A land subsidence undesirable result will occur in the Basin if:

1. The land subsidence MT of 0.1 foot of total subsidence is exceeded over a geographic area of 50 acres in a single year, or
2. Cumulative total subsidence of 0.2 foot is exceeded over a geographic area of 50 acres within a 5-year period, and
3. The MT exceedance is determined to be correlated with (1) groundwater pumping, and (2) a MT exceedance of the chronic lowering of groundwater-level SMC.

The geographic area of 50 acres was selected to reduce the likelihood that a very small area or a single data point anomaly within a single 2.5-acre grid could result in Basin-wide undesirable results. The cumulative cap of 0.2 foot within a 5-year period was selected to account for the risk of cumulative small amounts of annual total subsidence less than 0.1 foot adding up to a more significant level of subsidence. The 0.2 foot cumulative total represents an estimated minimum limit for elastic subsidence due to groundwater pumping from the Santa Rosa Plain (an area with similar clay-rich geologic materials and a historical pattern of groundwater-level decline and subsequent recovery), while maintaining protections to avoid the potential for future inelastic subsidence. The undesirable result is tied to groundwater pumping and an exceedance of the chronic lowering of groundwater-level SMC to isolate subsidence caused by groundwater pumping from other causes such as plate tectonics and hydrostatic loading.

4.9.4.1 Criteria for Defining Undesirable Results

An important aspect of the recommended SMC is the determination of whether total subsidence measured by InSAR is correlated to groundwater-level declines caused by pumping.

Activities that the GSAs will conduct if future MT exceedances occur to evaluate if inelastic land subsidence occurred due to groundwater pumping include:

- Review of land surface elevation data from InSAR, continuous GPS stations, or other measurement devices in the Basin
- Review of groundwater elevation measurements and trends in RMPs (established as part of the declining groundwater-level SMC) and other nearby wells being monitored, including an assessment as to whether groundwater levels are below historical lows or exceeding MTs
- Evaluation of time series plots of groundwater levels from nearby monitoring wells
- Review of seismic related data and records that might explain land subsidence observations
- Evaluation of known or estimated groundwater pumping patterns within the vicinity of any observed potential land subsidence

- Assessment of whether data gaps hamper the ability to determine the cause of MT exceedances

The number of the these actions implemented for each individual exceedance of an MT would depend upon the severity and extent of the MT exceedances.

4.9.4.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for land subsidence include the following:

- Decline of groundwater levels below historical lows due to groundwater pumping within the Basin could trigger inelastic subsidence in areas with clay-rich sediments.
- If the location and rates of groundwater pumping change as a result of projects implemented under the GSP, subsidence may occur.
- Shifting a significant amount of pumping to an area that is susceptible to subsidence could trigger subsidence that has not been observed before.
- The exceedance of an undesirable result for another sustainability indicator may lead to an undesirable result for subsidence.

4.9.4.3 Effects on Beneficial Users and Land Use

The undesirable result for subsidence does not allow any subsidence to occur in the Basin. Therefore, there is no negative effect on any beneficial uses and users.

4.10 Depletion of Interconnected Surface Water Sustainable Management Criteria

The SMC for the depletion of ISW is one of the more technically complex to develop and requires robust modeling tools, historical records of stream flow and groundwater levels near streams, and identification of potential impacts from streamflow depletion. In order to develop this SMC, GSA staff convened two practitioner work groups to provide expert input on (1) mapping GDEs, and (2) development of the SMC for the depletion of ISW. Collectively, these work groups met seven times between July 2020 and March 2021. The work group focused on the development of the SMC for the depletion of ISW and included the following participants:

- Rick Rogers, National Marine Fisheries Service
- Jessie Maxfield, California Department of Fish and Wildlife
- Natalie Stork, State Water Resources Control Board
- Val Zimmer, State Water Resources Control Board
- Sam Boland-Brien, State Water Resources Control Board
- Maurice Hall, Environmental Defense Fund
- Melissa Rohde, The Nature Conservancy
- Andrew Renshaw, California Department of Water Resources

Key themes and outcomes from work group members that assisted in developing the SMC for ISW are documented in **Appendix 4-C**. As described in **Appendix 4-C**, the SMC for depletion of ISW is unique in that information in the historical record linking surface water depletion directly to groundwater usage under the jurisdiction of the GSAs is very limited. Variable levels of correlation between simulated streamflow depletion and groundwater levels, a lack of existing in-stream flow targets, and limited data for assessing the presence of any historically significant and unreasonable conditions complicate the development of this SMC.[2] An additional complication is that depletions of surface water can be caused by diversions under surface water rights (for example, direct surface water diversions or wells pumping under appropriative or riparian rights) that are outside the jurisdiction of SGMA and the GSAs. Therefore, the cause of the depletion must be evaluated to assess if such depletions are caused by pumping under the jurisdiction of the GSA.

Empirical data are not currently available within the Basin on potential causes and effects of surface water depletion due to groundwater pumping to adequately determine when and how it adversely impacts GDEs or other beneficial surface water users. For this reason, this GSP includes:

- A detailed adaptive management plan for developing new information and data to refine the SMC during initial years of GSP implementation
- Initial SMC focused on not exceeding historical levels of depletion based on available data and modeling tools

[2] While it is recognized that low summer baseflows in certain years can impact aquatic species, until we know how much water they need to survive and thrive (for example, via in-stream flow targets), an MT is difficult to determine. The current approach requires using historical data and avoiding conditions lower than historical surface water depletion amounts.

4.10.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were determined based on public meetings and discussions with GSA staff, Work Group members, Advisory Committee members, and the GSA Board. Significant and unreasonable depletion of ISW in the Basin was defined as follows:

Significant and unreasonable depletion of surface water from interconnected streams occurs when surface water depletion, caused by groundwater pumping within the Basin, exceeds historical depletion or adversely impacts the viability of GDEs or other beneficial users of surface water.[3]

4.10.2 Minimum Thresholds

Section 354.28(c)(6) of the GSP Regulations states that "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results."

Available data are currently insufficient to directly calculate the rate or volume of surface water depletions from streamflow measurements or reliably estimate depletions from a surface water budget. Quantifying surface water depletion due to pumping is a challenge because (1) it cannot be measured directly; and (2) the influence of surface water depletion by pumping is often obscured by other factors, such as precipitation and runoff, surface water diversions, evapotranspiration, and natural groundwater/surface water interactions. Therefore, groundwater levels are used as a proxy for the rate or volume of surface water depletion for this initial SMC. The use of groundwater levels as a proxy metric for the depletion of ISW sustainability indicator is considered the best available criteria because:

- The depletion of ISW is driven by the gradient between the water surface elevation in the surface water body and groundwater elevations in the connected, shallow aquifer system
- Groundwater levels are also one of the controlling factors in supporting rooting depths for vegetation-based GDEs
- Groundwater levels represent criteria that the GSA has the direct authority to manage within the Basin (for example, compared with stream flows that can be strongly influenced

[3] Important definitions related to the significant and unreasonable statement include:
- "groundwater pumping" excludes any diversions by surface water rights holders
- "historical depletion" is estimated as simulated surface water depletion caused by groundwater pumping as informed by available historical measured data (2004-2018)
- "groundwater dependent ecosystems" includes aquatic species and vegetation, as defined in **Section 3, Basin Setting**
- "other beneficial users of surface water" include surface water rights holders and recreational uses (where applicable)

by the factors described in the preceding paragraph, as well as inflows from upland areas outside of the Basin)

4.10.2.1 Information and Methodology Used to Establish Surface Water Depletion Minimum Thresholds

The information used for establishing the MTs and MOs for the depletion of ISW sustainability indicator included:

- Frequency of observed or measured streamflow
- Comparison of interpolated groundwater levels within the shallow aquifer system and streambed elevations
- High frequency groundwater-level observations from shallow monitoring wells located near streams
- Map of ISW reaches within the Basin
- Map of the distribution of GDEs within the Basin
- Input from the practitioner work group for ISW

Appendix 4-D provides a description of the specific methodology used for developing the SMC for the depletion of ISW sustainability indicator, including (1) the selection of initial RMPs for the depletion of ISW; (2) the current methodology for determining initial MTs and MOs for the depletion of ISW at the RMPs; and (3) the framework for the planned future methodology for refining the MTs and MOs as additional information and data are collected through the adaptive management plan described in the following paragraphs.

The existing RMPs are located near the Petaluma River, Capri Creek, and Washington Creek and have fewer than 2 years of data for analysis. The monitoring network will be supplemented by three additional planned monitoring wells (constructed through the Proposition 68 grant) near the Petaluma River, Lichau Creek, and Adobe Creek. However, for the purposes of establishing the preliminary MTs and MOs for the 2022 GSP, a basic approach is proposed with the understanding that the SMC will be revised as more data and information are gathered through the adaptive management program described in the following paragraphs.

As detailed in **Appendix 4-D**, the general approach outlined here sets initial SMCs at RMP locations (**Figure 4-1**) to maintain the observed gaining/losing conditions during the 2019-2020 period in which data have been collected. Gaining/losing conditions are approximated by evaluating the position of shallow groundwater levels at RMP locations relative to the streambed and stream stage elevations. The approach will be modified to incorporate (1) modeling results to demonstrate the correlation between shallow groundwater levels and the depletion of ISW using future model results at RMP locations, and (2) and additional shallow groundwater-level monitoring data collected at each RMP.

These MT values were chosen to be 1 foot below the observed 2020 dry-season minimum groundwater levels. The goal of the MTs is to maintain the estimated rates and volume of streamflow depletion below historical levels, using groundwater-level measurements as a proxy. Lacking additional historical measurements at these RMPs, these MT choices were informed by observations from adjacent basins (Santa Rosa Plain and Sonoma Valley), which show that the years in the recent historical period with the greatest depletion (2014-2016) had shallow dry-season low groundwater levels typically slightly lower than 2019 and 2020 values. The MTs developed using this methodology are provided in **Table 4-8**.

Table 4-8. Minimum Thresholds and Measurable Objectives for the Depletion of Interconnected Surface Water

RMP Well	Proposed MT (feet amsl)	Proposed MO (feet amsl)
PET0172	13.2	15.4
PET0173	43.3	48.5
PET0174	57.2	59.1

Note:

amsl = above mean sea level

Adaptive Management to Address Data Gaps and Improve/Refine Sustainable Management Criteria

In recognition of the significant information and data limitations and the importance of ISW to beneficial users within the Basin, potential future studies and activities have been identified and prioritized in coordination with the work group according to relative importance and potential costs. These studies and activities listed below in two groups are described more thoroughly in **Section 7, Implementation Plan**, of this GSP for implementation in the early implementation phase of the GSP. Initial identification of monitoring network data gaps, which consider the distribution of currently mapped GDEs within the Basin, is also provided in **Section 5**. Additionally, at this time, none of the streams in the Basin have in-stream flow criteria established by the state. If and when the state agencies conduct habitat and other studies to establish in-stream flow criteria, the GSA will use this information to evaluate surface water depletions to ensure compliance with SGMA.

Group 1

This group will focus on the improved characterization of the causes and effects of depletion, lower-cost studies, and outside funding or leveraged funding opportunities with partners:

- Improve data/information on existing water wells and stream diversions
- Model improvements – focused calibration of surface water and groundwater interaction

- Improve GDE mapping/remote sensing for vegetation health (for example, use of the Normalized Difference Vegetation Index, TNC's GDE Pulse application, and other similar resources)

- Compile and evaluate existing and relevant habitat field surveys

- Evaluate future airborne geophysical data

Group 2

This group will focus on monitoring network improvements, higher-cost studies, and related tasks:

- Additional shallow monitoring wells and stream gauges
- Focused geophysical studies
- Geomorphic and streambed conductivity assessments
- Additional focused habitat field mapping in partnership with other agencies, as needed

4.10.2.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

An assessment of how other sustainability indicators could be influenced by the depletion of ISW MT indicates the following:

- **Chronic lowering of groundwater levels**. Groundwater levels are used as a proxy for monitoring the depletion of ISW MTs. Because the MTs for the depletion of ISW are generally set within close proximity to streambed elevations within the Basin, they are shallower (more protective) than MTs set for nearby RMPs for the chronic lowering of groundwater levels. Maintaining shallow groundwater elevations above the depletion of ISW MTs will similarly maintain groundwater levels above the chronic lowering of groundwater MTs. Therefore, the depletion of ISW MTs do not cause exceedances for the chronic lowering of groundwater-level MTs.

- **Reduction in groundwater storage**. The chronic lowering of groundwater levels MTs is used as a proxy for the change in groundwater storage MTs. Therefore, maintaining groundwater elevations above the depletion of ISW MTs will not result in an exceedance of the groundwater storage MTs, for the same reasons described for the chronic lowering of groundwater levels sustainability indicator.

- **Seawater Intrusion**. MTs for the depletion of ISW are intended to maintain groundwater levels near streams above historical levels, which is not anticipated to lead to seawater intrusion.

- **Degraded water quality**. MTs for the depletion of ISW are intended to maintain groundwater levels near streams above historical levels, which is not anticipated to lead to a degradation of water quality.

- **Subsidence**. MTs for the depletion of ISW are intended to maintain groundwater levels near streams above historical levels, which is not anticipated to lead to subsidence.

4.10.2.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Petaluma Valley Basin has two neighboring subbasins that are categorized as medium priority and are also subject to SGMA: the Santa Rosa Plain Subbasin to the north and the Sonoma Valley Subbasin to the east. The Petaluma Valley Basin is also adjacent to the very low-priority Wilson Grove Formation Highlands Basin to the northwest and Novato Valley Basin to the southwest, both of which are not subject to SGMA.

The reaches of interconnected streams within the Basin that are subject to the MTs for depletion of ISW do not flow into any of the neighboring basins or subbasins. Therefore, the MTs for the depletion of ISW will not have an effect on these neighboring basins and subbasins.

4.10.2.4 Effect on Beneficial Uses and Users

The MTs for the depletion of ISW measured using groundwater levels as a proxy assumes that maintaining groundwater levels at or above historical low levels in the Basin will avoid surface water depletion that exceeds historical levels. Avoiding surface water depletion at levels greater than historical conditions will provide a benefit to beneficial users and land uses that rely on ISW. The following specifically describes how MTs will benefit land and beneficial water use in the Basin:

- **Agricultural land uses and users**. Maintaining historical levels of surface water depletion should not impact agricultural land uses or irrigation water supplies.

- **Urban land uses and users.** Municipal groundwater pumpers are not anticipated to be affected if surface water depletion from groundwater pumping remains similar to historical levels.

- **Domestic land uses and users**. Maintaining rates of surface water depletion from groundwater pumping at or above historical levels will protect residential beneficial users of groundwater by keeping groundwater levels at or above historical low levels.

- **Ecological land uses and users**. The main benefit of the surface water depletion MTs is to GDEs (primarily aquatic species and riparian vegetation). Maintaining groundwater levels near streams at or above historical low levels helps maintain interconnected conditions and historical levels of baseflow. Better understanding the causal effects of ISW depletion due to groundwater pumping on GDEs and habitat is a primary focus of the early stages of GSP implementation and will be used to further evaluate the potential effects on GDEs and refine the MTs in future GSP updates, as appropriate.

4.10.2.5 Relation to State, Federal, or Local Standards

No federal, state, or local standards exist that specifically address depletion of ISW, however state and federal endangered species provisions call for the protection and restoration of conditions necessary for steelhead and coho salmon. These provisions were considered in the development of the surface water depletion MTs.

As new standards, such as in-stream flow targets, are developed by other agencies they will be evaluated and incorporated into any potential future refinements to the MTs for the depletion of ISW.

4.10.2.6 Method for Quantitative Measurement of Minimum Thresholds

Groundwater elevations will be measured in three RMPs used to initially monitor surface water depletion as a proxy. As described in **Section 7, Implementation Plan**, additional RMPs will be developed and incorporated into the monitoring network during the early stages of GSP implementation. Groundwater-level monitoring will be conducted in accordance with the monitoring protocol outlined in **Section 5.3.3**. For reporting seasonal highs and lows for future comparison with MTs, all measurements collected more frequently than monthly will be reported as monthly averages in order to better align with the measurement frequency within historical datasets used to calculate the MTs. During GSP implementation, individual groundwater-level measurements collected manually and by data loggers will be reviewed for quality control and analyzed for MT exceedances during compilation of GSP annual and 5-year update reports. As described in **Section 4.10.2.1**, and in **Sections 5** and **7**, additional work to fill data gaps and implement monitoring network improvements is identified as high-priority actions during GSP implementation.

4.10.3 Measurable Objectives

MOs for the depletion of ISW represent achievable target groundwater elevations near streams that allow for operational flexibility above MTs over a range of climate and hydrologic variability. In the absence of sufficient observed historical data at the three RMPs to evaluate hydrologic variability over a range of climate conditions, the initial MOs are set at the halfway point between the MT value and the average observed dry-season surface water stage for the available period of record (November 2019 through December 2020). **Table 4-8** lists the MOs for each RMP.

4.10.3.1 Method for Setting Measurable Objectives

A description of the specific methodology used for developing the MOs for the depletion of ISW sustainability indicator is provided in **Appendix 4-D**.

4.10.3.2 Interim Milestones

Interim milestones are intended to show how MOs will be achieved during the initial 20-year implementation period of the GSP. As the MOs are set at the near observed groundwater elevations during recent years, interim milestones are identical to the groundwater levels associated with the MOs.

4.10.4 Undesirable Results

4.10.4.1 Criteria for Defining Undesirable Results

The depletion of ISW undesirable result is defined using groundwater levels as a proxy. Per the GSP Regulations, the description of undesirable results is based on a quantitative description of the combination of MT exceedances that cause significant and unreasonable effects in the Basin. For the Basin:

An undesirable result occurs if the MT is exceeded at two wells during dry years or at one well during normal and wet years and is entirely or partially attributable to groundwater pumping under the jurisdiction of the GSA.

The different percentages associated with drought years versus non-drought years were selected to help address the concerns expressed by some work group and Advisory Committee members that setting MTs at levels experienced during significant droughts could be detrimental to aquatic species and associated habitat if allowed during future normal and wet years. Placing the different weights on drought and non-drought years helps address the expressed concern by ensuring that during normal/wet years the higher levels of estimated streamflow depletion from drought years are avoided. The methodology for determination of future drought years is provided in **Appendix 4-B**.

Exceedances of MTs at a single RMP will require investigation to determine if any actions should be considered to avoid the potential future onset of undesirable results, as described in **Section 4.10.4.2**.

4.10.4.2 Potential Causes of Undesirable Results

As described in the previous section, many factors influence surface water flows and ISW depletion that are outside the control of the GSA. For undesirable results to occur, the cause of surface water depletion must be related to the extraction of groundwater or other project and management actions implemented for groundwater sustainability, and not due to a lack of precipitation during periods of prolonged drought or surface water diversions under the jurisdiction of the SWRCB.

Undesirable results may occur in the future to GDEs if groundwater-level declines near creeks are caused by groundwater pumping or if there is reduced recharge in the shallow aquifer system.

Prior to determining if undesirable results are occurring based on MT exceedances, the GSA would need to assess whether potential causes of exceedances are related to depletions associated with groundwater pumping or other activities not under the jurisdiction of the GSA. GSA staff is currently working with staff of the SWRCB to develop a description of a coordination process with SWRCB to address this. The goal of the coordination process is to assess whether potential causes of exceedances are related to depletions (entirely or in part) associated with groundwater conditions under the jurisdiction of the GSA or other activities not under the jurisdiction of the GSA and will include (1) information and data sharing, (2) conferring on potential causes of exceedances, and (3) improving the SMC as needed based on outcomes and new information.

Additionally, to respond prior to the onset of undesirable results, the following actions would be implemented if a MT is exceeded at a single RMP that does not trigger an undesirable result:

- Review available data from full monitoring network (that is, non-RMP monitoring wells) to assess the potential scale of areas exhibiting declines
- Assess whether the exceedance is climate-related
- Review any known or potential changes in groundwater pumping patterns (for example, new wells brought online, changes in land/water use, and the like)
- Consider whether additional RMPs are needed
- Information sharing with other stakeholders, as appropriate

4.10.4.3 Effects on Beneficial Users and Land Use

If depletions of ISW were to reach undesirable results, adverse effects could include the reduced ability of the stream flows to meet in-stream flow requirements for local fisheries and critical habitat, including GDEs, in the Basin. Reduction of streamflow directly reduces the amount of suitable rearing habitat for fisheries, by reducing the amount of wetted area, stream depth, flow velocity, cover, and dissolved oxygen. Reduced flow can also result in increased water temperature. In extreme conditions, the dewatering of stream reaches eliminates the ability of fish to move to more suitable areas and can cause mortality. Reduced surface flows can also negatively affect permitted surface water diversions. Riparian vegetation GDEs can also be impacted by lowered groundwater levels in the vicinity of interconnected surface water within the Basin. Consideration of these factors was included as part of SMC development.

4.10.5 Consideration of Public Trust Resources

While SGMA does not require the Plan to address California's public trust doctrine, a 2018 California Court of Appeal ruling found that groundwater pumping that directly reduces the flow or volume of water in a navigable waterway (and tributaries that are known to supply those navigable waters) may violate the public trust doctrine under certain fact-specific circumstances where public trust resources are adversely affected. The public trust does not apply to groundwater itself. Rather, the public trust doctrine may apply if the extraction of groundwater adversely impacts a navigable waterway or tributary to a navigable waterway to which the public trust doctrine does apply (Environmental Law Foundation et al. v. State Water Resources Control Board [2018] 26 Cal.App.5th 844). As described elsewhere in this Plan, to the extent that tributaries in the Basin flow into the Petaluma River, the Plan analyzes potential impacts on ISW, GDEs, and public trust resources.

The public trust doctrine is the principle that the government holds in trust designated resources for the benefit of the people. Public trust uses can include commerce, recreation, and fishing in navigable waters, as well as wildlife habitat and recreation. It is a balancing doctrine that protects these resources to the extent feasible and includes a reasonable consideration of public trust resources in specific governmental decision-making processes. Here, the Plan reasonably considers and incorporates public trust resources protection to the extent feasible; the Plan accomplishes this by using an inclusive public process and using the best data and best available science.

The various beneficial uses and users of surface waters (including known water rights holders, ecological surface water users and uses, and recreational surface water users) were addressed when setting the ISW depletion SMC. This is a reasonable review of all uses and users in an attempt to balance all interests that must be considered. GSAs under SGMA are "charged with procedural and substantive obligations designed to balance the needs of the various stakeholders in groundwater in an effort to preserve [groundwater], and replenish [it] to the extent possible" (Environmental Law Foundation et al. v. State Water Resources Control Board*,* citing CWC Sections 10721[u],[v],[x][6]; 10723.2; 10725.2; 10725.4; 10726.2; 10726.4; 10726.5.) This is not an assessment about what constitutes a reasonable and beneficial use under Article X, Section 2 of the California Constitution. The SMC for depletion of ISW are developed as described in **Section 4.10** and in **Appendix 4-A**, including public information about critical habitat, locations of ISW derived from best available data, and available information about known water rights holders.

This Plan specifically recognizes the importance of protecting environmental public trust resources. As described in the introduction of section 4.10 the GSA sought expert advice regarding the best available science and applied for and received grant funding through Proposition 68 to convene and facilitate a Practitioners Working Group. The purpose of this working group, as described in **Section 4.10**, was to help develop the SMC for the consideration of ISW to avoid or reduce potential depletion. This process involved the reasonable analysis and consideration of public trust resources.

Another example of the GSA's efforts to consider public trust resources is a second Practitioners Working Group that was convened to assist with identifying the GDEs, including fish and wildlife that use stream flows which could be affected by potential depletion of ISW as applicable in some parts of the subbasin. This working group included representatives from National Marine Fisheries Service, California Department of Fish and Wildlife, TNC, San Francisco Estuary Institute, Permit Sonoma, Sonoma County Agricultural Preservation and Open Space District, Sonoma Ecology Center, and The Laguna de Santa Rosa Foundation.

As described in **Section 3.2.6**, available information for mapping ISW is limited in the Basin, and is further complicated by challenges in quantifying surface water depletion due to pumping (described in **Section 4.10**). The current monitoring network for ISW does include some data gaps, which are described in **Section 5.4.2**. The Plan proposes an aggressive adaptive management plan and methodology, described in **Appendices 4-A** and **4-B**, which use existing information to avoid adverse effects on public trust resources and make adjustments as new information and data become available. The implementation plan (**Section 7.2.4**) describes how these data gaps will be filled and the monitoring network and mapping will be improved within the first 5 years of implementation. This shows that the GSA has a proactive approach to fully understanding and taking steps to identify and avoid adverse effects on public trust resources. The GSA has taken steps to make use of the best available science, and has taken steps to make additional information and data available to update the best available science as soon as is feasible. Specifically, as it has in the past, the GSA will apply to DWR for the next round of available funding to support GSP implementation, including funding to further analyze and address data gaps, ISW, and public trust resources.

Section 5: Monitoring Networks
Groundwater Sustainability Plan for
Petaluma Valley Groundwater Basin

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5 MONITORING NETWORKS

This section describes the monitoring networks that are planned in the Basin and contributing watershed area for implementation of the GSP and how the existing monitoring networks described in **Section 2.4** were evaluated and refined. RMPs, for which sustainable management criteria are set, are identified in this section and the processes used to select suitable RMPs, along with monitoring objectives, are described. This section also presents an assessment of the monitoring networks identified for GSP implementation, including an identification of data gaps and improvements to the monitoring networks that are planned as part of GSP implementation.

5.1 Monitoring Network Objectives

SGMA regulations require monitoring networks be developed to collect data of sufficient quality, frequency, and spatial distribution to characterize groundwater and related surface water conditions in the Basin, and to evaluate changing conditions that occur during implementation of the GSP. Monitoring networks should accomplish the following:

- Demonstrate progress toward achieving measurable objectives described in the GSP
- Monitor impacts on the beneficial uses and users of groundwater
- Monitor changes in groundwater conditions relative to MOs and MTs
- Quantify annual changes in water budget components

Specific objectives for each monitoring network in the Basin are described in the following sections. To ensure the quality and consistency of the data collected, monitoring protocols have been established and are presented in **Appendix 5-A**.

5.2 Description of Monitoring Networks for Groundwater Sustainability Plan Implementation

The monitoring networks included in this section are based on existing monitoring networks described generally in **Section 2.4, Existing Monitoring Programs and Networks**. To relate monitoring stations to sustainability indicators, monitoring networks are described in the following paragraphs for each of the information types that are needed to evaluate the sustainability indicators described in **Section 4, Sustainable Management Criteria**.

5.2.1 Groundwater-level Monitoring Network

The existing groundwater-level monitoring network described in **Section 2.4** was evaluated in accordance with SGMA regulations and guidelines, with the monitoring network objectives in mind, and refined into the Groundwater-level Monitoring Network for GSP Implementation (GSP Implementation Network).

SGMA requirements and guidance for monitoring are described in the GSP Regulations and DWR's *Best Management Practices for the Sustainable Management of Groundwater Monitoring Protocols, Standards, and Sites* (2016b) and *Best Management Practices for the Sustainable Management of Groundwater Monitoring Networks and Identification of Data Gaps*

(2016c). These include the following data and reporting standards and guidance related to groundwater levels:

- Well location, accurate to within 30 feet
- Elevation of the ground surface and reference point, accurate to within 0.5 foot
- Field measurements measured and reported to accuracy of 0.1 foot
- Description of the well type (for example, public supply, irrigation, domestic, monitoring, or other type of well) and whether the well is active or inactive
- Construction information (casing perforations, borehole depth, and total well depth)
- Well completion reports, if available, from which the names of private owners have been redacted
- Identification of principal aquifers monitored
- Selection of wells should be aquifer-specific and wells that are screened across more than one aquifer should be avoided
- Active water-supply wells (for example, agricultural or municipal wells) can be used temporarily until either dedicated monitoring wells can be installed or an existing well can be identified that meets the required criteria
- If active water-supply wells are used for monitoring, the wells must be screened across a single water-bearing unit, and care must be taken to ensure that pumping drawdown has sufficiently recovered before collecting data from a well

Specific objectives for the groundwater-level monitoring network are to provide a sufficient number of monitoring sites with adequate spatial distribution, monitoring frequency, and data quality to:

- Produce seasonal maps of potentiometric surfaces throughout the Basin that clearly identify changes in groundwater-flow direction and gradient
- Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between the principal aquifer and surface water features
- Demonstrate groundwater occurrence, flow directions, and hydraulic gradients across Basin boundaries, when combined with data from adjacent basins
- Identify short-term and long-term trends and seasonal fluctuations when combined with historical data
- Track water levels relative to minimum thresholds and measurable objectives

- Support water budget calculations and calibration of the groundwater model for the Basin

5.2.1.1 Rationale for Selection of Groundwater Sustainability Plan Implementation Groundwater-level Monitoring Network Sites

The following criteria were used for the assessment and initial screening of the entire existing groundwater-level monitoring network to identify the wells that are suitable for inclusion in the GSP Implementation Network:

- Well Construction: Wells with known complete construction information (for example, total depth, casing diameter, depth of screened interval(s), and other construction details) are preferred. For wells selected for inclusion in the GSP Implementation Network that have incomplete construction information, attempts will be made to ascertain the information through records searches of applicable databases or records requests directly to the well owner and/or applying for video-logging services through the DWR Technical Support Services (TSS) program.

- Historical Data Record: Wells with complete data records of 10 years or longer that are part of a current monitoring program are preferred. In some cases, for wells where monitoring has been discontinued in the past few years (that is, 2017 or later), efforts are being made to reinstate monitoring as a part of GSP implementation.

- Well Type: Dedicated monitoring wells are preferred. Secondary preference is given to inactive supply wells and the lowest preference is given to active supply wells (that is, domestic, irrigation, or municipal). For active supply wells included in the GSP Implementation Network, special precautions will be taken to ensure representative measurements are collected as described in **Appendix 5-A**. Environmental monitoring wells were not considered for the GSP Implementation Network because they are typically privately owned and somewhat temporary in nature.

- Spatial Coverage: Monitoring sites were selected to maximize horizontal and vertical coverage of the entire Basin. Special considerations were given to areas near streams and areas of uncertainty such as near faults or Basin boundaries. Where available, wells outside of the Basin, but within the contributing watershed areas, are included in the GSP Implementation Network.

