and Chapter 10 – Implementation Plan, have been drafted and are included in your Agenda Packet.

Chapter 9: Projects and Management Actions describes the projects and management actions information to satisfy Sections 354.42 and 354.44 of the SGMA Regulations. The projects and management actions are designed to mitigate the overdraft conditions in the Edna Valley as described in Chapter 6 – Water Budget. This chapter includes a description of the projects and management actions the GSAs have determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the SLO Basin (Basin).

Chapter 10: Implementation Plan is intended to serve as a conceptual roadmap for each GSA to start implementing the GSP in accordance with Section 354.8(f)(2) and (3) of the SGMA regulations. The implementation plan provided in this chapter is based on current understanding of the 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

Also included as an attachment is a draft technical memorandum prepared by Stillwater Sciences regarding the GDEs in the Basin. GDEs are defined in SGMA as "ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR § 351(m)). This tech memo was previously referenced in Chapter 7: Monitoring Network and is reference in Chapter 9 as part of the expansion of the monitoring network management action. The tech memo summarizes known information about surface water hydrology relevant to GDEs in the Basin, identify GDEs overlying and dependent upon the aquifer, identify sustainable GDE indicators, and propose a hydrologic monitoring network to track these indicators over time.

Chapters 9 and 10 and the GDE TM will be uploaded to SLOWaterBasin.com for review and public comment after the GSC has recommended that each GSA receives and files the draft chapters and TM. The WSC Team will present an overview of Chapter 9 and 10 and the GDE TM.

Attachments:
1. Presentation
2. Draft Chapters 9 and 10
3. Draft Technical Memorandum on Groundwater Dependent Ecosystem (GDE)

DRAFT GSP Chapters 9 and 10: Projects and Management Actions and Implementation Plan Chapters

Dan Heimel
Michael Cruikshank

Projects and Management Actions Chapter Organization

- Introduction to Projects and Management Actions
- Overview of Potential Projects
  - P&MA Development
  - Addressing Sustainability Indicators
  - Overdraft Mitigation
- Integrated Surface Water and Groundwater Modeling
- *Projects*
  - *Project Benefits (§354.44.5)*
  - *Supply Reliability (§354.44.6)*
  - *Project Costs (§354.44.8)*
  - *Project Implementation (§354.44.4)*
  - *Basin Uncertainty (§354.44.9d)*
  - *Legal Authority (§354.44.7)*
  - *Permitting and Regulatory Processes (§354.44.3)*
  - *Public Notice and Outreach (§354.44B)*

Projects and Management Actions Chapter Organization

- Management Actions
  - Expand Monitoring Network
  - Groundwater Etraction Metering and Reporting Plan
    - De Minimis Self-Certification
    - Non-De Minimis Extraction and Reporting Program
- Demand Management Plan
  - Water Conservation Measures
  - Irrigation Efficiency Improvements
  - Volunteer Water Efficient Crop Conversion
  - Volunteer Fallowing of Crops
  - Pumping Reductions
- Adaptive Management

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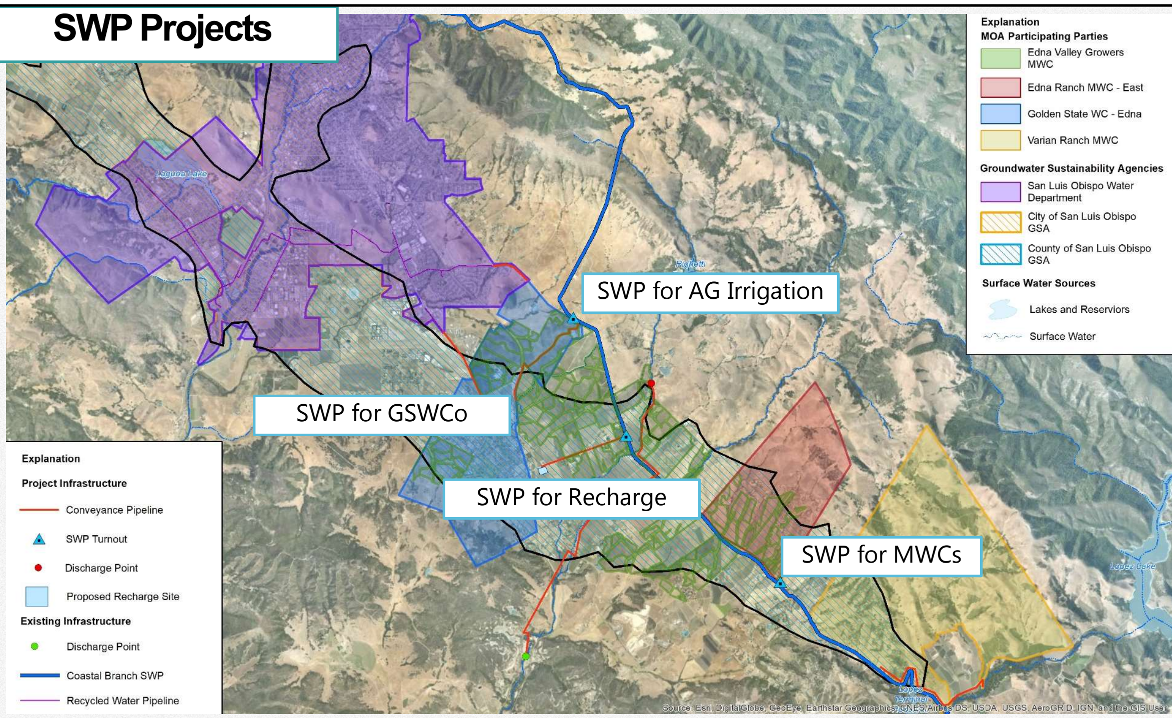
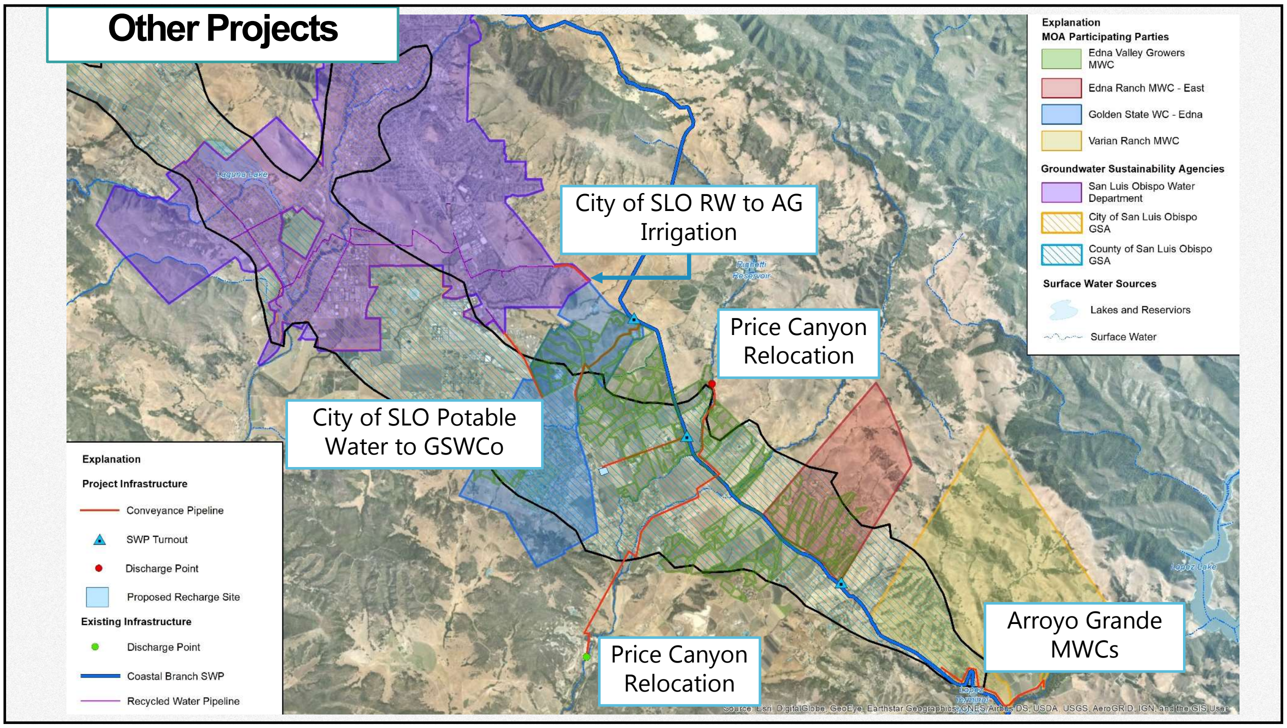
SWP Projects

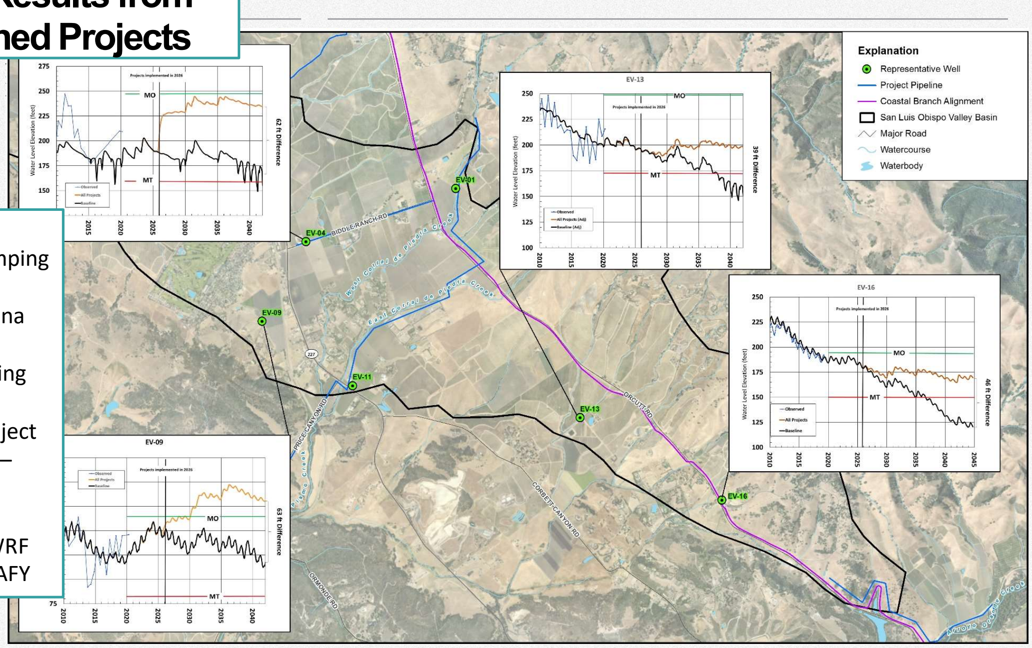


Other Projects



Model Results from Combined Projects

- Reduction of agricultural pumping by 1,000 AFY
- Reduction of Edna Valley water purveyor pumping by 250 AFY
- State Water Project Recharge Basin – 500 AFY
- Relocation of Sentinel Peak WRF discharge –350AFY

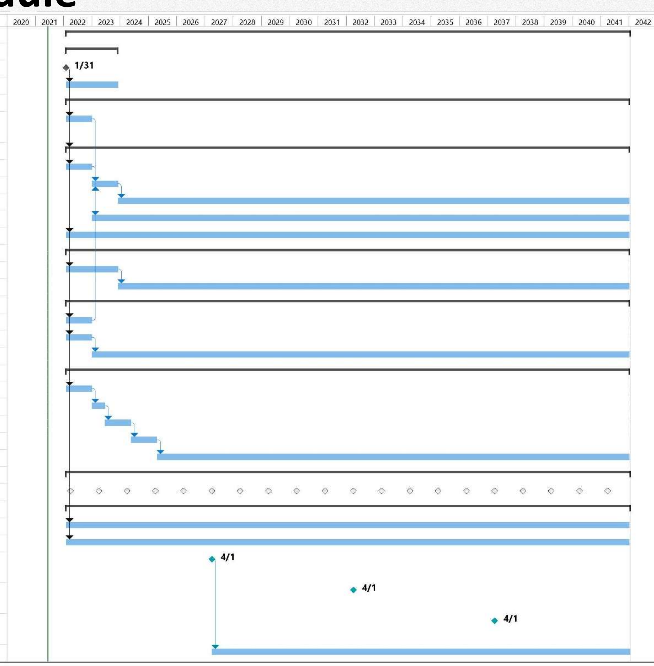


Implementation Chapter Outline

- GSP Implementation, Administration, and Management
  - Administrative Approach/Governance Structure
  - Implementation Schedule
  - Implementation Costs
  - Outreach and Communication
- Funding
- Reporting
  - Annual Reports
  - Five Year Evaluation Reports

Implementation 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



Implementation Costs (2022 – 2027, excluding projects)

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

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NEXT STEPS

August 11th GSC Meeting*

- Respond to Chapter 9 and 10 Comments
- Release Public Draft of the GSP for review (30-day review period)

October 6th GSC Meeting*

- Response to Comments on Public Draft
- Final Draft of the GSP for GSC to receive and file with the GSAs

December GSAs Board Meeting

- GSP Adoption

*Anticipated in-person meeting venue to be determined

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RECOMMENDATION

GSAs to Receive and File
Chapter 9: Projects and Management Actions and Chapter 10: Implementation Plan
GDE Tech Memo

Release for public comment

Public Comment period will be open tomorrow upon GSC approval and closes 07/21/21
30—days.

Go to **SLOWaterBasin.com** click on "Review Documents"

PUBLIC MEETINGS.

GSC Public Meeting
08/11/21 • 3:00pm-5:00pm

Learn more or register at **SLOWaterBasin.com**, click on "Calendar"

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

LIST OF FIGURES

TABLES

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
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**

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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.

