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CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE
715 P Street, 8th Floor | Sacramento, CA 95814 | P.O. Box 942836 | Sacramento, CA 94236-0001

January 26, 2023

Marcus Trotta
Petaluma Valley Groundwater Sustainability Agency
404 Aviation Boulevard, Santa Rosa, CA 95403
mtrotta@scwa.ca.gov

RE: Petaluma Valley Groundwater Basin - 2022 Groundwater Sustainability Plan

Dear Marcus Trotta,

The Department of Water Resources (Department) has evaluated the groundwater sustainability plan (GSP) submitted for the Petaluma Valley Groundwater Basin and has determined the GSP is approved. The approval is based on recommendations from the Staff Report, included as an exhibit to the attached Statement of Findings, which describes that the Petaluma Valley Basin GSP satisfies the objectives of the Sustainable Groundwater Management Act (SGMA) and substantially complies with the GSP Regulations. The Staff Report also proposes recommended corrective actions that the Department believes will enhance the GSP and facilitate future evaluation by the Department. The Department strongly encourages the recommended corrective actions be given due consideration and suggests incorporating all resulting changes to the GSP in future updates.

Recognizing SGMA sets a long-term horizon for groundwater sustainability agencies (GSAs) to achieve their basin sustainability goals, monitoring progress is fundamental for successful implementation. GSAs are required to evaluate their GSPs at least every five years and whenever the Plan is amended, and to provide a written assessment to the Department. Accordingly, the Department will evaluate approved GSPs and issue an assessment at least every five years. The Department will initiate the first five-year review of the Petaluma Valley Basin GSP no later than January 29, 2027.

Please contact Sustainable Groundwater Management Office staff by emailing sgmps@water.ca.gov if you have any questions related to the Department's assessment or implementation of your GSP.

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Thank You,

Paul Gosselin

Paul Gosselin
Deputy Director
Sustainable Groundwater Management

Attachment:

1. Statement of Findings Regarding the Approval of the Petaluma Valley Basin Groundwater Sustainability Plan

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STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

STATEMENT OF FINDINGS REGARDING THE APPROVAL OF THE PETALUMA VALLEY BASIN GROUNDWATER SUSTAINABILITY PLAN

The Department of Water Resources (Department) is required to evaluate whether a submitted groundwater sustainability plan (GSP or Plan) conforms to specific requirements of the Sustainable Groundwater Management Act (SGMA or Act), is likely to achieve the sustainability goal for the basin covered by the Plan, and whether the Plan adversely affects the ability of an adjacent basin to implement their GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) The Department is directed to issue an assessment of the Plan within two years of its submission. (Water Code § 10733.4.) This Statement of Findings explains the Department's decision regarding the Plan submitted by the Petaluma Valley Groundwater Sustainability Agency (GSA or Agency) for the Petaluma Valley Basin (Basin No. 2-001).

Department management has reviewed the Department Staff Report, entitled Sustainable Groundwater Management Program Groundwater Sustainability Plan Assessment Staff Report, attached as Exhibit A, recommending approval of the GSP. Department management is satisfied that staff have conducted a thorough evaluation and assessment of the Plan and concurs with staff's recommendation and all the recommended corrective actions. The Department therefore **APPROVES** the Plan and makes the following findings:

A. The Plan satisfies the required conditions as outlined in § 355.4(a) of the GSP Regulations (23 CCR § 350 et seq.):

    1. The Plan was submitted within the statutory deadline of January 31, 2022. (Water Code § 10720.7(a); 23 CCR § 355.4(a)(1).)

    2. The Plan was complete, meaning it generally appeared to include the information required by the Act and the GSP Regulations sufficient to warrant a thorough evaluation and issuance of an assessment by the Department. (23 CCR § 355.4(a)(2).)