- Well Ownership: Wells owned by a GSA member agency are preferred. Privately owned wells are also included in the GSP Implementation Network to maximize spatial coverage of the Basin.

5.2.1.2 Description of Refined Groundwater-level Monitoring Network for Groundwater Sustainability Plan Implementation

The GSP Implementation Network consists of a total of 20 wells within the contributing watershed area, including 15 wells within the Basin itself (**Figure 5-1a)**. Of the 20 wells in the GSP Implementation Network, 3 are dedicated monitoring wells, 5 are inactive municipal supply wells, and 12 are private supply wells. Details for wells in the GSP Implementation Network, including well construction, well use, and length of monitoring record are presented in **Table 5-1**.

Monitoring frequencies for wells in the GSP Implementation Network are shown in **Table 5-1**. Of the 20 wells in the GSP Implementation Network, 3 are high-frequency monitoring points with water-level data collected remotely on an hourly basis, 12 are monitored monthly, and 5 are monitored semiannually.

5.2.1.3 Basin Boundary Groundwater-level Monitoring Network

To monitor boundary conditions, a Basin Boundary Groundwater-level Monitoring Network (Boundary Network) has been developed. The Boundary Network includes wells that are outside of the Basin, but within the contributing watershed areas (included in the GSP Implementation Network described earlier in this section) and additional wells outside of the contributing watershed areas in adjacent groundwater basins and subbasins. The Boundary Network consists of 10 wells, including 5 wells in the Wilson Grove Formation Highlands Basin and 5 wells in the Santa Rosa Plain Subbasin (**Figure 5-1b)**. Details for wells in the Boundary Network, including well construction, well use, monitoring frequency, and length of monitoring record are presented in **Table 5-1**.

5.2.2 Groundwater Quality Monitoring Network

As described in **Section 4.8**, the Groundwater Quality Monitoring Network for the Basin is based on existing supply well monitoring programs. The GSA has identified sets of supply wells that are currently monitored (or are proposed to be monitored in the future) for various groundwater constituents and supply uses such as drinking water and irrigation water. Because these supply wells are monitored under different programs and may have different required sampling schedules (even under the same program), no one set of constituents will be sampled in all wells.

Existing monitoring programs included in the Groundwater Quality Monitoring Network are:

- Public supply wells, regulated by the SWRCB DDW. Public drinking water-supply wells are included in the Groundwater Quality Monitoring Network because they are routinely sampled to meet CCR Title 22 water quality reporting requirements as regulated by the SWRCB DDW. Title 22 analyses include arsenic, nitrate, and TDS, which are the Basin COCs. This dataset can be obtained from the SWRCB through the GAMA online portal.

Existing and future water quality monitoring programs may be used to help collect data during GSP implementation and establish consistency with other programs. There are not currently any identified data gaps in the Groundwater Quality Monitoring Network. Additional water quality monitoring networks will be developed specifically for monitoring projects and management actions during GSP implementation.

Table 5-1. Groundwater-level Monitoring Network for GSP Implementation

Data Management System ID	Data Management System ID							Data Record	Data Record
Station Name	Station Number	Informal Well Name	Type of Well	Well Depth[a]	Well Depth Category	Screened Interval[a]	Monitoring Frequency	From	Until
Wells Within the Petaluma Valley Groundwater Basin **High-frequency Monitoring Wells**									
PET0172	PET-D06-01_Corona	Petaluma River at Old Corona Road	Observation	40.5	Shallow (0-200 feet)	20-40	Hourly	11/25/2019	Present
PET0173	PET-E05-01_Casella	Capri Creek at Casella Way	Observation	45.5	Shallow (0-200 feet)	35-45	Hourly	11/25/2019	Present
PET0174	PET-F06-01_Garfield	East Washington Creek at Garfield Drive	Observation	35.5	Shallow (0-200 feet)	15-35	Hourly	11/26/2019	Present
CASGEM/Volunteer Program Wells									
PET0042	383076N1227041W001	05N08W02H001M	Supply	155	Shallow (0-200 feet)	30-150	Monthly	2/3/1976	7/14/2021
PET0036	382766N1226179W001	05N07W15K002M	Supply	177	Shallow (0-200 feet)	158-177	Monthly	12/1/1989	7/14/2021
PET0017	382117N1225556W001	04N06W07A001M	Supply	180	Shallow (0-200 feet)	140-180	Monthly	10/13/1980	7/14/2021
PET0033	382712N1226147W001	05N07W15Q001M	Supply	200	Shallow (0-200 feet)	?	Monthly	12/1/1989	7/14/2021
PET0006	381402N1223610W001	Casa De Arroyo	Municipal	229	Medium (200-500 feet)	89-229	Monthly	11/7/2012	7/22/2021
PET0012	381531N1224876W001	Sears Point	Supply	276	Medium (200-500 feet)	75-275	Semiannually	11/25/2014	3/18/2021
PET0011	381528N1223700W001	Garfield	Municipal	360	Medium (200-500 feet)	220-360	Semiannually	11/7/2012	3/18/2021
PET0023	382342N1225525W001	Cardinaux	Supply	370	Medium (200-500 feet)	30-370	Semiannually	5/5/2015	3/18/2021
PET0010	381522N1223733W001	Tahola	Municipal	425	Medium (200-500 feet)	305-382	Monthly	11/7/2012	7/22/2021
PET0009	381503N1223410W001	5/7-25 PG&E	Supply	426	Medium (200-500 feet)	40-406	Semiannually	1/27/2015	3/17/2021
PET0007	381408N1223633W001	Miwok	Municipal	460	Medium (200-500 feet)	90-460	Monthly	11/7/2012	7/22/2021
PET0013	381553N1223839W001	Station 1401	Municipal	562	Deep(>500 feet)	52-538	Monthly	11/7/2012	7/22/2021
Wells Outside of the Groundwater Basin but Within the Contributing Watershed Area **CASGEM/Volunteer Program Wells**									
PET0020	382305N1226654W001	05N07W31R002M	Supply	95	Shallow (0-200 feet)	?	Monthly	10/10/1980	7/14/2021
PET0028	382623N1227218W001	05N08W23M001M	Supply	100	Shallow (0-200 feet)	?	Semiannually	10/10/1980	2/13/2020
PET0025	382483N1226726W001	05N07W30K014M	Supply	185	Shallow (0-200 feet)	?	Monthly	11/10/1989	7/14/2021
PET0019	382277N1226740W001	05N07W31P003M	Supply	244	Medium (200-500 feet)	?	Monthly	11/10/1989	7/14/2021
PET0035	382749N1227071W001	05N08W14K002M	Supply	270	Medium (200-500 feet)	?	Monthly	10/14/1980	7/26/2021
Boundary Network Wells Outside of the Contributing Watershed Area									
SRP0367	SCWA_Copeland_A-3	Copeland A-3	Observation	122	Shallow (0-200 feet)	105-120	Hourly	5/15/2014	Present
SRP0121	SRP-L19-01	06N07W30R001M	Unknown	150	Shallow (0-200 feet)	?	Monthly	11/9/1989	11/26/2019
SRP0723	RECMW114	MW-114	Observation	37.5	Shallow (0-200 feet)	?	Semiannually	5/30/2007	10/10/2019
SRP0235	383096N1227098W001	St. John	Domestic	419	Medium (200-500 feet)	118-418	Semiannually	6/12/2015	10/22/2019
SRP0238	SRP-K19-01	RP Well 37	Municipal	380	Medium (200-500 feet)	130-380	Daily	11/1/1991	Present

[a] Well depth and screened interval reported in feet below top-of-casing

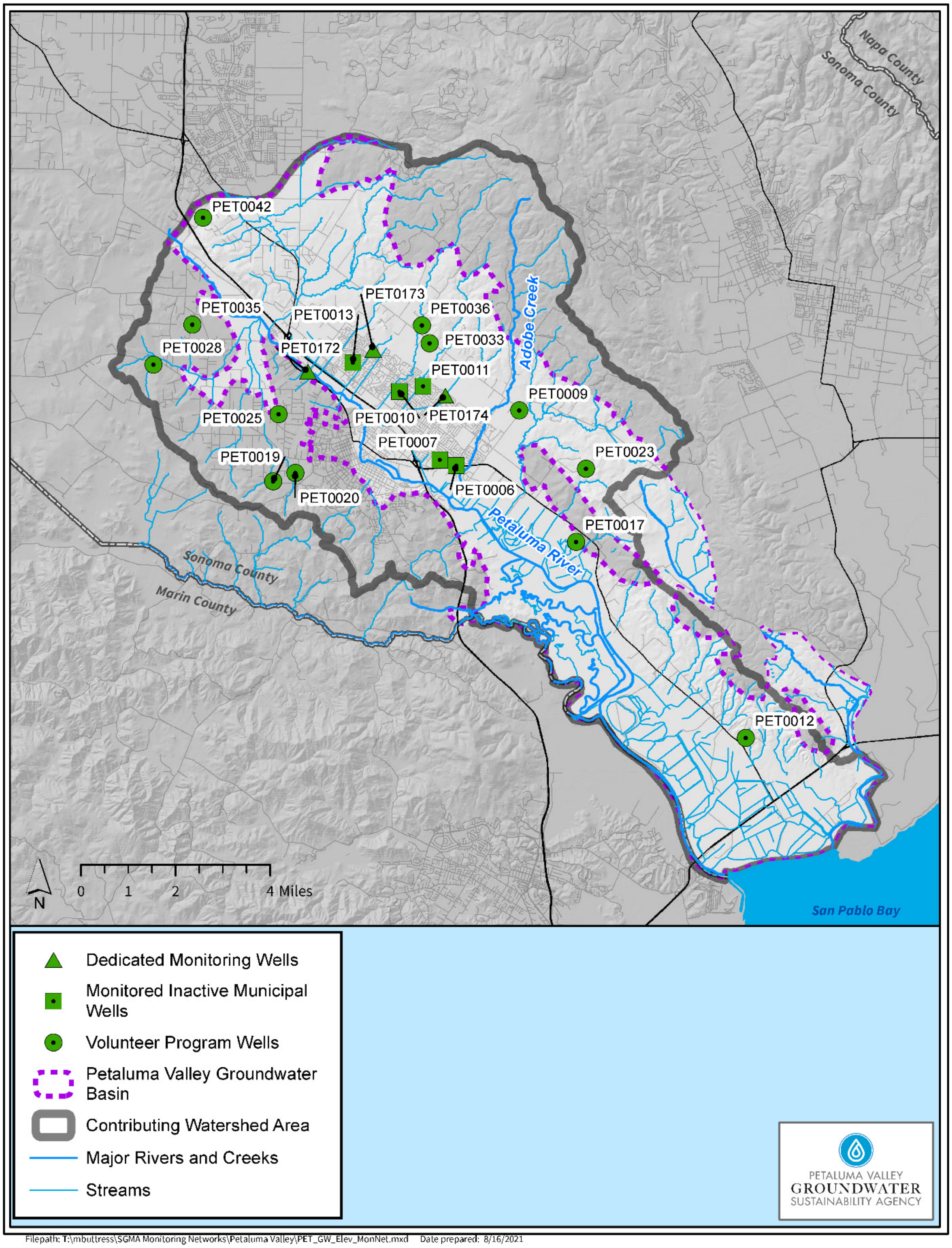

Figure 5-1a. Groundwater-level Monitoring Network for Groundwater Sustainability Plan Implementation

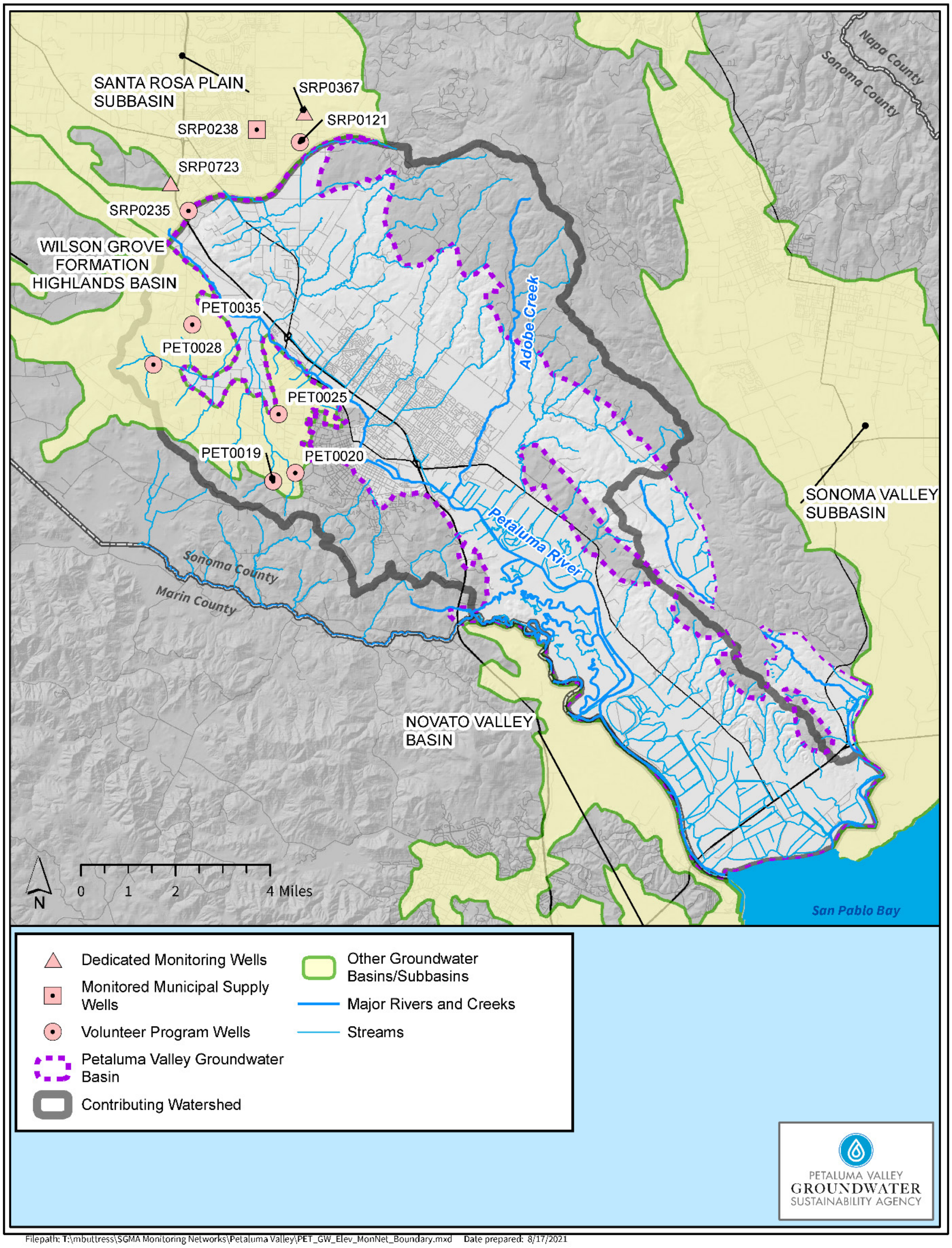

Figure 5-1b. Basin Boundary Groundwater-level Monitoring Network

5.2.3 Surface Water Monitoring Network

The surface water monitoring network in the Basin has been developed with the following objectives:

- Quantify inflow and outflow of surface water to and from the Basin
- Characterize spatial and temporal exchanges between surface water and groundwater
- Calibrate the tools and methods necessary to calculate depletions of surface water caused by groundwater extraction

The surface water monitoring network in the Basin includes 1 USGS stream gage and 15 stream gages operated by the City of Petaluma (**Table 5-2**; **Figure 5-2)**.

In 2019, the GSA partnered with DWR's TSS program to install three shallow groundwater monitoring wells adjacent to streams in the Basin to further the understanding of groundwater-surface water interaction. One of these shallow monitoring wells was installed adjacent to the stream gage on the Petaluma River at Corona Road, one was installed adjacent to the stream gage on East Washington Creek at Garfield Drive, and one was installed adjacent to the stream gage on Capri Creek at Casella Way (**Figure 5-2)**. All three of the shallow stream-adjacent monitoring wells are equipped with pressure transducers for collection of hourly temperature and groundwater-level data. Details of the stream-adjacent shallow monitoring wells, including well construction, monitoring frequency, and length of monitoring record are shown in **Table 5-1**.

5.2.4 Land Surface Elevation Monitoring Network

Available land surface elevation datasets for the Basin and contributing watershed area include measurements collected at one discrete GPS location since 2004 and by InSAR satellite in most of the Basin since 2015. The GPS station is monitored by the UNAVCO PBO program. The one station in the Basin is P198 (PET0127), located near the Petaluma Airport (**Figure 3-14a** in **Section 3**).

5.2.5 Seawater Intrusion Monitoring Network

The GSA has identified nine existing public water-supply wells for inclusion in the Seawater Intrusion Monitoring Network for the Basin. These wells are all within approximately 1 to 2 miles of the Baylands portion of the Basin (**Figure 5-3)**. The GSA is in the process of contacting well operators to facilitate semiannual sampling for chloride and the collection of groundwater-level measurements at the nine existing public supply wells. A summary of proposed improvements to the Seawater Intrusion Monitoring Network is included in **Section 5.4.3**.

Table 5-2. Surface Water Monitoring Network

USGS ID	Location Description	Parameters Measured	Continuous/ Seasonal	Adjacent Shallow Monitoring Well
11459150	Petaluma River at Copland Pumping Station	Discharge, Stream Stage	Continuous	
	Petaluma River at Corona Road	Stream Stage	Continuous	PET0172
	Capri Creek at Casella Way	Stream Stage	Continuous	PET0173
	E. Washington Creek at Garfield Drive	Stream Stage	Continuous	PET0174
	Adobe Creek at Manor Lane	Stream Stage	Continuous	
	Corona Creek at Sonoma Mountain Parkway	Stream Stage	Continuous	
	Adobe Creek at Sartori Drive	Stream Stage	Continuous	
	Willow Brook at Penngrove Park	Stream Stage	Continuous	
	Willow Brook at Old Redwood Highway Bridge	Stream Stage	Continuous	
	Wiggins Creek at Rainsville Road	Stream Stage	Continuous	
	Petaluma River at Twin Bridges	Stream Stage	Continuous	
	Lynch Creek at McDowell Boulevard	Stream Stage	Continuous	
	Washington Creek at McDowell Boulevard	Stream Stage	Continuous	
	Washington Creek at Holly Lane	Stream Stage	Continuous	
	Petaluma River at Shollenberger Park	Stream Stage	Continuous	
	Kelly Creek at Sunnyslope Road	Stream Stage	Continuous	

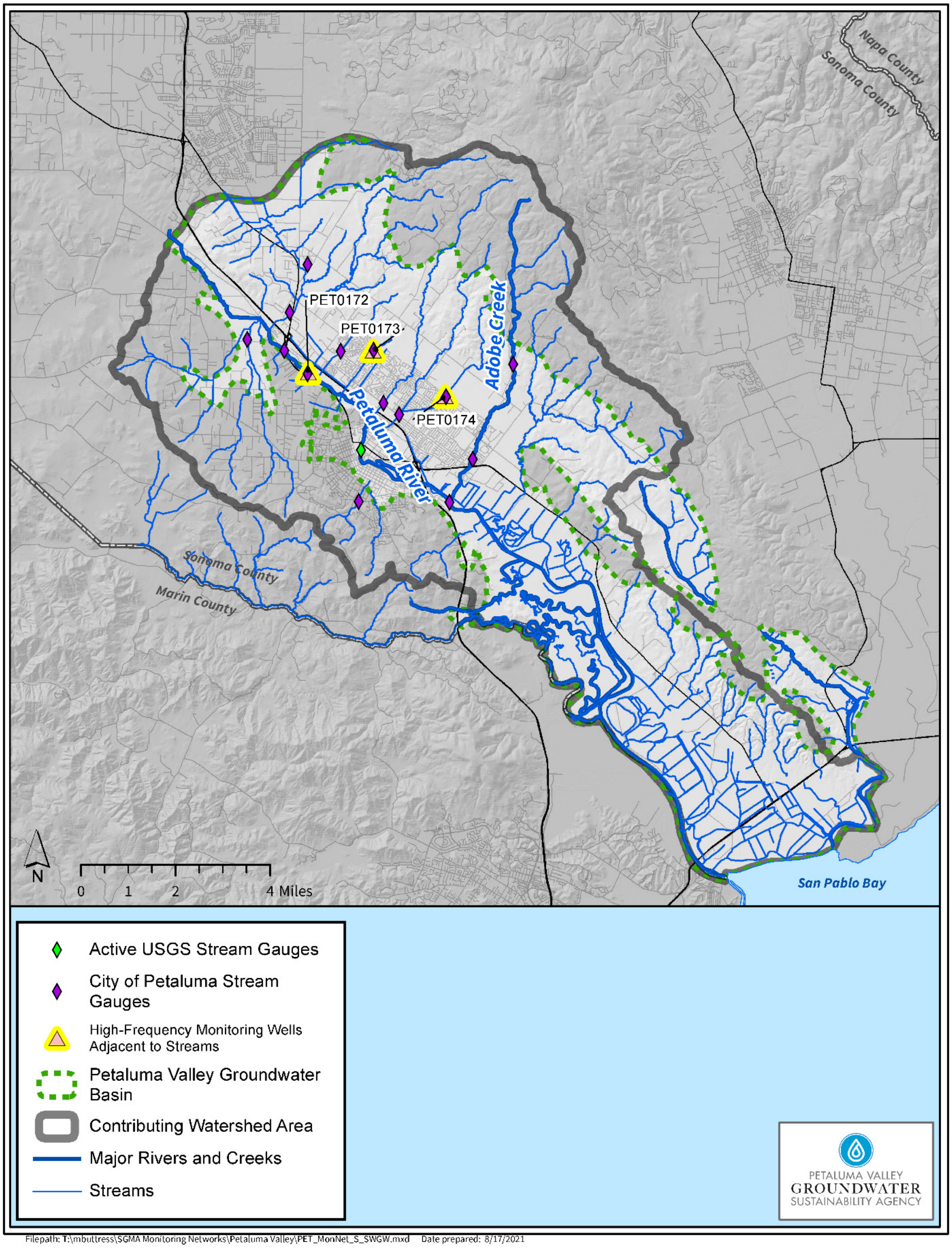

Figure 5-2. Surface Water Monitoring Network

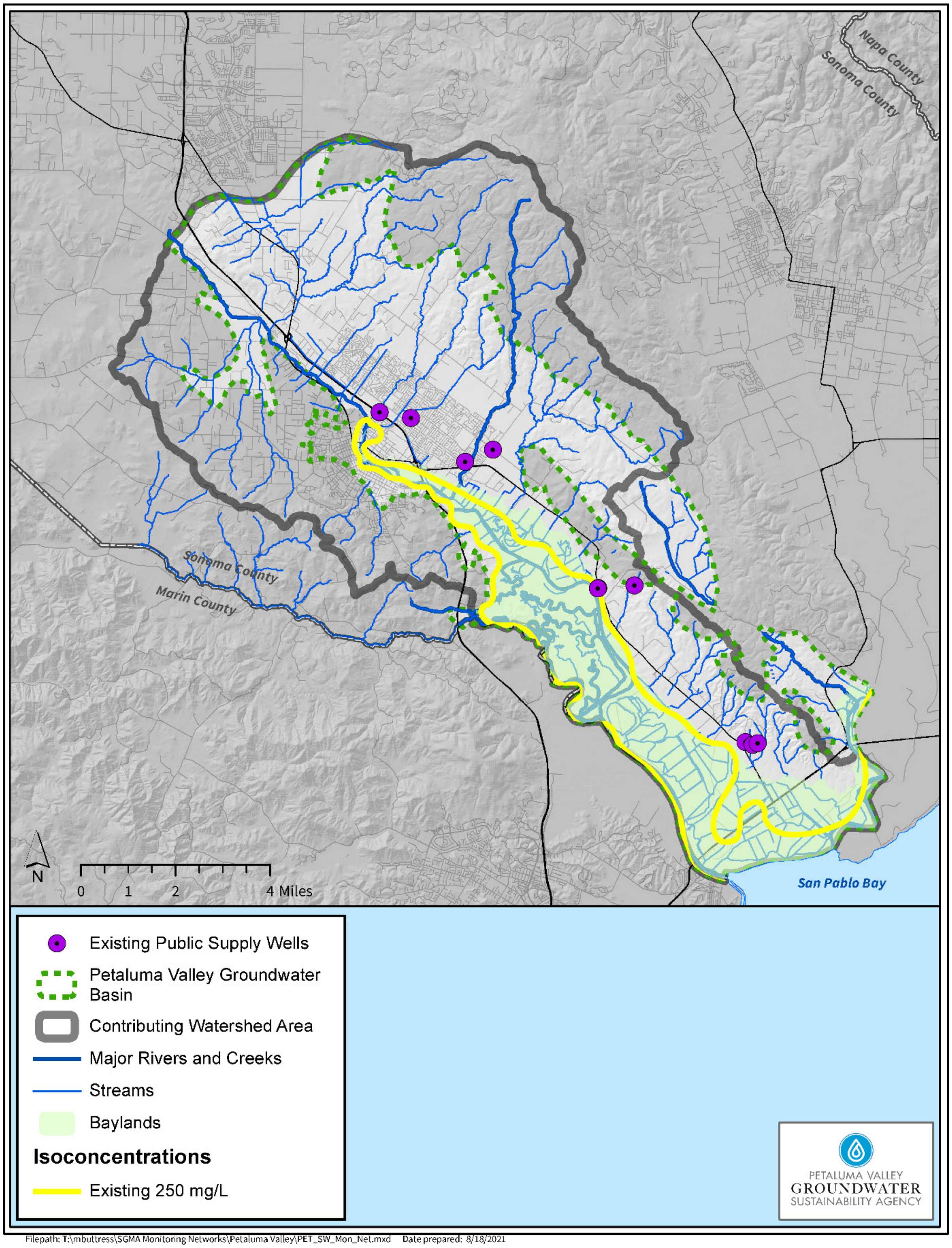

Figure 5-3. Seawater Intrusion Monitoring Network

5.3 Representative Monitoring Point Networks

As stated in the GSP Regulations, "Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined" (23 CCR 354.36).

5.3.1 Representative Monitoring Point Network for Chronic Lowering of Groundwater Levels

The same data and reporting standards and guidance related to groundwater levels described for the Groundwater-level Monitoring Network for GSP Implementation in **Section 5.2.1** apply to the RMP Network for the Chronic Lowering of Groundwater-level SMC (Groundwater-level RMP Network). In addition, the following SGMA requirements and guidance from the GSP Regulations and DWR's *Best Management Practices Monitoring Protocols, Standards and Sites* (DWR 2016b) and *Best Management Practices Monitoring Networks and Identification of Data Gaps* (DWR 2016c) apply to the selection of RMPs:

- "The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area" (23 CCR 354.36).
- "If RMPs are used to represent groundwater elevations from a number of surrounding monitoring wells, the GSP should demonstrate that each RMP's historical measured groundwater elevations, groundwater elevation trends, and seasonal fluctuations are similar to the historical measurements in the surrounding monitoring wells" (DWR 2016b).

5.3.1.1 Rationale for Selection of Representative Monitoring Point Network for Chronic Lowering of Groundwater-level Sites

Potential Groundwater-level RMPs were assessed using the same criteria used for the selection of GSP Implementation Network sites, as described in **Section 5.2.1**. These criteria include well type, well construction, well ownership, historical data record, and spatial coverage. In addition, the following criteria was used to assess potential Groundwater-Level RMPs:

Hydrograph Comparability: Once potential RMPs were identified using the criteria listed above, groundwater-level hydrographs were plotted for the potential RMPs along with hydrographs for nearby wells with available data. Linear regression trend lines were plotted for spring groundwater levels. Potential RMPs were further evaluated by comparing overall trends and the magnitude of seasonal variations in groundwater levels with nearby wells to determine whether the potential RMP could be considered representative of a given region. The comparative hydrographs for the potential RMPs and other nearby monitored wells are included in **Appendix 5-B**.

In some cases, newer wells (including new wells constructed specifically for SGMA compliance) with limited historical data records were selected as Groundwater-Level RMPs because they have favorable well type, well construction, well location, and/or well ownership attributes. For these wells, available historical data for nearby wells screened within the same aquifer system are plotted on the RMP comparative hydrographs to help assess historical groundwater levels and trends in the vicinity of the newer RMP wells.

5.3.1.2 Description of Representative Monitoring Point Network for Chronic Lowering of Groundwater Levels

The Groundwater-Level RMP Network consists of 11 wells within the Basin (**Figure 5-4)**. Three of the Groundwater-Level RMPs are dedicated monitoring wells, five are private supply wells, and three are inactive municipal wells. Details for wells in the Groundwater-Level RMP Network, including well construction, well use, and length of monitoring record, are presented in **Table 5-3**.

Monitoring frequencies for wells in the Groundwater-Level RMP Network are shown in **Table 5-3**. Three of the 11 Groundwater-Level RMP wells are equipped with pressure transducers for hourly water-level data collection, 6 of the RMP wells are monitored on a monthly basis, and the remaining 2 RMP wells are monitored semiannually.

5.3.2 Representative Monitoring Point Network for Degraded Water Quality

All of the public supply wells in the existing monitoring programs described in **Section 5.2.2** that have been sampled for COCs between 2015 and 2020 are initial RMPs for Degraded Water Quality (**Figure 5-5)**. This includes 18 wells sampled for arsenic, 30 wells sampled for nitrate, and 13 wells sampled for TDS.

5.3.3 Representative Monitoring Point Network for Depletion of Interconnected Surface Water

The three stream-adjacent shallow groundwater monitoring wells were evaluated as potential RMPs for Depletion of Interconnected Surface Water (**Figure 5-2)**. The monitoring wells have been instrumented with pressure transducers for collection of hourly groundwater-level and temperature data. After a minimum of 1 year of data collection, the groundwater-level data was compared with streambed elevation data at each location to assess the groundwater-surface water interconnection. Based on the assessment of interconnection, all three shallow stream-adjacent monitoring wells were initially selected as RMPs for Depletion of Interconnected Surface Water. Hydrographs showing groundwater-level data for the three RMP wells alongside streambed elevation data and stream stage data, where available, are presented in **Appendix 4-B**. The RMPs include one well adjacent to Capri Creek, one well adjacent to East Washington Creek, and one well adjacent to the Petaluma River. Details for the RMPs, including well construction and proximity to creeks, are presented in **Table 5-4**.