7

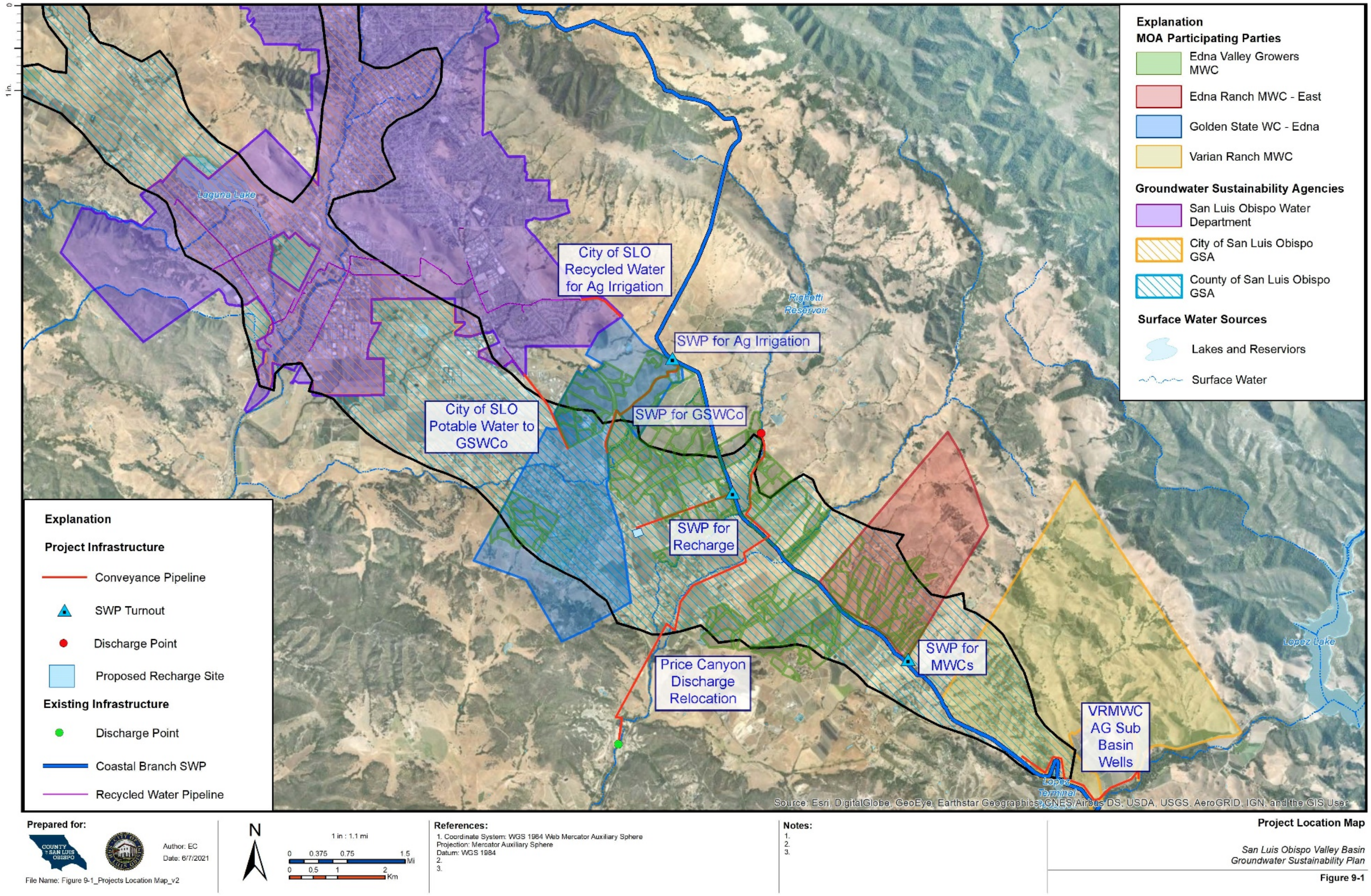

Figure 9-1. Project Location Map

8

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.

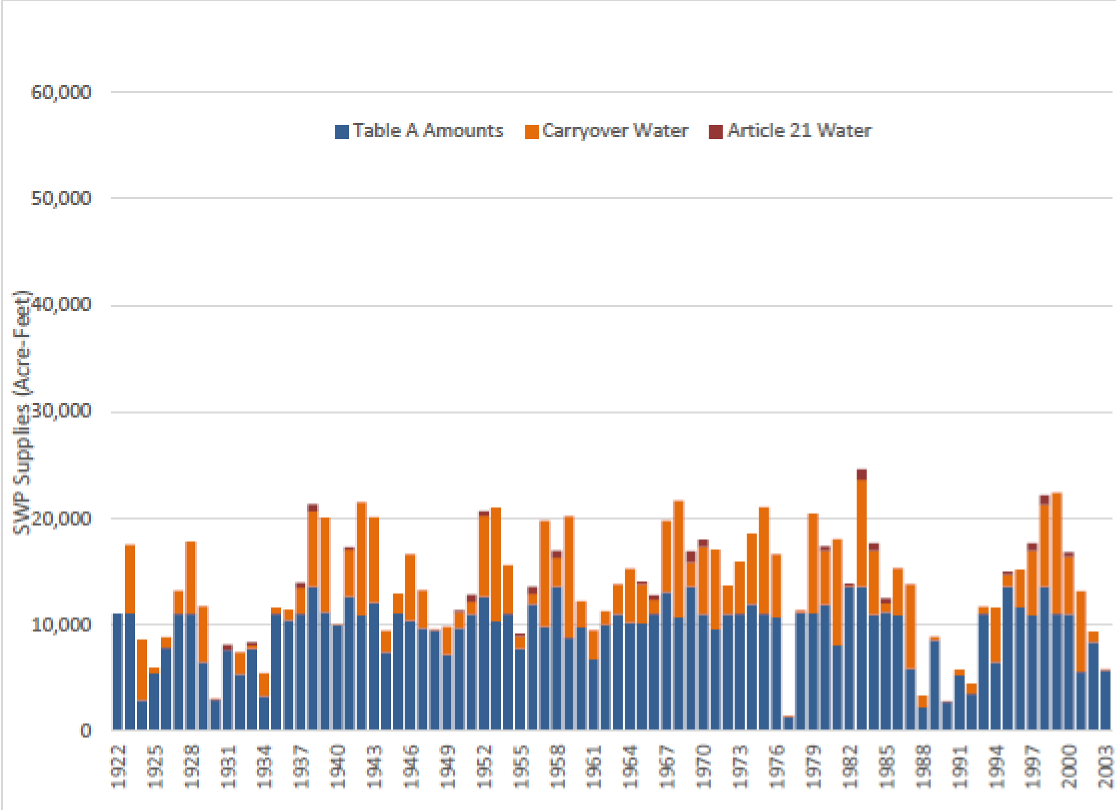

Figure 9-2 Anticipated Future Availability of District SWP Supplies Based on the Historic Hydrologic Period (1922-2003)

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.

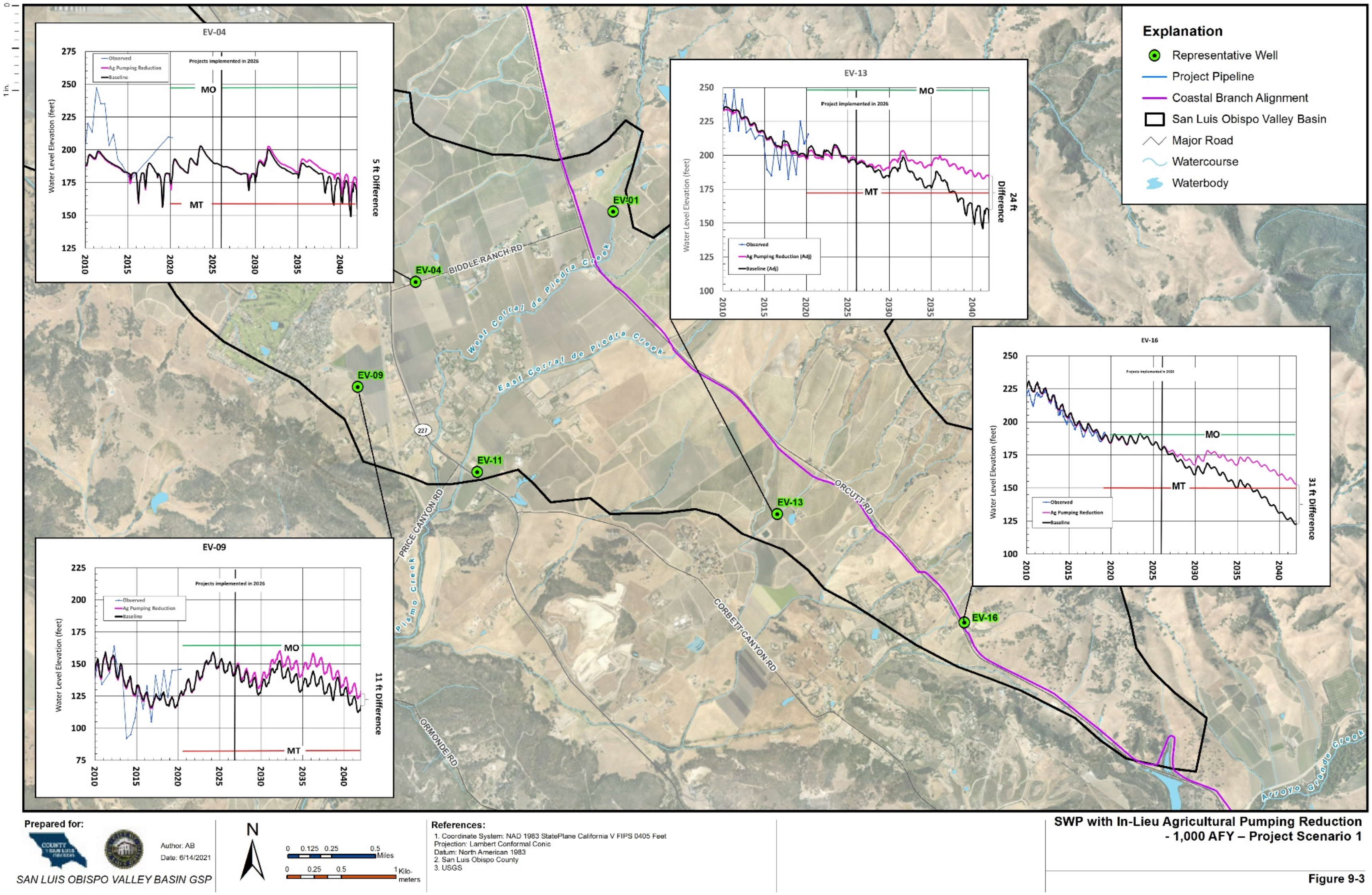

Figure 9-3 SWP with In-Lieu Agricultural Pumping Reduction - 1,000 AFY – Project Scenario 1

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.

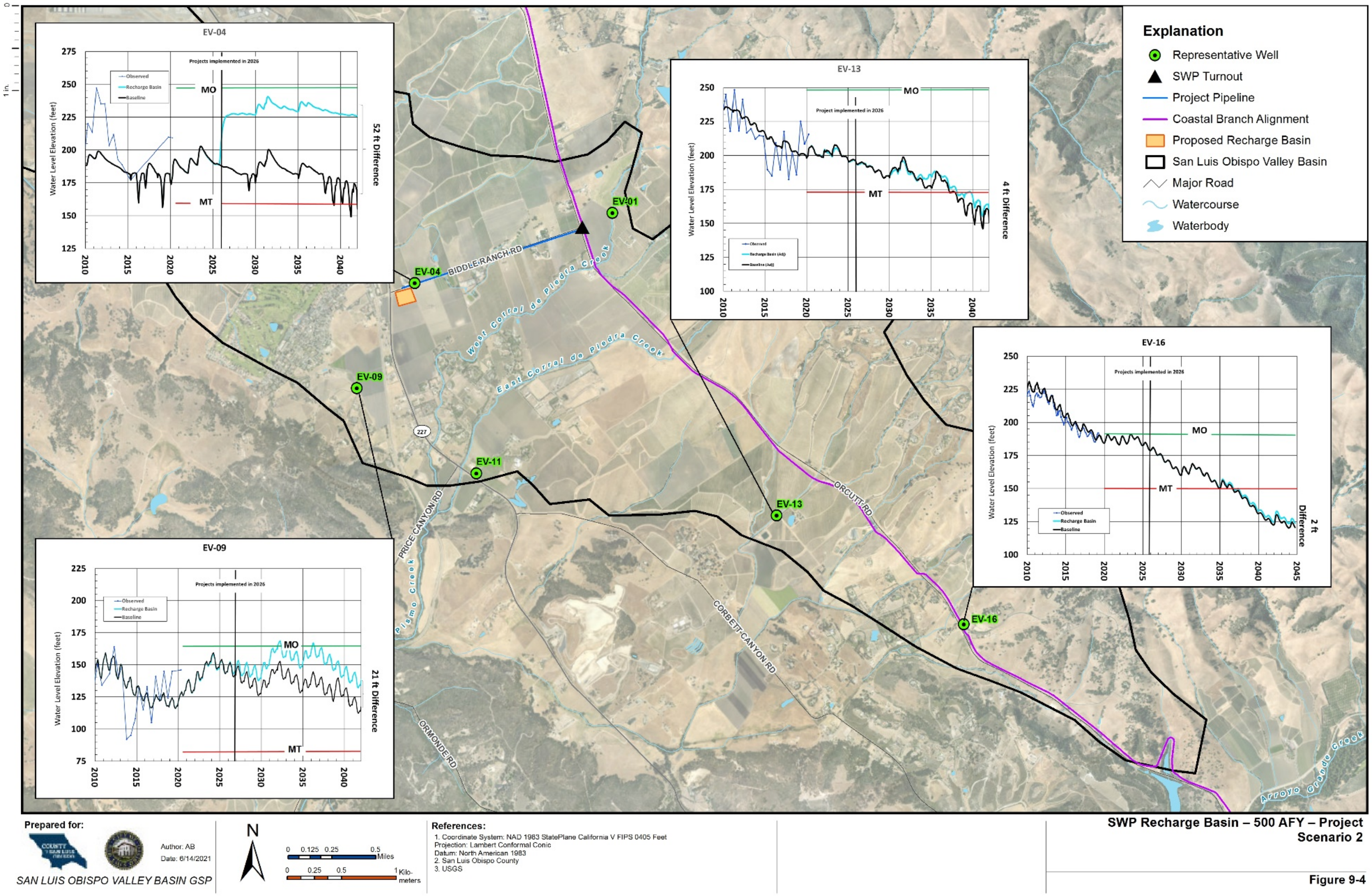

Figure 9-4. SWP Recharge Basin – 500 AFY – Project Scenario 2

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.

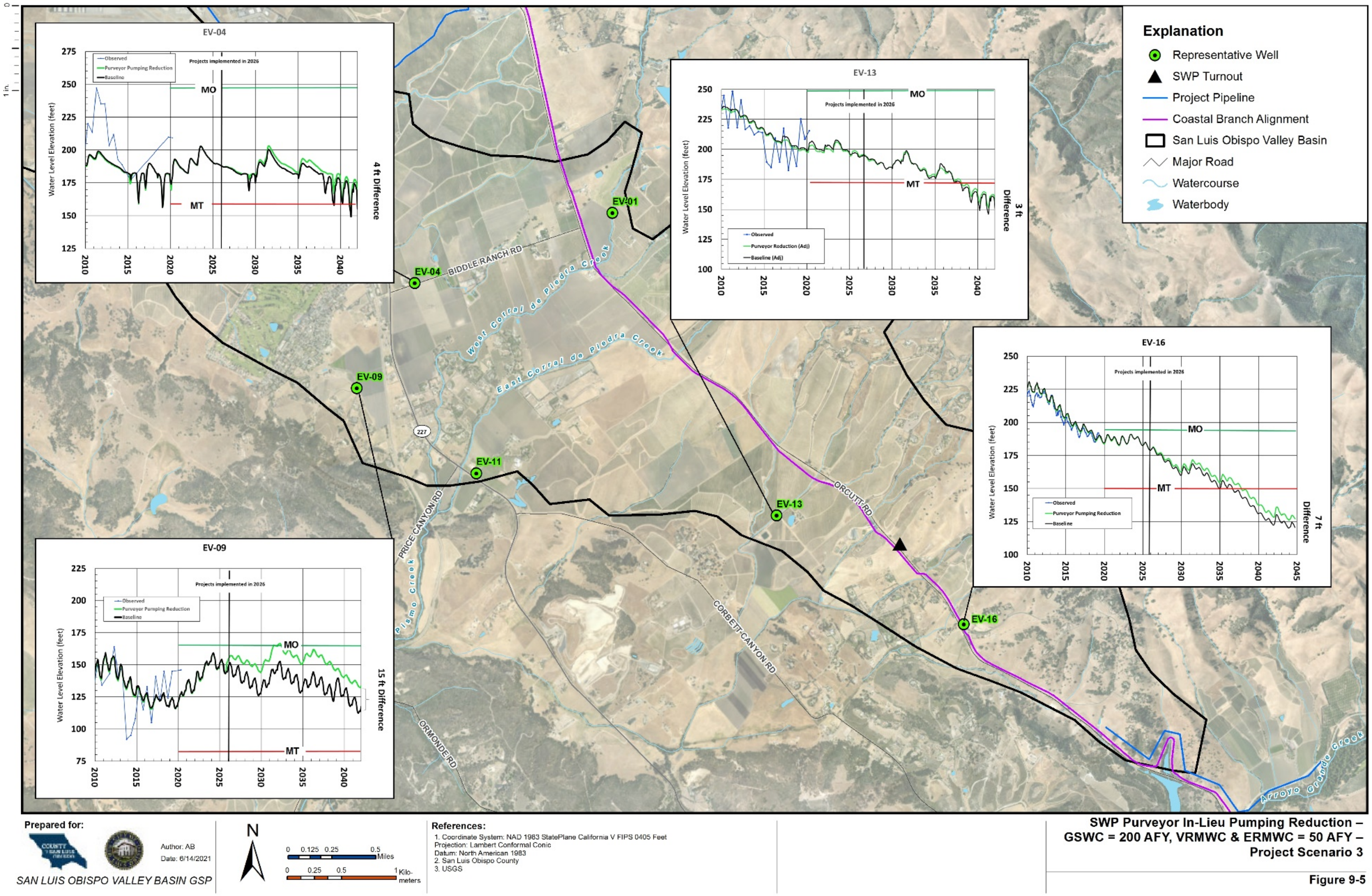

Figure 9-5 SWP Purveyor In-Lieu Pumping Reduction – GSWC = 200 AFY, VRMWC & ERMWC = 50 AFY – Project Scenario 3

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.