    3. The Plan, either on its own or in coordination with other Plans, covers the entire Basin. (23 CCR § 355.4(a)(3).)

B. The general standards the Department applied in its evaluation and assessment of the Plan are: (1) "conformance" with the specified statutory requirements, (2) "substantial compliance" with the GSP Regulations, (3) whether the Plan is likely

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to achieve the sustainability goal for the Basin within 20 years of the implementation of the Plan, and (4) whether the Plan adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) Application of these standards requires exercise of the Department's expertise, judgment, and discretion when making its determination of whether a Plan should be deemed "approved," "incomplete," or "inadequate." The statutes and GSP Regulations require Plans to include and address a multitude and wide range of informational and technical components. The Department has observed a diverse array of approaches to addressing these technical and informational components being used by GSAs in different basins throughout the state. The Department does not apply a set formula or criterion that would require a particular outcome based on how a Plan addresses any one of SGMA's numerous informational and technical components. The Department finds that affording flexibility and discretion to local GSAs is consistent with: the standards identified above; the state policy that sustainable groundwater management is best achieved locally through the development, implementation, and updating of local plans and programs (Water Code § 113); and the Legislature's express intent under SGMA that groundwater basins be managed through the actions of local governmental agencies to the greatest extent feasible, while minimizing state intervention to only when necessary to ensure that local agencies manage groundwater in a sustainable manner (Water Code § 10720.1(h)). The Department's final determination of a Plan's status is made based on the entirety of the Plan's contents on a case-by-case basis, considering and weighing factors relevant to the particular Plan and Basin under review.

C. In making these findings and Plan determination, the Department also recognized that: (1) it maintains continuing oversight and jurisdiction to ensure the Plan is adequately implemented; (2) the Legislature intended SGMA to be implemented over many years; (3) SGMA provides Plans 20 years of implementation to achieve the sustainability goal in a basin (with the possibility that the Department may grant GSAs an additional five years upon request if the GSA has made satisfactory progress toward sustainability); and, (4) local agencies acting as GSAs are authorized, but not required, to address undesirable results that occurred prior to enactment of SGMA. (Water Code §§ 10721(r); 10727.2(b); 10733(a); 10733.8.)

D. The Plan conforms with Water Code §§ 10727.2 and 10727.4, substantially complies with the GSP Regulations, and appears likely to achieve the sustainability goal for the Basin. It does not appear at this time that the Plan will

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adversely affect the ability of adjacent basins to implement their GSPs or impede achievement of sustainability goals.

1. The sustainable management criteria and goal to maintain groundwater conditions at or near 2015 conditions are sufficiently justified and explained. The Plan relies on decades of credible information and science to quantify the groundwater conditions that the Plan seeks to avoid and provides an objective way to determine whether the Basin is being managed sustainably in accordance with SGMA. (23 CCR § 355.4(b)(1).)

2. The Plan demonstrates a reasonable understanding of where data gaps exist and demonstrates a commitment to eliminate those data gaps. In particular, better understanding the hydrogeologic properties of the different aquifer units, the relationship between regional groundwater pumping and interconnected surface water depletions, and the extent of the seawater/freshwater divide will be important in reducing uncertainty regarding the GSAs ability to evaluate potential significant and unreasonable effects related to groundwater extraction in the Basin. Filling these known data gaps, and others described in the Plan, should lead to refinement of the GSA's monitoring networks and sustainable management criteria and help inform and guide future adaptive management strategies. (23 CCR § 355.4(b)(2).)

3. The projects and management actions, which focus largely on reducing water demand; increasing groundwater in storage; and increasing non-groundwater water supply, are reasonable and commensurate with the level of understanding of the Basin setting. The projects and management actions described in the Plan provide a generally feasible approach to achieving the Basin's sustainability goal and should provide the GSA with greater versatility to adapt and respond to changing conditions and future challenges during GSP implementation. (23 CCR § 355.4(b)(3).)

4. The Plan provides a detailed explanation of how the varied interests of groundwater uses and users in the Basin were considered in developing the sustainable management criteria and how those interests, including domestic wells, would be impacted by the chosen minimum thresholds. (23 CCR § 355.4(b)(4).)

5. The Plan's projects and management actions appear feasible at this time and appear likely to prevent undesirable results and ensure that the Basin is operated within its sustainable yield within 20 years. The Department will continue to monitor Plan implementation and reserves the right to

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change its determination if projects and management actions are not implemented or appear unlikely to prevent undesirable results or achieve sustainability within SGMA timeframes. (23 CCR § 355.4(b)(5).)