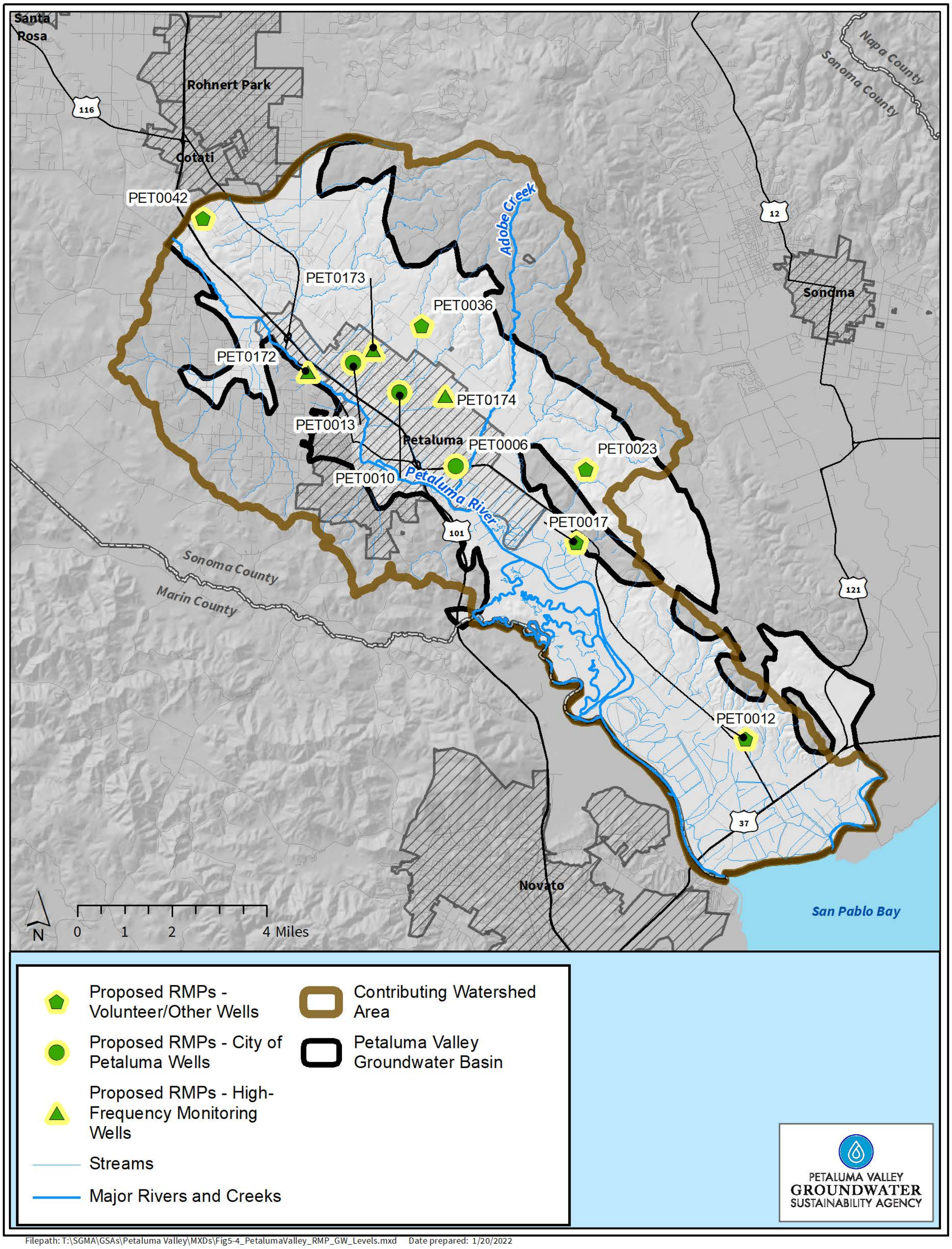

Figure 5-4. Representative Monitoring Point Network for Chronic Lowering of Groundwater Levels

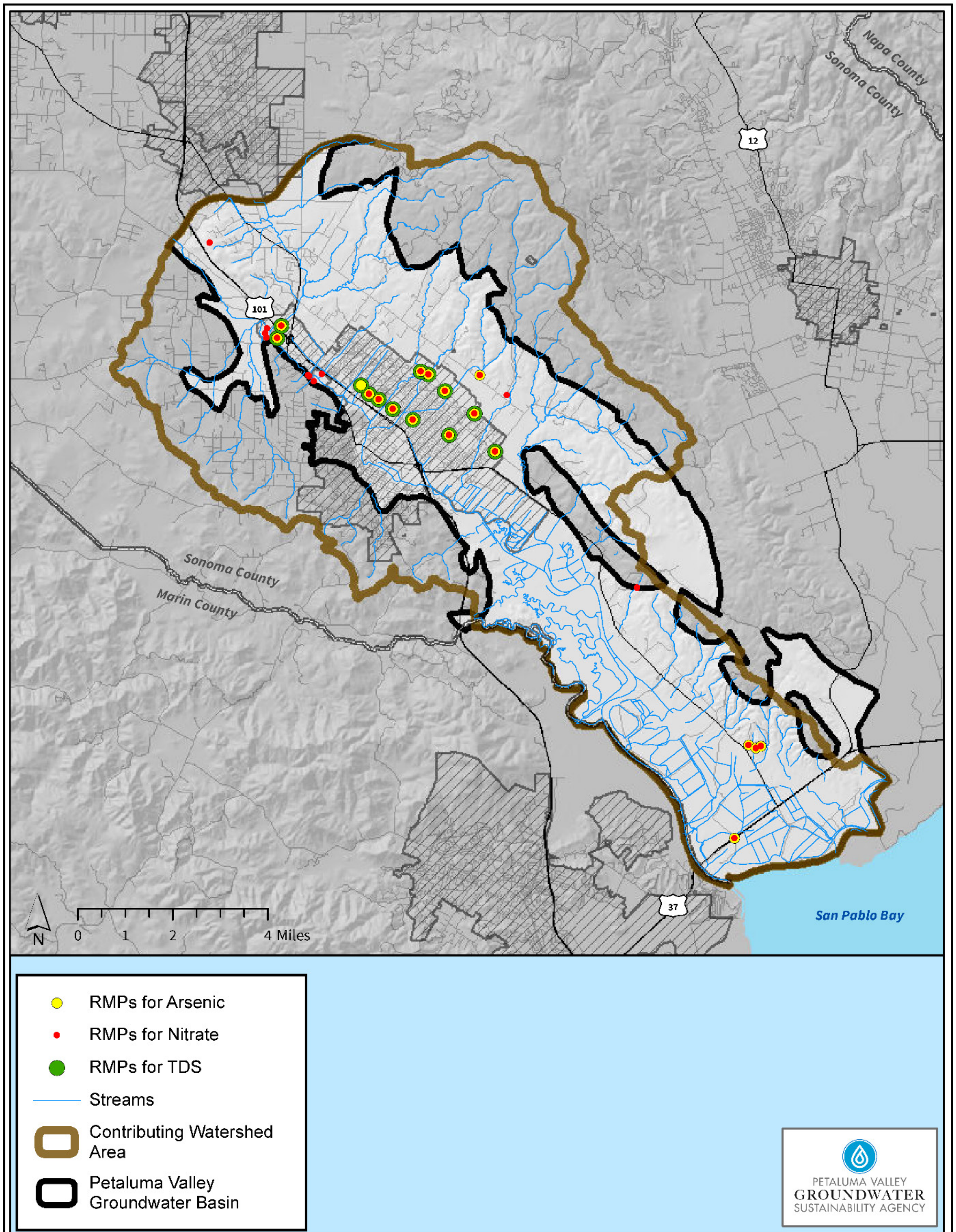

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Figure 5-5. Representative Monitoring Point Network for Degraded Water Quality

Table 5-3. Representative Monitoring Point Network for Chronic Lowering of Groundwater Levels

Data Management System ID	Data Management System ID					Data Record	Data Record		
Station Name	Station Number	Type of Well	Well Depth[a]	Screened Interval[a]	Current Monitoring Frequency	From	Until	Additional Information	Well Owner
PET0012	381531N1224876W001	Supply	276	75-275	Semiannually	11/25/2014	3/18/2021	Sears Point	Private
PET0017	382117N1225556W001	Supply	180	140-180	Monthly	10/13/1980	7/14/2021		Private
PET0023	382342N1225525W001	Supply	370	30-370	Semiannually	5/5/2015	3/18/2021	Cardinaux	Private
PET0006	381402N1223610W001	Municipal	229	89-229	Monthly	11/7/2012	7/22/2021	Casa de Arroyo	City of Petaluma
PET0174	PET-F06-01_Garfield	Observation	35.5	15-35	Hourly	11/26/2019	Present	East Washington Creek at Garfield Drive	Petaluma Valley Groundwater Sustainability Agency
PET0010	381522N1223733W001	Municipal	425	305-382	Monthly	11/7/2012	7/22/2021	Tahola	City of Petaluma
PET0036	382766N1226179W001	Supply	177	158-177	Monthly	12/1/1989	7/14/2021	05N07W15K002M	Private
PET0172	PET-D06-01_Corona	Observation	40.5	20-40	Hourly	11/25/2019	Present	Petaluma River at Old Corona Road	Petaluma Valley Groundwater Sustainability Agency
PET0173	PET-E05-01_Casella	Observation	45.5	35-45	Hourly	11/25/2019	Present	Capri Creek at Casella Way	Petaluma Valley Groundwater Sustainability Agency
PET0013	381553N1223839W001	Municipal	562	52-538	Monthly	11/7/2012	7/22/2021	Station 1401	City of Petaluma
PET0042	383076N1227041W001	Supply	155	30-150	Monthly	2/3/1976	7/14/2021	05N08W02H001M	Private

[a] Well depth and screened interval reported in feet below top-of-casing

Table 5-4. Representative Monitoring Point Network for Depletion of Interconnected Surface Water

Station Name	Station Number	Location Description	Well Depth[a]	Screened Interval[a]	Approximate Distance from Well to Creek (feet)	Direction of Well from Creek
PET0174	PET-F06-01_Garfield	East Washington Creek at Garfield Drive	35.5	15-35	50	northwest
PET0173	PET-E05-01_Casella	Capri Creek at Casella Way	45.5	35-45	50	northwest
PET0172	PET-D06-01_Corona	Petaluma River at Old Corona Road	40.5	20-40	85	north

[a] Well depth and screened interval reported in feet below top-of-casing

5.3.4 Representative Monitoring Point Network for Land Subsidence

As described in **Section 4.9**, each 100-square-meter InSAR pixel is considered an RMP for Land Subsidence. The InSAR dataset covers most of the Basin with the exception of data gap areas in the southwestern portion and central-eastern portion of the Basin (**Section 3**, **Figure 3-15**).

5.3.5 Representative Monitoring Point Network for Seawater Intrusion

The nine existing public water-supply wells are all considered initial RMPs for Seawater Intrusion (**Figure 5-3)**. As described in **Section 5.4.3** and in **Section 7**, the GSA will explore the installation of new dedicated monitoring wells and incorporation of additional existing water-supply wells into the Seawater Intrusion Monitoring Network. The RMP Network for Seawater Intrusion will be refined as these activities are completed.

5.4 Assessment and Improvement of Monitoring Networks

The GSP Regulations require a plan to include a review and evaluation of each monitoring network. As stated in the GSP Regulations, “Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency” (23 CCR 354.38).

5.4.1 Assessment and Identification of Data Gaps – Groundwater-level Monitoring Network

The following subsections describe the process and results of assessing spatial and temporal data gaps within the principal aquifer system, as well as an assessment of data quality.

5.4.1.1 Spatial Distribution Data Gap Assessment

With 20 currently monitored wells, the Groundwater-level Monitoring Network for GSP Implementation (GSP Implementation Network) contains a sufficient number of monitoring sites to meet the monitoring objectives in the central portion of the Basin. Significant data gaps exist in the northern and southern portions of the Basin. Inadequate funding is the main circumstance that has limited monitoring.

A preliminary assessment of spatial coverage data gaps in the GSP Implementation Network is presented on **Figure 5-6a**. The data gap areas apply to the Groundwater-level RMP Network as well as the GSP Implementation Network (**Figure 5-6a)**. If a dedicated monitoring well is installed in the future in one if the GSP Implementation Network data gap areas, it will likely also serve as a Groundwater-level RMP. This assessment was conducted during the GSP preparation process and used to inform monitoring network improvement projects, particularly the installation of up to four multi-level monitoring wells under a Proposition 68 grant planned for 2022. The initial assessment of the GSP Implementation and Groundwater-Level RMP Networks identified the following spatial data gaps (**Figure 5-6a**):

- Along the northern Basin boundary with the Santa Rosa Plain Subbasin
- In the central-northern portion of the Basin
- Along the eastern Basin boundary in the northern portion of the Basin

- Along the western Basin boundary with the Wilson Grove Formation Highlands Basin in the northern portion of the Basin
- Along the western Basin boundary with the Wilson Grove Formation Highlands Basin in the central portion of the Basin
- Along Lakeville Highway in the southern portion of the Basin
- Along Tolay Creek in the central-eastern portion of the Basin
- Along Tolay Creek in the southeastern corner of the Basin near the boundary with the Sonoma Valley Subbasin

Several of data gap areas are planned to be addressed through the installation of Proposition 68-funded multi-level monitoring wells in 2022 (**Figure 5-6a)**. The remaining data gap areas will be addressed through the expansion of voluntary monitoring programs and/or the installation of additional dedicated monitoring wells, as funding allows. Several previously identified data gaps were addressed through the installation of three shallow monitoring wells completed through DWR's TSS program in 2019.

Figure 5-6b presents the identified spatial data gaps in the Boundary Network. Half of the monitored wells in the Boundary Network (5 out of 10 wells) are in the Wilson Grove Formation Highlands Groundwater Basin to the west of the Petaluma Valley Basin. This is appropriate because much of the Wilson Grove Formation Highlands Basin is classified as a major natural recharge area (**Figure 2-9**) providing subsurface inflow to the Petaluma Valley Basin. This network is sufficient for monitoring groundwater-level trends in the Wilson Grove Formation Highlands Basin that could affect subsurface inflow to the Petaluma Valley Basin. One data gap area is shown in the Wilson Grove Formation Highlands Basin between the currently monitored wells along the Basin boundary with the Petaluma Valley Basin. The GSA will attempt to incorporate additional existing wells into the Boundary Network in this area. The remaining five monitored wells in the Boundary Network are in the Santa Rosa Plain Subbasin, just north of the border with the Petaluma Valley Basin. One data gap area is identified between currently monitored wells in the southern Santa Rosa Plain Subbasin. The Santa Rosa Plain GSA plans to install a multi-level dedicated monitoring well in this data gap area in 2022 using Proposition 68 grant funds.

5.4.1.2 Monitoring Frequency Data Gap Assessment

Water-level data is collected at least daily (typically hourly) using pressure transducers from 3 (High-frequency Monitoring Wells) of the 20 wells in the GSP Implementation Network. Manual water-level measurements are collected at least semiannually for all wells in the network. Included in the High-frequency Monitoring Wells are three shallow monitoring wells installed adjacent to streams and major creeks in 2019 with the intended purpose of monitoring shallow groundwater levels relative to nearby surface water levels. Three of the 11 wells in the RMP Network for Chronic Lowering of Groundwater Levels are equipped with pressure transducers for sub-daily water-level data collection. Six of the RMP wells are monitored on a monthly basis and the remaining two are monitored semiannually. The

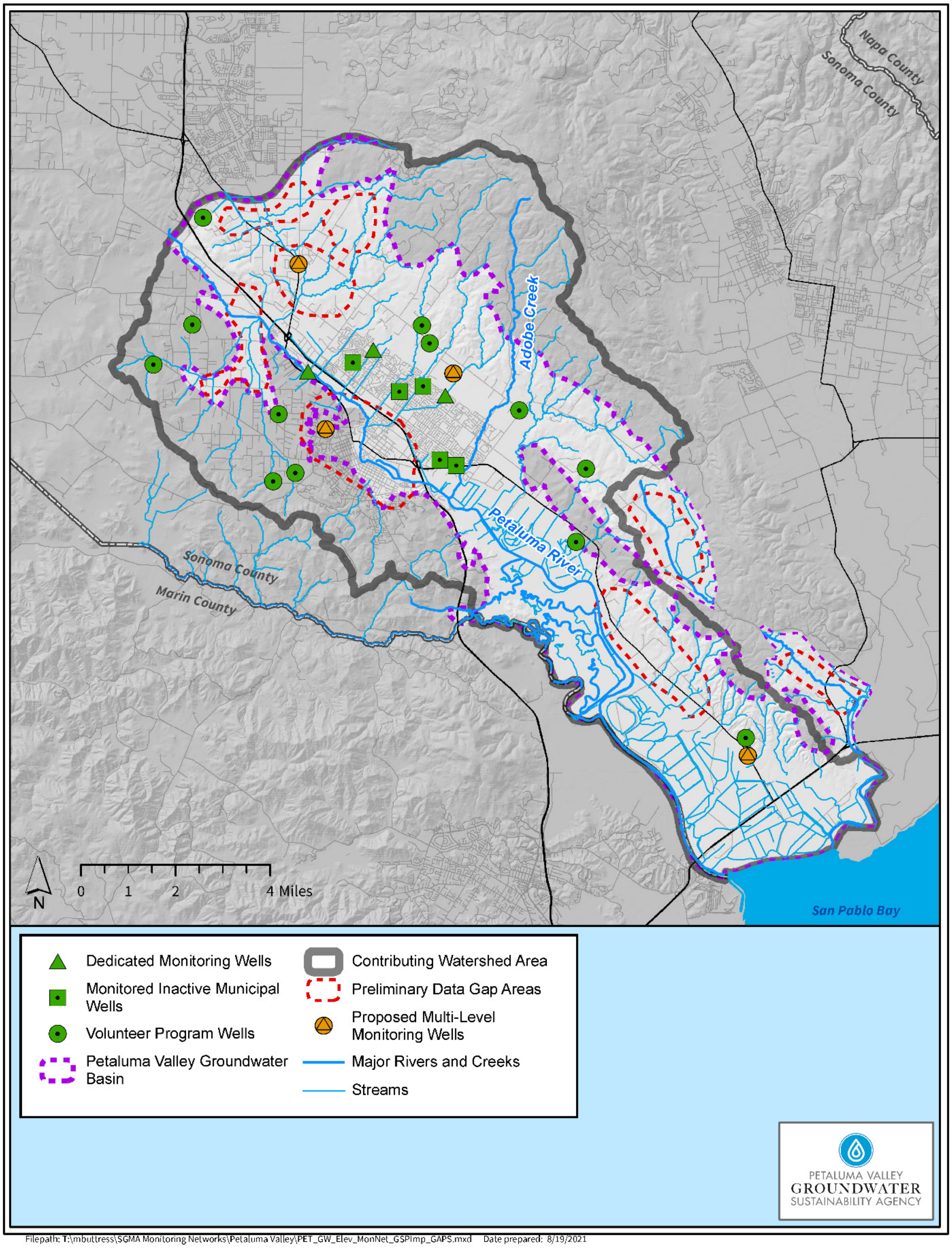

Figure 5-6a. Preliminary Data Gap Assessment – Groundwater-level Monitoring Network for Groundwater Sustainability Plan Implementation

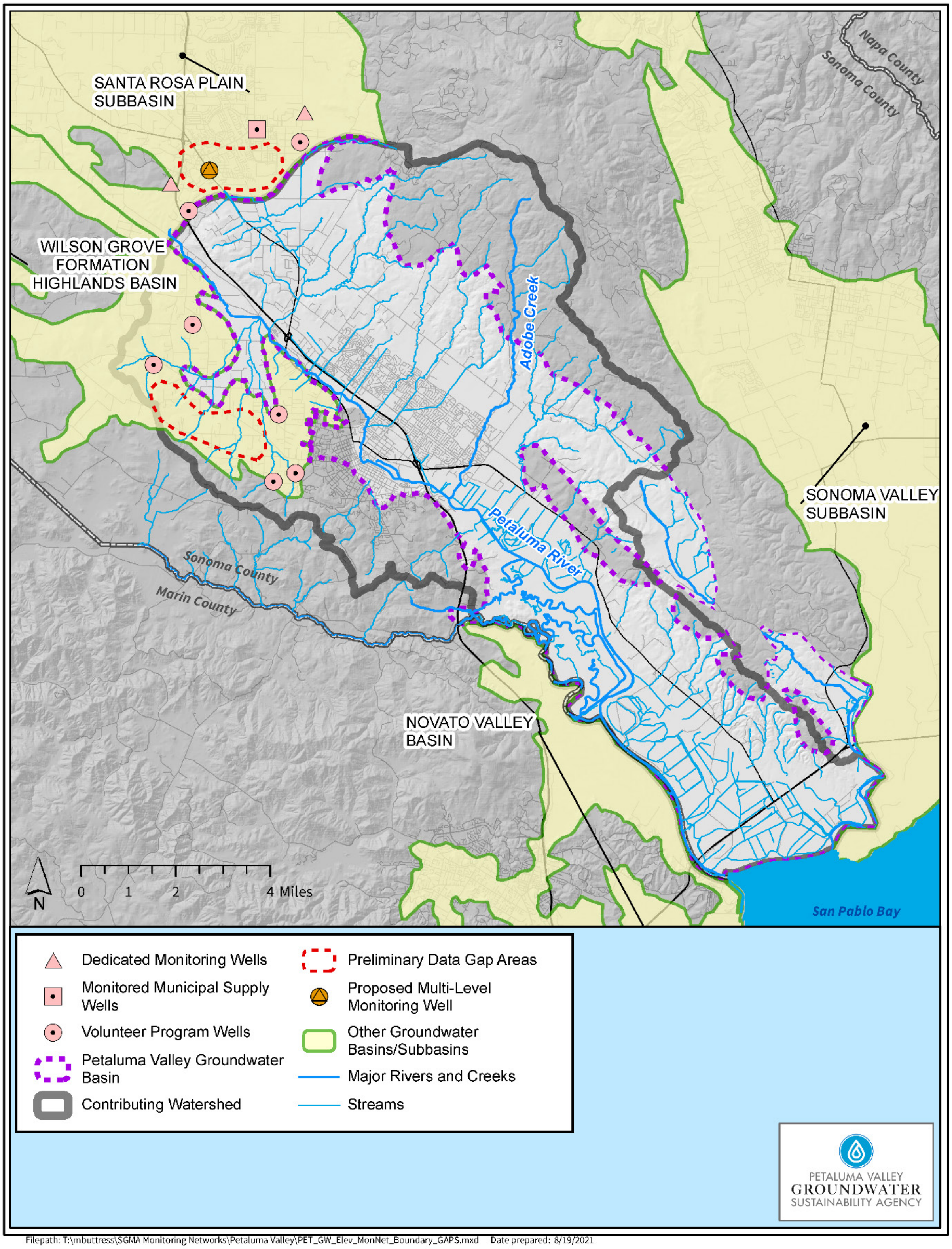

Figure 5-6b. Preliminary Data Gap Assessment – Basin Boundary Groundwater-level Monitoring Network

monitoring frequencies described are sufficient to meet the monitoring objectives for the Subbasin. Increased monitoring frequencies are recommended for the two RMP wells that are currently monitored on a semiannual basis. The GSA will contact well owners to request permission to increase the monitoring frequency to quarterly or monthly. The GSA will explore the possibility of installing remote monitoring equipment such as pressure transducers for sub-daily data collection in the eight RMP wells that are not currently High-frequency Monitoring Wells, dependent on funding availability, well owner willingness, and well compatibility.

5.4.1.3 Data Quality Assessment

An initial assessment of data gaps related to the ability of groundwater-level monitoring sites to satisfy applicable SGMA standards was conducted during GSP preparation. This section presents the initial assessment of data quality and identifies data gaps to be addressed during the GSP implementation phase. Specific SGMA standards or guidance for which data gaps were identified are:

- "Reference point elevations shall be measured and reported in feet to an accuracy of at least 0.5 feet, or the best available information, relative to NAVD88 [North American Vertical Datum of 1988], or another national standard that is convertible to NAVD88, and the method of measurement described" (23 CCR 352.4).
- For wells used to monitor groundwater conditions, the GSA will provide the following information: casing perforations, borehole depth, and total well depth.

  Wells that are part of the monitoring program should be dedicated groundwater monitoring wells with known construction information. The selection of wells should be aquifer-specific and wells that are screened across more than one aquifer should be avoided where possible.

The initial assessment of the groundwater-level monitoring networks indicated the following:

- Eleven of the twenty wells in the GSP Implementation Network lack sufficient reference point vertical survey data (that is, top-of-casing elevation). This includes 3 of the 11 wells in the RMP Network for Chronic Lowering of Groundwater Levels.
- Six of the twenty wells in the GSP Implementation Network lack complete construction information (that is, they are missing screened intervals and/or total depth information). This does not include any of the wells in the RMP Network for Chronic Lowering of Groundwater Levels.

The GSA will work to improve data quality in groundwater-level monitoring networks by a combination of the following activities:

- Performing survey activities for wells that lack sufficient reference point vertical survey data, as funding becomes available
- Obtaining well construction information from well owners or by conducting investigations (for example, video logging) as funding or technical assistance becomes available

- Replacing supply wells in the monitoring network that have data quality issues with dedicated monitoring wells, as funding becomes available

5.4.2 Assessment and Identification of Data Gaps – Surface Water Monitoring Network

The USGS stream gage and 15 City of Petaluma stream gages provide a well-distributed surface water monitoring network in the Basin and contributing watershed area. Three stream-adjacent shallow groundwater monitoring wells, combined with the surface water monitoring network, monitor groundwater-surface water interaction at important locations in the Basin. Data gaps in the understanding of interconnected surface water in the Basin are illustrated on **Figure 5-7a**. These data gap areas include:

- The lower reaches of the Willow Brook/Lichau Creek system in the northern portion of the Basin
- The lower reaches of Adobe Creek in the central portion of the Basin
- Tolay Creek in the southeastern portion of the Basin

A multi-level groundwater monitoring well adjacent to the Willow Brook at Penngrove Park stream gage planned for installation in 2022 will help to address the northernmost data gap area. The GSA will explore the potential for the installation of additional shallow monitoring wells in the remaining data gap areas and adjacent to existing stream gages that are not already paired with shallow monitoring wells.

Figure 5-7b illustrates the groundwater-level and surface water monitoring networks, data gaps, and mapped GDEs, as described in **Section 3.2.6.2**.

5.4.3 Assessment and Identification of Data Gaps – Seawater Intrusion Monitoring Network

Significant data gaps have been identified in the southern and central portions of the Basin that prevent adequate mapping and characterization of the spatial and temporal distribution of salinity in groundwater (**Figure 5-8**). In particular, groundwater quality data and well construction data are limited in this area and appropriate monitoring infrastructure is lacking. Addressing these data gaps as a high priority for the GSA, as further described in **Section 7** of this GSP.

The GSA is working to incorporate existing water-supply wells in and near the Baylands area into the Seawater Intrusion Monitoring Network. An additional three or more new dedicated multi-depth monitoring wells are anticipated to be needed to better characterize the distribution of chloride in groundwater, refine the initial locations of the baseline and reference 250 mg/L chloride concentration isocontours, and serve as RMPs during GSP implementation. Data gap areas in the Seawater Intrusion Monitoring Network along with proposed multi-depth monitoring wells are shown on **Figure 5-8**. Two proposed multi-depth monitoring wells in the central-western and southern portions of the Basin would also serve as Seawater Intrusion RMPs.