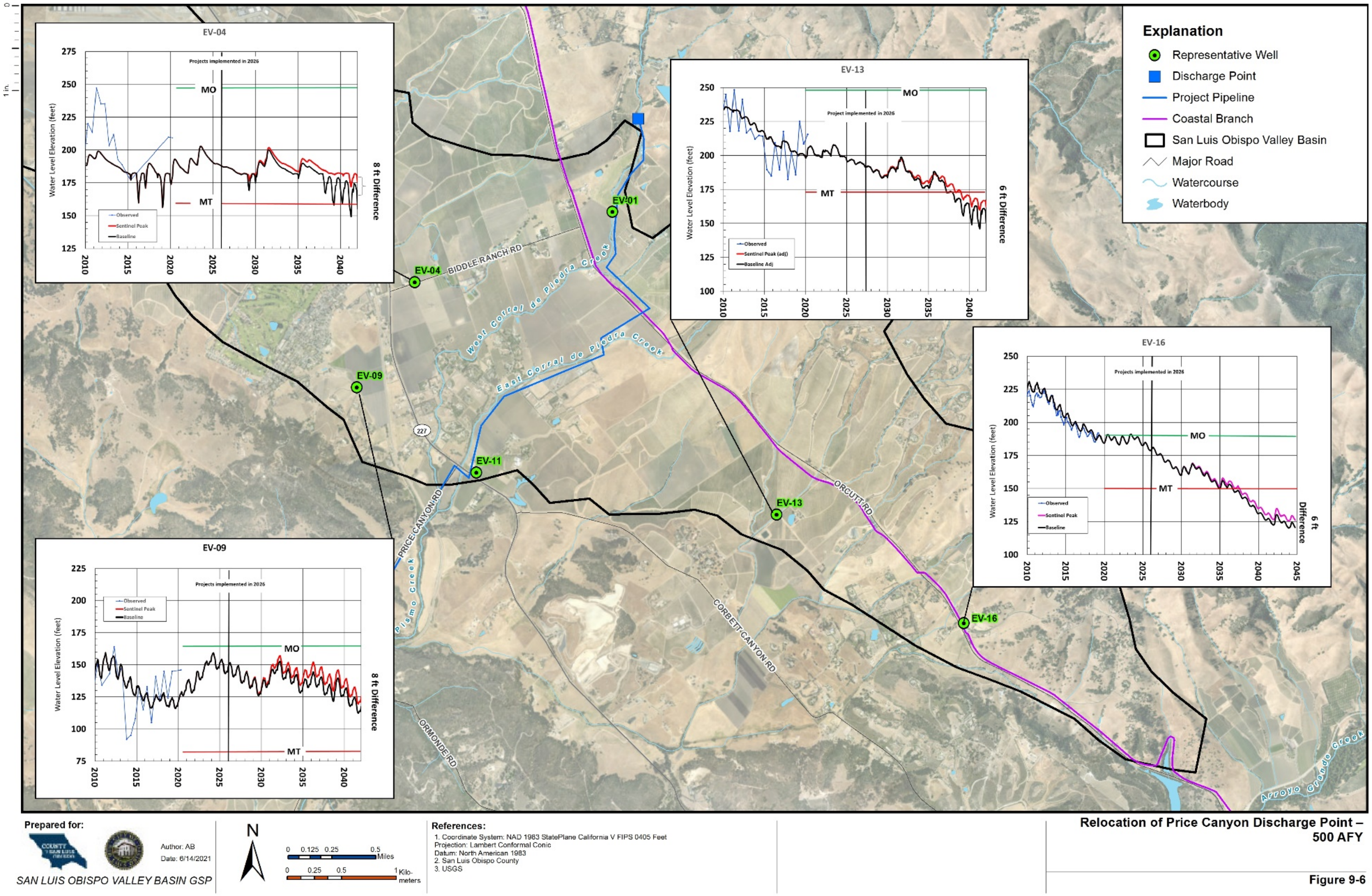

Figure 9-6. Relocation of Price Canyon Discharge Point – 500 AFY

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.

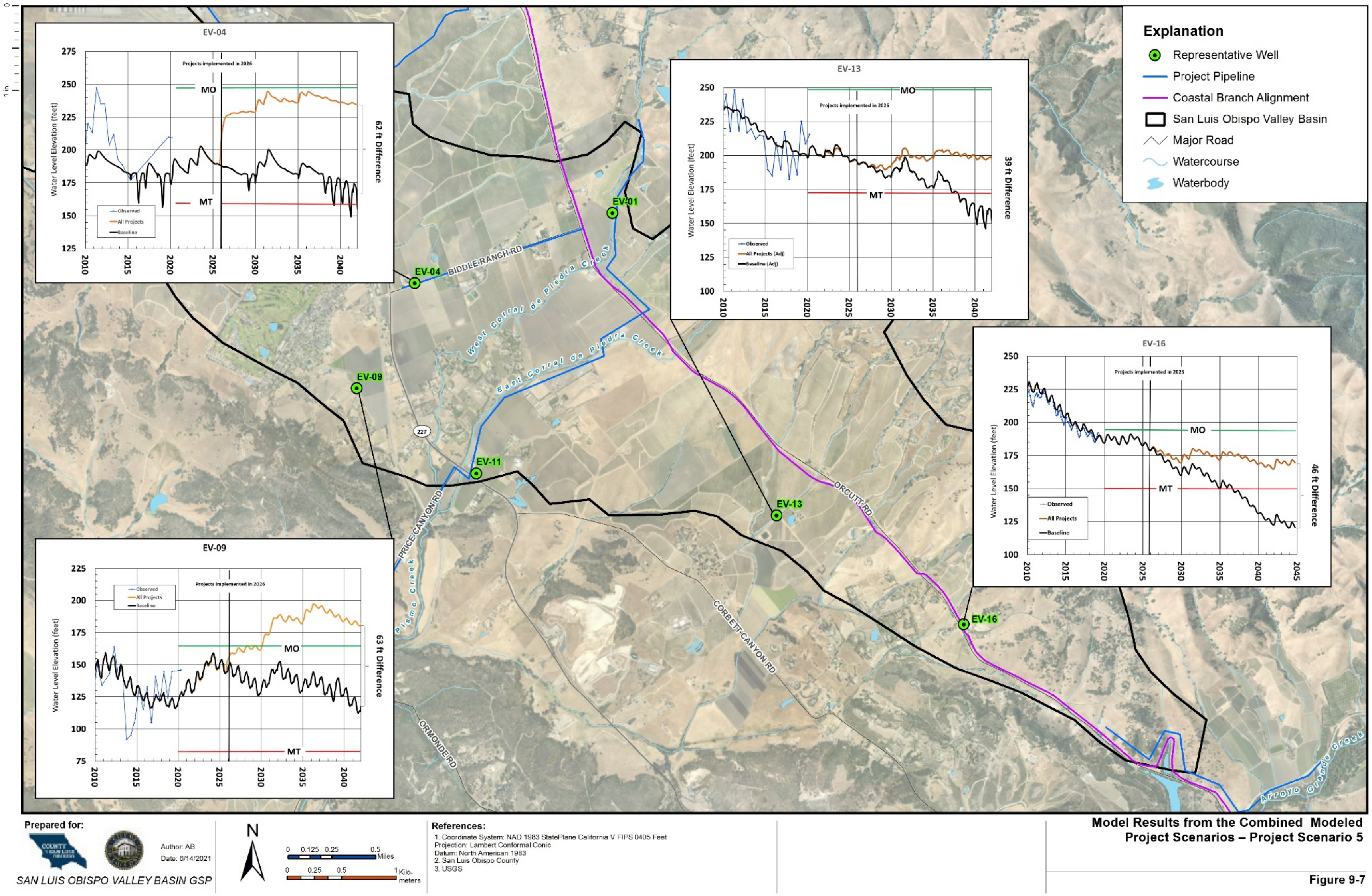

Figure 9-7Model Results from the Combined Modeled Project Scenarios – Project Scenario 5

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.

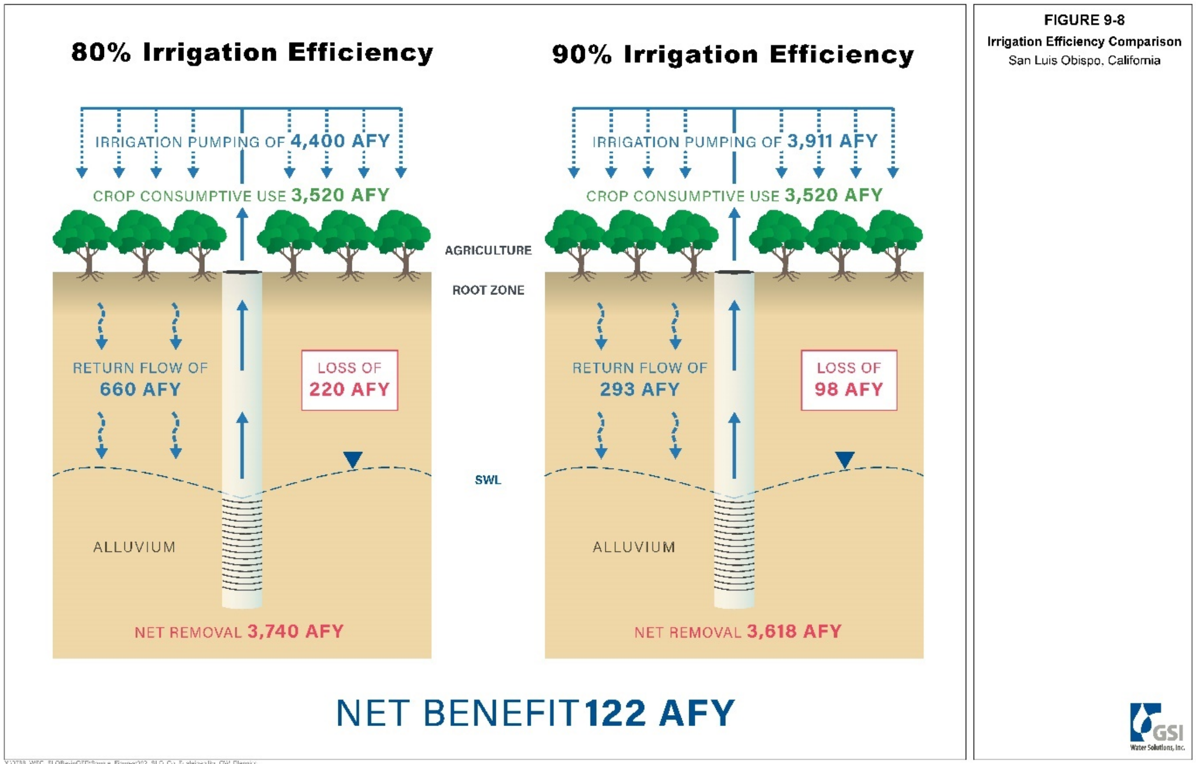

Figure 9-8 Irrigation Efficiency Comparison

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 Crop Type

Crop Type	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*	1.4	1.6	2	768
Vineyard	0.5	0.6	0.8	2410
Turfgrass	2	2.6	4.1	164

*60 percent of ET applied water to account for fallow fields

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 Fallowing of Crops

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

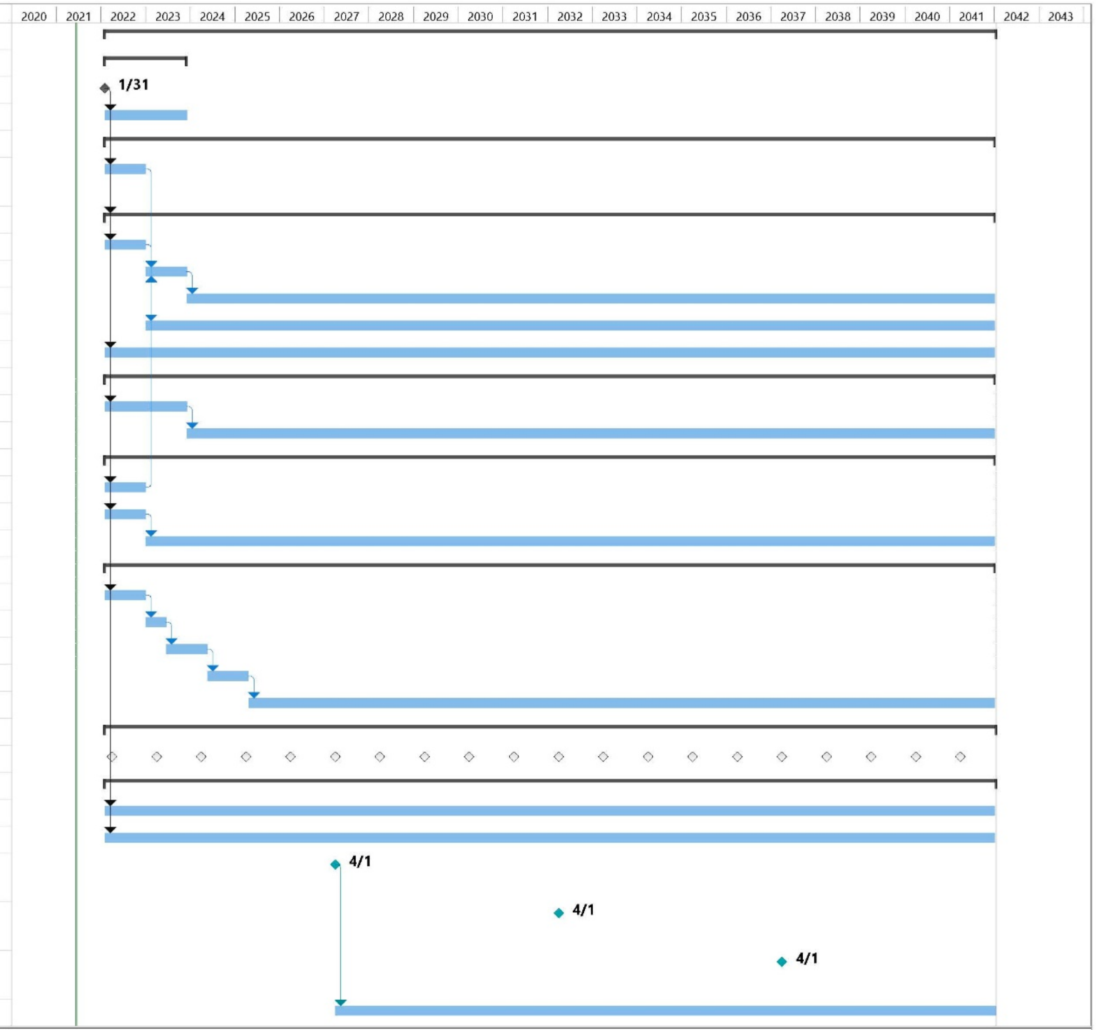

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Figure 10-1. SLO Basin GSP Implementation Schedule

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.