6. The Plan includes a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft, if present. (23 CCR § 355.4(b)(6).)

7. At this time, it does not appear that the Plan will adversely affect the ability of an adjacent basin to implement its GSP or impede achievement of sustainability goals in an adjacent basin. The Plan explains that GSP implementation will be closely coordinated with the neighboring groundwater sustainability agencies in the Santa Rosa Valley – Santa Rosa Plain Subbasin and Napa-Sonoma Valley – Sonoma Valley Subbasin. The Plan includes an analysis of potential impacts to adjacent basins related to the established minimum thresholds for each sustainability indicator. The Plan does not anticipate any impacts to adjacent basins resulting from the minimum thresholds defined in the Plan. (23 CCR § 355.4(b)(7).)

8. If required, a satisfactory coordination agreement has been adopted by all relevant parties. (23 CCR § 355.4(b)(8).)

9. The GSA's five member agencies (City of Petaluma, North Bay Water District, Sonoma Resource Conservation District, Sonoma County Water Agency, and County of Sonoma) have historically implemented numerous projects and management actions to address problematic groundwater conditions in the Basin. The GSA's member agencies and their history of groundwater management provide a reasonable level of confidence that the GSA has the legal authority and financial resources necessary to implement the Plan. (23 CCR § 355.4(b)(9).)

10. Through review of the Plan and public comments, the Department determines that the GSA adequately responded to comments that raised credible technical or policy issues with the Plan, sufficient to warrant approval of the Plan at this time. The Department also notes that the recommended corrective actions included in the Staff Report are important to addressing certain technical or policy issues that were raised and, if not addressed before future, subsequent plan evaluations, may preclude approval of the Plan in those future evaluations. (23 CCR § 355.4(b)(10).)

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E. In addition to the grounds listed above, DWR also finds that:

1. The Plan sets forth minimum thresholds for chronic lowering of groundwater levels that take into consideration the depths of shallow water supply wells (i.e., domestic, irrigation, industrial, and public supply wells). (Petaluma Valley GSP pp. 221-227.) The Plan utilizes a two-pronged approach for setting minimum thresholds which involves both the evaluation of historical low groundwater levels and a statistical analysis of the 95th percentile shallowest supply well depth (95% of wells being deeper than this depth) for wells located in the vicinity of each representative monitoring point. The final established minimum threshold value for each representative monitoring point was based on the shallower elevation between the historical low, minus a calculated drought buffer, or the nearby well impact depth (95th percentile supply well depth plus a saturated thickness factor of 10 feet). The Plan's compliance with the requirements of SGMA and substantial compliance with the GSP Regulations supports the state policy regarding the human right to water (Water Code § 106.3). The Department developed its GSP Regulations consistent with and intending to further the policy through implementation of SGMA and the Regulations, primarily by achieving sustainable groundwater management in a basin. By ensuring substantial compliance with the GSP Regulations, the Department has considered the state policy regarding the human right to water. (23 CCR § 350.4(g).)

2. The Plan acknowledges and identifies interconnected surface waters within the Basin. The GSA proposes initial sustainable management criteria to manage this sustainability indicator and measures to improve understanding and management of interconnected surface water. The GSA acknowledges, and the Department agrees, many data gaps related to interconnected surface water exist. The GSAs should continue filling data gaps, collecting additional monitoring data, and coordinating with resources agencies and interested parties to understand beneficial uses and users that may be impacted by depletions of interconnected surface water caused by groundwater pumping. Future updates to the Plan should aim to improve the initial sustainable management criteria as more information and improved methodology becomes available.

3. The California Environmental Quality Act (Public Resources Code § 21000 et seq.) does not apply to the Department's evaluation and assessment of the Plan.

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Accordingly, the GSP submitted by the Agency for the Petaluma Valley Basin is hereby **APPROVED**. The recommended corrective actions identified inthe Staff Report will assist the Department's future review of the Plan's implementation for consistency with SGMA. The Department therefore recommends the Agency address them by the time of the Department's five-year review, which is set to begin on January 29, 2027, as required by Water Code § 10733.8.