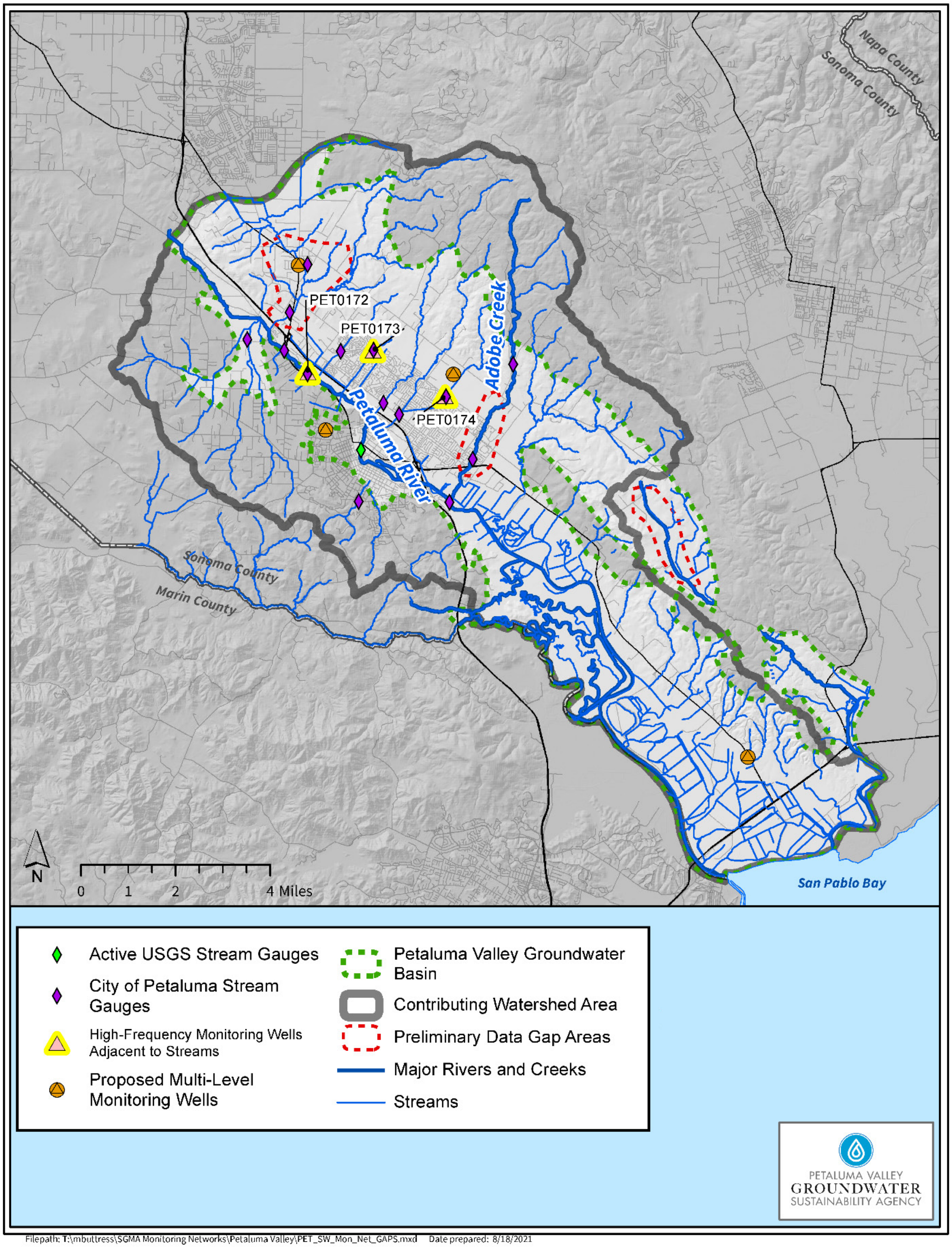

Figure 5-7a. Preliminary Data Gap Assessment – Surface Water Monitoring Network

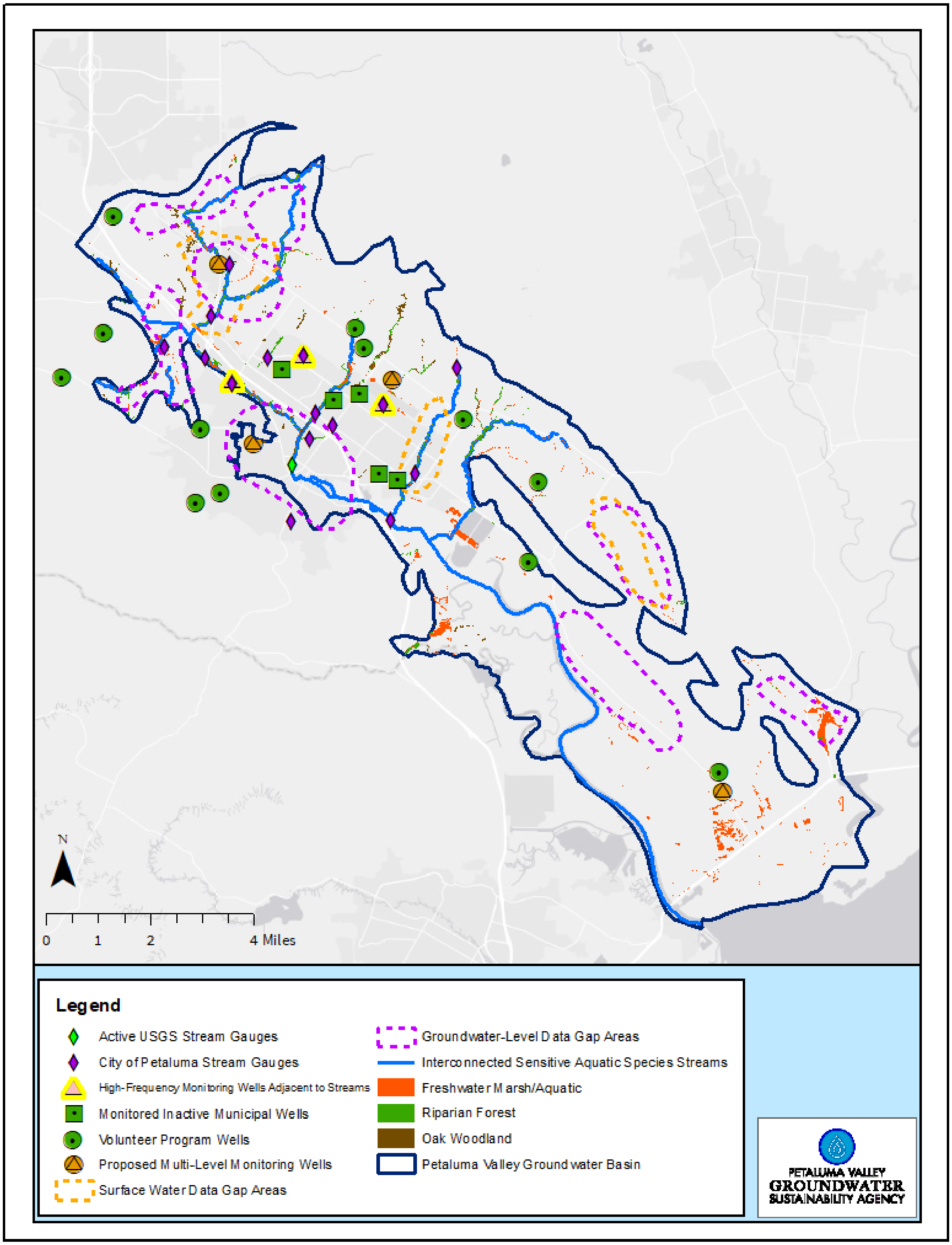

Figure 5-7b. Groundwater-level and Surface Water Monitoring Networks Shown with Groundwater Dependent Ecosystems

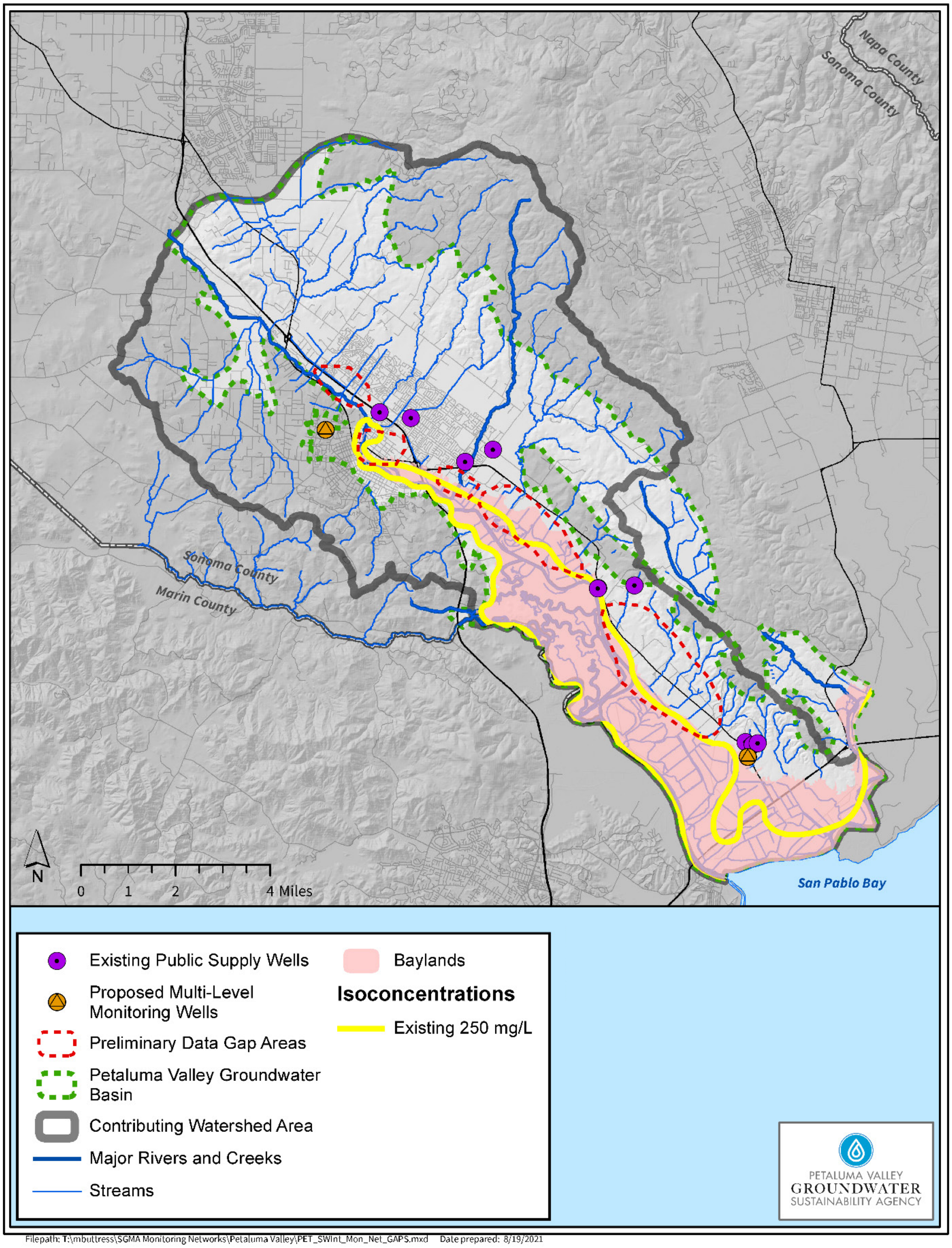

Figure 5-8. Preliminary Data Gap Assessment – Seawater Intrusion Monitoring Network

Section 6: Projects and Management Actions
Groundwater Sustainability Plan
Petaluma Valley Groundwater Basin

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Appendices

6 PROJECTS AND MANAGEMENT ACTIONS

This section satisfies Sections 354.42 and 354.44 of the SGMA regulations, which require that GSPs include descriptions of projects and possible management actions that the GSA has determined will help achieve the sustainability goal as well as respond to changing conditions in the basin over the 50-year planning horizon. Additionally, the GSP is required to include:

1. Which MO will benefit from a specific project or management action

2. Criteria and circumstances that would trigger implementation and future termination

3. The process by which the GSA will determine a project or management action is necessary to execute

Projects and management actions can be used to attain the MOs, meet interim milestones, and address MT exceedances and undesirable results.

The management actions and projects covered in this chapter outline a framework for maintaining sustainability; however, many details must be negotiated before many of the projects and management actions can be implemented. The costs for management actions and project implementation are additional to the funding required to sustain the operation of the GSA, and the funding needed for monitoring and reporting. The collection of projects and management actions discussed in this section demonstrate that sufficient options exist to maintain sustainability. Not all projects and actions have to be implemented to maintain sustainability. Therefore, the projects and management actions included herein should be considered a list of options that will be refined during GSP implementation.

6.1 Identification and Evaluation of Projects and Management Actions

The identification of projects and management actions was an iterative process which included significant Advisory Committee and GSA Board input and a substantial amount of staff work.

Input received from the Advisory Committee and GSA Board helped refine and categorize the selection of projects and management actions into those that could be initially evaluated as part of this GSP, and those that require further assessment or study prior to implementation. For example, some ideas raised by Advisory Committee and community members like recharge net-metering programs, water markets, and zero-net water use requirements for new development need further refinement. Management actions the GSA has under its authority, such as mandatory conservation or pumping reductions, will also be studied and considered during the first 5 years of GSP implementation, as described in **Section 6.4**.

- The projects and management actions considered for implementation and further planning build upon the successful, historical groundwater management activities conducted within the Basin that are listed below:

- Use of imported surface water by the City of Petaluma in lieu of local groundwater supplies.

- Development and use of recycled water supplies for meeting agricultural and landscape irrigation demands.
- Implementation of water-use efficiency and conservation programs within the urban water-use sector.
- Studies and implementation of water-use efficiency measures within the agricultural sector.
- Studies and initial planning for managed aquifer recharge, including studies, data collection, and pilot testing for stormwater recharge projects.

While some of these initiatives and activities have historically been developed and planned specifically to address groundwater conditions within the Basin, many have been developed and implemented to achieve other benefits, objectives, and purposes. Inclusion and further assessment of these initiatives and activities during implementation of the GSP will facilitate coordination and optimization of these initiatives and activities to support sustainable groundwater management. **Sections 6.2** through **6.4** describe the identified projects, summarize initial assessment of projects using scenario modeling, and describe identified management actions.

6.2 Project Descriptions

To prevent potential undesirable results and to achieve MOs, projects and management actions are planned as part of GSP implementation. As described in **Section 6.3**, only the voluntary water-use efficiency and alternate water source projects (Group 1 projects) are defined enough for evaluation using model scenarios and are deemed necessary in the near term. To address uncertainty and prepare for future droughts and other uncertain conditions, a portfolio of other projects and management actions (consisting of expanded recycled water deliveries, ASR, and stormwater capture and recharge) that have been discussed and considered by the Advisory Committee and GSA Board are described in this section, including information required by Section 354.44 of the GSP Regulations. Where applicable, a CEQA analysis will be performed for projects. A CEQA analysis includes an assessment of water supply impacts, GHG emissions, and impacts on Tribal cultural resources.

The GSA plans to immediately begin implementation of the voluntary water-use efficiency and alternate water source projects. For the other projects and management actions described in this section, initial implementation steps include performing studies or analyses to refine the concepts into actionable projects.

6.2.1 Water-use Efficiency and Alternate Water Source Projects (Group 1)

The water-use efficiency and alternate include smaller-scale dispersed land-owner projects, such as turf removal, rainwater harvesting, and stormwater capture and reuse. These projects are initially planned as voluntary, incentive-based projects focused on groundwater users, primarily rural, residential, agricultural, and commercial/industrial groundwater users. The programs and education offered to rural domestic and commercial groundwater users will mirror programs offered to regional municipal water users, which have led to a 37 percent reduction in per capita water use since 2010. It is assumed that existing water-use efficiency by municipal groundwater users will continue through the Sonoma-Marin Saving Water Partnership. In addition to the Sonoma-Marin Saving Water Partnership, as described in **Section 2.6**, numerous other regional and local water conservation programs are operational in the Plan Area, including the LandSmart Program and the Sustainable Winegrowing Program. Many grape growers already use drip irrigation and rely on new technologies to determine when and how much to irrigate vines. This program would be focused on leveraging existing tools and BMPs and working with farmers who haven't had access to or the resources available to reduce water use. Examples of the tools and BMPs included in these programs are:

- Indoor (high-efficiency toilets, fixtures, and washers) and outdoor (landscaping assistance, surveys, and retrofits) water-use efficiency
- Conservation rebate programs for high-efficiency appliances and fixtures, landscape water budgets, landscape and irrigation design, and irrigation scheduling
- Stormwater management through low-impact development practices
- Rainwater harvesting
- BMPs for conserving water use in commercial processing, including wineries
- Soil moisture monitoring and efficient irrigation scheduling

During the first year of GSP implementation, this project will include an assessment of the exact types of water-use efficiency tools and alternate water source projects that are expected to be most effective and feasible for Subbasin stakeholders, including of groundwater-use characteristics, existing levels of conservation and water-use efficiency, and recommendations on preferred tools and strategies for implementation (such as incentive options). While implementation of these projects is initially planned to be on a voluntary basis, the assessment will also identify specific metrics for evaluating the benefits of the projects and assess Basin conditions that may lead to mandatory implementation of demand management actions.

6.2.1.1 Objectives, Circumstances, and Timetable for Implementation

Implementation of the water use efficiency and alternate water source projects will help achieve MOs and avoid undesirable results for the chronic lowering of groundwater levels sustainability indicator. Achieving MOs and avoiding undesirable results for the chronic lowering of groundwater levels sustainability indicator is also expected to benefit the groundwater storage and land subsidence sustainability indicators. Additionally, depending upon the locations within the Basin where projects are implemented, there may be benefits to the MOs for the depletion of interconnected surface water sustainability indicator.

After a short planning period, it is assumed that water use efficiency and alternate water source projects will begin in 2023. Initial implementation will include an assessment of the exact types of water-use efficiency tools and alternate water source projects that are expected to be most effective and feasible for Basin stakeholders. The assessment will also evaluate specific metrics for evaluating the benefits of the projects and assess Basin conditions that may lead to mandatory implementation of management projects.

6.2.1.2 Expected Benefits

The water use efficiency and alternate water source project scenarios are described in detail in **Appendix 6-A**. For the purpose of estimating the potential benefits of water use efficiency and alternate water source projects, it was assumed that the Group 1 scenario simulates the impacts of a 20 percent reduction in all rural domestic use and a 10 percent reduction in consumptive use for all vineyards, both beginning in 2025. This assumption was considered to represent a reasonable level of groundwater use reduction based on the outcomes from existing BMPs and other water-use efficiency programs. Other groundwater-use sectors would be included in the project, including commercial, industrial, and other agricultural crops. However, for the purposes of conducting the scenario modeling, only reductions in rural domestic and vineyard groundwater use were applied, as these components were most readily able to be incorporated in the model.

General findings from the Group 1 model scenario indicate the following benefits relative to the baseline scenario:

- **Groundwater Levels**: Changes in groundwater elevation with Group 1 implementation are moderate, with less than 5 feet of increase from baseline expected by 2040, and less than 10 feet expected by 2070. These simulation results indicate that the benefit from Group 1 projects in terms of increasing groundwater levels will be most significant during drought conditions, and least significant during wet periods when the water table is relatively shallow and there is minimal (unsaturated) storage capacity.

- **Stream-Aquifer Interaction:** Results show that with Group 1, there is a projected increase in the magnitude of net groundwater discharge to surface water. This is due to diminished rates of stream leakage into the groundwater system rather than increased groundwater discharge to streams.

The planned initial assessment of water use efficiency and alternate water source projects will include recommendations for evaluating specific metrics for the actual benefits of the projects during implementation.

6.2.1.3 Public Noticing, Permitting and Regulatory Process

Public notice and outreach communications will be a critical component of the success of implementing water use efficiency and alternate water source projects, because these actions are initially planned as voluntary actions and will rely on Basin stakeholders clearly understanding their importance and benefits. Activities described in **Section 7.2.2** will include outreach to DACs, Tribal, rural residential, commercial, industrial, and agricultural stakeholders on the benefits of participating.

Many of the types of projects and actions planned for inclusion in water use efficiency and alternate water source projects do not have any permitting or regulatory requirements. Any projects that may include permit or regulatory requirements, such as graywater systems, would need to comply with local requirements and ordinances.

6.2.1.4 Estimated Costs and Funding Plan

A total of $60,000 is included in the initial 5-year budget provided in **Section 7.2** to perform the assessment of water use efficiency and alternate water source projects and to fund initial rollout of voluntary measures. To continue and expand implementation of water use efficiency and alternate water source projects, the GSA will seek grant funding. The GSA is also considering applying for funding for high-efficiency toilet replacement and agricultural BMP implementation through the State's 2021 Drought Relief Program or other applicable grant opportunities.

6.2.1.5 Legal Authority

No legal authority is anticipated to be needed to voluntarily implement the water use efficiency and alternate water source projects.

6.2.2 Recycled Water Expansion

Recycled water is wastewater that enters into the wastewater collection system from within the service area of the City of Petaluma and is treated to tertiary standards at the ECWRF. Recycled water has been and will continue to be an important source of irrigation water to offset the use of local groundwater and potable water supplies in the Basin. Recycled water can be used in applications where potable water is often used (such as the irrigation of public parks and golf courses and for agriculture). In addition to allowing for potable water offsets, recycled water use may potentially facilitate in lieu groundwater recharge. For example, if a farm that has historically used pumped well water for pasture or crop irrigation begins using recycled water instead, the groundwater aquifer beneath may potentially recover through reduced pumping and natural recharge. Recycled water is a sustainable water source and allows potable supplies to be reserved for the best and highest use. Additionally, using recycled water for irrigation also means a decrease in discharge of treated wastewater to local water bodies such as the Petaluma River.

The ECWRF opened in July 2009 and provides advanced secondary treatment, anaerobic digestion, and tertiary treatment of wastewater. The treatment facility treats domestic, commercial, and industrial wastewater generated in the City of Petaluma and in the unincorporated Penngrove area. The facility treats on average 4.2 million gallons of wastewater each day and 1.5 to 1.8 billion gallons annually, although not all influent wastewater is treated to tertiary standards. During the winter months ECWRF is permitted to discharge treated wastewater into the Petaluma River.

Tertiary-treated recycled water, distributed through a system of pump stations and pipelines, provides irrigation for agriculture, golf courses, school yards, parks, and other landscaped areas.

Urban use of recycled water saves potable water and supplements the city's potable water supply. Agricultural use of recycled water reduces the amount of groundwater pumping for local farming, including dairy pastures and vineyards.

Recent production and deliveries of recycled water from the ECWRF are approximately 650 AFY within the city's service area and 1,115 AFY outside of the city's service area (primarily to agricultural customers). The city plans for an expansion of the urban recycled water system aimed at delivering recycled water to more parks and schools throughout the service area, and also continues to plan for an expansion to deliver recycled water to more agricultural customers, further extending the service area.

6.2.2.1 Objectives, Circumstances, and Timetable for Implementation

Implementation of expanding recycled water deliveries will help to achieve MOs and avoid undesirable results for the chronic lowering of groundwater levels sustainability indicator. Achieving MOs and avoiding undesirable results for the chronic lowering of groundwater levels sustainability indicator is also expected to benefit the groundwater storage, seawater intrusion and land subsidence sustainability indicators. Additionally, depending upon the locations within the Basin where recycled water projects are expanded, there may be benefits to the measurable objectives for the depletion of interconnected surface water sustainability indicator.

Recycled water projects require permitting, environmental analysis, and engineering design. The City of Petaluma's planned recycled water projects have been included in the Final Environmental Impact Report (EIR) (Environmental Science Associates 2018) developed for the Phase 2 North Bay Water Reuse Program. Initiation of design is dependent upon securing funding for the project. The timing of projects is based on availability and securing of funding and may shift as GSP implementation proceeds, depending upon project needs at the time.

6.2.2.2 Expected Benefits

Potential benefits from the implementation of recycled water projects are anticipated to include a reduction in groundwater pumping and localized increases in groundwater levels. Benefits from recycled water projects would primarily be evaluated using changes in measured groundwater levels and improvements to groundwater storage changes through implementation of the monitoring activities described in **Section 5**.

6.2.2.3 Public Noticing, Permitting and Regulatory Process

Public notice for aspects of the recycled water projects will be carried out by the lead agency, which is anticipated to be the City of Petaluma. For recycled water projects where the GSA is not the lead agency, the GSA will provide support for outreach activities to nearby well owners and the local community. Compliance with CEQA is incorporated into the existing EIR for the Phase 2 North Bay Water Reuse Project (Environmental Science Associates 2018). Any additional recycled water projects would be included in future CEQA analysis, as-needed. A

CEQA analysis includes an assessment of water supply impacts, GHG emissions, and impacts on Tribal cultural resources.

Existing wastewater treatment and recycled water production occur at the ECWRF in compliance with Order No. R2-2016-0014 (National Pollution Discharge Elimination System [NPDES] Permit No. CA0037810) issued by the San Francisco Bay RWQCB. It is anticipated that future expansion of recycled water deliveries would also occur under this or future revised or amended orders.

6.2.2.4 Estimated Costs and Funding Plan

The City of Petaluma is a member of North Bay Water Reuse Authority, a regional water recycling and management initiative which covers areas north of the San Francisco Bay. The North Bay Water Reuse Program is comprised of member agency recycled water projects, including City of Petaluma projects. Through North Bay Water Reuse Authority, the City continues to pursue funding opportunities for projects included in North Bay Water Reuse Program Phase 2. Additionally, the city will update the 2004 Recycled Water Master Plan (City of Petaluma 2004) in the near term to allow for Council priorities and program growth alignment. The planned expansion of the recycled water system is separated into three parts:

- Tertiary Treatment Expansion (TTE): This project will increase ECWRF tertiary treatment capacity by 2.12 millions of gallons per day, providing a yield of 712 AFY. Existing capacity is 4.68 millions of gallons per day for Title 22 disinfected tertiary. This project will allow the city to meet increasing demands of both urban and agricultural irrigation sectors. The Tertiary Treatment Expansion project is currently under design, and recently received $3.6 million in DWR Integrated Regional Water Management grant funding through North Bay Water Reuse Program Phase 2. Overall project costs are projected to be $12,080,00.

- Agricultural Pipeline Expansion: Expanded agricultural distribution pipeline to provide 1,343 AFY of recycled water for irrigation. Agricultural Pipeline Expansion costs are projected to be $10,200,000 and are anticipated to be funded through a combination of grant funding, public funding and cost share from project beneficiaries.

- Urban Pipeline Expansion: Expanded urban distribution pipeline system to provide 173 AFY of potable water offsets for primarily institutional irrigation. Urban Pipeline Expansion costs are projected to be $14,000,000 and are anticipated to be funded through a combination of grant funding, public funding, and cost share from project beneficiaries.

A total of $25,000 is included in the GSA's initial 5-year budget provided in **Section 7.2** for the GSA to coordinate with the City of Petaluma to assess additional recycled water opportunities. It is anticipated that the assessment will include:

- Evaluation of existing and future availability, delivery commitments, and constraints
- Assessment optimization options for existing and projected future supplies
- Preliminary cost and benefit analysis for future prioritizing options

- Recycled water masterplan development
- Feasibility studies for potential recycled water storage locations

6.2.2.5 Legal Authority

The City of Petaluma owns its recycled water and has the legal authority to sell its recycled water in alignment with its policies. CWC Section 10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges.

6.2.3 Aquifer Storage and Recovery

As described in **Section 2.6**, regional planning for ASR and well-specific assessments have been performed by local agencies in neighboring Subbasins (GEI et al. 2013 and City of Petaluma 2008). Conceptually, an ASR program would involve the diversion and transmission of surplus Russian River water produced at existing drinking water production facilities during wet weather conditions (that is, the winter and spring seasons) for storage in the deep aquifer system of the Basin. The stored water would then be available for subsequent recovery and use during dry weather conditions (that is, the summer and fall seasons) or emergency situations. The Groundwater Banking Feasibility Study (GEI et al. 2013) provided an evaluation of the regional needs and benefits, source water availability and quality, regional hydrogeologic conditions, and alternatives for groundwater banking. Prior to implementing long-term ASR programs, pilot studies are recommended to verify location specific feasibility, including aquifer capacity for recharge and recovery operations and geochemical compatibility. Pilot testing involves injecting potable drinking water into the Basin's aquifers and recovering it to assess injection and recovery capacities and monitor potential water quality impacts to native groundwater resources. Information generated by pilot test evaluations will help inform the degree to which ASR is a feasible strategy to improve the reliability water supply, along with helping to evaluate whether or not an ASR project can be developed and operated in a manner that will achieve both supply reliability and groundwater sustainability benefits. In 2018 a successful pilot study project was completed in the nearby Sonoma Valley Subbasin which provides information that can inform future ASR planning within the Basin (GEI et al. 2020).

The feasibility study also found that adequate water for the hypothetical 5,000 AFY groundwater recharge program would be available for diversion from Sonoma Water's diversion facilities along the Russian River more than 90 percent of the time. This divertible flow was calculated by simulating the river system operations to meet Water Agency demands, simulating Water Agency diversions, and then subtracting minimum flows needed to meet the Biological Opinion and other instream requirements. In general, water is expected to be available for groundwater recharge in most years during the months of December through May. Because of the high-flow rates in these winter and spring months (with 100 cubic feet per second or more divertible flow expected 90 percent of the time), this pattern of availability is expected to be present under higher future levels of demand. Some water would also be available for diversion to groundwater storage during June through November, though less frequently (GEI et al. 2013). An updated assessment of water available for recharge will be performed during the early stages of GSP implementation.

6.2.3.1 Objectives, Circumstances, and Timetable for Implementation

Implementation of ASR projects would help achieve MOs and avoid undesirable results for the chronic lowering of groundwater levels sustainability indicator. Achieving MOs and avoiding undesirable results for the chronic lowering of groundwater levels sustainability indicator is also expected to benefit the groundwater storage and land subsidence sustainability indicators. Additionally, depending upon the locations within the Basin where ASR projects are implemented, benefits to the MOs for the depletion of interconnected surface water sustainability indicator may also be realized.

While current conditions and existing assumptions for future projections do not indicate the occurrence of undesirable results, the GSA will initiate planning for ASR in the Basin to help address uncertainty related to future conditions and the potential for future severe droughts. Early planning for ASR consists of participating with the Santa Rosa Plain and Sonoma Valley GSAs, along with Sonoma Water and other interested municipal water purveyors in updating the 2013 Groundwater Banking Feasibility Study to address current source water (Russian River) availability and transmission system capacity assumptions, an assessment of locations and operations that specifically benefit GSP implementation, and design and implementation of pilot studies for favorable areas.

ASR projects require permitting, environmental analysis, and engineering design, which could begin following completion and recommendations from the update to the regional groundwater banking feasibility study (planned for completion in 2023). The timing of projects is based on best estimates and may shift as GSP implementation proceeds based upon the needs at the time. Additionally, it is recognized that other water purveyors are pursuing initiation of ASR in the Basin on a more expedited timeframe in response to the 2020/2021 drought and associated funding opportunities. The GSA will coordinate and provide support for planning and implementation of ASR projects that may be developed and implemented by Sonoma Water and other project proponents in response to current drought conditions.

6.2.3.2 Expected Benefits

Expected benefits from implementation of ASR projects include:

- Limiting the potential for chronic lowering of groundwater levels and undesirable results for other associated sustainability indicators.
- Enhanced reliability of the regional water supply during droughts, natural hazard events (for example, earthquakes), and periods of peak seasonal water demands.

Benefits from ASR projects would primarily be evaluated using changes in measured groundwater levels and improvements to groundwater storage changes through the monitoring network described in **Section 5**.

6.2.3.3 Public Noticing, Permitting and Regulatory Process

Public notice for aspects of the ASR pilot projects will be carried out by the lead agency for each project. For ASR projects where the GSA is not the lead agency, the GSA will provide support for outreach activities to nearby well owners and the local community. For the full-scale ASR project, public noticing is anticipated to occur through compliance with the CEQA for any facilities or plans associated with the project. This includes the development of an underground storage supplement to permit the storage of water in the Basin that is required by the SWRCB, and through discussions of the proposed project at public meetings. A CEQA analysis includes an assessment of water supply impacts, GHG emissions, and impacts on Tribal cultural resources.