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TECHNICAL MEMORANDUM (DRAFT)

DATE:	October 19, 2020
TO:	WSC and Cleath-Harris Geologists
FROM:	Aleksandra Wydzga and Ethan Bell (Stillwater Sciences)
SUBJECT:	Groundwater-Dependent Ecosystems in the San Luis Obispo Valley Groundwater Basin

The purpose of this memo is to summarize known information about surface water hydrology relevant to Groundwater Dependent Ecosystems (GDEs) in the San Luis Obispo (SLO) Valley Groundwater Basin (Section 1), identify GDEs overlying and dependent upon the SLO Valley Groundwater Basin (Section 2), identify sustainable GDE indicators (Section 3) for the SLO Valley Groundwater Basin, and propose a hydrologic monitoring network to track these indicators over time (Section 4). GDEs are defined in California's Sustainable Groundwater Management Act (SGMA) as "ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR § 351(m)).

1 EXISTING SURFACE WATER HYDROLOGY

1.1 Overview of GDE Relevant Surface and Groundwater Hydrology

The Basin is overlain by two watersheds: San Luis Obispo (SLO) and Pismo (Figure 1). Flows in SLO 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. Dry season instream flows, however, if present, are fed primarily by groundwater. 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 entire dry season (creating perennial conditions). 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. Due to climactic changes or groundwater pumping, over time streams can transition from historically perennial to intermittent conditions (Barlow and Leake 2012). Dry season flows supported by groundwater in the SLO and Pismo Creeks are critical for the survival of various special-status species, including but not limited to the federally threatened California red-legged frog (CRLF) *(Rana draytonii)* and Steelhead (*Oncorhynchus mykiss)*.

SLO Creek and Pismo Creek are underlain by numerous aquifers. These aquifers are connected to one another, and to surface waters, but the degree of connection varies spatially. Aquifers can include confined aquifers, unconfined aquifers, and perched aquifers (see Chapter 4 of the Draft

Groundwater Sustainability Plan). Aquifers may be hydrologically linked with ponds, lakes, wetlands, and creeks. In the SLO Valley Groundwater Basin, few data exist to characterize the connection between surface water and groundwater.

The SLO Valley Groundwater Basin is divided into two sub-basins: the SLO Valley sub-basin and the Edna Valley sub-basin. While the groundwater in these basins is hydraulically connected, a shallow subsurface bedrock divide between the two sub-basins partially isolates the deeper portions of the two aquifers (Appendix A). Groundwater in the Edna sub-basin flows both towards the SLO Valley sub-basin 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. A 1954 DWR map (Appendix B) best illustrates the groundwater flow from the Edna Valley sub-basin both towards SLO and into Price Canyon. As groundwater from the Edna sub-basin flows towards Price Canyon and rises to the surface, it creates a perennial reach of Pismo Creek that flows through Price Canyon and supports year-round critical habitat for threatened steelhead.

1.2 Losing and Gaining Reaches

Streams are often subdivided into losing and gaining reaches to describe their connection to groundwater. 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 1 shows the likely extent of known gaining and losing reaches in SLO and Pismo Creeks during typical late spring and dry season conditions. This map is compiled from various data sources, including a field survey of wet and dry reaches of SLO 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 SLO and Pismo Creeks (Stillwater Sciences 2014), spring and summer low flow measurements in SLO 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 SLO and Pismo Creeks and their tributaries for which no data exist are left unhighlighted in Figure 1. In general, the extent of losing or gaining reaches can vary by water year type or pumping conditions. For example, East Corral de Piedra and West Corral de Piedra on the north-east side of the basin can be dry in the spring and summer during drier years but be flowing in wetter years (Creek Lands Conservation 2019). In contrast, gaining reaches shown on SLO Creek appear fairly consistent across water year types (Bennett 2015, Creek Lands Conservation 2019). Figure 1 is based on limited data sources and improved mapping of losing and gaining reaches is recommended (Section 4).

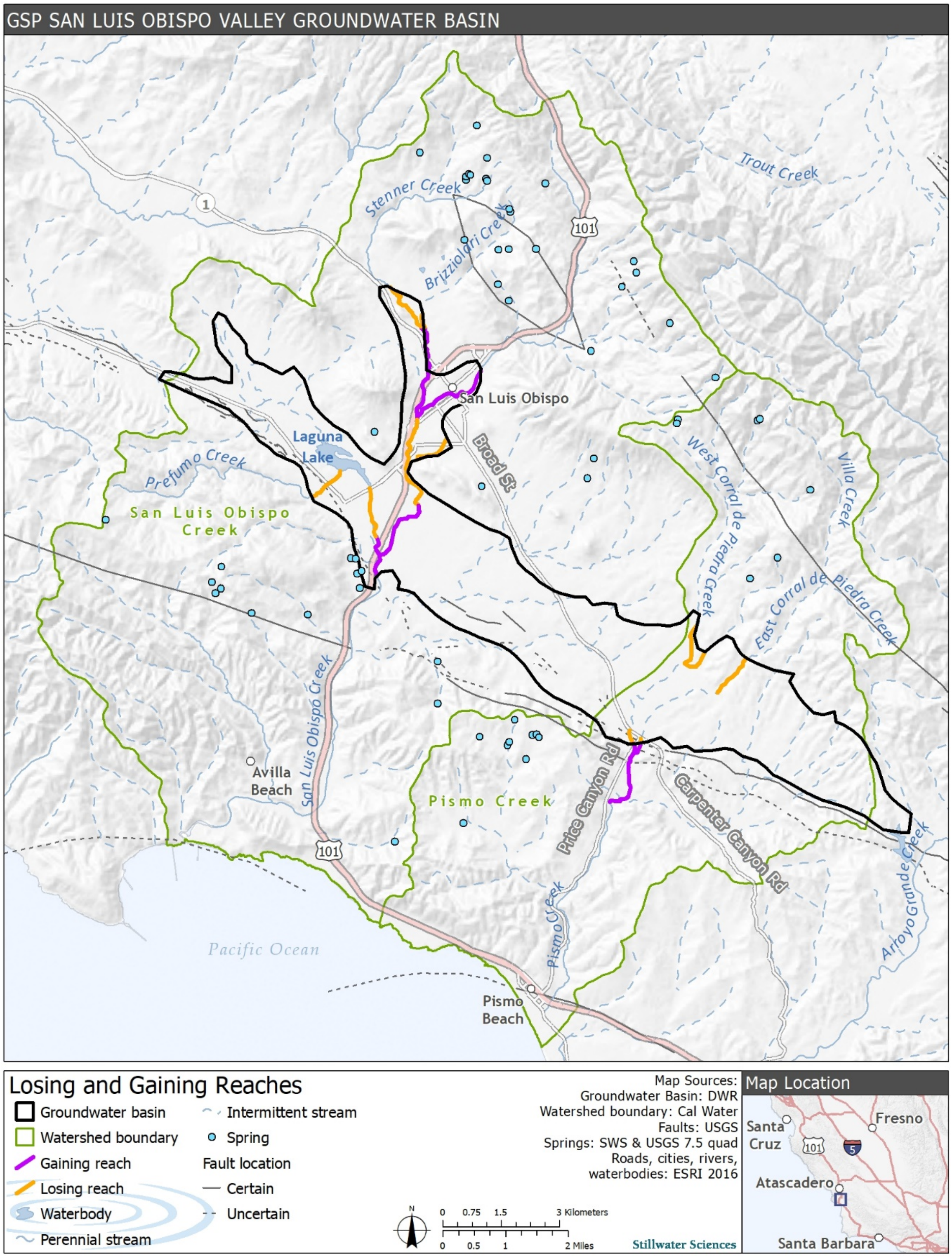

Figure 1. Typical late spring and dry season losing and gaining reaches in the basin. Portions of the SLO and Pismo Creeks and their tributaries for which no data exist are left unhighlighted.

1.3 Relevance to GDEs

Depending on location and time of year, GDEs that overly the SLO Valley Groundwater 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 driven flow (e.g. 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. groundwater discharge into streams during the dry season). In the wet season, GDEs overlying the SLO Groundwater Basin are supported by a wider range of surface and groundwater hydrological sources than in the dry season. In the dry season, the primary water source supporting the GDEs is groundwater, although in some reaches irrigation return flow may be present. Irrigation return flow can have surface water sources from outside the basin (e.g. City of SLO parcels) or local groundwater (e.g. Edna Valley). Groundwater supporting GDEs overlying the SLO Valley Groundwater Basin can originate outside of the groundwater basin or within the groundwater basin. Both our proposed our strategy to identify sustainable GDE indicators (Section 3) and our proposed monitoring network (Section 4) take advantage of and integrate these hydrologic realities to focus on the assessment and monitoring of GDEs in locations and during seasons that are reliant on groundwater originating in the SLO Groundwater Basin.

2 POTENTIAL GROUNDWATER DEPENDENT ECOSYSTEMS (GDES) AND ASSOCIATED FLORA AND FAUNA

2.1 Distribution of Potential GDEs Based on Best Available Vegetation and Wetland Data

Groundwater dependent ecosystems (GDEs) are defined in California's Sustainable Groundwater Management Act (SGMA) as "ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (23 CCR § 351(m)). As described in The Nature Conservancy's guidance for GDE analysis (Rohde et al. 2018), a GDE's dependence on groundwater refers to reliance of GDE species and/or communities on groundwater for all or a portion of their water needs. The Department of Water Resources (DWR) compiled a statewide Natural Communities Commonly Associated with Groundwater database (DWR 2019). This database identifies potentially groundwater dependent ecosystems based on the best available vegetation and wetland data (Klausmeyer et al. 2018). DWR (2019) 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 SLO Valley Groundwater Basin, the best available vegetation mapping dataset (FVEG) was from the California Fire and Resource Assessment Program Vegetation (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 in the SLO Groundwater Basin. 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, particularly coast live oak riparian woodlands, because coast live oak (*Quercus agrifolia*) is known to make use of groundwater at depths of up to 36 ft (see Steinberg 2002 and references cited therein). Some other species of California oak, particularly blue oak (*Q. douglasii*) are known to develop deeper roots that can access deeper groundwater in fractured bedrock on hillslopes (up to 70 feet [Lewis and Burgy 1964]), however such landscape positions are substantially different from what would be expected for GDEs occurring within a recognized groundwater basin on valley bottom or floodplain alluvial deposits. Therefore, we rely on the species-specific rooting and groundwater depth data for coast live oak cited by Steinberg (2002).

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 2). Depth to groundwater was interpolated from seventeen wells for which groundwater level data was available in the spring of 2019 (WSC in progress). The depth to groundwater shown in Figure 2 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 GDEs, different assumptions were made for the SLO versus Edna Valley sub-basins in areas of no groundwater data. In the SLO sub-basin (underlying SLO 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-basin 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-basin is generally deeper. 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.

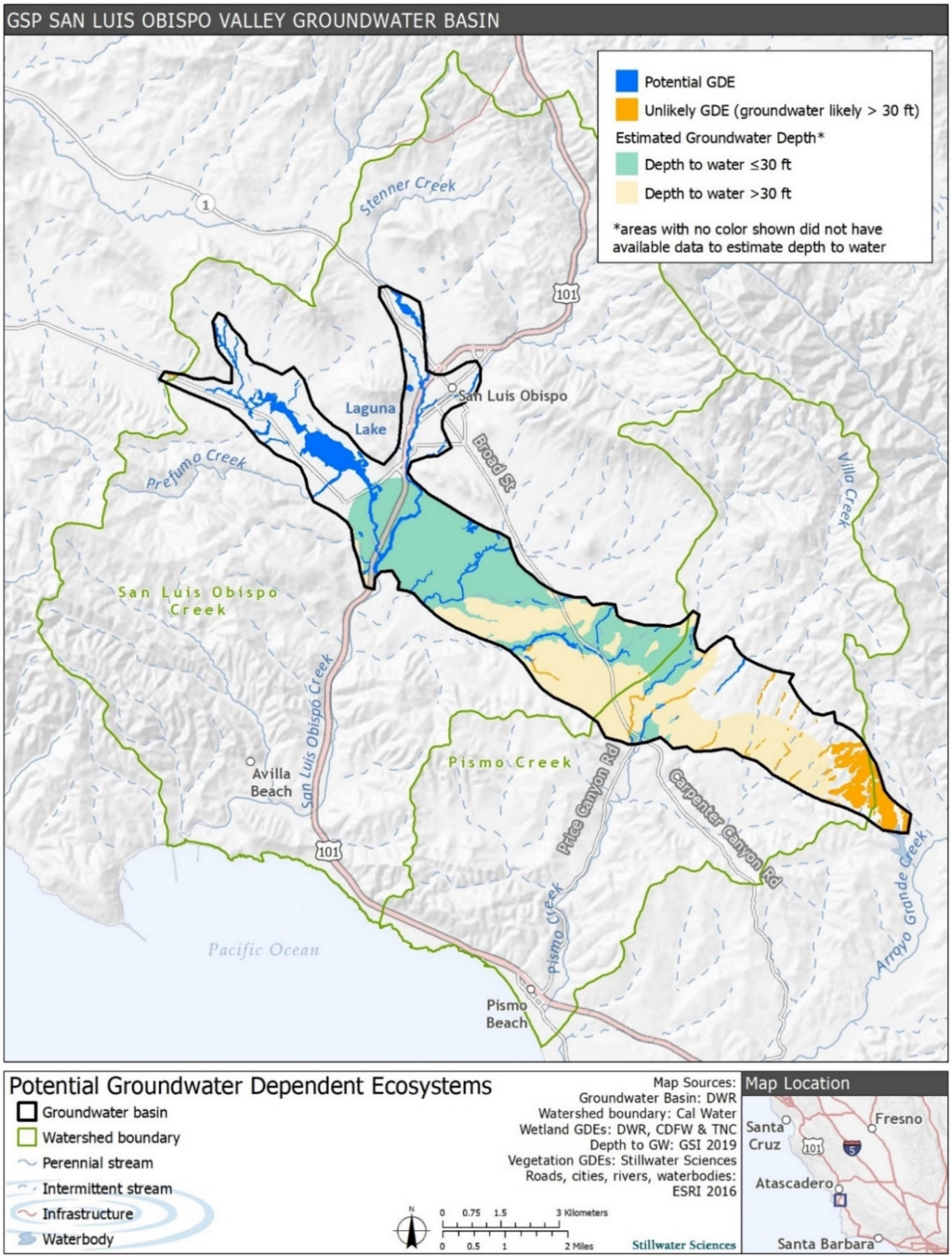

Figure 2. Potential Groundwater Dependent Ecosystems.

2.2 Special-Status Species and Sensitive Natural Communities Associated with GDEs

For the purposes of this memorandum, 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);
- 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 2020) 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 2020).

To determine the terrestrial and aquatic special-status species that may utilize potential GDE units overlying the SLO Valley Groundwater 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 2019b), 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 and to be associated with the vegetation and aquatic communities in or immediately adjacent to the potential GDEs. Table 1 summarizes these special-status species and sensitive natural communities, describes their habitat preferences and potential dependence on GDEs, and identifies known nearby occurrences (Table 1). Wildlife species were evaluated for potential groundwater dependence using the Critical Species Lookbook (Rohde et al. 2019).

The SLO 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 SLO 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 implementation of operating criteria to ensure instream flows allow for essential steelhead habitat functions (NMFS 2013).