Signed:

Karla Nemeth

Karla Nemeth, Director

Date: January 26, 2023

Exhibit A: Sustainable Groundwater Management Program Groundwater Sustainability Plan Assessment Staff Report – Petaluma Valley Groundwater Basin

State of California
Department of Water Resources
Sustainable Groundwater Management Program
Groundwater Sustainability Plan Assessment
Staff Report

Groundwater Basin Name:	Petaluma Valley Groundwater Basin (Basin No. 2-001)
Submitting Agency:	Petaluma Valley Groundwater Sustainability Agency
Submittal Type:	Initial GSP Submission
Submission Date:	January 29, 2022
Recommendation:	Approved
Date:	January 26, 2023

The Petaluma Valley Groundwater Sustainability Agency (GSA or Agency) submitted the Petaluma Valley Basin Groundwater Sustainability Plan (GSP or Plan) for the Petaluma Valley Basin (Basin) to the Department of Water Resources (Department) for evaluation and assessment as required by the Sustainable Groundwater Management Act (SGMA)[1] and GSP Regulations.[2] The GSP covers the entire Basin for the implementation of SGMA.

After evaluation and assessment, Department staff concludes that the Plan includes the required components of a GSP, demonstrates a thorough understanding of the Basin based on what appears to be the best available science and information, sets well explained, supported, and reasonable sustainable management criteria to prevent undesirable results as defined in the Plan, and proposes a set of projects and management actions that will likely achieve the sustainability goal defined for the Basin.[3] Department staff will continue to monitor and evaluate the Basin's progress toward achieving the sustainability goal through annual reporting and future periodic evaluations of the GSP and its implementation.

- ***Based on the current evaluation of the Plan, Department staff recommend the GSP be approved with the recommended corrective actions described herein.***

This assessment includes five sections:

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[1] Water Code § 10720 *et seq*.
[2] 23 CCR § 350 *et seq*.
[3] 23 CCR § 350 *et seq*.

- **Section 1 – Summary:** Overview of Department staff's assessment and recommendations.
- **Section 2 – Evaluation Criteria:** Describes the legislative requirements and the Department's evaluation criteria.
- **Section 3 – Required Conditions:** Describes the submission requirements, Plan completeness, and basin coverage required for a GSP to be evaluated by the Department.
- **Section 4 – Plan Evaluation:** Provides an assessment of the contents included in the GSP organized by each Subarticle outline in the GSP Regulations.
- **Section 5 – Staff Recommendation:** Includes the staff recommendation for the Plan and any recommended or required corrective actions, as applicable.

1 SUMMARY

Department staff recommend approval of the Petaluma Valley GSP. The GSA has identified areas for improvement of its Plan (e.g., expanding monitoring networks and addressing data gaps related to interconnected surface water, hydrogeologic properties of the different aquifer units, and extent of the seawater/freshwater divide). Department staff concur that those items are important and recommend the GSA address them as soon as possible. Department staff have also identified additional recommended corrective actions within this assessment that the GSA should consider addressing by the first periodic evaluation of the Plan. The recommended corrective actions generally focus on the following:

(1) identification of certain surface water imports,

(2) providing additional details and discussion related to specific components the GSA used to establish chronic lowering of groundwater levels sustainable management criteria,

(3) continuing to fill data gaps, collecting additional monitoring data, and coordinating with resources agencies and interested parties to understand beneficial uses and users that may be impacted by depletions of interconnected surface water caused by groundwater pumping,

(4) and providing additional details related to the monitoring networks.

Addressing the recommended corrective actions identified in Section 5 of this assessment will be important to demonstrate, on an ongoing basis, that implementation of the Plan is likely to achieve the sustainability goal.