The SWRCB has recognized that it in the best interest of the state to develop a comprehensive regulatory approach for ASR projects, and has adopted general waste discharge requirements for ASR projects that inject drinking water into groundwater (Order No. 2012-0010-DWQ or ASR General Order). The ASR General Order provides a consistent statewide regulatory framework for authorizing both pilot ASR testing and permanent ASR projects. Pilot tests and any future permanent ASR facility will be permitted under the ASR General Order. Oversight of these regulations is done through the Regional Water Quality Control Boards (RWQCBs) and will require project proponents to comply with the monitoring and reporting requirements of the ASR General Order. Any additional permits required for the construction and operation of an ASR facility will be obtained by the lead agency for each ASR project as needed. Future GSP implementation projects or actions that require their own site-specific monitoring network, such as ASR, would take into consideration any localized COCs and regulatory requirements to avoid potential impacts on beneficial users, including domestic well users and DACs.

6.2.3.4 Estimated Costs and Funding Plan

Preliminary cost estimates to test, permit and construct project facilities for ASR is estimated to range from about $300,000 to $3,600,000 depending upon the complexity of each project with the lower cost estimates representing the use of existing wells that have the necessary monitoring infrastructure (GEI et al. 2013). The range of the costs also varies dependent upon whether existing facilities could be retrofitted or new facilities would need to be constructed. Preliminary costs will need to be further refined and provided upon completion of site-specific evaluation and pilot testing. The current plan for developing ASR in the Basin would utilize existing infrastructure, meaning that new infrastructure would be greatly limited, thus allowing for earlier onset of both incremental drought supply and groundwater sustainability benefits.

A total of $30,000 is included in the initial 5-year budget provided in **Section 7.2** to contribute to an updated regional ASR feasibility study. To continue and expand implementation of ASR projects, the GSA will coordinate with other project proponents who may be pursuing ASR projects, consider providing additional funding in future years and will seek opportunities for grant funding.

6.2.3.5 Legal Authority

Local water supply agencies and the GSA have the authority to develop water supply projects, such as ASR for both water supply benefits and to provide groundwater sustainability benefits.

6.2.4 Stormwater Capture and Recharge

As described in **Section 2.6**, planning for stormwater capture and recharge efforts, including site investigations have been initiated by local agencies and growers within the Basin. Stormwater capture and recharge projects are intended to cover two general types of stormwater capture activities that have been identified in the Southern Sonoma SWRP. The first stormwater capture activity involves retaining and recharging onsite runoff. Examples of this type of activity include low-impact development and on-farm recharge of local runoff. The second stormwater capture activity involves recharge of unallocated storm flows, which could include multi-benefit projects such as managed floodplain inundation. These actions require temporary diversions of storm flows from streams, and conveyance of those flows to recharge locations. State programs and grants (such as FLOOD-MAR, Proposition 68) and local entities (such as RCDs) can be used as resources to move forward on stormwater capture and recharge efforts.

Prior to implementing long-term stormwater capture and recharge programs, site-specific field investigations and assessments will be needed to identify suitable locations. Therefore, early stages of implementation are anticipated to include site-specific investigations and pilot studies of on-farm and other dispersed recharge opportunities that consider and include the following:

- Water available for recharge
- Areas with permeable near-surface soils
- Optimal methods and techniques
- Outreach to interested landowners with locations that could help sustain baseflows to streams and support GDEs

6.2.4.1 Objectives, Circumstances, and Timetable for Implementation

Implementation of the stormwater capture and recharge projects are primarily anticipated to help achieve MOs and avoid undesirable results for the depletion of interconnected surface water sustainability indicator. Depending upon the location of the projects and hydraulic connection between surficial recharge locations and the shallow aquifer system, there may be benefits to the chronic lowering of groundwater levels, groundwater storage and land subsidence sustainability indicators.

Stormwater capture and recharge projects require permitting, environmental analysis, and engineering design, which would begin in 2022. Depending upon results of pilot studies (planned to be initiated in 2024) and identified needs for projects, full-scale implementation of stormwater capture and recharge projects could begin in 2028. However, implementation of smaller-scale low-impact development type projects may proceed sooner, as permitting requirements are anticipated to be much less involved that projects that involve recharging diverted streamflows. The timing of projects is based on best estimates and may shift as GSP implementation proceeds, depending upon the needs at the time and resources available.

6.2.4.2 Expected Benefits

Expected benefits from implementation of stormwater capture and recharge projects are anticipated to raise localized groundwater levels within the shallow portions of the aquifer system and increase baseflows to streams located near the projects. Benefits from stormwater capture and recharge projects would primarily be evaluated using changes in measured groundwater levels and surface water flows near and downstream of project locations using the monitoring networks described in **Section 5**.

6.2.4.3 Public Noticing, Permitting and Regulatory Process

Public outreach would be conducted to identify landowners interested in participating in stormwater capture and recharge projects. The degree of public noticing will vary depending upon the scale and type of recharge project.

Recharge of stormwater by retaining and recharging onsite runoff does not require permits. Recharge of unallocated storm flows is currently subject to the SWRCB's permit program for groundwater recharge by capturing high flow events. Recharge of unallocated storm flows will be subject to the terms of these 5-year permits. Stormwater capture may also be subject to CEQA permitting. Additionally, stormwater management projects will need to comply and coordinate with existing NPDES and MS4 permits for regional municipal stormwater systems. Future GSP implementation projects or actions that require their own site-specific monitoring network, such as some stormwater capture and recharge projects, would take into consideration any localized COCs and regulatory requirements to avoid potential impacts on beneficial users, including domestic well users and DACs.

6.2.4.4 Estimated Costs and Funding Plan

A total of $135,000 is included in the initial 5-year budget provided in **Section 7.2** to perform site-specific investigations and to fund a pilot study. To continue and expand implementation of stormwater capture and recharge projects, the GSA will coordinate with other project proponents who may be pursing multi-benefit projects, consider providing additional funding in future years, and seek opportunities for grant funding.

6.2.4.5 Legal Authority

In addition to acquiring required permits and the right to divert stormwater, other legal authorities required to implement stormwater capture and recharge will depend upon the lead implementing agency for the projects. CWC Section 10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges.

6.3 Evaluation of Projects Through Scenario Modeling

For the purposes of conducting initial evaluation of projects for this GSP, staff used the PVIHM to simulate the Group 1 projects, which represent voluntary, incentive-based water-use efficiency and alternate water source projects focused on rural residential and agricultural groundwater users. Examples include smaller-scale dispersed land-owner projects, such as turf removal, rainwater harvesting, and irrigation efficiency practices. The exact types of these dispersed projects are not distinguished for the purposes of evaluating potential benefits using model scenarios. Other new or significantly expanded projects and actions that would require further studies and planning for implementation were not evaluated using the scenario modeling, as the projected baseline scenario does not indicate the need for additional projects and management actions.

The model scenarios were performed as an initial evaluation of benefits of the Group 1 projects and management actions relative to the baseline 50-year projected scenario and incorporate the future climate change and growth assumptions described in **Section 3.3.6**. The methodology and results of the scenario modeling are described in **Appendix 6-A**. Project scenarios help limit groundwater declines during the latter portion of the projected period (affected by the major drought) and improve net groundwater discharge to streams.

Considering current uncertainties pertaining to modeling, data gaps, and project information, these project scenarios provide a pathway for reaching sustainability and preparing for future changed conditions in the Subbasin to meet GSP requirements. Additional data collection and project conceptualization during early phases of GSP implementation will help refine and allow for consideration of additional scenarios. The projects will also be supplemented by the planned management actions described in **Section 6.4** for the GSA Board's consideration.

6.4 Management Actions

In addition to initiating the projects detailed in this section, the GSA will further assess and implement the following management actions:

- Assessment and prioritization of potential policy options
- Coordination of Farm Plans with GSP implementation

Additionally, as provided by SGMA, should the above-described projects and management actions not be sufficient to eliminate undesirable results during implementation of the GSP, the GSA has authorities to limit groundwater pumping. **Section 6.4.2.5** further describes these authorities and potential situations where they may be considered.

6.4.1 Assessment of Potential Policy Options for GSA Consideration

SGMA provides several authorities to GSAs, which can be used to achieve groundwater sustainability and requires coordination between GSAs and land use agencies.

This management action involves a collaboration between the GSA Board, local land use agencies, GSA member agencies, and stakeholders to assess future policy options that may be appropriate for the GSA to consider adopting or recommending for adoption by other agencies. Based on input from the Advisory Committee, GSA Board, and the public, the following initial list of policy options has been developed for potential inclusion in the assessment:

- Water conservation plan requirements for new development
- Discretionary review of well permits for any special areas identified in GSP
- GSA review of discretionary projects that impact groundwater resources
- Low-impact development or water efficient landscape plan requirements expansion
- Well construction and permitting recommendations (such as water quality sampling and reporting for COCs, requirement for water-level measurement access, and procedures for preventing cross-screening of multiple aquifers)
- Well metering program
- Development of a drinking water well mitigation program
- Study of water markets
- Permitting and accounting of water hauling

This list represents initial ideas for policy options, which will be informed through the continued stakeholder engagement and outreach efforts described in Section 7. As required by SGMA, it is expected that the GSA will participate with the County in the development of future General Plan amendments and updates. During this process, additional policy options may be developed and considered.

6.4.1.1 Objectives, Circumstances, and Timetable for Implementation

The objectives for this management action are to develop, prioritize, and vet potential policy options that may be needed to supplement or replace the projects described above. As the timeframe for conducting the community outreach, studies, and procedural requirements for adopting policy options can be lengthy, the assessment and prioritization will be initiated in the initial few years of GSP implementation. The circumstances and timetable for adopting and implementing any of the recommended policy options will be based on ongoing monitoring of groundwater conditions and progress of project implementation. Policy options that focus on demand management would be applied in the case of a situation where planned projects and management actions are determined to be insufficient to reach and/or maintain sustainability and undesirable results are occurring and are not projected to be eliminated by 2042 using other available projects and management actions.

6.4.1.2 Expected Benefits

Specific expected benefits for this management action will depend upon the type and scope of any policy options that are recommended and adopted by the GSA Board and/or partner agencies. However, the types of policy options considered and recommended will be those that focus on avoiding undesirable results and achieving the sustainability goal.

6.4.1.3 Public Noticing, Permitting and Regulatory Process

Public noticing will be a key aspect of implementing this management action, as considerable engagement with stakeholders will be needed to assess potential benefits and impacts to current and future groundwater users. Any policy options that result in limitations or curtailments of groundwater users would be conducted in an open and transparent process. The permitting and regulatory process associated with this management option will also depend upon the type of policy options under consideration.

6.4.1.4 Estimated Costs and Funding Plan

A total of $30,000 is included in the initial 5-year budget provided in **Section 7.2** for the GSA to perform the assessment and initiate implementing recommendations. The total cost associated with implementing the management action will depend upon the type and scope of any policy actions considered for implementation.

6.4.2 Legal Authority

The legal authorities required for implementing any policy options will depend upon the type of policy options being considered. For policy options that include mandatory reductions or limitations on groundwater use, CWC Section 10726.4 (a)(2) provides GSAs the authority to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate. The County and City of Petaluma retain legal authorities for policy options which involve land use policy changes. Similarly, for any policy options related to well permitting, the legal authorities reside with the county.

6.4.2.1 Coordination of Farm Plans with Groundwater Sustainability Plan Implementation

Farm Plans are voluntary plans developed by third party organizations in collaboration with individual landowners that identify BMPs and provide site-specific actions to mitigate issues like sediment runoff or to improve water quality. In some areas of California, regulatory fees are reduced for landowners with Farm Plans that are certified by agreed-upon third parties. Currently, most Farm Plans do not include aspects of groundwater management that would directly support the GSA’s efforts to comply with the requirements of the SGMA.

This management action involves a collaboration between the three Sonoma County GSA’s and interested members of the agricultural community to evaluate the feasibility of developing a program that coordinates Farm Plans, developed at individual farm sites, with the implementation of the basin-wide GSP. This effort will identify areas of mutual interest (for example, improved water use efficiency, increased groundwater recharge, increased monitoring and data collection, coordinated information sharing, and reporting) in addition to challenges that need to be addressed (such as, data confidentiality, data quality requirements, and verification of Farm Plan performance).

6.4.2.2 Objectives, Circumstances, and Timetable for Implementation

Objectives of the management action include:

- Strengthening partnerships and coordination between the GSA and growers
- Identifying requirements or standards that need to be met to demonstrate that the implementation of the Farm Plan contributes to compliance with SGMA
- Developing metrics that will be measured and verified during implementation of the Farm Plan
- Considering options for Farm Plan sites to receive a form of credit for the contributions of the subject farm to the compliance with SGMA.

Coordination activities will begin in the first year of GSP implementation and it is anticipated that within 1 year of funding approval, staff would submit a report to the GSA Board with recommendations on the viability of such a program and next steps, as appropriate.

6.4.2.3 Expected Benefits

Expected benefits would include information sharing and coordination between the GSA and growers within the Subbasin. Other benefits will depend upon the outcome of the coordination activities and identification of mutual areas of interest to incorporate into Farm Plans. Potential areas of benefit include improvements to the GSAs monitoring network, filling key data gap areas, and advancing projects (such as water-use efficiency or recharge projects) that support the sustainability goal and avoid undesirable results to sustainability indicators.

6.4.2.4 Public Noticing, Permitting, and Regulatory Process

Public notice of actions and outcomes from the coordination process would be provided at the GSA’s regular Board and Advisory Committee meetings. The permitting and regulatory process would depend upon the outcome of the coordination and identification of mutual areas of interest to include within the Farm Plans.

6.4.2.5 Estimated Costs and Funding Plan

A total of $40,000 is included in the initial 5-year budget provided in **Section 7.2** for developing and beginning implementation of the work plan. It is assumed that costs for portions of the study will be shared with the Santa Rosa Plain and Sonoma Valley GSAs.

6.4.2.6 Legal Authority

Any needed legal authorities would depend upon the outcome of the coordination and identification of mutual areas of interest to include within the Farm Plans.

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Groundwater Sustainability Plan for Petaluma Valley Groundwater Basin

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7 IMPLEMENTATION PLAN

This implementation plan serves as an initial roadmap for addressing GSP implementation activities between 2022 and 2042 with a primary focus on implementation activities within the initial 5 years (2022 through 2026). This section describes the plans for implementing the activities and actions identified in **Sections 4** through **6** in this GSP, including:

- GSA's governance structure and planned administrative approach
- Main implementation components and estimated costs for the initial 5 years of implementation
- Initial approach to funding
- Schedule

This implementation plan is based on the current understanding of Basin conditions, identified data gaps, monitoring needs and projects and management actions. In order to successfully implement the GSP, the implementation plan will adapt over time based on new information and data, model development, and input from Basin stakeholders.

7.1 Governance Structure and Planned Administrative Approach

The GSA anticipates that the current governance and general administrative structure will remain in place through the implementation period. As described in **Section 1.3.2**, the six member agencies currently plan to continue operating under the Joint Powers Authority agreement that created the GSA. The Board will continue serving as the governing body, making decisions regarding the implementation of projects and management actions; closing data gaps; contracts; administration; funding; and other governance issues. A stakeholder-based Advisory Committee representing multiple stakeholder interests will continue providing guidance and recommendations to the Board and GSA staff. Both the GSA Board and Advisory Committee will continue to hold regular public meetings in compliance with California's laws governing public meetings (commonly known as the Brown Act).

Currently, the GSA contracts with Sonoma Water for technical, outreach, grant administration, and GSA management services and contracts with other consultants for legal, facilitation, and some monitoring services. As the GSA transitions from GSP development to implementation starting in 2022, staffing needs will be evaluated to determine how to move forward efficiently and effectively. To reduce costs and for consistency for groundwater users within Sonoma County, it is possible that the GSA will coordinate management and other services with the Santa Rosa Plain and Sonoma Valley GSAs.

7.2 Groundwater Sustainability Plan Implementation Components and Estimated Costs

This section describes details of each of the main implementation components, assumptions, and estimated costs for the initial 5 years.

7.2.1 Administration and Finance

Administration and finance costs include day-to-day management of the agency, as-needed legal costs, applying for and administering grants, tasks associated with implementation of a fee, auditing and accounting services, administration of the well registration program, facility fees, and office supplies. Annual administration costs to range from $220,000 to $245,000 annually.

7.2.2 Communication and Stakeholder Engagement

To meet the requirements of SGMA, the GSA will continue the activities described in **Section 1**, including:

- Holding regular meetings of a diverse, stakeholder-based Advisory Committee to receive feedback on implementation efforts and to solicit outreach ideas and assistance
- Informing, educating, and soliciting feedback from stakeholders on the progress of implementing projects and management actions and on Basin conditions through social media, the GSA website, periodic community meetings, focused stakeholder briefings, and paid and free media
- Approaching and engaging a diverse set of stakeholders and groundwater users by continuing to reach out to and meet with organizations that represent disadvantaged communities (with a focus on Spanish-language speakers), farmers, environmental interests, rural landowners, and business interests
- Conduct government-to-government communication with federally and non-federally recognized Tribal governments to reassess interest in participating in GSA activities

The GSA will maintain and improve two products currently under development: the Groundwater User Information Data Exchange program, which will allow well owners to review and correct well and groundwater use information, and the Groundwater Data Dashboard, which will provide groundwater data in a visual, user-friendly format.

The GSA will conduct, in cooperation with other agencies or organizations, outreach and education programs on specific topics relevant to groundwater users within the Basin, such as the importance of well maintenance, management, and best practices, with the goal of empowering well owners with an understanding of well construction, pump and storage practices, water quality considerations and treatment options, and well abandonment.

In addition, the GSA will continue to engage and coordinate with local, state, and regional agencies (including City of Petaluma, Permit Sonoma, other GSAs, Agricultural Commissioner, Sonoma County Agricultural Preservation and Open Space District, DWR, SWRCB's DDW and Water Rights Division, and SFBRWQCB) on filling data gaps and implementation of projects and actions. This coordination will include discussions of partnering opportunities for funding implementation components that are mutually beneficial.

An important component of this engagement will be ongoing coordination with the agencies responsible for regulating groundwater quality. The GSA will regularly coordinate with SFBRWQCB, SWRCB-DDW, and others to understand and develop a process for determining whether groundwater management is resulting in degraded water quality and to assess whether any additional COCs should be considered in the future.

A focused area of engagement in the early stages of GSP implementation is anticipated to be continued coordination and information sharing with agencies that have land use responsibilities and authorities, including Permit Sonoma, city planning departments, and county and city planning commissions. This coordination will build on ongoing coordination that has occurred through development of the GSP and activities that Permit Sonoma has initiated using Proposition 68 grant funding. Coordination will include the sharing of information, including the tracking of land use changes and number of new well permits, as well as new agricultural permits (including cannabis projects) within the Basin/contributing watershed and surrounding areas. In addition, as required by SGMA, the GSA will also engage in General Plan updates and any specific planning area processes in Petaluma Valley. In addition, the GSA will engage in and review General Plan amendments, other local policies, and issues related to groundwater resources in the Basin.

Annual outreach and communication are estimated to cost $80,000 in the first 4 years of implementation, and $100,000 in the fifth year, when additional outreach will be needed for the preparation of the 5-year GSP update.

7.2.3 Annual Monitoring, Data Evaluation, and Reporting

Monitoring of the six sustainability criteria is a key component for successful implementation of the GSP. Most monitoring relies on existing monitoring programs, some of which will be enhanced or expanded as described in **Section 5** and **Section 7.2.4.2**. Data from the monitoring programs will be routinely evaluated to ensure progress is being made toward sustainability, identify whether undesirable results are occurring, and assess and investigate conditions that may lead to undesirable results. Data will be maintained in the data management system and will be used by the GSA to guide decisions on projects and management actions and to prepare annual reports to Basin stakeholders and DWR.

7.2.3.1 Monitoring and Data Evaluation

Specific planned monitoring activities are summarized herein and in **Table 7-1** and are more fully described in **Section 5**.

- Groundwater-level monitoring activities will include the collection of groundwater-level data at the 11 existing RMPs and new planned RMPs identified in **Section 5.3.1** for comparison to MTs and MOs. The groundwater-level monitoring will also include the coordination and evaluation of measurements from nine additional wells within the Basin and contributing watershed areas described in **Section 5.2.1** to continue tracking trends in these wells with historical data and support the development of groundwater-level contour maps and storage change estimates. The groundwater-level data will be collected in accordance with the monitoring protocols outlined in **Section 5.3.1**. Monitoring network data gaps identified in **Section 5.4.1** will be addressed through the activities described in **Section 7.2.4**. Groundwater elevation data will be uploaded to the DWR data portal semiannually; before January 1 and July 1 of each year.

- Water quality monitoring activities will include the compilation and evaluation of water quality data reported from existing public water supply wells and compared with the MTs and MOs for the seawater intrusion and water quality sustainability indicators.
  - For the water quality sustainability indicator, the data review will focus on exceedances of MTs, or MCLs and SMCLs for the three COCs (arsenic, nitrate, and TDS) identified for this GSP. However, if during review of the water quality data, additional constituents appear to frequently exceed MCLs and SMCLs, MTs and MOs will be considered for these additional constituents during GSP 5-year updates. The number of public water supply wells routinely monitored for each COC is shown in **Table 7-1**. If any other routine monitoring of supply wells is initiated in the Basin at a later date, these wells will also be considered for inclusion in the water quality monitoring network.
  - Monitoring for seawater intrusion just north and along the perimeter of the San Pablo Baylands area will be conducted using a combination of existing water supply wells and additional proposed new dedicated monitoring wells constructed during implementation of the GSP, depending upon well access, construction, and funding availability. Initially, this network will include existing public water supply wells within 1 mile of the Baylands area. The future monitoring network will be designed to more accurately map the location of the 250 mg/L chloride isocontour.
- Monitoring for land surface subsidence will be measured using satellite InSAR data provided by DWR. InSAR data will be downloaded from the DWR website annually, checked and verified for completeness and reasonableness, and used to develop annual change in elevation maps. The average value for each 100 square meter pixel and elevation change maps will be used to compare with MTs and MOs for the land surface subsidence sustainability indicator.
- Monitoring for surface water and groundwater interaction will include the following monitoring activities:
  - Compilation and evaluation of surface water data from five active stream gages within the Basin and contributing watershed area.
  - Measurement and evaluation of groundwater elevations from the three RMPs used to monitor surface water depletion as a proxy. For reporting seasonal highs and lows for future comparison with MTs, all measurements collected more frequently than monthly will be reported as monthly averages in order to better align with the measurement frequency within historical datasets used to calculate the minimum thresholds.

Plans for assessing and improving the monitoring network for surface water and groundwater interaction are described in **Section 7.2.4.1**.

Table 7-1. Monitoring Networks and Initial Representative Monitoring Point Networks

Sustainability Indicator	Monitoring Network	Initial Representative Monitoring Point Network
Chronic Lowering of Groundwater levels	20 wells within the contributing watershed area (including 15 wells in the Basin)	11 wells (3 dedicated monitoring wells; 5 private supply wells; 3 inactive municipal wells)
Reduction in Groundwater Storage	Same as monitoring network for Chronic Lowering of Groundwater Levels	Same as monitoring network for Chronic Lowering of Groundwater Levels
Seawater Intrusion	Within 1 to 2 miles of Baylands: 9 public water supply wells	Within 1 to 2 miles of Baylands: 9 public water supply wells
Degraded Water Quality	Existing supply well groundwater quality monitoring programs, as follows: Arsenic: 18 wells Nitrate: 30 wells Salts: 13 wells	Existing supply well groundwater quality monitoring programs, as follows: Arsenic: 18 wells Nitrate: 30 wells Salts: 13 wells
Land Surface Subsidence	1 GPS location; InSAR satellite in most of the Basin	InSAR dataset
Interconnected Surface Water	16 stream gages; 3 shallow monitoring wells adjacent to streams	3 shallow monitoring wells adjacent to streams

7.2.3.2 Annual Reports

Annual reports will be developed to present data, information, and the implementation status for each WY and meet SGMA requirements. As defined by DWR, annual reports must be submitted for DWR review by April 1 of each year following the GSP adoption, except in years when 5-year or periodic assessments are submitted. Annual reports are anticipated to include three key sections: General Information, Basin Conditions (including SMC status and progress towards achieving measurable objectives), and Implementation Actions and Activities.

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 goal, a description of GSP projects and their progress, and an annual update to the GSP implementation schedule.

Basin Conditions

The Basin Conditions section will describe the current groundwater conditions and monitoring results. This section will also include an evaluation of how conditions have changed over the previous year and will compare groundwater data for the WY to historical groundwater data. Estimated 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 RMPs
- Groundwater extraction data and estimates by water-use sector
- Groundwater quality at RMPs
- Surface water supply availability and use data by water-use sector and source
- Streamflow data
- Total water-use data
- Change in groundwater in storage
- Subsidence rates and associated data

As part of the monitoring program reporting, the status of SMC will also be reported, including MT and MO status of RMPs. Additionally, information on land use changes and additional permitting of wells and projects that use groundwater will be tracked and reported in the annual reports.

GSP Implementation Progress

Progress toward GSP implementation will be included in the annual reports. 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, to be measured by whether the GSA is achieving the milestones provided in the Implementation Schedule (**Figure 7-1**)
- Progress toward achieving the Basin sustainability goals
- Any changes that may be considered necessary for successful GSP implementation

Development of an annual report will begin following the end of the WY, September 30, and will include an assessment of the previous WY. The annual report will be submitted to DWR before April 1 of the following year. The 2022 annual report covering WY 2021 will be submitted by the GSA by April 1, 2022. Four annual reports for the Basin will be submitted to DWR each April between 2022 and 2025, prior to the first 5-year update of this GSP, which will be prepared in 2026 and submitted to DWR in January 2027.

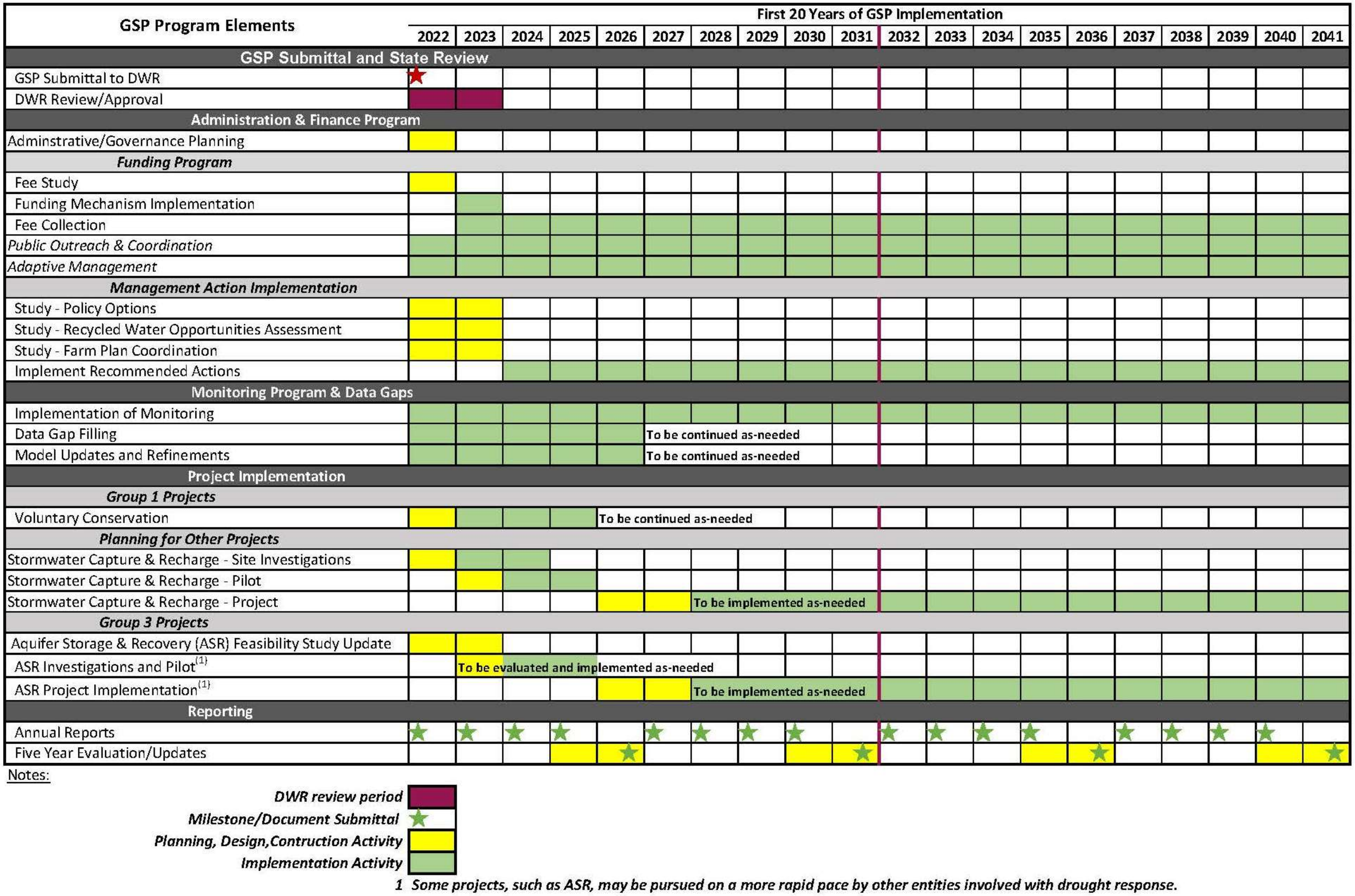

Figure 7-1. Implementation Schedule

The estimated annual cost of performing annual monitoring, data evaluation, and reporting ranges from $150,000 to $200,000, with a cumulative 5-year cost ranging from $750,000 to $1,000,000.

7.2.4 Addressing Data Gaps

Through development of this GSP, a number of key data gaps have been identified in **Sections 3** through **5**. These data gaps were shared and discussed with Basin stakeholders to prioritize activities and actions needed to address the data gaps.