The SLO 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 (Table 1); and (2) the vulnerability of these species and their habitat to changes in groundwater levels (Rohde et al. 2018).

Table 1. Special-status species and sensitive natural communities documented in the vicinity of the San Luis Obispo (SLO) Valley Groundwater Basin with a potential GDE association.

Common name *Scientific name*	**Status[1] Federal/ State/CRPR**	**Potential to occur**	**Query source**	**GDE association[2]**	**Habitat association and occurrence**
Birds					
Bank swallow *Riparia*	–/ST/–	Some potential	eBird	Indirect	Nests in vertical bluffs or banks, usually adjacent to water (i.e., rivers, streams, ocean coasts, and reservoirs), where the soil consists of sand or sandy loam. This species relies on surface water that may be supported by groundwater (Rohde et al 2019). eBird occurrences in SLO Valley including Laguna Lake.
Least bittern *Ixobrychus exilis*	–/SSC/–	Some potential	eBird	Direct	Freshwater and brackish marshes with dense aquatic or semiaquatic vegetation interspersed with clumps of woody vegetation and open water. eBird occurrences in SLO Valley including Laguna Lake.
Loggerhead shrike *Lanius ludovicianus*	–/SSC/–	Likely	CNDDB, eBird	Indirect	Open shrubland or woodlands with short vegetation and and/or bare ground for hunting; some tall shrubs, trees, fences, or power lines for perching; typically nest in isolated trees or large shrubs. CNDDB occurrences in SLO Valley.
Northern harrier *Circus hudsonius*	–/SSC/–	Some potential	eBird	Indirect	Nests, forages, and roosts in wetlands or along rivers or lakes, but also in grasslands, meadows, or grain fields. eBird occurrences in SLO Valley including Laguna Lake.
Peregrine falcon *Falco peregrinus*	–/SFP/–	Some potential	eBird	Indirect	Wetlands, woodlands, cities, agricultural lands, and coastal area with cliffs (and rarely broken-top, predominant trees) for nesting; often forages near water. eBird occurrences in SLO Valley including Laguna Lake.
Redhead *Aythya americana*	–/SSC/–	Some potential	eBird	Direct	Freshwater emergent wetlands with dense stands of cattails (*Typha* spp.) and bulrush (*Schoenoplectus* spp.) interspersed with areas of deep, open water; forage and rest on large, deep bodies of water. Summer resident in southern California. eBird occurrences in SLO Valley including Laguna Lake along SLO Creek.

Common name *Scientific name*	**Status**[1] **Federal/ State/CRPR**	**Potential to occur**	**Query source**	**GDE association**[2]	**Habitat association and occurrence**
Tricolored blackbird *Agelaius tricolor*	–/ST/–	Likely	CNDDB, eBird	Direct	Feeds in grasslands and agriculture fields; nesting habitat components include open accessible water with dense tall emergent vegetation, a protected nesting substrate (including flooded or thorny vegetation), and a suitable nearby foraging space with adequate insect prey. Relies on groundwater dependent ecosystems for breeding and roosting (Rohde et al 2019). CNDDB occurrence in Edna Valley and eBird occurrence in SLO Valley including Laguna Lake, Pismo Creek, and Stenner Creek.
White-tailed kite *Elanus leucurus*	–/SFP/–	Likely	CNDDB, eBird	Indirect	Lowland grasslands and wetlands with open areas; nests in trees near open foraging area. CNDDB and eBird occurrences in SLO Valley including Laguna Lake.
Mammals					
Pallid bat *Antrozous pallidas*	–/SSC/–	Likely	CNDDB	Potential Indirect	Roosts in rock crevices, tree hollows, mines, caves, and a variety of vacant and occupied buildings; feeds in a variety of open woodland habitats. CNDDB occurrence in SLO Valley.
Amphibians and reptiles					
California red-legged frog *Rana draytonii*	FT/SSC/–	Likely	CNDDB	Direct	Breeds in still or slow-moving water with emergent and overhanging vegetation, including wetlands, wet meadows, ponds, lakes, and low-gradient, slow moving stream reaches with permanent pools; uses adjacent uplands for dispersal and summer retreat. Relies on surface water that may be supported by groundwater (Rohde et al. 2019). Critical habitat is within the SLO watershed. CNDDB occurrences include SLO Creek and tributaries.
Coast Range newt *Taricha torosa*	–/SSC/–	Likely	CNDDB	Direct	Chaparral, oak woodland, and grasslands. Relies on surface water that may be supported by groundwater for breeding. CNDDB occurrences are in SLO Creek and Brizziolari Creek.
Foothill yellow-legged frog *Rana boylii*	–/SE/–	Unlikely	CNDDB	Direct	Shallow tributaries and mainstems of perennial streams and rivers, typically associated with cobble or boulder substrate; occasionally found in isolated pools, vegetated backwaters, and deep, shaded, spring-fed pools. All CNDDB occurrences are historical (1958) in Arroyo Grande Creek and population is possibly extirpated.

Common name *Scientific name*	**Status[1] Federal/ State/CRPR**	**Potential to occur**	**Query source**	**GDE association[2]**	**Habitat association and occurrence**
Northern California legless lizard *Anniella pulchra*	–/SSC/–	Likely	CNDDB	Indirect	Chaparral, pine-oak woodlands, desert scrub, sandy washes, and stream terraces with sycamores, cottonwoods, or oaks. Occurs in moist warm loose soil with plant cover. CNDDB occurrences in Edna Valley.
Western pond turtle *Emys marmorata*	–/SSC/–	Likely	CNDDB	Direct	Ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches with basking sites. Relies on surface water that may be supported by groundwater. CNDDB occurrences include SLO and Edna Valley, as well as, Pismo Creek, Miossi Creek, Prefumo Creek, and Mainstem and East Fork of SLO Creek
Fish					
Steelhead, South Central California DPS *Oncorhynchus mykiss*	FT/–/–	Likely	CNDDB	Direct	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat; typically rear in fresh water for one or more years before migrating to the ocean. Suitable habitat present (migration, rearing); species known to occur in SLO and Pismo Creek and their tributaries (i.e., West Corral de Piedra Creek).
Plants and Sensitive Natural Communities					
San Luis Obispo sedge *Carex obispoensis*	–/–/1B.2	Likely	CNDDB	Direct	Seeps, often with serpentine and sometimes gabbro soils or clay soils in closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, and valley and foothill grassland (CNPS 2020); all CNDDB observations are along Prefumo Creek and Froom Creek outside of the groundwater basin
Congdon's tarplant *Centromadia parryi* subsp. *congdonii*	–/–/1B.1	Likely	CNDDB	Direct	Valley and foothill grassland (CNPS 2020); all CNDDB observations are within the SLO Creek watershed including around Laguna Lake and East Fork of SLO Creek
Chorro Creek bog thistle *Cirsium fontinale* var. *obispoense*	FE/SE/1B.2	Likely	CNDDB	Direct	Serpentine seeps and drainages in chaparral, cismontane woodlands, coastal scrub, and valley and foothill grassland (CNPS 2020); CNDDB observations are limited to the SLO Creek watershed and are associated with seeps and springs,
Adobe sanicle *Sanicula maritima*	–/CR/1B.1	Likely	CNDDB	Direct	Clay and serpentine soils in chaparral, coastal prairie, meadows and seeps, and valley and foothill grassland (CNPS 2020); multiple CNDDB occurrences in open grassy area of Laguna Lake Park, along Laguna Creek, and South Hills

Common name ***Scientific name***	**Status[1] Federal/ State/CRPR**	**Potential to occur**	**Query source**	**GDE association[2]**	**Habitat association and occurrence**
Saline clover *Trifolium hydrophilum*	–/–/1B.2	Likely	CNDDB	Direct	Marshes and swamps, mesic and alkaline soils in valley and foothill grassland, and vernal pools (CNPS 2020); one CNDDB occurrence, located in Laguna Lake Park
Coastal and Valley Freshwater Marsh	–/S2.1/–	Likely	CNDDB	Direct	Dominated by perennial, emergent monocots including tules (*Schoenoplectus* spp.) and cattails (*Typha* spp.). May form completely closed canopies (Holland 1986). CNDDB observations around Laguna Lake.

[1] **Status codes:**
Federal
FE = Federally listed endangered
FT= Listed as threatened under the federal Endangered Species Act
– No federal status
State Rank
SE = Listed as Endangered under the California Endangered Species Act
ST = Listed as Threatened under the California Endangered Species Act
SFP = CDFW Fully Protected species
SSC = CDFW species of special concern
CR = California State listed as rare
S2.1 = CDFW imperiled and threatened species
– No state status
California Rare Plant Rank (CRPR)
1B = Plants rare, threatened, or endangered in California and elsewhere
CRPR Threat Ranks
0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
– No CRPR status

[2] **Groundwater Association**
Direct: Species directly dependent on groundwater for some or all of its water needs (e.g., cottonwood with roots in groundwater, juvenile steelhead in dry season)
Indirect: Species dependent upon other species that rely on groundwater for some or all of their water needs (e.g., riparian birds)

3 GDE EVALUATION AND SUSTAINABLE INDICATORS

In Section 2 we identified potential GDEs distributed throughout the SLO Valley Groundwater Basin. In Section 3 we identify specific GDE types that are likely or have potential to occur in the SLO Valley Groundwater Basin. Each GDE type has a different requirement to sustainably function. For each GDE type we then identify sustainable GDE indicators and target values. Sustainable GDE indictors are metrics that can be monitored to determine if undesirable impacts are occurring. The target values are set based on the best available data for each GDE type. These values are determined by the needs of special-status species, sensitive natural communities, or keystone species associated with each GDE type. As more data becomes available, the indicator type or target value may be refined. Furthermore, sustainable GDE indicator target values may not be met due to management activities (e.g., pumping) or due to climate (e.g., extended drought conditions). Thus if sustainable indicator target values are not met, additional studies or assessments to determine the cause may be required.

3.1 GDE Types

Eight distinct likely or uncertain types of GDEs have been identified in the SLO Valley Groundwater Basin. Likely GDE types include riverine (fast moving), riverine (slow moving), riparian, lacustrine, and wetland/marsh. Three uncertain GDE types include seasonal wetlands/wet meadows, springs and seeps, and oak woodlands. Seasonal wetlands are uncertain because their dependence of surface water versus groundwater is unknown and may be site specific. Spring and seeps are uncertain because they may be dependent on recharge from fractured bedrock in the surrounding hills rather than SLO Valley Groundwater Basin water. Oak woodlands are uncertain because groundwater elevation data from areas they are present (e.g. the eastern Edna Valley) are unavailable. Additional studies for these GDE types are recommended in Section 3.2.

The diversity of GDEs overlying the SLO Valley Groundwater Basin is due to the unique hydrogeomorphology of the basin, whereas the groundwater basin is oriented perpendicular to the general direction of surface water flow (Figure 2). A description of each GDE type along with associated special-status species, natural sensitive communities, and/or keystone species are listed in Table 2. Keystone species are defined as species that serve as indicators of GDEs sustainability. If the sustainable indicator target value is met for a GDE type with a keystone species, all habitats and species associated with that GDE type are assumed to be protected.

While a complete list of special-status species with known occurrence or presence of suitable habitat in potential GDE units overlying or within 1 mile of the SLO Valley Groundwater Basin are listed in Table 1, only those species that have a direct association with GDEs are included in Table 2. Examples of species omitted from Table 2 include species that are believed to have be extirpated from this area (e.g., foothill yellow-legged frog) or have an indirect association with GDEs (e.g., loggerhead shrike). Species that have an indirect association are assumed to be protected if the GDE indicators listed above are met. For example, the loggerhead shrike is known to occur within the SLO Valley Groundwater Basin. It lives in shrublands or woodlands with short vegetation and/or bare ground for hunting, uses tall shrubs and trees for perching, and typically nests in isolated trees. Some trees or shrubs used for perching or nesting may be part of a GDE; which is assumed to be protected if GDE indicators that are developed for each GDE type (Table 2) are met.

Table 2. Summary of Groundwater Dependent Ecosystem (GDE) types known to occur in the San Luis Obispo (SLO) Valley Groundwater Basin.

GDE type	GDE habitat description	Associated special-status species[A], sensitive natural communities[B], or keystone species[C]	Key life stages primarily dependent on groundwater	Sustainable GDE indicator	Monitoring period[D]	Location and target value
Riverine (Fast moving)	Fast moving, flowing water	Steelhead, South Central California DPS[C] *Oncorhynchus mykiss*	Juvenile steelhead	Flow rate (cfs)	Late spring (May-June) and dry season (July–Oct)	1) Stenner Creek at Nipomo St = 0.85 cfs (late spring); 0.33 cfs (dry season) (SWS 2014) 2) SLO Creek at Marsh St = 1.20 cfs (late spring); 0.90 cfs (late summer) (SWS 2014)
					Late spring (May–June) and dry season (July–Oct)	Pismo Creek at Railroad crossing = 1.50 cfs (late spring)/; 0.50 cfs (dry season) (Stillwater 2016)
Riverine (Slow moving)	Slow moving or still water; interspersed or interconnected with wetlands, marshes, or grasslands	California red-legged frog[C] *Rana draytonii*	Larval development and metamorphosis	Water depth (ft)	Late spring (May–June) and dry season (July–Oct)	East Fork of SLO Creek at Jespersen Road = 2.3 ft
		Coast Range newt *Taricha torosa*	Larval development and metamorphosis			
		Western pond turtle *Emys marmorata*	Foraging adults and juveniles			
Lacustrine/ Lacustrine Connected	Open water. Interspersed or interconnected with wetlands, marshes, tributaries, or grasslands	Least bittern *Ixobrychus exilis*	All life stages	TBD[E]	TBD	Laguna Lake Target values TBD
		Redhead *Aythya americana*	Adults; potential for limited resident breeding			
		Tricolored blackbird *Agelaius tricolor*	All life stages			

GDE type	GDE habitat description	Associated special-status species[A], sensitive natural communities[B], or keystone species[C]	Key life stages primarily dependent on groundwater	Sustainable GDE indicator	Monitoring period[D]	Location and target value
Wetland/ Marsh	Dominated by perennial, emergent monocots including tules (*Schoenoplectus* spp.) and cattails (*Typha* spp.). May form completely closed canopies (Holland 1986)	Coastal and Valley Freshwater Marsh	Adult plants	TBD	TBD	Tank Farm wetlands Target value TBD
Riparian	Dominated by mature woody vegetation including cottonwoods, sycamores, and willows	California Sycamore Woodland; Fremont Cottonwood Forest and Woodland and/or Black Cottonwood Forest and Woodland	Adult trees	Depth to groundwater (ft) and/or rate of groundwater elevation change[F]	TBD	See Figure 3 and Table 3 for all proposed locations Target values TBD
Seasonal wetland/wet meadow	An area that is inundated by water seasonally (i.e., present during the growing season but absent by the end of the growing season in most years) (FGDC 2013)	Adobe sanicle *Sanicula maritima* Congdon's tarplant *Centromadia parryi* ssp. *congdonii,* Saline clover *Trifolium hydrophilum*	Adult plants	TBD	TBD	TBD
Springs and seeps	A location where water from the ground rises to the surface, commonly with saturated soil, standing, or flowing water year-round.	Chorro Creek bog thistle *Cirsium fontinale* var. *obispoense* SLO sedge *Carex obispoensis*	Adult plants	TBD	TBD	TBD

GDE type	GDE habitat description	Associated special-status species[A], sensitive natural communities[B], or keystone species[C]	Key life stages primarily dependent on groundwater	Sustainable GDE indicator	Monitoring period[D]	Location and target value
Oak woodlands	Coast live oak riparian woodlands	Coast live oak[C] *Quercus agrifolia*; Pallid bat *Antrozous pallidas*[G]	Adult trees	Depth to groundwater (ft) and/or rate of groundwater elevation change	TBD	TBD

[A] A list of special-status species with known occurrence or presence of suitable habitat in potential GDE units overlying the or within 1 mile of the SLO Valley Groundwater Basin are listed in Table 1. Of those species, only those species that are likely or have some potential to occur and that have a direct association with potential GDEs are listed in Table 2.
[B] Sensitive natural communities as defined as vegetation communities that are critically imperiled, imperiled, or vulnerable on the most recent California Sensitive Natural Communities List (CDFW 2020) or by CNPS 2020.
[C] Keystone species.
[D] Monitoring is proposed only for those time periods for which each GDE type is anticipated to be primarily dependent upon groundwater originating in the SLO Valley groundwater Basin (see Section 4 for discussion).
[E] TBD = To be determined
[F] Depth to groundwater or the rate of groundwater elevation change in the dry season is anticipated to be the sustainable indicator for mature woody riparian vegetation and oak woodland based on research by Amlin, N. M., and S. B. Rood. 2002; Mahoney, J. M., and S. B. Rood. 1998; Rood, S. B., and J. M. Mahoney. 1990; Segelquist, C. A., M. L. Scott, and G. T. Auble. 1993; Shafroth, P. B., J. C. Stromberg, and D. T. Patten. 2002; and Vaghti, M. G., and S. E. Greco. 2007.
[G] Pallid bats utilize oak savannahs, black oaks, oak grasslands, and open oak woodlands (Pierson and Rainey 2002). Oak savannahs are usually characterized by valley oak, blue oak, interior live oak, or coast live oak, with the specific composition dependent on latitude and elevation. Pallid bats typically roost in caves, crevices, bridges, buildings and occasionally tree hollows.