2 EVALUATION CRITERIA

The GSA submitted a single GSP to the Department to evaluate whether the Plan conforms to specified SGMA requirements[4] and is likely to achieve the sustainability goal for the Petaluma Valley Basin.[5] To achieve the sustainability goal for the Basin, the GSP must demonstrate that implementation of the Plan will lead to sustainable groundwater management, which means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.[6] Undesirable results must be defined quantitatively by the GSAs.[7] The Department is also required to evaluate whether the GSP will adversely affect the ability of an adjacent basin to implement its GSP or achieve its sustainability goal.[8]

For the GSP to be evaluated by the Department, it must first be determined that the Plan was submitted by the statutory deadline,[9] and that it is complete and covers the entire basin.[10] If these conditions are satisfied, the Department evaluates the Plan to determine whether it complies with specific SGMA requirements and substantially complies with the GSP Regulations.[11] "Substantial compliance means that the supporting information is sufficiently detailed and the analyses sufficiently thorough and reasonable, in the judgment of the Department, to evaluate the Plan, and the Department determines that any discrepancy would not materially affect the ability of the Agency to achieve the sustainability goal for the basin, or the ability of the Department to evaluate the likelihood of the Plan to attain that goal."[12]

When evaluating whether the Plan is likely to achieve the sustainability goal for the Basin, Department staff reviewed the information provided and relied upon in the GSP for sufficiency, credibility, and consistency with scientific and engineering professional standards of practice.[13] The Department's review considers whether there is a reasonable relationship between the information provided and the assumptions and conclusions made by the GSA, including whether the interests of the beneficial uses and users of groundwater in the basin have been considered; whether sustainable management criteria and projects and management actions described in the Plan are commensurate

[4] Water Code §§ 10727.2, 10727.4.
[5] Water Code § 10733(a).
[6] Water Code § 10721(v).
[7] 23 CCR § 354.26 *et seq*.
[8] Water Code § 10733(c).
[9] 23 CCR § 355.4(a)(1).
[10] 23 CCR §§ 355.4(a)(2), 355.4(a)(3).
[11] 23 CCR § 350 *et seq.*
[12] 23 CCR § 355.4(b).
[13] 23 CCR § 351(h).

with the level of understanding of the basin setting; and whether those projects and management actions are feasible and likely to prevent undesirable results.[14]

The Department also considers whether the GSA has the legal authority and financial resources necessary to implement the Plan.[15]

To the extent overdraft is present in a basin, the Department evaluates whether the Plan provides a reasonable assessment of the overdraft and includes reasonable means to mitigate the overdraft.[16] The Department also considers whether the Plan provides reasonable measures and schedules to eliminate identified data gaps.[17] Lastly, the Department's review considers the comments submitted on the Plan and evaluates whether the GSA adequately responded to the comments that raise credible technical or policy issues with the Plan.[18]

The Department is required to evaluate the Plan within two years of its submittal date and issue a written assessment of the Plan.[19] The assessment is required to include a determination of the Plan's status.[20] The GSP Regulations define the three options for determining the status of a Plan: Approved,[21] Incomplete,[22] or Inadequate.[23]

Even when review indicates that the GSP satisfies the requirements of SGMA and is in substantial compliance with the GSP Regulations, the Department may recommend corrective actions.[24] Recommended corrective actions are intended to facilitate progress in achieving the sustainability goal within the basin and the Department's future evaluations, and to allow the Department to better evaluate whether the Plan adversely affects adjacent basins. While the issues addressed by the recommended corrective actions do not, at this time, preclude approval of the Plan, the Department recommends that the issues be addressed to ensure the Plan's implementation continues to be consistent with SGMA and the Department is able to assess progress in achieving the sustainability goal within the basin.[25] Unless otherwise noted, the Department proposes that recommended corrective actions be addressed by the submission date for the first five-year assessment.[26]

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[14] 23 CCR §§ 355.4(b)(1), (3), (4) and (5).
[15] 23 CCR § 355.4(b)(9).
[16] 23 CCR § 355.4(b)(6).
[17] 23 CCR § 355.4(b)(2).
[18] 23 CCR § 355.4(b)(10).
[19] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[20] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[21] 23 CCR § 355.2(e)(1).
[22] 23 CCR § 355.2(e)(2).
[23] 23 CCR § 355.2(e)(3).
[24] Water Code § 10733.4(d).
[25] Water Code § 10733.8.
[26] 23 CCR § 356.4 *et seq*.