- Amounts, locations, and depths of groundwater pumping (rural residential, agricultural, public water systems, commercial, and industrial)
- Role of faults within and along the boundaries of the Basin
- Distribution and extent of brackish groundwater along the margins of the Baylands area
- The interconnection of streams to the shallow aquifer system, including seasonal variability and how groundwater pumping and surface water diversions affect streamflow
- Basin boundary characteristics, such as the direction and magnitude of groundwater fluxes across Basin boundaries
- Aquifer hydraulic properties, recharge and discharge mechanisms, and volumes of both the shallow and deep aquifer systems
- Three-dimensional data gaps in the monitoring network for each primary aquifer

Studies and activities planned to address these identified data gaps within the initial 5 years of GSP implementation are identified in the following sections and categorized as either studies and information gathering or monitoring network improvements.

7.2.4.1 Studies and Information Gathering

Planned studies and information gathering include the following activities.

<u>Improve information on existing water wells and groundwater extraction</u>. The objective of this task is to better assess the locations, depths, volumes, and timing of groundwater pumping from water-use sectors that have not historically measured and reported water use, such as rural residential, agricultural, commercial, and industrial. This will improve the assessment of potential impacts from groundwater pumping to beneficial users and uses within the Basin, including existing residential and other water wells and GDEs. The task will include the following activities, which will be performed within the initial 2 years of GSP implementation:

- Integration of parcel-specific information obtained through the planned well registration program with existing well log databases

- Assessment of available remote sensing data on actual ET to help constrain the estimates of groundwater demands for irrigation supplies

Aquifer system properties assessment: The objective of this task is to improve the understanding of the aquifer system hydrogeologic framework, the distribution and potential effects of faults on groundwater flow, and Basin boundary characteristics. Completion of this task will also improve the GSA's ability to assess potential impacts from groundwater pumping on beneficial users and uses within the Basin, including existing residential and other water wells and GDEs. As part of this task, the GSA will:

- Evaluate the airborne electromagnetic (AEM) survey results (data collection and compilation funded by DWR) and incorporate them into the existing HCM. DWR is planning to collect geophysical data from the Basin through its AEM survey program in 2021 or 2022. Additional focused geophysical surveys to refine information in key areas (that is, areas identified for potential managed aquifer recharge projects) will also be considered.

- Based on these data collection and evaluation efforts, perform aquifer testing at up to three locations. It is anticipated that the aquifer testing will be completed within the initial 3 years of GSP implementation and is planned to be completed within the initial 2 years of GSP implementation. Wells for testing will be identified using the following criteria:

  - Wells are owned by willing well owners
  - Wells have known well completion information
  - Wellheads are completed such that water elevations in wells can be monitored with data loggers
  - Wells are equipped with accurate flow meters
  - Wells have an area or system for the discharge of test water
  - Preferred wells will have nearby wells that can be monitored during the test and will be located near key data gap areas, Basin boundaries, and interconnected surface water

Baylands area voluntary water quality sampling program: The objective of this task is to improve the understanding of the distribution and extent of brackish groundwater along the margins of Baylands area and provide data to assist in the selection of locations for future RMPs needed for the seawater intrusion monitoring network. The study will be designed to supplement data collected through previous studies and monitoring programs. The task will include the following activities:

- Outreach to well owners within and near the Baylands area through the outreach activities described in Section **7.2.2**.

- Assessment of potential candidate wells for sampling.

- Collection of water quality samples for the analysis of chloride and TDS from up to 25 existing water wells.
- Evaluation of water quality sampling results to inform the development of a seawater intrusion monitoring network.

Interconnected surface water and GDE studies: As indicated in **Section 4.10.2.1**, in recognition of the significant information and data limitations and the importance of interconnected surface water to beneficial users within the Basin, the following studies and activities are planned:

- Develop improved information on the locations and amounts of surface water diversions under the jurisdiction of the SWRCB, including both direct diversions from streams and diversions that may occur from water wells near streams under riparian water rights. This information will be developed through the coordination process established between the GSA and SWRCB related to depletions of interconnected surface water.
- Perform studies that determine the impact of groundwater pumping on surface water depletion through a combination of differential stream gaging, tracer experiments, temperature profiling, and other methods.
- Assess the influence of groundwater pumping and groundwater levels on GDE health using available remote sensing tools and datasets. The GDE Pulse web application developed by TNC provides data on long-term temporal trends of vegetation metrics. This information will be integrated with available groundwater-level data and information to assess the relationship between groundwater conditions and GDEs. Conduct field visits as-needed to verify the findings of the remote sensing assessment regarding GDE locations and health. The potential GDEs identified in this GSP will be field verified to ensure that groundwater-dependent communities exist, and that the shallow groundwater is connected to regional aquifers that will be managed as part of this GSP.
- Compile and evaluate existing and relevant habitat field surveys that aid in understanding potential impacts of groundwater pumping on habitat associated with interconnected surface water.

To help prioritize and schedule these activities, the GSA will regularly consult with interested members of the GDE and ISW practitioner workgroups to address these important data gaps within the Basin. It is anticipated that this consultation will be scheduled within the first 6 months of implementation.

7.2.4.2 Monitoring Network Improvements

Based on the assessment of data gaps in **Section 5**, the following activities for improving the monitoring networks are planned.

Development of seawater intrusion monitoring network: Following completion of the voluntary water quality sampling program, the GSA will develop an improved sea water intrusion monitoring network. It is anticipated that the network will include a combination of appropriately constructed and located existing wells through a long-term voluntary sampling program and new dedicated monitoring wells. The monitoring network will be designed to adequately map the chloride concentration isocontour in both the shallow and deep aquifer systems. For the purposes of estimating costs, it is assumed that four new dedicated multi-level monitoring wells would be constructed for the seawater intrusion monitoring network between years 2 and 4 of GSP implementation.

Refinement of groundwater-level monitoring network: As described in **Section 5**, many of the identified data gaps in the groundwater-level monitoring network are being addressed through new wells being constructed under the Proposition 68 grant. For remaining data gap areas, the GSA will evaluate both the use of existing voluntary wells and the construction of new dedicated monitoring wells. For the purposes of estimating costs, it is assumed that three new dedicated multi-level monitoring wells would be constructed for the groundwater-level monitoring network. The GSA intends to conduct outreach and expand the voluntary groundwater-level monitoring program in the Basin during GSP implementation.

Additionally, the GSA will work to improve data quality in groundwater-level monitoring networks by a combination of the following activities:

- Performing survey activities for wells that lack sufficient reference point vertical survey data, as funding becomes available
- Obtaining well construction information from well owners or by conducting investigations (for example, video logging) as funding or technical assistance becomes available
- Replacing wells in the monitoring network that have data quality issues with dedicated monitoring wells, as funding becomes available

Refinement of interconnected surface water monitoring network: Following completion of the interconnected surface water and GDE studies and information gathering, improvements to the interconnected surface water monitoring network will be developed. For the purposes of estimating costs, it is assumed that four new dedicated shallow aquifer system monitoring wells would be constructed for the interconnected surface water monitoring network between years 2 and 4 of GSP implementation. Additionally, it is assumed that remote sensing assessments of vegetation health will continue to be performed and reported at key intervals such as the 5-year GSP updates.

The 5-year cost of addressing data gaps is estimated to be from $1,500,000 to $2,000,000.

7.2.5 Maintaining, Updating, and Making Improvements to the Model

The Basin groundwater model (PVIHM) informs the project and management activities and ongoing performance assessment of the SMC. Periodic updates to the groundwater model will be required to continue to refine and improve its capabilities and maintain ongoing functionality. This includes incorporating new model tools and features, updates to HCM, incorporating new monitoring data, and related work to support ongoing simulations of projects and management actions. Improvements will be focused on the initial 3 years of implementation to facilitate reassessing preliminary SMC, as appropriate, and planning for any projects and actions. Model updates and refinements will be informed by data and information collected during early stages of implementation, including the planned activities for assessing data gaps, described in **Section 7.2.4**. A detailed plan for model improvements and updates is provided in **Appendix 7-A**. The preliminary areas of focus identified for model updates and improvements include:

- Focused calibration of surface water and groundwater interaction
- Assessment of aquifer properties
    - Calibration contingent on the availability of groundwater-level observation data, aquifer pump tests, simulation results, and other data
- Assessment of model boundary conditions, including mountain front recharge, general head boundaries, and simulated faults
- Improved model estimates of groundwater pumping, including responses to climate change and the impact of surface water diversions and recycled water

The 5-year cost of performing updates and making improvements to the model is estimated to be from $200,000 to $300,000.

7.2.6 Study and Implementation of Projects and Actions

To prevent potential undesirable results and to achieve MOs, projects and management actions are planned as part of GSP implementation. As described in **Section 6**, a portfolio of projects and management actions has been developed with the goal of addressing relevant sustainability indicators, including the circumstances under which they may be implemented.

Only the voluntary water-use efficiency and alternate water source projects (Group 1 projects) are defined enough for evaluation using model scenarios and are deemed necessary in the near term based on the current sustainable conditions within the Basin. To account for the significant data gaps in the Basin and prepare for future droughts and other uncertain conditions, a portfolio of other projects and management actions requiring further assessment (consisting of expanded recycled water deliveries, stormwater capture and recharge and ASR) have been included in the GSP. For these projects and management actions included in **Section 6**, initial implementation steps include performing studies or analyses to refine the concepts into actionable projects. Studies and work efforts may include, but are not limited to, CEQA studies and documentation, and engineering feasibility studies and preliminary design reports.

After the necessary initial studies are completed, other projects and management actions will undergo, as necessary, final engineering design (in the case of infrastructure projects) and public noticing and outreach, after which construction projects can occur followed by ongoing operations and maintenance.

The following activities related to projects and actions are planned during the first 5 years of implementation.

Implementation of Group 1 Projects:

- Assessment and implementation of conservation and groundwater use efficiency opportunities. This project would include an assessment of groundwater use characteristics, existing levels of water-use efficiency, and recommendations on preferred tools and strategies and incentives for implementation.

Planning for Other Projects Included in **Section 6**:

- Update 2013 feasibility study for other ASR opportunities
    - Update source water (Russian River) availability and transmission system capacity assumptions
    - Assess locations/operations that benefit GSP implementation (that is, areas of depletion)
    - Design and implement pilot studies for favorable areas
- Coordinate with City of Petaluma to assess additional recycled water opportunities
    - Optimize existing and projected future available supplies
    - Perform a cost/benefit analysis for future alignment options
    - Identify optimal locations for future storage
- Site-specific investigations and pilot study of on-farm and other stormwater capture and recharge opportunities
    - Identify water available for recharge
    - Locate areas with permeable near-surface deposits
    - Determine optimal methods and techniques
    - Focus on locations that could help sustain baseflows/support GDEs for recharge
    - Coordinate with Petaluma Flood Zone 2a's Upper Petaluma River Watershed Feasibility Analysis and other ongoing studies

Management Actions:

- Study potential policy options for future GSA consideration or recommendation, including this initial list of potential policy options:
  - Water conservation plan requirements for new development
  - Discretionary review of well permits for any special areas identified in GSP
  - Expanded low-impact development or water-efficient landscape plan requirements
  - Well construction and permitting recommendations (for example, water quality sampling/reporting for COCs, requirement for water-level measurement access, prevent cross-screening of multiple aquifers)

- GSA review of discretionary projects that impact groundwater resources
  - Metering program
  - Drinking water well mitigation program
  - Permitting and accounting of water hauling

  This list represents initial ideas for policy options, which will be informed through continued stakeholder engagement and outreach. In particular, it is expected that as the GSA participates in future General Plan amendments and updates processes with the County, as required by SGMA, additional policy options may be developed and considered.

- Coordinate farm plans, developed at individual farm sites, with implementation of the Basin-wide GSP:
  - Identify areas of mutual interest (for example, improved water-use efficiency, increased groundwater recharge, increased monitoring and data collection, coordinated information sharing and reporting) in addition to challenges that need to be addressed (for example, data confidentiality, data quality requirements, verification of farm plan performance)

  - This project would: (1) identify requirements or standards that would demonstrate the benefits of GSP implementation, (2) develop metrics that would be measured and verified, and (3) consider options for incentivizing actions of mutual benefit.

The costs of refining and implementing these projects and actions are estimated to be from $150,000 to $350,000, as summarized in **Table 7-2**.

Table 7-2. Summary of Estimated 5-year Costs for Projects and Management Actions, Excluding Capital Project Costs

Project/Action	Project Group	Estimated 5-year PV GSA Costs	Other Potential Funding Sources	Assumptions
Conservation/Water-Use Efficiency/Alternate Water Sources	1	$40,000 to $80,000	Other GSAs	Split equally among three GSAs
Stormwater Capture and Recharge		$80,000 to $190,000	Grants	
Site Investigations				
Aquifer Storage and Recovery		$20,000 to $40,000	Other GSAs, Sonoma Water/water contractors	Other GSAs and Sonoma Water/water contractors will also contribute funding
Participate in Regional Feasibility Study				
Farm Plan Coordination		$20,000 to $60,000	Other GSAs	Other GSAs will also contribute funding
Recycled Water Expansion		$20,000 to $30,000	City of Petaluma	
Assess additional opportunities				
Policy Options		$20,000 to $40,000	County	County and other GSAs will also contribute funding
		$200,000 to $440,000 $320,00	Total range Midrange	

It is anticipated that capital project costs within the initial 5 years will be paid for by some combination of individual project proponents/beneficiaries and grant funding. Specific details regarding roles of project proponents and the cost share mechanisms are anticipated to be determined as the projects are further defined and scoped. Therefore, costs associated with implementation of capital project implementation are not included in the GSP implementation budget estimate shown in **Table 7-2**.

It is also anticipated that each implemented project and management action will have its own set of monitoring objectives and data collection requirements to allow for project and management action evaluation and confirmation assessments, and, if necessary, modifications to improve project and management action effectiveness. The costs of specific projects that are not covered by beneficiaries/project proponents will include assumptions about financing the projects over time.

7.2.7 Five-year Update to Groundwater Sustainability Plan

As required by SGMA regulations, an evaluation of the GSP and the progress toward meeting the approved SMC and the sustainability goal will occur at least every 5 years and with every amendment to the GSP. A written 5-year evaluation report (or periodic evaluation report) will be prepared and submitted to DWR. The information that will be included in the evaluation reports includes:

- A sustainability evaluation that 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 MOs and interim milestones that achieve sustainability by 2042 will be included, along with an evaluation of the status relative to MTs. If interim milestones are not being achieved, the evaluation will identify obstacles to achieving the interim milestones. The evaluation will include a plan for overcoming those obstacles and provide a new assessment of interim milestones.

- An implementation plan progress section that 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.

- A discussion of GSP elements. GSP elements will be reconsidered as additional monitoring data are collected, land uses and community characteristics change, and GSP projects and management actions are implemented, and it may become necessary to reconsider elements of this GSP and revise the GSP as appropriate. GSP elements to be reassessed may include the Basin setting, management areas, undesirable results, MTs, and MOs. If appropriate, a revised GSP, completed at the end of the 5-year evaluation 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.

- A description of the monitoring network, including an assessment of the monitoring network's function and an analysis of the data collected to date. If data gaps are identified, the GSP will be revised to include a method for addressing those data gaps, along with an implementation schedule for addressing the gaps and a description of how the GSA will incorporate updated data into the GSP.

- A description and evaluation of the new information available since the last 5-year evaluation or GSP amendment. If the new information should warrant a change to the GSP, this will also be included, as described previously for the discussion of GSP elements.

- A summary of the regulations or ordinances related to the GSP that have been implemented by DWR or others since the previous report. The summary will include a discussion of any required updates to the GSP.

- A summary of legal or enforcement actions taken by the GSA in relation to the GSP, including an explanation of how such actions support sustainability in the Basin.
- A description of amendments to the GSP, including adopted amendments, recommended amendments for future updates, and amendments that are underway.
- A description of ongoing coordination activities among the GSA; members of the Advisory Committee; other local, state, and federal partners; and the public. The 5-year evaluation report will describe activities such as meetings, joint projects, data collection and sharing, and groundwater modeling efforts.
- A record of outreach activities associated with the GSP implementation, assessment, and GSP updates.

The initial 5-year GSP evaluation is due to be submitted to DWR in 2027. The cost of preparing the initial 5-year GSP update is estimated to be from $200,000 to $300,000.

7.2.8 Estimated 5-year Implementation Costs

The cost of the items described in **Sections 7.1.1** through **7.1.7** will vary from year to year but the average cost of implementation is approximately $1.0 million annually for the first 5 years (fiscal year 2022-2023 through fiscal year 2027-2028), excluding the construction costs of specific capital projects, as summarized in **Table 7-3**.

To enhance efficiencies and provide similar benefits to nearby groundwater users in the Santa Rosa Plain and Petaluma Valley GSAs, it is assumed that the development costs of common projects and actions will be shared among the three GSAs. In addition, the budget assumes that costs will be shared for the development of projects and actions conducted in cooperation with local, regional, and state partners (such as sanitation districts, water suppliers, RCDs, and others).

Table 7-3. Total Estimated 5-year Implementation Costs

GSP Implementation Item	Year 1 2022 to 2023	Year 2 2023 to 2024	Year 3 2024 to 2025	Year 4 2025 to 2026	Year 5 2026 to 2027
GSA Administration and Operations	$245,000	$235,000	$230,000	$220,000	$235,000
Communication and Stakeholder Engagement	$80,000	$80,000	$80,000	$80,000	$100,000
Annual Monitoring, Evaluation, and Reporting	$190,000	$170,000	$170,000	$170,000	$170,000
Data Gap Filling	$55,000	$515,000	$885,000	$265,000	$25,000
Conceptual Projects	$20,000	$95,000	$185,000	$10,000	$10,000
Model Updates	$0	$30,000	$50,000	$100,000	$70,000
5-year GSP Updates	$0	$0	$0	$100,000	$200,000
Subtotal	$590,000	$1,125,000	$1,600,000	$945,000	$810,000

GSP Implementation Item	Year 1 2022 to 2023	Year 2 2023 to 2024	Year 3 2024 to 2025	Year 4 2025 to 2026	Year 5 2026 to 2027
10 Percent Contingency - rounded to nearest $5,000	$60,000	$115,000	$160,000	$95,000	$80,000
Total	$650,000	$1,240,000	1,760,000	$1,040,000	$890,000

Note:
Preliminary average annual costs are equal to approximately $1 million

Estimates of future implementation costs (years 6 through 10) will be provided in the 5-year GSP update.

7.3 Funding

Development of this GSP was partially funded through grants from DWR through the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) and the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68). Additional support was provided through the DWR Technical Support Services program, which included the drilling of 12 shallow monitoring wells. GSA member agencies, as described in **Section 1.3.1**, funded the remainder of the GSP development and GSA administration. The grant funding ends after submittal of this GSP, and the member-agency funding agreement ends on June 30, 2022. Therefore, additional funding streams are needed for GSP implementation.

GSP implementation will partially be funded by an implementation fee that is the current subject of an ongoing fee study. Other potential funding sources include grants through DWR, SWRCB, and federal and local entities; DWR technical support; and partnerships with member agencies and other GSAs and entities interested in leveraging mutually beneficial programs, projects, and studies.

7.3.1 Fees, Grants, and Other Funding Sources

SGMA provides GSAs with the authority to impose certain fees, including groundwater pumping fees. In September 2021, the GSA engaged a consultant, SCI Consulting, to conduct a fee study to evaluate and provide recommendations for GSP implementation funding. The study will include outreach and education to inform and solicit feedback from groundwater users and other stakeholders. Any imposition of a fee, tax, or charge will comply with California law and all applicable constitutional requirements, based on the nature of the fee.

The fee will be designed to pay for the costs of implementing the GSP that will not be covered by grants, low-interest financing, project beneficiaries and project partners. An implementation budget provided in **Table 7-3** provides a high-level overview of costs, and indicates items that could be eligible for grant funding. Administrative and operational costs are generally not eligible for grants or loans, but the remainder of the items listed in the budget (with the exception of contingency funds) may be partially or fully eligible for grant funding, depending on the grant source and availability. The GSA has successfully applied for and received more than $2.2 million in grant funding and technical support services, and will continue to pursue grants and low-interest financing to offset the costs of monitoring, filling data gaps, and for planning and implementing projects and actions.

In addition, funding could be provided by project partners (such as other agencies) or project beneficiaries (such as farmers, businesses and nearby groundwater users) who directly benefit from project implementation.

A more detailed budget will be developed as part of the fee study process and will be available in Winter 2022. The GSA Board will consider adoption of the implementation fee in Spring 2022, and fee collection is anticipated to begin in December 2022.

7.4 Schedule

The implementation schedule is shown on **Figure 7-1**. The final GSP will be submitted to DWR no later than January 31, 2022. While DWR has 2 years to review the GSP, **Figure 7-1** assumes that implementation begins immediately, and provides an overview of the preliminary schedule for agency administration and finance, monitoring, project implementation, and reporting. Many of these categories consist of ongoing tasks and efforts that will continue throughout GSP implementation.

Administration and finance activities shown on **Figure 7-1** include:

- Completion and implementation of the fee study
- Adaptive management tasks related to ongoing development and assessment of the SMC for seawater intrusion and interconnected surface water (as described in **Section 4**)
- Outreach and communication
- Studies and implementation of management actions, including farm plan coordination and development of the policy options (described in **Section 7.1.6**).

The monitoring task includes collecting and analyzing data from existing and future RMPs, and planning for new monitoring sites to fill the data gaps discussed in **Section 5**. Specifically, this category includes the installation of stream gages and the development of associated shallow wells to fill data gaps for the depletion of interconnected surface water and the development of additional monitoring sites to assess seawater intrusion.

The project implementation schedule includes the development and implementation of Group 1 projects, as described in **Section 6**. After a short planning period, it is assumed that Group 1 project implementation will begin in 2023. Timing for the implementation of other projects and management actions will be based on conditions within the Basin, an ongoing evaluation of the potential for undesirable results to occur in the future, and completion of the initial planning activities. The timing of projects is based on best estimates and may shift as GSP implementation proceeds based upon the needs at the time.

GSP reporting will occur on an annual and a 5-year basis as required under SGMA. Annual reports will be submitted to DWR by April 1 of each year. Periodic reports (every 5 years or following substantial GSP amendments) will be submitted to DWR by April 1 at least every 5 years (2027, 2032, 2037, and 2042). The contents of annual and periodic reports are described in **Section 7.3**.

Section 8: References

Groundwater Sustainability Plan for
Petaluma Valley Groundwater Basin

Table of Contents

8 REFERENCES

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8.2 Petaluma Valley GIS Data Sources

Bureau of Indian Affairs – California Department Forestry and Fire Protection Land Ownership

City Footprints – Permit and Resource Management Department (PRMD), County of Sonoma, 2006

Climate Station Locations – MesoWest, CoCoRaHS and UC Davis, Sonoma Water

County Line – County of Sonoma GIS Central

Elevation – Sonoma County Vegetation Mapping and LiDAR Program, North American Vertical Datum 1988 (NAVD88)

General Plan Land Use – Sonoma County Permit Resource Management Department, 2020 General Plan

GSP Study Area Watershed – Sonoma Water

Groundwater Availability – Sonoma County Permit and Resource Management Department (Permit Sonoma)

Groundwater Basins – California Department of Water Resources, Bulletin 118

Land Use Survey – Department of Water Resources, 2012 land use survey

Major Rivers and Creeks – Department of Water Resource, National Hydrography dataset

Managed Wetlands – Department of Water Resources, 2014 Crop Mapping

Protected Areas – California Protected Areas Database, 2017 holdings

Resource Conservation District (RCD) – County of Sonoma GIS Central

Vegetation and Agriculture classes – Sonoma County LiDAR and Vegetation Mapping Program and Sonoma Water

Water Companies & Other Public Water Suppliers – County of Sonoma GIS Central

Water Infrastructure – Sonoma Water

Water Wells and Well Density – by Sonoma County Water Agency with source data courtesy of California Department of Water Resources Online System for Well Completion Reports (OSWCR - https://data.cnra.ca.gov/dataset/well-completion-reports), Permit Sonoma, and the USGS Well Density and Known well Locations – U.S. Geological Survey dataset developed for Hydrologic and Geochemical Characterization of the Santa Rosa Plain Watershed, Sonoma County, California (https://pubs.usgs.gov/sir/2013/5118/)

Appendix 1-A
Comments Received on Petaluma Valley Groundwater Sustainability Plan

PETALUMA VALLEY GROUNDWATER SUSTAINABILITY PLAN COMMENTS EXECUTIVE SUMMARY			
DATE RECEIVED	**NAME**	**COMMENTS**	**RESPONSE TO COMMENTS**
COMMENTS RECEIVED BEFORE OCTOBER 1, 2021			
9/7/2021	Robert Pennington	General comment - I recommend shortening this section where possible. A few suggestions of sections that could be shortened include: Discussion of pre-SGMA GMP History related to basin boundary geology section (paragraph two of HMC) water budget (perhaps methods, descriotions of climate scenarios and other details could be reserved for main body of report).	Section revised, as recommended.

PETALUMA VALLEY GROUNDWATER SUSTAINABILITY PLAN COMMENTS SECTION 1 INTRODUCTION			
DATE RECEIVED	NAME	COMMENTS	RESPONSE TO COMMENTS
COMMENTS RECEIVED OCTOBER 1-31, 2021			
10-31-2021	Coalition including: The Nature Conservancy, Audubon California, Local Govt Commission, Union of Concerned Scientists, Clean Water Action/Clean Water Fund (Coalition)	Stakeholder engagement during GSP development is insufficient. SGMA s requirement for public notice and engagement of stakeholders is not fully met by the description in the Community Engagement Plan (Appendi 1-E). The GSP states that the GSA Advisory Committee includes representatives from the tribal and environmental stakeholder community, and that the Advisory Committee will continue to meet during GSP implementation. However, we note the following deficiencies with the overall stakeholder engagement process: The GSP documents opportunities for public involvement and engagement through monthly informational emails, the GSA website, public forums, presentations to stakeholder groups within the subbasin, a rural community engagement program, and GSA Board, Advisory Committee and community meetings. There is no e plicit identification of a DAC representative on the Advisory Committee or other outreach targeted to DACs and drinking water users. Other than representation on the Advisory Committee, outreach to tribes and environmental stakeholders is described in general terms. The role that the Advisory Committee plays during the GSP implementation process is unclear. **RECOMMENDATIONS: 1.** In the Community Engagement Plan, describe active and targeted outreach to engage DACs and domestic well owners throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. 2. Provide more information on the role of the Advisory Committee during the GSP implementation process. 3. Utilize DWR s tribal engagement guidance to comprehensively address all tribes and tribal interests in the subbasin within the GSP.	Specific stakeholder engagement during various phases of GSP development and implementation is described in Sections 1.4.2. Language added describing specific outreach to drinking water users (rural residential well owners). Language added to Section 1.4 regarding outreach to tribes , environmental and other stakeholders, and in Section 1.4.2.4 regarding the ongoing role of the Advisory Committee. Langauge added to Section 1.4. The community engagement plan will be updated during the GSP implementation process. Language added. Comment noted. Language added regarding post-GSP tribal engagement.
COMMENTS RECEIVED BEFORE OCTOBER 1, 2021			

DATE RECEIVED	NAME	COMMENTS	RESPONSE TO COMMENTS
2/7/2021	Peter iel	No comment	Comment acknowledged
1/25/2021	Drew A Buechley	Seems fine and informative. Provided grammatcial, punctuation and style comments.	Comment acknowledged
1/24/2021	Rebecca C Ng	My comments are regarding typos or word choices not content.	Section revised, as recommended
1/21/2021	John Shribbs	Section 1. Good description of the the processes that are going into the formation of the GSA and how it meets state requirements. Terrible description of what is groundwater, what is a GSA, what does it actually do, why does anyone care, etc. Yes we are coming up with plan but no idea what that plan is all about. Introduction should start with what a GSA does and the current need for it, why is state requiring it, etc. Lots of verbiage about process, it is dominating the whole section. Another gripe I have is the many sections about community outreach in process using surveys and social media but very little has been done to date. I doubt most citizens in Petaluma even now what GSA stands for. I have to e plain to to most of the people I talk to. The process parts all say what we are going to do but not if it actually happened. Long lists of good intentions. Sounds like it was written to meet state requirements rather than be something public could read to understand what the GSA is or does.	Comment acknowledged.
9/7/2021	Michael Healy	p. 1-4 I wasn t aware that portions of Marin County are included in our Basin. Also, Figure 1 doesn t seem to support that, unless the boundary minimally jumps over the meanders of San Antonio Creek.	Marin County is not included in Basin. Section revised to correct this.