3.2 Evaluation of Potential GDEs and GDE Types

The potential GDEs and GDE types identified herein were based on the best available but limited groundwater data, wetland data and low-resolution vegetation data. These potential GDEs and GDE types require ground-truthing to determine the dominant vegetation types and quality, habitat types and quality, existing hydrologic conditions and their spatial extent to improve our understanding of their distribution and groundwater dependence. Ground-truthing should include reconnaissance level field-survey of a sub-set of accessible areas mapped as potential GDEs. At each site, field biologists could assess the following: (1) vegetation data (e.g., dominant vegetation types and plant species, indications of the proportion of live vs. senescent canopy, and vegetation density); (2) qualitative observations of hydrologic conditions (e.g. flowing or standing water); and, (3) habitat conditions for special-status or keystone species by comparing each species' habitat preferences (e.g., large trees, open water or herbaceous cover, etc.) to conditions present at the site. Based on this field data, GDE distribution, GDE type, and habitat for associated special-status species could be refined. Habitat assessments should be focused on federally or state threatened or endangered flora or fauna with direct groundwater association including the state threatened species Tricolored blackbird *(Agelaius tricolor),* the federally threatened California red-legged frog (*R. draytonii*), the federally threatened Steelhead trout (*O. mykiss*), and the federally endangered Chorro Creek bog thistle (*Cirsium fontinale* var. *Obispoense)*.

Furthermore, seven of the eight GDE types (Table 2) may require additional assessment/analysis to either determine the extent to which the GDE type is groundwater dependent, the timing of groundwater dependence, and/or to refine the sustainable GDE indicator or target values. To this extent the following are proposed for consideration:

1. **Riverine (fast moving).** Conduct an instream flow study of mainstem SLO and Stenner Creeks to identify flows required by juvenile steelhead in the late spring and summer/early fall dry season, as well as, an assessment of the quality of steelhead habitat in the East Fork of SLO Creek and Davenport Creek.
2. **Lacustrine.** Conduct a study of Laguna Lake to determine the magnitude, timing and duration of the dependence of the Lake on groundwater originating from the SLO Valley Groundwater Basin (e.g. a surface-groundwater assessment/model). Based on the results of the study and associated special-status species habitat assessments, develop sustainable GDE indicator(s), timing of groundwater dependence, and indicator target values.
3. **Wetland/Marsh.** Conduct an assessment of wetlands and marshes found within the SLO Valley Groundwater Basin that support special-status species or sensitive natural communities; determine the magnitude, timing and duration of their dependence on groundwater originating from the SLO Valley Groundwater Basin; and develop sustainable GDE indicator(s) and associated information.


Oak tree along East Corral de Piedra Creek

4. **Riparian.** Install groundwater monitoring wells at proposed locations (Table 3), collect and analyze data. Refine GDE indicator(s) and develop site specific target values for the depth to groundwater below the surface (ft) that will sustain the GDE at each location.
5. **Seasonal wetlands.** Conduct an assessment of seasonal wetlands and wet meadows found within the SLO Valley Groundwater Basin, especially those that support groundwater dependent special-status species including Adobe sanicle, Congdon's tarplant, and Saline clover. While these plants need soil saturation or inundation for seed germination, establishment and growth, the dependence on groundwater versus surface water is unknown and may be site specific. If seasonal wetlands primarily dependent on groundwater originating in the SLO Groundwater Basin are indentified, develop sustainable GDE indicator(s) and associated information.
6. **Springs and seeps.** Conduct an assessment of springs and seeps within the SLO Valley Groundwater Basin to identify their locations and to determine their dependence on groundwater originating from the SLO Valley Groundwater Basin. The study could include measurements of the magnitude and timing of flow rates and/or an isotopic analysis to identify water sources. It is anticipated that many springs and seeps will be dependent on recharge from fractured bedrock in the surrounding hills rather than SLO Valley Groundwater Basin water. Springs and seeps within the basin that are known to occur include but are not limited to the base of the South Hills, Irish Hills, and hills surrounding Laguna Lake. If appropriate, develop a sustainable groundwater indicator and associated information.
7. **Oak woodlands.** Conduct an assessment of oak woodlands within the SLO Valley Groundwater Basin to determine the oak species composition and distribution, with a particular focus on coast live oak riparian woodlands. Utilize existing wells or install new monitoring wells to monitor depth to groundwater. Utilizing the assessment and monitoring data determine if oak woodlands (e.g. Eastern Edna Valley) (Figure 2) are groundwater dependent. For example, coast live oak may have several deep main roots that tap groundwater if present within approximately 36 feet of the soil surface (Canadell et al 1996; Cooper 1922; Plumb 1980). If the oak woodlands are determined to be groundwater dependent, conduct an assessment of Pallid bat habitat distribution within oak woodlands and develop sustainable GDE indicators and associated data.

3.3 Identification of Sustainable GDE Indicators

Each type of GDE (Table 2) has a different suite of fauna and flora associated with it. For some GDE types, we also identified associated sensitive natural communities (as identified by CDFW 2020 or CNPS 2020) or keystone species. Keystone species are defined as species that serve as indicators of GDEs sustainability. To develop indicators for each GDE type the requirements of sensitive or keystone species were considered. To this extent the life histories and habitat requirements of key faunal species are discussed in the following section, along with an explanation of the development of GDE indicators dependent on faunal species.

3.4 Life Histories and Habitat Requirements of Key Faunal Species

3.4.1 Key aquatic species

Steelhead

Steelhead have one of the most complex life histories of any salmonid species, exhibiting both anadromous and freshwater resident life histories. Freshwater residents are typically referred to as rainbow trout, and those exhibiting an anadromous life history are called steelhead (NMFS 1998).

Steelhead exhibit highly variable life history patterns throughout their range but are broadly categorized into winter and summer reproductive ecotypes. Winter steelhead, the most widespread reproductive ecotype and the only type currently present in Central California Coast streams, become sexually mature in the ocean, enter spawning streams in summer, fall or winter, and spawn a few months later in winter or late spring (Meehan and Bjornn 1991; Behnke 1992).The timing of upstream migration is correlated with higher flow events, such as freshets or sand bar breaches, and seasonal decline of associated lower water temperatures in winter (NMFS 2006)

Spawning occurs primarily from January through March but may begin as early as late December and may extend through April (Hallock 1987). Individual steelhead may spawn more than once, returning to the ocean between each spawning migration. Steelhead may spawn more than one season before dying (iteroparity), in contrast to other species of the *Oncorhynchus* genus. Upon emerging from the gravel, fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger. Cover is an important habitat component for juvenile steelhead, both as velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. In winter, they become inactive and hide in any available cover, including gravel, cobbles, or woody debris. Juvenile steelhead rear a minimum of one and typically two or more years in fresh water before migrating to the ocean during smoltification (the process of physiological change that allows ocean survival). Juvenile migration to the ocean generally occurs from December through August.

Although various steelhead life stages occur in aquatic habitats that overly the SLO Groundwater Basin, these aquatic habitats are supported by a range of surface and groundwater sources (see Section 1 for discussion). However, during the late spring and dry season, the primary source supporting steelhead in GDEs overlying the SLO Valley Groundwater Basin is groundwater. Thus the dependence of steelhead on groundwater is greatest during the late spring and the summer-fall dry season and it is for these times of the year that target values for sustainable GDE indicators are proposed (Table 2). Target values are based on the best available data.

In 2014 Stillwater Sciences completed a county-wide instream flow study for steelhead trout during their two most flow sensitive periods for minimum instream flows: late spring (May and June) and late summer (August and September) (Stillwater 2014). All available hydrologic and physical terrain data and instream flow assessments were reviewed and analyzed to explore appropriate watershed stratification and to assess the ability to extrapolate existing instream flow analyses throughout all watersheds of the County. A predictive model, based on watershed area, was developed to estimate minimum instream flows during these time periods. The purpose of the Stillwater (2014) study analysis was to provide a preliminary estimate of the magnitude and timing of instream flows that would support steelhead in creeks of SLO County and was not intended to provide sufficient precision or detail from which to establish regulatory limits. However, due to an absence of a detailed instream flow study in SLO Creek, this study is utilized to set preliminary target flow values herein. Two sites were selected for monitoring: Stenner Creek at the Nipomo Street Bridge and Mainstem SLO Creek at the Marsh Street Bridge (Table 2, Figure 3). These locations were selected because in the dry season these are in hydrologically gaining reaches, indicating that at the proposed locations the instream flows are primarily supported by SLO Valley Groundwater Basin groundwater. In Stenner Creek at Nipomo Street the sustainable flow target is set at 0.85 cfs for the late spring (May-June) and 0.33 cfs for the dry season (July-Oct) (SWS 2014) and at SLO Creek at the Marsh Street bridge the target is set at 1.20 cfs (late spring) and 0.90 cfs (dry season) (SWS 2014). To evaluate the approximate streamflow values proposed herein, a detailed instream flow study for SLO Creek for SLO and Stenner Creeks is recommended.

In 2016 Stillwater Sciences completed an instream flow study on Pismo Creek (Stillwater 2016). Based on this study, the streamflow target values recommended for mainstem Pismo Creek at the railroad crossing are set at 2.50 cfs in May, 1.50 cfs in June, and 0.50 cfs from July through the end of October. Similar to the approach used for SLO Creek, this location was selected for monitoring because it is located in a hydrologically a gaining reach and is likely supported by groundwater originating in the SLO Valley Groundwater Basin during the dry season.

California Red-legged Frog (CRLF)

CRLF is a federally listed as threatened and is a CDFW species of special concern. The species' range occurs from south of Elk Creek in Mendocino County to Baja California, with isolated remnant populations occurring in the Sierra foothills, from sea level to approximately 8,000 ft (Stebbins 1985, Shaffer et al. 2004). Most California red-legged frog populations are currently largely restricted to coastal drainages on the central coast of California.

CRLF habitat includes wetlands, wet meadows, ponds, lakes, and low-gradient, slow-moving stream reaches. Breeding habitats are generally characterized by still or slow-moving water with deep pools (usually at least 2.3 ft deep, although frogs have been known to breed in shallower pools) with emergent and overhanging vegetation (Jennings and Hayes 1994). Breeding sites can be ephemeral or permanent; if ephemeral, inundation is usually necessary into the summer months (through July or August) for successful metamorphosis. Although some adults may remain resident year-round at favorable breeding sites, others may disperse overland up to a mile or more (Fellers and Kleeman 2007). Movements may be along riparian corridors, but many individuals move directly from one site to another without apparent regard for topography or watershed corridors (Bulger et al. 2003). CRLFs sometimes enter a dormant state during summer or in dry weather (aestivation), finding cover in small mammal burrows, moist leaf litter, root wads, or cracks in the soil. However, CRLFs in coastal areas are typically active year-round because temperatures are generally moderate (USFWS 2002, Bulger et al. 2003).

The breeding (i.e., mating and egg-laying) season begins as early as late November and lasts though as late as April (Jennings and Hayes 1994). Females lay egg masses containing approximately 2,000–6,000 eggs (USFWS 2002). Eggs hatch within 6–14 days and tadpoles require approximately 11–20 weeks to metamorphose, generally from May to September (USFWS 2002), although overwintering by CRLFs has been documented at non-forested breeding sites (Fellers et al. 2001). CRLFs become reproductively mature frogs at 2 to 4 years, with females taking longer to develop (Jennings and Hayes 1994).

Pools with water depths greater than 2.3 feet deep are optimal, though not required, to support a majority of the breeding and larval development periods. This water depth is used to set the sustainable GDE target value. Although CRLF begin to breed as early as late November, and tadpole growth and development continues through as late as September, the aquatic habitats utilized by CRLF are supported by a range of surface and groundwater sources throughout the year. However, during the late spring and dry season, the primary source supporting CRLF in GDEs overlying the SLO Valley Groundwater Basin is groundwater. For the slow moving riverine GDE type, the target values for sustainable GDE indicators are proposed based on CRLF requirements for the late spring and summer (Table 2). We propose that CRLF is a keystone species for the slow moving riverine GDE type, and if the proposed sustainable indicator criterion is met for the late spring and summer, it assumed that sufficient groundwater will be available year-round for all habitats and species associated with this GDE type, including newts and western pond turtles.

Coast Range Newt

Coast Range newts occur commonly in the Coast Ranges from central Mendocino County south to northern San Diego County. Populations south of the Salinas River in Monterey County are considered by CDFW as a Species of Special Concern. Coast Range newts breed in ponds, reservoirs, and streams. Habitats are often in or near streams in valley-foothill hardwood and hardwood-conifer areas (Morey 1988); in southern California, suitable habitats include a generally drier zone of chaparral, oak woodland, or grassland. Stream-breeding newts in southern California commonly lay eggs in deep, slow pools, occasionally in runs, and almost never in riffles (Gamradt and Kats 1997, as cited in AmphibiaWeb 2020). Egg masses may be attached to aquatic vegetation, branches, and the outer surfaces of rocks; in southern California, egg masses are usually laid under rocks in quiet stream pools (AmphibiaWeb 2020) After metamorphosis, California newts disperse from aquatic habitats to terrestrial uplands. Deep leaf litter and animal burrows may be used as summer aestivation sites. During or after winter/spring rains, Coast Range newts return to their breeding site to mate, often migrating large distances and in large numbers. During a study by Trenham (1988), newts were recaptured up to 3,200 m (nearly two miles) away from the breeding pond where they were originally captured and marked.

Migration from aestivation sites to breeding sites generally begins anywhere from late December to February, depending on the amount of rainfall, though populations that breed in stream pools migrate later, typically in March and April after stream flooding has subsided (Nafis 2020). Egg incubation to hatching times may vary at different locations, ranging from two weeks to two and a half months depending on water temperature, and the larval period lasts several months (Nafis 2020, AmphibiaWeb 2020). Larvae transform and begin to live on land at the end of the summer or in early fall, until as late as October (Nafis 2020). In summary stream-breeding Coast Range newts require quiet stream pools from March through October.