The staff assessment of the GSP involves the review of information presented by the GSA, including models and assumptions, and an evaluation of that information based on scientific reasonableness, including standard or accepted professional and scientific methods and practices. The assessment does not require Department staff to recalculate or reevaluate technical information provided in the Plan or to perform its own geologic or engineering analysis of that information. The staff recommendation to approve a Plan does not signify that Department staff, were they to exercise the professional judgment required to develop a GSP for the basin, would make the same assumptions and interpretations as those contained in the Plan, but simply that Department staff have determined that the assumptions and interpretations relied upon by the submitting GSA are supported by adequate, credible evidence, and are scientifically reasonable.

Lastly, the Department's review and approval of the Plan is a continual process. Both SGMA and the GSP Regulations provide the Department with the ongoing authority and duty to review the implementation of the Plan.[27] Also, GSAs have an ongoing duty to provide reports to the Department, periodically reassess their plans, and, when necessary, update or amend their plans.[28] The passage of time or new information may make what is reasonable and feasible at the time of this review to not be so in the future. The emphasis of the Department's periodic reviews will be to assess the progress toward achieving the sustainability goal for the basin and whether Plan implementation adversely affects the ability of adjacent basins to achieve their sustainability goals.

3 REQUIRED CONDITIONS

A GSP, to be evaluated by the Department, must be submitted within the applicable statutory deadline. The GSP must also be complete and must, either on its own or in coordination with other GSPs, cover the entire basin.

3.1 SUBMISSION DEADLINE

SGMA required basins categorized as high- or medium-priority and not subject to critical conditions of overdraft to submit a GSP no later than January 31, 2022.[29]

The GSA submitted its Plan on January 29, 2022.

[27] Water Code § 10733.8; 23 CCR § 355.6.
[28] Water Code §§ 10728 *et seq.*, 10728.2.
[29] Water Code § 10720.7(a)(2).

3.2 COMPLETENESS

GSP Regulations specify that the Department shall evaluate a GSP if that GSP is complete and includes the information required by SGMA and the GSP Regulations.[30]

The GSA submitted an adopted GSP for the entire Basin. After an initial, preliminary review, Department staff found the GSP to be complete and appearing to include the required information, sufficient to warrant a thorough evaluation by the Department.[31] The Department posted the GSP to its website on February 7, 2022.[32]

3.3 BASIN COVERAGE

A GSP, either on its own or in coordination with other GSPs, must cover the entire basin.[33] A GSP that is intended to cover the entire basin may be presumed to do so if the basin is fully contained within the jurisdictional boundaries of the submitting GSAs.

The GSP intends to manage the entire Petaluma Valley Basin and the jurisdictional boundary of the submitting GSA fully contains the Basin.[34]

4 PLAN EVALUATION

As stated in Section 355.4 of the GSP Regulations, a basin "shall be sustainably managed within 20 years of the applicable statutory deadline consistent with the objectives of the Act." The Department's assessment is based on a number of related factors including whether the elements of a GSP were developed in the manner required by the GSP Regulations, whether the GSP was developed using appropriate data and methodologies and whether its conclusions are scientifically reasonable, and whether the GSP, through the implementation of clearly defined and technically feasible projects and management actions, is likely to achieve a tenable sustainability goal for the basin. The Department staff's evaluation of the likelihood of the Plan to attain the sustainability goal for the Basin is provided below.

[30] 23 CCR § 355.4(a)(2).
[31] The Department undertakes a preliminary completeness review of a submitted Plan under section 355.4(a) of the GSP Regulations to determine whether the elements of a Plan required by SGMA and the Regulations have been provided, which is different from a determination, upon review, that a Plan is "incomplete" for purposes of section 355.2(e)(2) of the Regulations.
[32] https://sgma.water.ca.gov/portal/gsp/preview/132.
[33] Water Code § 10727(b); 23 CCR § 355.4(a)(3).
[34] Petaluma Valley GSP Section 1.3, p. 62.