PETALUMA VALLEY GROUNDWATER SUSTAINABILITY PLAN COMMENTS SECTION 2 PLAN AREA			
DATE RECEIVED	**NAME**	**COMMENTS**	**RESPONSES TO COMMENTS**
COMMENTS RECEIVED OCTOBER 1-31			
11/2/2021	Rick Savel	Groundwater basin overdraft cone of depression, the shifting of the southern basin boundary divide separating the Laguna Santa Rosa and Petaluma groundwater basins in the vicinity of the surface watershed divide boundaries, and hydraulic inter-connection flow reversal of sub-surface groundwater recharge. (CWD Cardwell,1951). Penngrove s EIR lawsuit against the city of Rohnert Park found the city s General Plan EIR inadequate as it had not properly evaluated groundwater drawdown impacts to water supply wells outside the city. The PES Environmental MODFLOW model analysis noted overdraft conditions and a cone of depression of depths up to 200 feet in the groundwater basin due to e cessive pumping of the city s 42 municipal water supply wells. Further analysis of groundwater basin conditions was conducted by the City of Rohnert Park: 2004 Water Supply Assessment and the 2005 Sonoma County Canon Manor West EIR. Both studies identified groundwater basin overdraft conditions and anomalies to the historically documented location (CWD Cardwell,1951) of the Laguna Santa Rosa and Petaluma sub-surface groundwater basin divide. The Canon Manor West EIR noted: Groundwater pumping patterns have changed over time in the study area with groundwater pumping increasing significantly in the 1970s and early 1980s. As a result of this pumping increase, groundwater levels declined over a significant portion of the basin and the groundwater divide between Copeland Creek and Lichau Creek shifted southward from its documented 1950 location in the Canon Manor area to its current location in the vicinity of East Railroad Ave. north of the main stem of Lichau Creek. This shift in the groundwater basin divide induced hydraulic sub-surface inflow to the northern basin effectively capturing recharge occurring in the watershed drained by the northernmost tributaries of Lichau Creek. This change in flow direction represents capture by municipal wells to the north of groundwater recharge that historically flowed to the south	As waterlevels continue to recover near the boundary of the Santa Rosa Plain Subbasin and the Petaluma Valley Basin, this issue raised by the comment becomes diminishingly important. Now that waterlevels near the boundary are nearly flat, there is likely no longer a flow reversal .
10-31-2021	Coalition	RECOMMENDATIONS: Provide a map of DACs and more information about the population of each identified DAC. 1. Identify the sources of drinking water for DAC members, including an estimate of how many people rely on groundwater (e.g., domestic wells, state small water systems, and public water systems). 2. Include a domestic well density map for the subbasin. 3) Include a map showing domestic well locations and average well depth across the subbasin.	Figure 2-3 modified to show DACs . Language added regarding domestic well numbers. Current information regarding specific well types are inadequate to show domestic well density, locations and average well depths.
COMMENTS MADE BEFORE OCTOBER 1, 2021			
1/24/2021	Rebecca C Ng	1) The font styles and font sizes change in the document. Some areas are in the Table of Contents and bottom of page 12 and top of page 13. The Table of Contents is in a different font from the rest of the chapter.	Section revised, as recommended
		2) 2.8 of the Table of Contents, titled Additional GSP Elements (Reg. 354.8(g)) should be organized better and differently. Should the City of Petaluma General Plan 2025 be moved to be with the City of Petaluma General Plan in 2.6?	TOC reorganized.
		3) On page 4 in Section 2.2 , Table 2-1 is referenced but Table 2-1 was not provided as part of Chapter 2.	Reference removed

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		4) It is noted on page 7 in Public Water Supply Well Monitoring, that SWRCB monitors water systems that serve the public with 15 or more connections and data is available. for those. You might know that Sonoma County Environmental Health monitors State Small Water Systems with 4 - 14 connections and Transient and Nontransient noncommunity water systems. Environmental Health would probably share water quality information with the PVGWSA.	Comment acknowledged
		5) Spaces needed to separate words: Last sentence on page 7 first paragraph of Stormwater Management Planning, third sentence.	Section revised, as recommended
		6) First sentence of last paragraph on page 9, integrates should be integrate.	Section revised, as recommended
		7) Fourth paragraph of Water Conservation Program: ,,,new performance measures for CII water use . What is CII?	Acronym spelled out
		8) First sentence at top of page: spell out VOMWD.	Section revised, as recommended
		9) In the same paragraph discussing Sonoma-Marin Saving Water Partnership within the Subbasin, why is the city of Sonoma and VOMWD in the Petaluma Valley groundwater basin and the city of Petaluma is not?	Reference removed and corrected
		10)In section 2.7, Well and Project Permitting Policies and Procedures, the well permitting and Project permitting is repetitive. Can the project permitting section be re-written so it s not a repeat?	Section revised, as recommended
3/10/2021	John Shribbs	Abbreviations in figures aren t defined and are confusing	Figures revised
		Will there be a description of the figures?	Figures are described in te t
		Generic references to studies and plans, but no analysis	Comment acknowledged
9/9/2021	Chelsea Thompson	The San Francisco Bay Regional Water uality Control Board (SFBRW CB) implements water quality regulations in the watershed, including establishing Total Ma imum Daily Loads for pathogens and sediment in Sonoma Creek, adopting General Waste Discharge Requirements (WDRs) for vineyard discharges, and for stormwater and wastewater discharges.... **Throughout paragraph, SFGBRWQB change to SFBRWQCB**	Section revised, as recommended
		Pg 2-2. Within the Basin, UWMPs are prepared by Sonoma Water (as a wholesaler Sonoma Water 2016) and the City of Petaluma (as a water retailer City of Petaluma 2016). The two UWMPswere adopted in 2016 and were updated in 2021. The UWMPs discuss and describe thefollowing:...**Update UWMP reference to adopted 2020 Plan?**	Section revised, as recommended
		Pg 2-9. The Sonoma-Marin Saving Water Partnership represents 10 water utilities in Sonoma and Marin counties that are signatories to the California Urban Water Conservation Council (CUWCC) and have joined to create a regional approach to water use efficiency. Within the Basin, these utilities include the City of Petaluma and Sonoma Water. Each of these member utilities have water conservation programs to assist their communities in reducing water use. Water conservation and water use efficiency program elements specific to the Sonoma-Marin Saving Water Partnership include the following: **Update CUWCC with California Water Efficiency Partnership (CalWEP)**	Section revised, as recommended

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
9/7/2021	Robert Pennington	It would be useful to identify streams that are listed as critical habitat for threatened and endangered aquatic species.	Habitat dependent streams are identified in Section 3, in groundwater-dependent ecosystem discussion.

COMMENTS MADE ON PRIOR COMBINED SECTIONS 1 AND 2			
DATE RECEIVED	**NAME**	**COMMENTS**	**RESPONSES**
1/4/2019	Chelsea Thompson	In 2014, the State of California enacted the Sustainable Groundwater Management, including in the Petaluma Valley	Section revised, as recommended
		I don t believe there is an active USGS stream gauge on the Petaluma River. There was one at Copeland but it has been inactive since October 2016.	Section revised, as recommended
		There is no Figure 2-7b, there are two Figures labeled 2-7c.	Figure revised
		IRMWP, change to IRWMP	Section revised, as recommended
		Signatories to California Water Efficiency Partnership (CalWEP), no longer to CUWCC.	Section revised, as recommended

PETALUMA VALLEY GROUNDWATER SUSTAINABILITY PLAN COMMENTS SECTION 3 BASIN SETTING			
DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
COMMENTS RECEIVED OCTOBER 1-31, 2021			
10/25/2021	Roy Smith	The basis for policies and actions in this GSP stem from a 50 year predictive model of 30 years of normal rainfall followed by 20 years of severe drought. Such a model is not supported by current Climate Change science, but rather opts for a highly optimistic near-term environment, and a future stress run without consideration of compounding factors. Future conditions are far more likely to be non-linear. That is, precipitation patterns will not reflect historic periods, but rather shift back and forth violently, just as we have seen with this year s severe drying followed by sudden flooding deluge (13 of rainfall total last year, and then10 in the last 48 hours). The basis for such volatility can be found in the increasing loss of temperature differential between the Arctic and temperate North American continent. As this differential diminishes, the dominant jet stream band breaks down to a greater and greater degree, leading to incipient high pressure off the California coast, heat domes, and monsoon precipitation events. It is possible to predict the breakdown of the jet stream by looking at modeling for the loss of Arctic sea ice, which is now e pected by the end of this decade. This implies that an assumption of 30 years of normal wet years moving forward is wildly optimistic, and misleading as a basis for planning	See appendi 3-E for source of data used in projected model simulations. The climate projection used in the future simulations is model output from a global circulation model. The climate does reflect the current Climate Change science.
		Predictions for groundwater pumping rates for land owners during prolonged drought assume household efficiencies comparable to urban residents, and, if need be, mandated monitoring and restrictions on e traction. However, this fails to take into account the larger system impacts such a severe, prolonged drought would have on the residents of Sonoma County. When (not if) we enter a cycle of prolonged drought and heat, agriculture in the Central Valley will also be e periencing equal or greater stress. The precautionary principle must assume not just a local water availability issue, but a collapse in California s water-intensive agricultural sector. In response to diminished supply and increased cost for food, land owners in Sonoma County will be compelled to plant crops or fodder on scale. Intensive food production in our dry-summer climate is e tremely water demanding, even with modern technology, and a shift to cropping would result in groundwater pumping far e ceeding the models employed in this GSP. Attempts by local government agencies to limit pumping at the cost of a communities ability to feed themselves would lead to rampant social crisis.	Comment noted.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
10/29/2021	Sebastian Bertsch	Fig. 3-40: The budget is predicated on abnormally wet years at the start of the model. The budget should also be provided with a more realistic precipitation prediction. Table 3-2: The current water budget does not consider that there may be very dry years during the life of the GSP, such as we have e perienced in the past. This water budget is dependent on an unrealistic hope for consistent high rainfall years.	The approach used in these GSPs is based on data and models vetted by the scientific community and applicable to CA. Therefore, the modeling analysis used the best available science that was available at the time the GSP was developed. The California 4th Climate Change Assessment is the current benchmark in climate change analysis for the state.The chosen model includes an e tremely dry and hot period near the last 20-years of the simulation period. Adaptive management and updates to data and science in the future will allow to re-evaluate climate scenarios and effects of GSP implementation through the assessments every 5 years.
11/2/2021	Rick Savel	Below is an e cerpt from a report (see SAVEL PV SRP_11022021 comment) I compiled and submitted to PRMD regarding Penngrove area Community Separator recommendations. 3) involves the shifting of the southern basin boundary divide separating the Laguna Santa Rosa and Petaluma groundwater basins in the vicinity of the surface watershed divide boundaries and hydraulic inter-connection flow reversal of sub-surface groundwater recharge. (CWD Cardwell,1951). My question is: **#1) will this unresolved "sub-surface" divide condition be taken into consideration when determining the basin boundaries for further analysis and evaluation of existing and future conditions and #2) as the EIR data and analysis pointed out, this involves drafting recharge from Lichau Creek which is identified as Steelhead bearing creek.** According to the State Fish & Game Lichau Creek Survey Report (See Savel_Attchmnt1_PetalumaR_LichauCr_Willowbrook), conducted summer 2007, completed March 2008, Lichau Creek should be managed as an anadromous, natural production stream. **What impact is this hydraulic inter- connection “flow reversal” of sub-surface groundwater recharge having on Lichau Creek recharge flows on Penngrove wells and fish habitat?**	Obtaining improved information on the subsurface nature and hydraulic communication accross Subbasin boundaries (including potential changes in the direction and magnitude of groundwater gradients) is identified as a primary data gap in Section 3.1.8. Planned studies and information gathering to address this data gap are described in Section 7.2.4 and include evaluation of geophysical data collected across boundaries, performance and analysis of aquifer tests, and evaluation of future groundwater-level monitoring data. It is noted, that subsequent to the conditions described by the commentor, groundwater levels within the southern portions of the Santa Rosa Plain Subbasin have recovered, reducing the potential for any future flow reversals across the boundary.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
10/12/2021	Deborah Eppstein	Thank you for all your work on these GSAs. Although I not am a water e pert, I am a scientist. As a scientist, I am very concerned that the climate model chosen, predicting wetter weather for the ne t 20 years, does not reflect best current knowledge concerning hotter drier climate, with significantly more water loss to evaporation-transpiration. Even with a slightly wetter model, predictions are for precipitation to come in shorter, more intense periods during the winter, with much less during the former shoulder periods of spring and fall. Even if greater total precipitation, this pattern causes more runoff and less ground water recharge. Also climate predictions include more intervening years of severe drought which further cause ground water levels to lower, even if they are followed by wetter years. Using only a model that predicts more than average rainfall for the ne t 20 years is ignoring the science. At very least I recommend that you use a range of options, and prepare for the worst scenario. If updates are made every 5 years, we could be left high and dry (literally) in 5 years if we base our current planning on a wetter ne t 20 years, but that does not materialize. I have not down an e haustive search, but for e ample, see article below by McEvoy et al (2020): Earths Future Vol 8, issue 11 Nov 2020 Projected Changes in Reference Evapotranspiration in California and Nevada: Implications for Drought and Wildland Fire Danger. Daniel J. McEvoy, David W. Pierce, Julie F. alansky, Daniel R. Cayan, John T. Abatzoglou. First published: 29 October 2020. https://doi.org/10.1029/2020EF001736 Also, what analysis is being done for all the unincorporated areas that are not within the three GSAs? Both agriculture and cannabis as well as homes use ground and surface water in these areas, and this usage may increase significantly if there is not a solid water availability analysis to guide future permitting. Even the state Department of Cannabis Control has asked the county (through Permit Sonoma) to perform analyses of cumulative impacts of water usage across the entire county, for all water uses, surface and groundwater. NOAA has also requested such. I hope you will commit to revise these GSA s before they need to be submitted, to include additional climate prediction models encompassing less precipitation, greater water loss due to evapotranspiration, and periodic years fo e tended drought. This may be the new normal. Thank you for your consideration.	The concern that the chosen model does not reflect best current knowledge is unfounded (see appendi 3-E). The best current knowledge is actually derived, in part, from the chosen model. The chosen model (HadGEM2-ES RCP8.5) is one of the Climate Model Intercomparison Project version 5 (CMIP5) models that was used in the McEvoy et al (2020) listed by the commentor. As such the chosen model is well-founded and defensible. Secondly, the increased evaporative demand referenced by the comment is very well accounted for by the groundwater flow model. The groundwater model uses a sophisticated set of computations to account for the impact of increased temperatures on evaporative demand. Similarly the changed hydrologic patterns mentioned by the comment will be well accounted for by the model. Groundwater use outside of the Subassin area have been accounted for in the groundwater model. This includes current and projected ag, rural, and municipal groundwater users.
10/31/2021	Coalition	The GSP states (p. 3-49): Initial mapping of interconnected surface water in the Basin was informed by conditions simulated using the hydrologic model developed by the USGS (further described in Section 3.3). The model was used to evaluate stream reaches that are simulated to be more interconnected to shallow groundwater. Results of this analysis indicate that much of the mainstem of the Petaluma River, along with much of Tolay Creek and the lower reaches of Lichau, Lynch, Washington, Adobe, Ellis, and Capri creeks are likely interconnected surface waters. However, no map of stream reaches in the basin is provided.	Fig. 3-20a added to show interconnected streams.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		Section 3.3 (Water Budget) does present values of stream leakage to groundwater as estimated by the Petaluma Valley Integrated Groundwater Flow Model (PVIHM), although does not present further information on the groundwater model. This section says that more information on the model is presented in Appendi 3-A. However, Appendi 3-A is entitled Water Year Type Classification for Petaluma Valley, Santa Rosa Plain, and Sonoma Valley . The actual appendi that describes the PVIHM appears to be missing from the Draft GSP. **RECOMMENDATIONS:** 1. Include the missing appendi that describes the PVIHM. Ensure that the appendi describes data incorporated into the model, including spatial location of monitoring wells and screening depths, stream gauge data, and description of the temporal (seasonal and interannual) variability of the data used to calibrate	Fi ed added Appendi 3-C. Fi ed added Appendi 3-C.
		2. Provide a map showing all the stream reaches in the basin, with reaches clearly labeled as interconnected (gaining/losing) or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP 3. Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. 4. Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California s climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.	Fig. 3-20a has been added to illustrate interconnected surface water. Due to data gaps within the groundwater level monitoring network, output from PVIHM was used as the primary source of information for mapping ISW. The ISW mapping will be further refined with measured data collected during GSP implementation. As noted above, output from the PVIHM were used as the primary source of information for mapping ISW. Monthly output from the entire simulation period of 1969 through 2018, which encompasses seasonal data over multiple water types was used for this analysis. The ISW mapping will be further refined with measured data collected during GSP implementation.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		5. Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustere wells) along surface water features in the Monitoring Network section of the GSP.	Data gap areas for Interconnected Surface Water monitoring are depicted on Figure 5-7a. A multi-level monitoring well is proposed in one of the three identified data gap areas. Additional stream-adjacent shallow monitoring well sites will be identified during GSP implementation.
		The identification of Groundwater Dependent ecosystems is incomplete. The GSP maps GDEs using the Sonoma County Veg Map, which we agree is the best available data for the subbasin. To identify where the potential GDEs are likely to have connection with groundwater, the rooting depths of common tree species were compared to available depth-to-groundwater data. The GSP states (p. 3-51): The DTg mapping UTILI ED available contoured springtime datasets for the shallow aquifer system (from 2015 and 2016) and high-resolution LiDAR data. To address GDE Work Group member concerns that groundwater levels were generally at lower levels in 2015 and 2016 due to dry conditions, minor adjustments in some areas were made to incorporate the shallowest depth-to-water on record for each well based on review of all available data from 2005 to 2020. However, no further details on the available data from 2005 to 2020 was provided.	Maps generated to support the analysis of areas with depth to water shallower than 30 feet using all available data from 2005 to 2020, which were shared with the GDE practitioner work group, have been added to Appendi 4-C.
		The GSP states (p. 3-51): Following guidance from TNC, potential vegetation GDEs were mapped for areas with DTW of 30 feet or less to incorporate the potential rooting depths of oak trees (TNC 2018). If Valley Oaks e ist in the subbasin, we recommend instead that an 80-foot depth-to-groundwater threshold be used when inferring whether Valley Oak polygons in the Veg Map derived potential GDE map are likely reliant on groundwater. This recommendation is based on a recent correction in TNC s rooting depth database,2 after finding a typo in the ma rooting depth units for Valley Oak. This resulted in a specific change in the ma rooting depth of Valley Oak from 24 feet to 24 meters (80 feet). For all other phreatophytes, we continue to recommend that a 30-foot depth-to-groundwater threshold be used when inferring whether all other vegetation polygons are likely reliant on groundwater.	The citation provided in comment refers to Valley Oaks inhabiting fractured and jointed metamorphic rock . Vegetation inhabiting such geologic conditions are not relevant to the GSP as these conditions are not found within the boundary of the Subbasin. (Lewis DC Burgy RH (1964) The relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing. J. Geophys. Res. 69(12):2579-2588.) Rooting depths for vegetation GDEs are planned to be further assessed as part of the additional studies described in Section 7.2.4.1.
		RECOMMENDATIONS: 1. Discuss available shallow groundwater data. Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around Veg Map derived potential GDE polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the Veg Map derived potential GDE map are supported by groundwater in an aquifer.	Comment noted. As described above, all available groundwater level data from 2005 to 2020 were used to evaluate areas with depth to water shallower than 30 feet (results added to Appendi 4-C). These areas will continue to be refined during GSP implementation as new monitoring locations are added.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		2. Refer to Attachment B for more information on TNC s plant rooting depth database. Deeper thresholds are necessary for plants that have reported ma imum root depths that e ceed the averaged 30-ft threshold, such as Valley Oak (uercus lobata). We recommend that the reported ma rooting depth for these deeper-rooted plants be used if these species are present in the subbasin. For e ample, a depth-to-groundwater threshold of 80 feet should be used instead of the 30-ft threshold, when verifying whether Valley Oak polygons are connected to groundwater.	The citation provided in comment refers to Valley Oaks inhabiting fractured and jointed metamorphic rock . Vegetation inhabiting such geologic conditions are not relevant to the GSP as these conditions are not found within the boundary of the Subbasin. (Lewis DC Burgy RH (1964) The relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing. J. Geophys. Res. 69(12):2579-2588.) Rooting depths for vegetation GDEs are planned to be further assessed as part of the additional studies described in Section 7.2.4.1.
		3. Further discuss data gaps for GDEs, including specific plans and locations for additional shallow monitoring wells.	A new figure (Figure 5-8) has been developed showing the proposed shallow aquifer system and interconnected surface water monitoring networks and initial data gap areas overlain with GDEs, which includes interconnected surface water. See section 7 for information on how GSP will address data gaps in the GDE s.
		Native vegetation and Managed Wetlands: Native vegetation and managed wetlands are required to be included in the water budget. The integration of native vegetation into the water budget is insufficient. The water budget includes a separate item for evapotranspiration, but combines crop, native vegetation, and riparian Evapotranspiration into one term. The omission of e plicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the subbasin.	The water budget components of native vegetation and managed wetlands will be assessed in future implementation. The presence of wetlands are shown on Figure 2-3 and described in Section 2.
		RECOMMENDATIONS: 1. uantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation.	The native vegetation component of the water budget will be incorporated in future updates to the GSP.
		2. State whether or not there are managed wetlands in the subbasin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets. **RECOMMENDATIONS (Water model and climate change):**	It is assumed that managed wetlands shown on Figure 2-3 within the Subbasin do not rely on groundwater. However, this is an area of uncertainty that will be evaluated during GSP implementation.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		1. Consider other GCM projections to account for uncertainty beyond median statistics. 2. Integrate climate change, including e treme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions. 3. Incorporate climate change into surface water flow inputs, including imported water, for the projected water budget. 4. Incorporate climate change scenarios into projects and management actions.	The median statistics were generally used to compare various GCM s and their appropriateness for the Sonoma County GSP s. The downscaled, transient GCM output for the Santa Rosa Plain Subbasin was used for the projected simulation model, not the median statistic. The chosen model includes an e tremely dry and hot period near the last 20-years of the simulation period. The chosen model includes an e tremely dry and hot period near the last 20-years of the simulation period. This was performed for the GSP. See appendi 3-E, section 3.5, which shows that the Russian River is capable of meeting demands for all climate scenarios. This was performed for the GSP.
COMMENTS RECEIVED BEFORE OCTOBER 1, 2021			
9/7/2021	Michael Healy	The December 22, 2020 memo from Pete Parkinson discussing Rural Residential Housing Unit Projections is outdated, in that it does not include the County s (very high) draft RHNA allocations for the unincorporated area. I realize the County has appealed, seeking to reduce that allocation by half. The appeal is unlikely to succeed, but even half of the draft allocation would mean a lot more units than what is discussed in Pete s memo.	Comment acknowledged. Due to the current uncertainity, the housing numbers will be revised in the five-year update, or sooner if data and funding are available.
9/7/2021	Robert Pennington	Interconnected surface waters are defined in the GSP Regulations as surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. ~~A stream segment is interconnected where (and when) the groundwater water table elevation equals or e ceeds the streambed elevation.~~ See strike out above. This statement is inconsistent with the preceding definition interconnected surface water, and inconsistent with te t lower down in the same paragraph. If groundwater levels must be at or above the stream, then interconnected-losing streams would not be considered interconnected.	Section revised, as recommended.

PETALUMA VALLEY GROUNDWATER SUSTAINABILITY PLAN COMMENTS SECTION 4 SUSTAINABLE MANAGEMENT CRITERIA			
DATE RECEIVED	**NAME**	**COMMENTS**	**RESPONSES TO COMMENTS**
10/31/2021	Community Alliance with Family Farmers	Sustainable Management Criteria. We are concerned that the metric for wells with historical declines then recovery uses 2010-2019, which include drought years when a number of local wells went dry and other significant impacts occurred. Setting these relatively low water levels as a base standard could allow for far greater impacts during future droughts. Regarding Depletion of Interconnected Surface Water Setting a minimum threshold at 40 percent of representative monitoring point wells during drought years would allow for significant impact to riparian habitat including vegetation, aquatic species and all related ecosystems. Sustainable agriculture depends on healthy, diverse surrounding ecosystems that support populations of beneficial birds, insects and other creatures, and could have a significant impact on the potential loss of recharge opportunities.	Comment not applicable to this basin. Comment not applicable to this basin.
10-31-2021	Coalition	The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is insufficient. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds. **RECOMMENDATIONS:** 1. Chronic Lowering of Groundwater Level. Describe direct and indirect impacts on DACs, drinking water users and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels.	DACs in the GSP are grouped into beneficial user types based on their source of water supply, which is primarily municipal water or water from private domestic wells. The effects of minimum thresholds and undesirable results for chronic lowering of groundwater levels on all beneficial users, including DACs, drinking water users and tribes, are described in Sections 4.5.2.4 and 4.5.4.3, respectively. Additional language has been added to Section 4.5.4.3 to clarify that these specific beneficial users are considered. The methodology for establishing minimum thresholds for chronic lowering of groundwater levels incorporates the statistical evaluation of known completion information for water supply wells located within the vicinity of each potential RMP, to avoid potential impacts on e isting well users, including DACs, drinking water users and tribes.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		2. Degraded Water uality. Describe direct and indirect impacts on DACs, drinking water users and tribes when defining undesirable results for degraded water quality. For specific guidance on how to consider these users, refer to Guide to Protecting Water uality Under the Sustainable Groundwater Management Act.	DACs in the GSP are grouped into beneficial user types based on their source of water supply, which is primarily municipal water or water from private domestic wells. The effects of minimum thresholds and undesirable results for degraded water quality on all beneficial users, including DACs, drinking water users and tribes, are described in Sections 4.8.2.7 an 4.8.4.3, respectively. As described in Section 4.8.2.7, the minimum thresholds are designed to avoid negative effects to groundwater quality associated with implementation of the GSP. Avoiding degradation of groundwater quality from the identified COCs helps maintain drinking water quality providing benefits for domestic well users. Additional language has been added to Section 4.8.4.3 to clarify that these specific beneficial users are considered.
		3. Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on DACs, drinking water users and tribes.	As described in Section 4.8.2.7, the minimum thresholds are designed to avoid negative effects to groundwater quality associated with implementation of the GSP. Avoiding degradation of groundwater quality from the identified COCs helps maintain drinking water quality providing benefits to DACs, drinking water users and tribes.
		4. Set minimum thresholds and measurable objectives for all water quality constituents within the subbasin that are impacted by groundwater use and/or management. Ensure they align with drinking water standards **<u>Groundwater Dependent Ecosystems and Interconnected Surface Waters</u>** **RECOMMENDATIONS:**	As described in Section 4.8.1, the GSP identified COCs based on three criteria: 1. They have an established level of concern such as an MCL or secondary ma imum contaminant level (SMCL), or a level that reduces crop production 2. They have been found in the Subbasin at levels above the level of concern and are routinely analyzed and reported through e isting regulatory monitoring programs 3. The occurrence of the COC is e tensive throughout the Subbasin New or additional water quality constituents may be identified as potential COCs applicable to the GSP implementation activities through the planned routine consultation and information sharing with other regulatory agencies described in Section 7.2.2. The GSA would then consider adding potential COCs and assigning SMC during the 5-year GSP updates.

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		When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., e tent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when significant and unreasonable effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds can be determined.	As described in Sections 4.10.2.1 numerous and significant information and data gaps limit the GSA s ability to characterize the potential effects of groundwater conditions on biological response impacts to GDEs. Section 7.2.4 describes plans to fill these data and information gaps during the initial years fo GSP implementation, which would be used to consider future refinements of the SMC for chronic lowering of groundwater levels.
		When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the subbasin are reached.15 The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-e isting state or federal law.	As described in Sections 4.10.2.1 numerous and significant information and data gaps limit the GSA s ability to characterize the potential effects of groundwater conditions on biological response impacts to GDEs. Section 7.2.4 describes plans to fill these data and information gaps during the initial years fo GSP implementation, which would be used to consider future refinements of the SMC for chronic lowering of groundwater levels.
		When establishing SMC for the subbasin, consider that the SGMA statute Water Code 10727.4(l) specifically calls out that GSPs shall include impacts on groundwater dependent ecosystems .	GDEs are identified as beneficial users within the GSP and potential impacts on GDEs are specifically addressed with other ecological land uses and users in Section 4 for each sustainability indicator.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
10/28/2021	California Dept of Fish and Wildlife	Sustainable Management Criteria (SMC) for Depletion of Interconnected Surface Waters (ISWs) Comment: The GSA has established the following Minimum Threshold (MT) for the SMC for Depletion of ISWs sustainability criteria: Maintain estimated streamflow depletions below historical ma imum amounts. Metric: Shallow groundwater elevations are used as a pro y for stream depletion. The MT is the equivalent groundwater level, representing the 3 years (2014-2016) during which the most surface water depletion due to groundwater pumping was estimated between 2004- 2018. Minimum Thresholds should ensure regional groundwater e tractions do not lead to significant and adverse impacts on fish or wildlife resources by meeting plant and animal species temporal/spatial water needs including water availability especially for Threatened and Endangered species and Species of Special Concern. They should be designed to account for climatic/water year type variability. Where specific data are lacking, MTs should be conservative with respect to preserving fish and wildlife beneficial users of groundwater from undesirable results. Furthermore, the GSP states undesirable result occurs if MTs are e ceeded at 40 percent of RMP wells during drought years and 10 percent of RMP wells during non-drought years . It is unclear how these percentages relate to ecological impacts. The GSP should identify monitoring metrics for GDEs that will enable the GSA to characterize GDE vulnerability to groundwater depletion and associated undesirable results, and to undertake management intervention accordingly. The Department understands the need to use placeholder Sustainable Management Criteria and Minimum Thresholds due to the current lack of groundwater and stream discharge data throughout the planning area. However, numerous times during the Work Group meetings resource agency representatives commented that using a threshold that maintains estimated streamflow depletions at historically low levels is not appropriate for protecting ESA-listed salmonids. Setting Minimum Thresholds and measurable objectives using data from years with historically low rainfall (i.e., 2014- 2016) would likely create historically high streamflow depletion rates and potentially negatively impact GDEs and their critical habitat.	RESPONSE: Thank you for the recommendation. As outlined in Section 4.10.4.2, groundwater pumping is one of several factors that can contribute to depletion of interconnected surface water (ISW), including factors outside of GSA jurisdiction, like surface water diversions, lack of precipitation, and evapotranspiration by riparian vegetation. Because depletion of ISW by groundwater pumping cannot be measured directly, determining the proportion of depletion due to pumping is challenging. Recognizing the significant information and data limitations, as well as the importance of ISW to beneficial users in the basin, the depletion of ISW by pumping SMC is set using an adaptive approach. The current Minimum Thresholds for each RMP were chosen to be slightly below 2019 and 2020 groundwater levels. Lacking additional historical measurements at these RMPs, these MT choices were informed by observations from adjacent basins (Santa Rosa Plain and Sonoma Valley), which show that the years in the recent historical period with the greatest depletion (2014 2016) had shallow dry-season low groundwater levels typically slightly lower than 2019 and 2020 values. Given the limited period of record of data collection at RMP locations, an adaptive approach is outlined in Appendi 4-C in which future modifications to SMCs for this sustainability indicator will be incorporated as more data become available and as model simulations of surface water depletion are improved. While the Petaluma Valley Hydrologic Model (PVHM) offers a robust platform to accurately simulate most hydrologic processes in the basin, at present, it is not sufficiently calibrated to simulate surface water depletion from pumping with the degree of accuracy required to use the results here. It is anticipated that future updates to the model and additional data collection at each RMP will make these analyses possible at or before the 5-year update. Appendi 4-B outlines the adaptive approach for incorporating future model results and additional groundwater level observations to determine SMCs for depletion of ISW.