Western Pond Turtle

Western pond turtle is a CDFW species of special concern. Western pond turtles inhabit fresh or brackish water characterized by areas of deep water, low flow velocities, moderate amounts of riparian vegetation, warm water and/or ample basking sites, and underwater cover elements, such as large woody debris and rocks (Jennings and Hayes 1994). Along major rivers, western pond turtles are often concentrated in side-channel and backwater areas. Turtles may move to off-channel habitats, such as oxbows, during periods of high instream flows (Holland 1994). Although adults are habitat generalists, hatchlings and juveniles require specialized habitat for survival through their first few years. Hatchlings spend much of their time feeding in shallow water with dense submerged or short emergent vegetation (Jennings and Hayes 1994). Although an aquatic reptile, western pond turtles require upland habitats for basking, overwintering, and nesting, typically within 0.6 mi from aquatic habitats (Holland 1994). Reese and Welsh (1998) recorded frequent and prolonged year-round use of terrestrial habitat up to 0.3 mi (500 m) from the Trinity River for both nesting and overwintering activities.

Western pond turtle eggs are typically laid in June and July, though they may be laid throughout the year (Holland 1994, Reese 1996); local climatic and water level variations can alter the timing of nesting in this species (Crump 2001). Egg-laying sites vary from sandy shorelines to various forest soil types, although they are generally located in grassy meadows, away from trees and shrubs (Holland 1994), with canopy cover commonly less than about 10% (Reese 1996). Incubating eggs are extremely sensitive to increased soil moisture, which can cause high mortality (Bettelheim 2005, Shaffer 2005, Ashton et al. 1997). Young hatch in late fall and emerge either immediately or overwinter in the nest and emerge in early spring. Low fecundity, low hatchling and juvenile survivorships, high adult survivorship, and potentially long lifespans are characteristic of this species (Jennings et al. 1992). Western pond turtles have temperature-dependent sex determination, where the temperature of the egg during incubation determines the sex (Spinks et al. 2003). In summary, while pond turtles nest sites occur only in upland habitats, aquatic habitat is used year-round by foraging adults and juveniles, particularly deep pools with low flow.

3.4.2 Key birds

Least Bittern

Least bittern is a CDFW species of special concern. The smallest of the ardeids, they are cryptic marsh associates that are seldom seen. Because of their secretive nature, there are significant knowledge gaps regarding breeding behavior and interannual movement patterns.

Breeding populations exist in small patches throughout the state but are concentrated in the Central Valley and along the Southern Coast (Sterling 2008; Poole et al. 2020), with some documented breeding populations in the eastern Sierra (Kirk 1995) and Klamath basin (Poole et al. 2020). SLO County is within the known breeding range (Sterling 2008).
Least bittern are known to breed in both freshwater and brackish marshes (Sterling 2008, Poole et al. 2020), where they build nests atop platforms secured to the stalks of emergent vegetation (usually *Typha* or *Scirpus* spp., but occasionally *Phragmites* spp.) (Weller 1961, Poole et al. 2020). Nests are built up to 75 centimeters above the water surface where water depth is between eight centimeters and one meter. Least bittern show a preference for habitat that includes dense stands of emergent vegetation with adjacent pockets of open water. (Weller 1961, Poole et al. 2020). Breeding usually begins in late April and lasts through August (Kirk 1995, Sterling 2008, Poole et al. 2020). Population abundances decrease outside of the breeding season, which suggests seasonal migration, though some birds are likely winter residents. While foraging, least bittern stalk prey beneath the water surface by perching on the stalks of emergent vegetation (Weller 1961). Important food resources include small fish, terrestrial and aquatic invertebrates, amphibians, and occasionally small mammals (Weller 1961, Poole et al. 2020).

Flooded stands of emergent vegetation are a critical requirement for successful breeding (minimum depth of 8 cm) and foraging. Maintaining stable water levels in Laguna Lake such that emergent vegetation on the lake margins remains inundated throughout the nest selection and breeding season (April–August) is the most important consideration for least bittern in the SLO watershed. However, the role of groundwater in maintaining these water elevations is unclear.

Redhead

A CDFW species of special concern, redheads are medium-bodied freshwater diving ducks (pochards) that occur throughout the United States. Pacific flyway redheads breed predominantly in Alaska, Canada, and the midwestern United States (Bellrose 1980, Beedy and Deuel 2008, Baldassarre 2014, Woodin and Michot 2020), however, resident populations occur year-round in California and breed in limited numbers from April through August (Gibbs et al. 1992 as cited in Beedy and Deuel 2008). 2019 CDFW breeding waterfowl surveys estimated 5,051 breeding individuals in the state, with a long-term average of 3,958 breeding individuals (Skalos and Weaver 2019). Seasonal migrants winter throughout California between September and April (Beedy and Deuel 2008, Baldassarre 2014). Resident breeding populations occur mostly in the Central Valley and the northeastern region of the state (in Siskiyou and Modoc County, and the Klamath Basin) (Bellrose 1980, Beedy and Deuel 2008). However, breeding occurrences have been documented outside of the "typical" range in Alameda, Monterey, and Ventura counties

(Beedy and Deuel 2008), so breeding could occur within the SLO watershed if habitat requirements for successful nesting are met.

Redheads tend to build nests in dense stands of emergent vegetation (typically *Typha* and *Scirpus* spp.) over shallow water, though they have been recorded building ground nests in dense cover (Bellrose 1980, Baldassarre 2014, Beedy and Deuel 2008). Proximity to open water is a key requirement for successful breeding, as hens lead broods to water approximately one day after hatching (Bellrose 1980, Yerkes 2000, Baldassarre 2014). Redheads exhibit flexibility in foraging behavior, diving for submerged aquatic vegetation in water up to one meter deep, and tipping up or dabbling in shallower water (Bellrose 1980, Baldassarre 2014, Woodin and Michot 2020). Wigeon grass (*Rupia* spp.), duckweed (*Lemna* spp.), pond weed (*Potamogeton* and *Stuckenia* spp.), and both terrestrial and aquatic invertebrates are important food resources (Bellrose 1980, Baldassarre 2014, Woodin and Michot 2020). Most breeding pairs documented in California occupied permanent or semipermanent wetlands containing ponds with water deeper than one meter (CDFG and USFWS unpubl. data as cited in Beedy and Deuel 2008). Research in other geographic areas has tied reproductive success to water permanence, depth of water beneath nest sites, and overland distance from nest locations to foraging water (Bellrose 1980, Yerkes 2000). Other than maintaining a hydrologic regime conducive to the growth of critical forage plants and nesting substrate, the maintenance of permanent open water approximately one meter deep is the most important consideration for this species in the SLO watershed.

For redheads, maintaining a depth of one meter in open water would be a good target for the breeding season for reproduction and year-round for wintering birds. However, the role of groundwater in maintaining open water is unclear.

Tricolored blackbird

Tricolored blackbird is listed as threatened by the state of California. Tricolored blackbirds are the most prodigious colonially nesting bird in North America (Cook and Toft 2005, Beedy et al. 2020). Endemic to California, their breeding range includes most of the Central Valley and parts of the Central and Southern California Coast (Beedy 2008, Beedy et al. 2020). SLO County is within the known breeding range (Beedy 2008), however in 2017 only three birds were observed breeding in the County during annual surveys (Meese 2017).

Nest initiation begins in late March with breeding lasting through August (Beedy 2008, Wilson et al. 2016, Beedy et al. 2020). Historically, tricolored blackbird colonies nested in flooded stands of vegetation (particularly *Typha* spp. and *Schoenoplectus* spp.) (Cook and Toft 2005, Wilson et al. 2016, Beedy et al. 2020). However, since the arrival of Europeans in California, there has been an observable shift in behavior, with tricolored blackbirds often utilizing protective stands of non-native upland vegetation such as Himalayan blackberry (*Rubus armeniacus*). It is thought that this switch has resulted from the widespread degradation or outright disappearance of historic Central Valley wetlands. Colonies occupying non-native upland habitat exhibit increased reproductive success when compared to colonies that nest in native flooded vegetation (Cook and Toft 2005).

Successful reproduction for tricolored blackbirds requires a combination of access to open water, appropriate nesting substrate, and proximity to high-quality foraging habitat (Beedy and Hamilton 1997). This species primarily feeds on terrestrial arthropods, including Coleoptera, Orthoptera, Diptera, Hemiptera, Arachnids, and Lepidoptera (Beedy and Hamilton 1997, Crase and DeHaven 1977). Colonies are usually located within a few kilometers of productive grassland, shrubland, forest, or agricultural land (Beedy and Hamilton 1997, Wilson et al. 2016).

Maintaining open water in proximity to suitable nesting habitat (whether emergent vegetation or substantial stands of armored upland vegetation) during the nesting season would be a good target for this species. However, the role of groundwater in maintaining open water in proximity to nesting habitat is unclear.

4 PROPOSED SURFACE WATER MONITORING NETWORK

Depending on location and time of year, GDEs that overly the SLO Valley Groundwater 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 driven flow (e.g. 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. groundwater discharge into streams during the dry season). Because GDEs overlying the SLO Groundwater Basin are supported by a wider range of surface and groundwater hydrological processes in the wet season, we propose to focus monitoring of GDEs in the late spring baseflow period and summer/early fall dry season. During the late spring and summer/early fall dry season, the primary sources supporting these GDEs are likely groundwater, although in some reaches irrigation return flow may also be a factor. Irrigation return flow could have surface water sources from outside the basin (e.g. City of SLO parcels) or be dependent on local groundwater (e.g. Edna Valley). Base flows and groundwater levels during the late spring and summer/early fall dry seasons are also critical to ensure sustainable ecological conditions for many groundwater dependent species. Groundwater supporting GDEs overlying the SLO Valley Groundwater Basin can originate outside of the groundwater basin or within the groundwater basin. Our proposed monitoring network accounts for these two sources of groundwater by selecting locations that are likely primarily dependent of groundwater originating in the SLO Groundwater Basin. For example, proposed monitoring locations for instream flows (Table 3, Figure 4) are located in reaches that are likely hydrologically gaining in the late spring and dry season (Figure 1). Herein we assume that if the GDE indicators are met in the late spring and dry season, then sufficient groundwater would also be available in the wet season to sustain GDEs. However, we recommend that as more data becomes available, this assumption be revisited.

Mainstem SLO Creek several hundred feet upstream of the Marsh St Bridge, September 2020

4.1 Proposed Monitoring Network

There are six existing County stage gages within or adjacent to the SLO Valley Groundwater Basin (Figure 3, Table 3). An additional three stage gages are proposed. These proposed stream gage locations may be modified as future work is completed in the basin. Rating curves, which correlate stage with stream flows, should be developed for all nine sites. In addition, we propose that groundwater be monitored at all of these nine sites plus five additional sites (Figure 3, Table 3) for riparian and wetland/marsh GDE types.

In addition to the above stage, stream flow, and groundwater monitoring, we recommend that streamflow is spatially mapped across a range of seasons and water year types to identify losing and gaining reaches with the SLO Groundwater Basin. Identifying losing and gaining reaches is fundamental to understanding surface-groundwater connectivity. 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. An example of this type of data collection on Stenner Creek is provided in Appendix C.

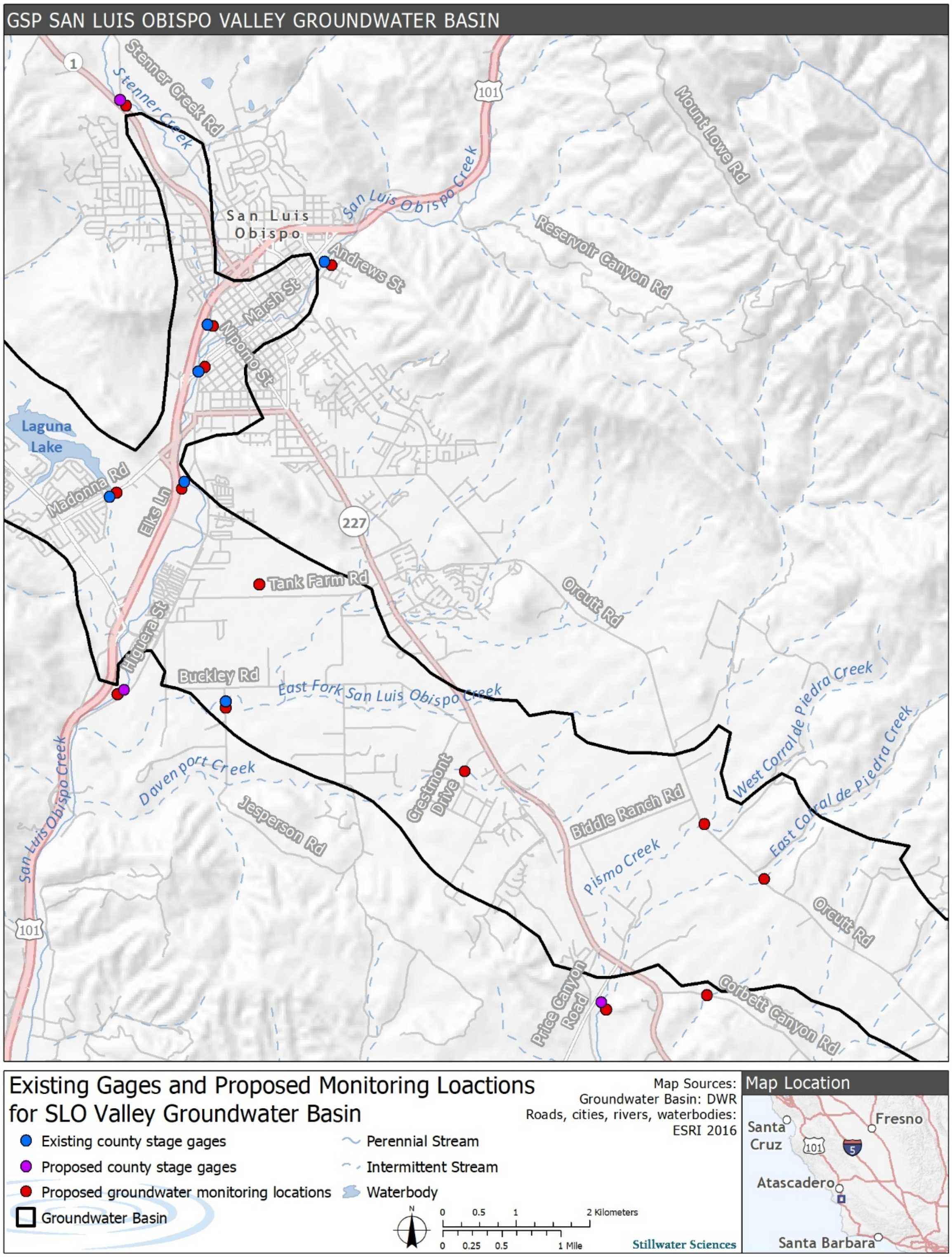

Figure 3. Existing and proposed monitoring locations for Groundwater Dependent Ecosystems.

Table 3. Summary of proposed hydrologic monitoring for the SLO Valley Groundwater Basin.