4.1 ADMINISTRATIVE INFORMATION

The GSP Regulations require each Plan to include administrative information identifying the submitting agency, describing the Plan area, and demonstrating the legal authority and ability of the submitting agency to develop and implement a Plan for that area.[35]

The Plan provides administrative information identifying the submitting agency, the Petaluma Valley Groundwater Sustainability Agency.[36] The Plan describes in some detail the GSA's authority to manage groundwater in the Basin which was generally presented in an understandable format using appropriate data. The GSP states that "the Petaluma Valley GSA is governed by a board, which receives and considers recommendations from an advisory committee representing multiple stakeholder interests."[37] The Advisory Committee contains ten members from the five-member agencies and five members representing each of the following local interests: environmental, rural residential well owner, the business community, agricultural, and the at-large community.[38]

The GSP described the Plan area. The Basin contains approximately 46,000 acres and is bordered by the San Pablo Bay to the south, the Sonoma Mountains to the east, and the low-lying hills of the Mendocino Range to the west.[39] Neighboring basins/subbasins include the high-priority Sonoma Valley Subbasin to the east, the medium-priority Santa Rosa Plain Subbasin to the north, and the very low -priority Wilson Grove Formation Highlands and Novato Valley Basins to the northwest and southwest, respectively. The northern boundary of the Basin is delineated by the topographic and surface watershed divide between the Basin and the adjacent Santa Rosa Plain Subbasin. The Basin is part of the Petaluma Valley watershed, which is drained by the Petaluma River into the San Pablo Bay. The Basin shares a hydraulic connection with watershed areas outside of the Basin boundaries, and according to the GSP, these areas represent an important source of inflow to the Basin both in the form of surface streamflow and subsurface flow. A map showing the Basin and adjacent subbasins/basins is shown in Figure 1 below.

[35] 23 CCR § 354.2 *et seq*.
[36] Petaluma Valley GSP, Section 1.3, p. 63.
[37] Petaluma Valley GSP, Section 1.4, p. 65.
[38] Petaluma Valley GSP, Appendix 1-D, p. 410
[39] Petaluma Valley GSP, Section ES.2, p 10.