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		How Minimum Threshold prevents undesirable results	observations to determine SMCs for depletion of ISW. In general, this adaptive approach will mirror the approach given in the Santa Rosa Plain and Sonoma Valley GSPs. In these basins, model results demonstrate correlation between simulated shallow groundwater levels and simulated depletion of ISW by groundwater pumping. Thus, shallow groundwater levels Minimum Thresholds were chosen to appro imate the average amount of depletion during the 3 years with the highest levels of simulated streamflow depletion between 2004 and 2018. Mathematically, this 3-year average value over the 15-year evaluation period roughly corresponds with the 10th percentile of historical streamflow depletion at that location, by year, during 2004 2018. Undesirable results would occur if MT e ceedances occurred at two RMP wells during dry years or one RMP during normal or wet years. As described in Section 4.10.4.1, these percentages were selected based on input from the Interconnected Surface Water Practitioners Work Group. Recognizing that sources of depletion are varied, and likely include lack of precipitation during drought years, placing the different weights on drought and non-drought years helps address concerns e pressed by some Work Group and Advisory Committee members by ensuring that during normal/wet years the higher levels of estimated streamflow depletion from 2014-2016 are avoided (Appendi 4-C).
		The effect the Minimum Threshold will have on environmental beneficial uses and users of groundwater, and what impact it will have on fish and wildlife	**RESPONSE:** Thank you for the recommendation. As stated in **Section 4.10**, it is recognized that low summer baseflow in certain years can impact aquatic species, but until the amount of summer baseflow needed for these species is quantified (e.g., via instream flow targets), the specific impacts of the MT on beneficial uses and users of groundwater remain difficult to quantify. The current approach leverages historical data to avoid conditions lower than historical surface water depletion amounts.
		How the Minimum Threshold accounts for climatic/water year type variability	RESPONSE: Thank you for the recommendation. Undesirable results would occur if

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		Groundwater Elevations as a Proxy for Depletion of Interconnected Surface Water Minimum Thresholds The GSP fails to identify a significant correlation between ground water elevations and interconnected surface water depletions. The GSP identifies that the GSA will use groundwater elevation as a pro y for the depletion of interconnected surface water. In order for the GSA to use groundwater elevations as a pro y for depletion of interconnected surface water, the GSP should identify a significant correlation between groundwater elevations and interconnected surface water depletions as required by Title 23 CCR section 354.36(b)(1).The GSP currently attempts to correlate groundwater elevations with streamflow by modeling results however, a specific rate or volume of surface water depletions caused by groundwater should be developed to correlate groundwater levels with streamflow depletions. If a significant correlation is not determined, groundwater elevations used as a pro y for surface water depletions may misinform groundwater management activities and poorly predict instream habitat conditions for fish and wildlife species. The current proposed approach to maintain shallow groundwater gradients at current/historic levels may serve as an interim management approach but should be revisited to address the relationship between surface water - groundwater connectivity.	MT e ceedances occurred at two RMP wells during dry years or one RMP during normal or wet years. As described in **Section 4.10.4.1**, these percentages were selected based on input from the Interconnected Surface Water Practitioners Work Group. Recognizing that sources of depletion are varied, and likely include lack of precipitation during drought years, placing the different weights on drought and non-drought years helps address concerns e pressed by some Work Group and Advisory Committee members by ensuring that during normal/wet years the higher levels of estimated streamflow depletion from 2014-2016 are avoided (**Appendix 4-C**).

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		RECOMMENDATION: The GSP should either: 1) specify how groundwater elevations are significantly correlated to surface water depletions or 2) specify monitoring actions that will be taken to identify the location, quantity, and timing of surface water depletions caused by groundwater use, per Title 23 CCR Section 354.28(c)(6)(A), to better inform minimum thresholds for depletions of interconnected surface water. The monitoring plan should specify dates for completion of each monitoring task and should include a commitment to periodically re-evaluate groundwater usage based on the data collected.	**RESPONSE:** Thank you for the recommendation. The Petaluma Valley Integrated Hydrologic Model, Version 1 (PVIHM) is a sophisticated MODFLOW OWHM 1 model used to simulate inflows, outflows, e changes, and stores of water in the surface-water and groundwater system. It was developed by the USGS for the purposes of developing accurate water budgets for SGMA. The model leverages the best available data and science to accurately simulate key hydrologic processes. While the PVHM offers a robust platform to accurately simulate most hydrologic processes in the basin, at present, it is not sufficiently calibrated to simulate surface water depletion from pumping with the degree of accuracy required to use the results here. Where data are limited, the uncertainty of simulated hydrologic processes increases. The GSP notes that—like for nearly all GSAs—data are particularly limited for characterizing groundwater/surface-water interactions and surface water depletion due to pumping, resulting in greater uncertainty of these simulated processes. Appendi 4-D emphasizes that q uantifying surface water depletion due to pumping is a challenge because (1) it cannot be measured directly and (2) the influence of surface water depletion by pumping is often obscured by other factors, such as precipitation and runoff, diversions, evapotranspiration, and natural groundwater/surface-water interactions. The adaptive management strategy given in Section 4.10 outlines how additional data collection will guide model improvements to better represent groundwater/surface-water interactions and depletion of ISW by groundwater pumping. Additionally, Section 7.2, Section 5, and Appendi 7-A outline specific steps to implement additional studies and data gathering and improve model simulation of these processes during the implementation phase. As noted in Section 4.10 and Appendi 4-D, these improvements may inform the determination of appropriate revised SMCs for depletion of interconnected surface water.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
			1 Boyce, S.E., Hanson, R.T., Ferguson, I., Schmid, W., Henson, W., Reimann, T., Mehl, S.M., and Earll, M.M., 2020, One-Water Hydrologic Flow Model: A MODFLOW based conjunctive-use simulation software: U.S. Geological Survey Techniques and Methods 6-A60, 435 p., https://doi.org/10.3133/tm6a60Sonoma County Water Agency, 2020. Sonoma Valley Integrated Groundwater Flow Model, http://sonomavalleygroundwater.org/
10/30/2021	Milo Baker Chapter of the California Native Plant Society	These comments were created after reviewing Section 4 of the Draft Groundwater Sustainability Plan (DGSP) for the Santa Rosa Plain Ground Water Subbasin however, these comments are general enough that they can be applied to all three subbasins in Sonoma County.	
		The DGSP identi es various tools for evalua:ng the groundwater, from remote sensing to stream gauges and weather monitoring instrumentation, but this is monitoring, and the report does not discuss how they will apply this information. We are concerned that this is relying too much on deeper ground water resources and ignoring the shallower resources that are sustaining our native plants and vegetation communities. An additional cross check could be to use tree health, not only along riparian corridors but also in the plains. For e ample, valley oaks and their regeneration could be used for monitoring sub- surface waters levels. It has been documented that the best growth is attained when water tables are about 33 feet (10 m) below the surface and the trees are inundated every 5 years (Howard 1992). Ofen associated with seaonal wetlands, this species could be used to show the health of near surface water storage.	Section 5 of the GSP includes detailed monitoring plans, with information about monitoring the shallow aquifer. Comment noted on monitoring using tree health. Section 7.2.4.1 of the GSP describes the use of available remote sensing tools and datasets, such as the GDE Pulse tool developed by the Nature Conservancy will be assessed for tracking and comparing vegetation health with groundwater conditions.
		One of the sustainability indicators of the DGSP (Table 4-1) is depletion of interconnected surface water, but the emphasis on streamflows ignores the seasonal wetlands and seeps that are also direct indicators and can be evaluated and mapped on Google Earth based on size. We are concerned that depletion of water levels below 40 feet will likely change the native vegetation within the Santa Rosa basin, especially wetland endemics that are some of the more rare and endangered plants in the County.	Seasonal wetlands and seeps that are considered groundwater-dependent are also included within the freshwater marsh/aquatic classification that is incorporated within the GDE map (Figure 3-19). As described in Sections 4.10.2.1 numerous and significant information and data gaps limit the GSA s ability to characterize the potential effects of groundwater conditions on biological response impacts to GDEs. Section 7.2.4 describes plans to fill these data and information gaps during the initial years fo GSP implementation, which would be used to consider future refinements of the SMC for chronic lowering of groundwater levels.

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		The DGSP identifies surface and groundwater budgets and estimates groundwater overdraft but how can that be known if you don t have a baseline. There are two periods identified, historical (1976-2018) and current (2012 2018). According to ca.water.usgs.gov drought years in the historical period occurred between 1976-1977 (2 year of drought), 1987-1992 (6 years), 2001-2002 (2 year), 2007-2009 (3 years), with normal or above normal rainfall in between years. In the current year drought years occurred between 2012-2016 (5 years) with only barely normal rainfall. Since 2000, the longest duration of drought in California lasted 376 weeks (December 27, 2011 March 5, 2019) (7 years) (ca.water.usgs.gov) and that has been classified as a severe to e treme drought (ncdc.noaa.gov). NOAA also states that the 1980s and 1990s were characterized by unusual wetness with short periods of droughts of e tensive droughts, while the first two decades of the 2000s saw e tensive drought and e tensive wetness. What will the baseline be after a 3-year e treme drought (2019-2021) that is classified as intense with higher evapotranspiration rates (due to higher air temperatures)?	The impact of climate (including the current drought) on groundwater conditions will be monitored and evaluated during GSP implementation. Data and information obtained through this monitoring will be incorporated into future 5-year updates to the GSP.
10/29/2021	Sebastian Bertsch	GSP regulations require The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results. The GSP does not meet this standard. The GSP merely proposes an initial SMC focused on not e ceeding historical levels of depletion based on available data and modeling tools . There is no evidence provided that surface water depletion will be prevented by allowing continue historic levels of depletion. If there is no evidence that historical groundwater levels sufficient to protect surface water depletion, then they cannot be used as a standard. It is well known that many creeks and springs do not flow as they historically did. The assumption therefore, barring further evidence, is that groundwater e tractions are currently depleting surface flow.	As described in Appendi 4-B, information in the historical record linking surface water depletion and any related impacts to beneficial users directly to groundwater usage under the jurisdiction of the GSAs is very limited. For this reason, for this reason additional data collection focused on improving the understanding of surface water depletion is prioritized in the implementation plan. As additional information and data is collected during GSP implementation and potential impacts to benefical users, including GDEs, the measurable objectives will be further evaluated and refined as needed.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		Significant and unreasonable water quality conditions occur if an increase in the concentration of COCs in groundwater leads to adverse impacts on beneficial users or uses of groundwater, due to either: Direct actions by Petaluma Valley GSP projects or management activities As worded, this means depleted water quality is only a concern if it is the result of GSP projects. This seems to allow water contamination from any other source, such as agriculture which is historically a polluter of the aquifer.	As described in Section 4.8.2.7, the minimum thresholds are designed to avoid negative effects to groundwater quality associated with implementation of the GSP. Degraded water quality is the subject of robust federal, state, and local regulatory regimes carried out by a number of different entities and is not regulated by SGMA. For e ample, discharges and contamination from land uses, including agriculture is regulated by the NCRW CB. The GSA is not responsible for natural changes in groundwater quality or groundwater degradation caused by others.
		Maintain above historical low elevations while accounting for droughts/climate variability This is a disappointingly low standard to set. This will allow groundwater conditions to worsen to the worst possible historical record, while also providing a loop-hole that during droughts levels can be further depleted. This also makes climate change impacts a get out of jail free card, allowing further depletion.	In addition to the drought factor, a well impact depth is also calculated for each RMP and used to set the minimum threshold where potential impacts may occur to nearby water wells if groundwater levels reach historical lows. Additionaly, the implementation plan includes the development of improved information on well depths and locations and GDEs to better inform potential impacts to beneficial users related to the minimum thresholds. This information and data collected during GSP implementation will help determine whether future modifications to the minimum thresholds are needed.
COMMENTS RECEIVED BEFORE OCTOBER 1, 2021			
8/27/2021	National Marine Fisheries Service	Comment re: Minimum Thresholds: To develop sustainable management criteria for the depletion of interconnected surface water, the GSAs of the Sonoma County subbasins convened a Sonoma Sustainable Management Criteria for Depletion of Interconnected Surface Water Practitioner Work Group , which met several times in early 2021. NMFS was a participant in this group, and generally agrees with the sequential approach being proposed within the Sonoma County subbasins for developing sustainable management criteria addressing streamflow depletion caused by groundwater pumping. Essentially, the approach is to develop and use interim criteria until more appropriate and precise criteria, informed by studies relating groundwater levels, streamflow depletion rates, and instream habitat effects, can be developed.	Comment noted

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		We understand the need to use placeholder sustainable management criteria due to the current lack of groundwater and stream discharge data throughout the County. Gathering this data during the first few years of GSP implementation and updating the sustainable management criteria accordingly is a sound plan. However, as raised numerous times during the Work Group meetings, we do not feel an interim minimum threshold that maintains estimated streamflow depletions at historical ma imum amounts, as is currently proposed for the Santa Rosa Plain and Sonoma Valley subbasins, is appropriately protective when dealing with ESA-listed salmonids. Basic hydraulic principles dictate that groundwater flow is proportional to the difference between groundwater elevations at different locations along a flow path. Using this basic principle, groundwater flow to a stream, or conversely seepage from a stream to the underlying aquifer, is proportional to the difference between water elevation in the stream and groundwater elevations at locations away from the stream.	Minimum thresholds represent the groundwater elevation below which significant and unreasonable depletions of streamflow occur and represents a condition the GSA seeks to avoid, not maintain . The objective of SGMA is not to maintain levels at minimum thresholds but rather to be at the more aspirational measurable objectives by 2042, or even higher. Maintaining levels at minimum thresholds could certainly cause undesirable results and that is not the intention of SGMA nor this GSP.
		Minimum thresholds and measurable objectives consistent with the lowest groundwater elevations on record would likely create historically high streamflow depletion rates that, when combined with low surface flow input, would be very likely to adversely affect ESA-listed salmonids and their critical habitat. Analysis within the draft Sonoma Valley subbasin Sustainable Management Criteria chapter confirms the significant impact to instream flow volume that would likely occur under the proposed minimum criteria simulated instream flow within Sonoma Creek during 2014, 2015, and 2016 was diminished by appro imately 90 percent due to groundwater pumping (Figure 23).	Measurable objectives have been established to represent the average dry-season groundwater levels between 2004 and 2020 and are not consistent with the lowest groundwater elevation on record .
		Recommendation: NMFS is committed to working with GSAs, CDFW, and other stakeholders in determining what streamflow depletion level avoids significant and unreasonable impacts to beneficial uses of surface water, as those beneficial uses relate to ESA-listed salmon and steelhead survival and recovery. However, while data is collected to inform that analysis, we suggest the GSA follow guidance by the California Department of Fish and Wildlife that recommends conservative sustainability management criteria be established to ensure groundwater dependent ecosystem protection (CDFW 2019).	Comment noted

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		Comments re: Measurable Objective: The stated measurable objective (i.e., maintain groundwater levels within historical observed ranges) is likewise inappropriate when considering streamflow depletion impacts on ESA-listed salmon and steelhead. According to DWR (2017), measurable objectives are quantitative goals that reflect the basin s desired groundwater conditions and allow the GSA to achieve the sustainability goal within 20 years. Within groundwater subbasins where past streamflow depletion likely impacted ESA-listed salmonids and their habitat (e.g., near 90 percent depletion during 2014-16), maintaining groundwater levels within historical ranges is unlikely to result in sustainable groundwater management (i.e., avoiding all undesirable results) as required by SGMA regulation. Recommendation: We recommend the GSA craft measurable objectives that avoid potential streamflow depletion impacts on beneficial uses of surface water.	Measurable objectives have been established to represent the average dry-season groundwater levels between 2004 and 2020 and are not consistent with the lowest groundwater elevation on record . In addition to the description of measurable objectives the commentor provides, DWR (2017) also states that measurable objectives shall ...take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty . As additional information and data is collected during GSP implementation and potential impacts to benefical users, including ESA-listed salmon and steelhead, the measurable objectives will be further evaluated and refined as needed. Comment noted
8/9/2021	John Shribbs	Section 4.5.2.1. As indicated in Table 4-5-1, minimum thresholds for three of the 12 RMPs represent the calculate d well impact depths (i.e., at these locations the well impact depth is shallower than the historical low with the drought factor and is considered more protective of beneficial users). At the nine remaining RMPs the minimum thresholds based on the historical lows minus the drought factor were determined to be above (i.e., protective of) the calculated well impact depths. This is a paragraph below the table 4.5.1. Data is referenced but do not know which datapoints. Do you really e pect reader know which datapoints? Which are in the set of 12 and which are in the set of 9? You need to put in an e ample. Too many variables in equation to understand the process or calculation	Comment addressed. Clarifying te t, along with illustrative diagrams have been added to Section 4.5.2.1.
		Section 4.5.2.4. AG users section: Do we really know all the crops and farmers in the Baylands area and how they are using water? Reference is made to Fig 2-5 of the Plan Area but could not find immediately. Needs to be separate map inside the paragraph for easy reference.	Comment acknowledged. While we don t know every farmer, land use, vegetation and well location data provide a reliable picture of the basin. Figure 2-5 will be readily accessible in the final GSP.
		Section 4.5 to 4.7:Lots of repetitive ideas seems redundant. Yes there are impacts and if one factor goes bad, yes others can go bad too. but this whole section is burdensome. When is there no impact? Really amorphous on measuring impacts described. Lots of possibilities without definition. So what if there is an impact? What is GSA going to do about it? Do more studies? When does action kick in?	Comment acknowledged. Actions are listed in Section 6.
		Section 4.8: N and As and TDS mentioned and monitored. I have heard Hg is a concern in the Bay area. Will we test for Hg?	Mercury is naturally occuring constituent that can be found in surface water throughout the North Bay, and is tested in public supply wells by water quality regulators.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
		Section 4.10: ey themes and outcomes from work group members that assisted in developing the SMC for interconnected surface water are documented in Appendi 4-10-1. As described in Appendi 4-10 -1, the SMC for depletion of interconnected surface water is unique in that information in the historical record linking surface water depletion directly to groundwater usage under the jurisdiction of the GSAs is very limited. Variable levels of correlation between simulated streamflow depletion and groundwater levels, a lack of e isting instream flow targets, and limited data for assessing the presence of any historically significant and unreasonable conditions complicate the development of this SMC. 2)An additional complication is that depletions of surface water can be caused by diversions under surface water rights (e.g., direct surface water diversions or wells pumping under appropriative or riparian rights) that are outside the jurisdiction of SGMA and the GSAs . Therefore, the cause of the depletion must be evaluated to assess if such depletions are caused by diversions under the jurisdiction of the GSA. Empirical data are not currently available Reference to appendi 4-10-1 not clear on what is documented. Lots of backpedaling here. Need to reference actual surface waters that could be impacted or do impact on groundwater. How many ag ponds and creeks are involved? The marshlands are part of surface water. Will marsh or creek habitats be affected if gw is depleted?	Appendi 4-B (previously referred to as 4-10-1) provides a methodology and process that will be used to better determine impacted surface water as more data becomes available. Marshes are considered in the mapping of groundwater dependent ecosystems.
		Overall: I get lost in the generalities and repetitiveness. Better to state those things outside the repetitive pattern or highlight them in some way.	Comment acknowledged.
8/8/2021	Rebecca Ng	Section 4 put everything together. It was good to see how everything was connected. I have no comments on anything e cept I could not find Figure 4-7-1.	Comment acknowledged. Figure added.
		I understood everything e cept one sentence and nee someone to e plain to me. Page 35, the third bullet: Degraded water quality. The seawater intrusion minimum thresholds may have a beneficial impact on groundwater quality by preventing increases in chloride concentrations at supply wells.	Replied via email.
8/9/2021	Heidi Bauer	The only comment/question I have is on the Table on Page 13 shouldn t an undesirable result from depletion of interconnected surface waters also include negative impacts to GDE s?	The significant and undreasonable statement in this table adresses the potential for adverse impacts to GDEs.

DATE RECEIVED	NAME	COMMENTS	RESPONSES TO COMMENTS
9/7/2021	Robert Pennir	MTs and MOs reference historical or recent . It appears that historical for the MOs and MTs is not being used consistently with the model periods from the Basin Setting section. It also appears that different data ranges are used for RMPs with different trends. It could be confusing 20 or 50 years to know what date ranges should be compared against. This could be particularly problematic for RMP with No Trend or no data within the historic range, it may be useful to develop alternative MOs and MTs for these. I suggest creating a table that specifies the date ranges or definitions of recent and historic for RMPs with various trends.	Added to glossary

PETALUMA VALLEY GROUNDWATER SUSTAINABILITY PLAN COMMENTS SECTION 5 MONITORING PLAN			
DATE RECEIVED	**NAME**	**COMMENTS**	**RESPONSE TO COMMENTS**
10/28/2021	California Dept of Fish & Wildlife	The planned monitoring to address data gaps is insufficient for understanding interconnected surface waters in the basin. Section 5.4.2 of the GSP discussed data gap areas needed to better understand ISWs. These data gap areas include the lower reaches of the Willow Brook/Lichau Creek system, the lower reaches of Adobe Creek, and Tolay Creek in the southeastern portion of the Basin. The GSP does mention plans for a multi-level groundwater monitoring well adjacent to the Willow Brook at Penngrove Park stream gage to be installed in 2022 which will help address the northernmost data gap area. The three e isting Representative Monitoring Point wells for Depletion of Interconnected Surface Waters are not well distributed geographically throughout the GSP area. RECOMMENDATION: The GSP should include plans for additional wells to address the other areas where data gaps are known to e ist. According to the 2015 report titled Petaluma Watershed Steelhead Monitoring Report 2014/2015 Spawning Surveys I nformation suggests that steelhead occur in Adobe, Lichau, Lynch, Willow Brook, and San Antonio creeks. Of these listed tributaries, Adobe, Lynch, and Lichau Creeks have had the highest number of recent steelhead observations (Robbins, Bobier, and Hubacker, 2015). Based on this information, the GSA should consider adding wells in Adobe, Lichau and/or Lynch Creeks.	Thank you for the recommendation. The GSA recognizes the importance of ISW monitoring. As outlined in **Section 5-2**, Sonoma Water monitors 16 stream gages on the Petaluma River and its tributaries, as well as 3 dedicated, high-frequency, stream-adjacent monitoring. **Section 7.2.4.2** outlines future refinements for the ISW monitoring network. Specific locations for additional ISW monitoring locations will be identified following future ISW and GDE studies and information gathering.
COMMENTS RECEIVED BEFORE OCTOBER 1, 2021			
9/7/2021	Rebecca Ng	I have a question about multi-level monitoring wells that is intended for installation for groundwater monitoring and seawater intrusion. My assumption is that multi-level wells will be screened in different aquifers. Is that correct? I also assume it is less e pensive to construct multi-level wells rather than multiple wells. Would the multi-level wells present potential cross contamination between aquifers? It was also stated somewhere in the document that wells should not screened in different aquifers. Please e plain.	(Replied to question via email.) The assumption is correct the multi-level wells will consist of a single borehole with multiple PVC casings and well screens. The borehole annular space between each aquifer zone and well screen interval will be sealed with bentonite clay to limit the potential for cross communication between aquifer zones.

DATE RECEIVED	NAME	COMMENTS	RESPONSE TO COMMENTS
8/27/2021	John Shribbs	Somewhere I missed the e planation of the difference between the watershed and the contributing watershed which e cludes San Antonio Creek and area west of the lower river. Where do I find this e planation? Also some of the upper area of the east side seem to be e cluded since does not seem e act match with watershed map //sonomarcd.org/district-watersheds/petaluma-river/	The contributing watershed area was defined to be a portion of the larger watershed, which does e clude those areas you note. The reason for this is that for the GSP, contributing watershed is intended to represent watershed areas with the potential to contribute groundwater inflows to the Bulletin 118 Groundwater Basin (the jurisdictional area of GSA and area subject to SGMA). The San Antonio Creek watershed is located entirely within fractured rocks of the Franciscan Fm (which transmit very little flow into the basin). Surface water flow and ET processes in the San Antonio Creek watershed area are, however, accounted for in the groundwater model used to develop the water budget. We will look into the potential discrepancies you point out on the east side.
		Will there be a Section 8 on the impact on ecosystems or is that a separate report? I thought that was going to be large stand alone section or report.	SGMA requires the GSP to consider and develop sustainable management criteria for the connection between groundwater and interconnected surface water, specifically regarding the impacts that depletion of groundwater could have on beneficial users and uses of surface water. As part of this analysis, a practitioners working group assisted in identifying the aquatic species and habitats that could be adversely affected by lowered groundwater levels in principal aquifers and interconnected surface water depletion. This is discussed in Section 3.2.6. The SMC for interconnected surface water is discussed in Section 4.10, and the methodology for developing the SMC is described in much more detail in Section 4 appendices. Finally, Section 5 describes how the SMC for interconnected surface water will be monitored and how the monitoring will be enhanced over time. Section 8 will be a compilation of appendices.

DATE RECEIVED	NAME	COMMENTS	RESPONSE TO COMMENTS
		Fig 5.5: Seems like dots on map are for surface water. Are some well water? Do we not have to separate water quality from well water vs. surface water? Surface water quality could be coming from other sources than groundwater. Need to tighten up process of investigation if wells or Y surface water start to so lower water quality. May need to repeat what we mean by water quality since there are so many parameters resulting in low quality. E.g. if N shows up in wells vs. surface water, will investigation take a different course of action?	The points on Figure 5-5 are public supply wells that are included in e isting water quality monitoring programs as described in Subsection 5.3.2. The GSA will be monitoring groundwater, not surface water for this sustainability indicator.
		5.2.4. SWI-- I counted 9 wells but three together should count only as one. All are public wells. Are they all in operation and being sampled at least monthly, or how often?	Subsection 5.2.5 states that The GSA is in the process of contacting well operators to facilitate semiannual sampling for chloride and the collection of groundwater-level measurements at the nine e isting public supply wells
		5.3.2 the map shows a symetric grid of pts. . Are these wells? Why the grid cluster? Why are these wells or points not spread throughout the basin like other monitoring wells? If we have these grid spaced wells monitoring, why not use them for other factors if they are good enough for water quality?	The data points clustered in the City of Petaluma on Figure 5-5 are the City s supply wells, which are included in the water quality monitoring network because they are part of e isting water quality monitoring programs.
		App 5-b (e ample hydrographs) Not sure why these graphs included. Where is the e planation for these graphs? Hard to fathom what they mean just by looking at them. Usually there is enough added caption te t to e plain what we are looking at and why we should look at them, take away concept. Overall this section looks good.	Comment noted. The purpose of the hydrographs is e plained in Section 5.3.1.1.

PETALUMA VALLEY GROUNDWATER SUSTAINABILITY PLAN COMMENTS SECTION 6 PROJECTS AND MANAGEMENT ACTIONS			
DATE RECEIVED	**NAME**	**COMMENTS**	**RESPONSE TO COMMENTS**
10/25/2021	Roy Smith	The core focus should be on capture and recharge, as articulated in section 6.2.4. High-energy weather patterns may result in normal annual rates (30 inches) of measured precipitation, but very low levels of functional rainfall. Functional precipitation is that which is reasonably absorbed into soils and aquifers. This last storm of October 24th/25th had a great deal of measured rainfall, but a very low level of absorbed rainfall (the vast majority flowing to the Bay within a few hours). Methods such as stream flow diversion or Aquifer Storage and Recovery are ingenious, but are either disruptive or demand high energy inputs. ASR may work technically, but to take river water and filter, pump-down, pump-up, and filter again is a strategy based on massive amounts of low-cost energy this is not the future we can e pect by 2042	In regards to comments about ASR and energy use - Sonoma Water currently provides its wholesale water entirely with carbon-free energy. Such considerations will be important in the future, but continuing to provide carbon-free water will likely remain possible.
10-31-2021	Coalition	The consideration of beneficial users when developing projects and management actions is insufficient, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users. The management actions described in Section 6.4.3 (Assessment of Potential Policy Options for GSA Consideration) and Section 6.4.1 (Coordination of Farm Plans with GSP Implementation) describe improvement to water quality through sediment runoff mitigation and water quality sampling. The GSP specifically describes projects with benefits to GDEs, including the Stormwater Capture and Recharge Project described in Section 6.2.2. However, the plan fails to identify or describe projects or management action with e plicit benefits to DACs or drinking water users, including a domestic well mitigation program. **RECOMMENDATIONS:**	Comment noted. A major focus of the initial five years of implementation will be to gather information and data in many key areas to improve the understanding of potential impacts associated with groundwater conditions to sensitive beneficial users, primarily shallower domestic well users (including DACs) and GDEs. This information and data will inform consideration of future refinements to SMC and appropriate response actions (projects and management actions) protective of these sensitive beneficial users. Projects and management actions with e plicit benefits to DACs and drinking water users include any of the projects that are anticipated to raise groundwater levels. These primarily include water-use efficiency and alternate water source projects and aquifer storage and recovery.

DATE RECEIVED	NAME	COMMENTS	RESPONSE TO COMMENTS
		1. For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.	While a drinking water well impact mitigation program is not considered to be needed in the near-term based on current conditions, consideration of a well impact mitigation program has been added to the list of potential policy options for the GSA to consider in Section 6.4.3 of the GSP.
		2. For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.	The following language was added to the description of projects that could potentially impact water quality: Future GSP implementation projects or actions that require their own site-specific monitoring network would take into consideration any localized COCs and regulatory requirements to avoid potential impacts to beneficial users, including domestic well users and DACs.
		3. Recharge ponds, reservoirs, and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the Multi-Benefit Recharge Project Methodology Guidance Document .	Comment noted.
		4. Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.	All projects and management actions have been simulated with the projected conditions model which includes climate change assumptions. See Section 6 and Appendi 6-A.
10/28/2021	California Dept of Fish & Wildlife	Comment: Management actions should include specifics on how and on what timeline adverse impacts will be reversed, if observed. The GSP should specify adaptive management strategies to account for lag impacts wherein groundwater responses to changes in management regimes are delayed due to aquifer characteristics. Projects and management actions should seek to ma imize multiple-benefit solutions, including habitat improvements.	Comment noted. Adaptive management strategies are being developed through the assessment of potential policy options, including demand management measures, that could be utilized to address potential lag in projects and management action implementation and results.