Water Body	Location	Proposed monitoring parameters	Purpose	Sustainable GDE indicators	Sustainable GDE indicator target values
Existing county stage gage and proposed groundwater monitoring locations					
1) Stenner Creek	Nipomo Street	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Water budget 2) Surface-groundwater connectivity 3) Sustainable GDE indicators	Flow rate (cfs)	0.85 cfs (late spring); 0.33 cfs (dry season)[A]
				Depth to groundwater below ground surface (ft)	TBD
2) Mainstem SLO Creek	Andrews Street	1) Stage (ft) 2) Flow rate (ft/sec)	1) Flow into the basin for water budget 2) Surface-groundwater connectivity 3) Sustainable GDE indicator	Depth to groundwater below ground surface (ft)	TBD
3) Mainstem SLO Creek	Marsh Street	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Water budget 2) Surface-groundwater connectivity 3) Sustainable GDE indicators	Flow rate (cfs)	1.20 cfs (late spring); 0.90 cfs (dry season)[A]
				Depth to groundwater below ground surface (ft)	TBD
T4) Mainstem SLO Creek	Elks Lane	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Water budget 2) Surface-groundwater connectivity 3) Sustainable GDE indicator	Depth to groundwater below ground surface (ft)	TBD
5) East Fork SLO Creek	Jespersen Road	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Water budget 2) Surface-groundwater connectivity 3) Sustainable GDE Indicators	Water depth (ft)	2.3 feet[B] (late spring and dry season)
				Depth to groundwater below ground surface (ft)	TBD
6) Prefumo Creek	Madonna Road	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Water budget 2) Surface-groundwater connectivity 3) Laguna Lake study 4) Sustainable GDE indicator	Depth to groundwater below ground surface (ft)	TBD

Water Body	Location	Proposed monitoring parameters	Purpose	Sustainable GDE indicators	Sustainable GDE indicator target values
New proposed stage gage and groundwater monitoring locations					
7) Stenner Creek	Stenner Creek Road	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Flow into the basin for water budget 2) Surface-groundwater connectivity 3) Sustainable GDE indicator	Depth to groundwater below ground surface (ft)	TBD
8) Mainstem SLO Creek	Old bridge, near Higuera Street	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Flow out of the basin for water budget 2) Surface-groundwater connectivity 3) Sustainable GDE indicator	Depth to groundwater below ground surface (ft)	TBD
9) Pismo Creek	Railroad Crossing	1) Stage (ft) 2) Flow rate (ft/sec) 3) Groundwater elevation (ft)	1) Water budget 2) Surface-groundwater connectivity 3) Sustainable GDE indicators	Flow rate (cfs)	1.50 cfs (late spring)/; 0.50 cfs (dry season) (Stillwater 2016)
				Depth to groundwater below ground surface (ft)	TBD
New proposed groundwater monitoring locations					
10) Tank Farm Wetlands	Near Tank Farm Rd	Groundwater elevation (ft)	GDE indicator	Groundwater depth below surface (ft)	TBD
11) Davenport Creek	Crestmont Road	Groundwater elevation (ft)	GDE indicator	Groundwater depth below surface (ft)	TBD
12) East Corral de Piedra	Orcutt Road	Groundwater elevation (ft)	GDE indicator	Groundwater depth below surface (ft)	TBD
13) West Corral de Piedra	Orcutt Road	Groundwater elevation (ft)	GDE indicator	Groundwater depth below surface (ft)	TBD
14) Canada de Verde	Corbett Canyon Rd	Groundwater elevation (ft)	GDE indicator	Groundwater depth below surface (ft)	TBD

[A] In 2014 Stillwater Sciences completed a county-wide instream flow study for steelhead trout during their two most flow sensitive periods for minimum instream flows (late spring and later summer). A predictive model, based on watershed area, was developed to estimate minimum instream flows during these time periods. Values reported here are based on this model assuming that Stenner Creek at the Nipomo Street bridge has a watershed area of 11.0 square miles and SLO Creek at the Marsh Street Bridge has a 24.5 square mile watershed area

[B] Jennings and Hayes 1994

[C] Stillwater Sciences 2016

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Appendices

Appendix A

Basin Sediment Thickness Map
(GSI 2017)

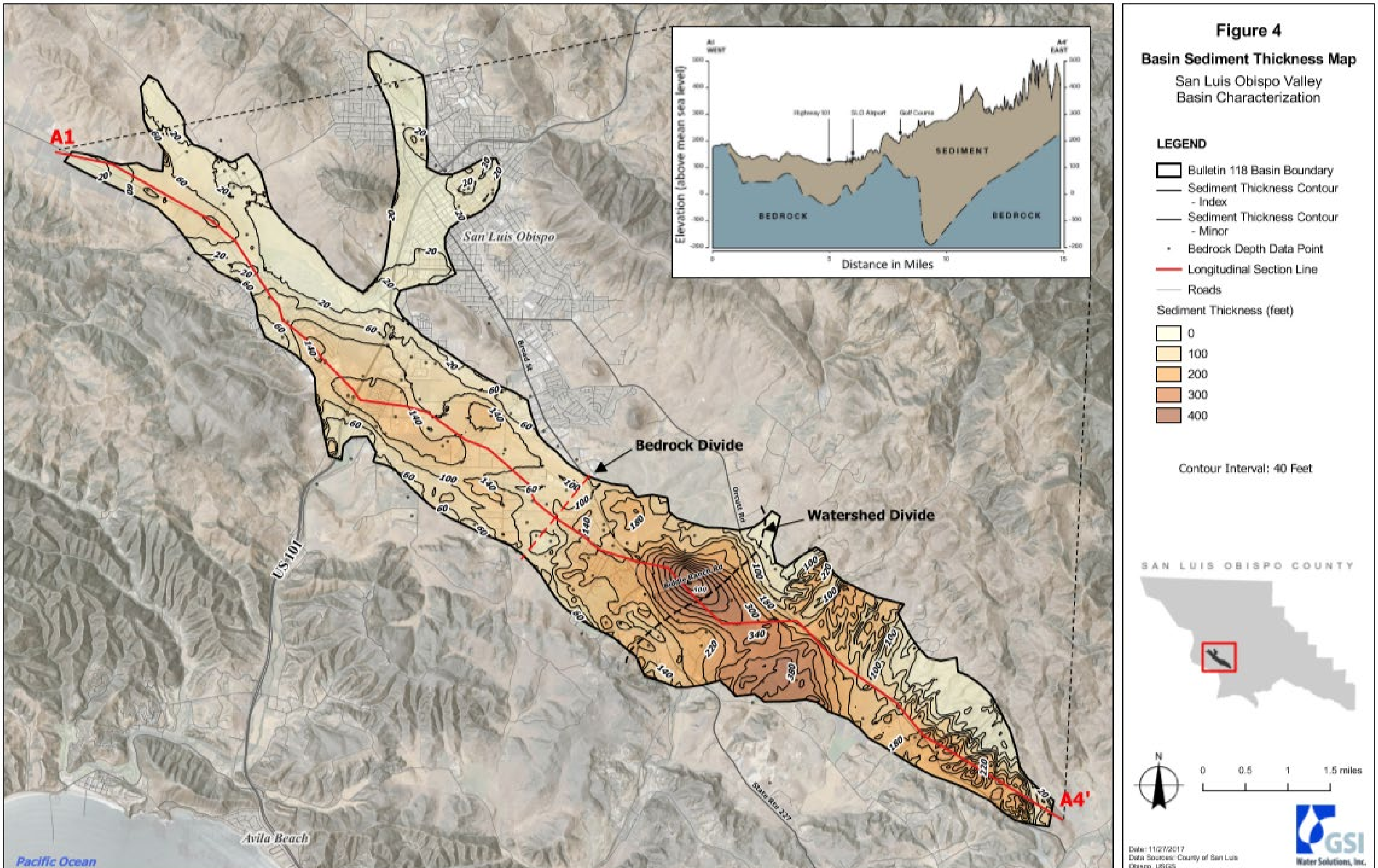

Figure A-1. SLO Groundwater Valley Basin Sediment Thickness Map (GSI 2017).

Appendix B

Fall 1954 Water Level Map
(GSI 2017)

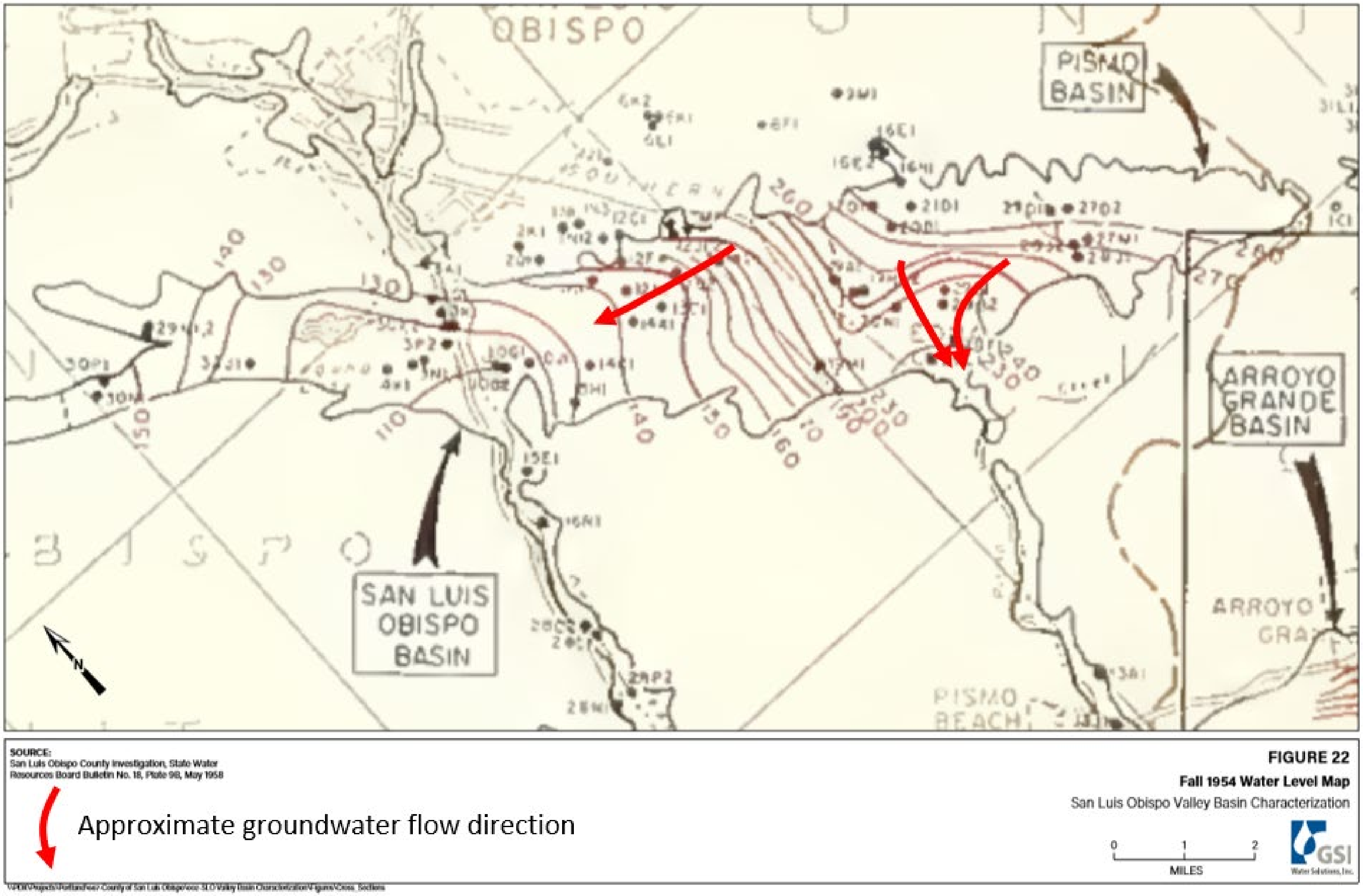

Figure B-1. SLO Groundwater Valley Basin 1954 Water Level Map (Data from DWR, Figure from GSI 2017; direction of groundwater flow (red arrows) added by Stillwater Sciences)

Appendix C

Map of Gaining and Losing Instream Flow Conditions, Stenner Creek, September 2020 (Creek Lands Conservation, unpublished data)

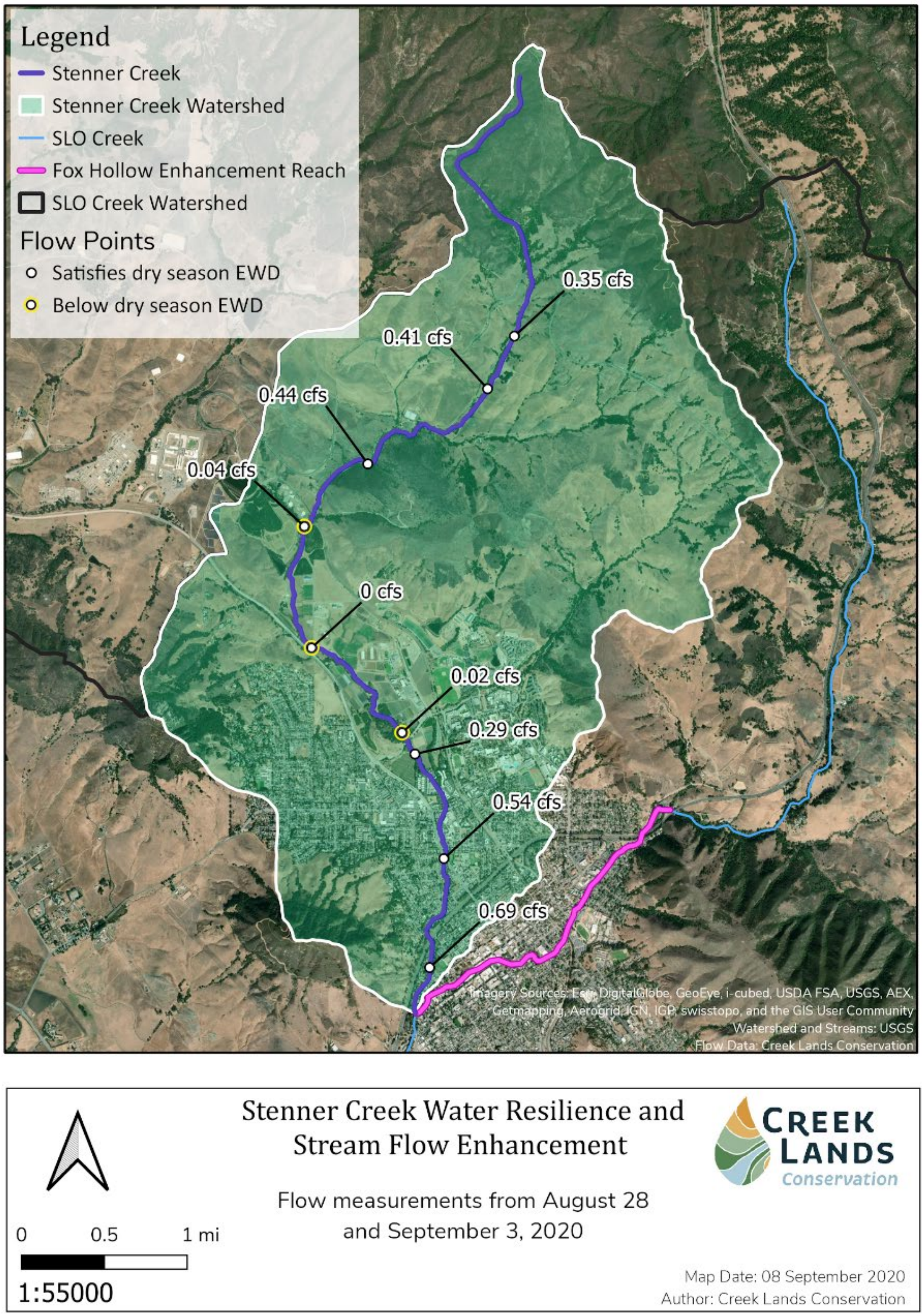

Figure C-1. Stenner Creek flow rate (cfs) as measured by Creek Lands Conservation (CLC) in late August/early September 2020 showing losing and gaining hydrologic conditions. Flow is also compared to environmental water demand (EWD) as defined by Stillwater Sciences (2014). (Figure by CLC)