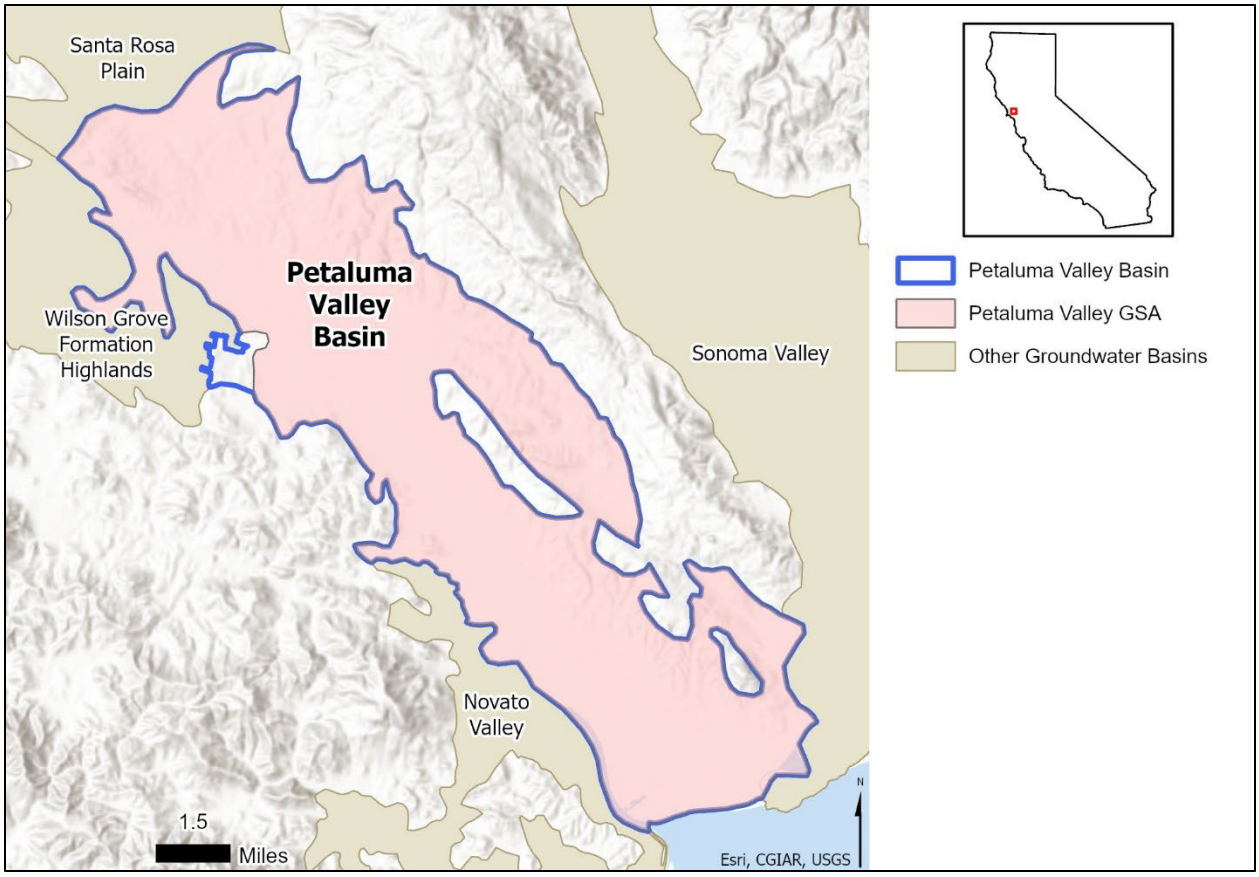

Figure 1: Petaluma Valley Basin Location Map.

The GSP states that the Agency's implementation of SGMA is closely coordinated with the neighboring GSAs in the Sonoma Valley Subbasin and the Santa Rosa Plain Subbasin.[40] The coordination between the Santa Rosa Plain GSA and the Petaluma GSA includes filling data gaps along the northern Basin boundary by installing groundwater-level representative monitoring points to better understand basin boundary flow conditions.

Department staff did not note any significant inconsistencies or contradicting information and consider the information presented in the Plan to satisfy the general requirements of the GSP Regulations. The Plan contains sufficient detail regarding the beneficial uses and users of groundwater,[41] water use types,[42] existing water monitoring and resource programs,[43] and types and distribution of land use and land use plans for the Basin.[44]

[40] Petaluma Valley GSP, Section 1.3.3, p. 65.
[41] Petaluma Valley GSP, Section 1.4.1, p. 66.
[42] Petaluma Valley GSP, Section 2.3, p. 81.
[43] Petaluma Valley GSP, Section 2.4, pp. 86-92, Section 2.5, pp. 92-104.
[44] Petaluma Valley GSP, Figure 2-4a-c, pp. 78-80.

The Agency provides a list of public meetings, materials, and notifications on its website, and lists of meetings and public comments and how they were addressed by the GSA are included in the appendices of the GSP. The administrative information included in the Plan substantially complies with the requirements outlined in the GSP Regulations.

4.2 BASIN SETTING

The GSP Regulations require information about the physical setting and characteristics of the basin and current conditions of the basin, including a hydrogeologic conceptual model; a description of historical and current groundwater conditions; and a water budget accounting for total annual volume of groundwater and surface water entering and leaving the basin, including historical, current, and projected water budget conditions.[45]

4.2.1 Hydrogeologic Conceptual Model

The GSP Regulations require a descriptive hydrogeologic conceptual model of the basin that includes a written description supported by cross sections and maps, identifies and describes principal aquifers, identifies recharge areas, and discusses the source and points of delivery of imported water supplies.[46]

The Plan discusses the geology of the Basin and identifies a principal aquifer. The Plan describes the regional geologic setting, geologic structures in the Basin, stratigraphy, and geologic formations; supported by a cross section, stratigraphic column, and maps of geologic unit thicknesses.[47] The Plan defines a single principal aquifer system for the Basin that is composed of the Petaluma and Wilson Grove Formations, the Sonoma Volcanics, the Quaternary mixed unit, and the Quaternary alluvial deposits.[48] The Plan acknowledges that these units have distinct lithologies and aquifer properties; however, the Plan states that there is insufficient data with regard to the hydraulic connections between these units to characterize any one of them as a separate aquifer.[49] The GSP describes how the GSA intends to address data gaps and uncertainty related to the physical aquifer system, such as: hydrogeologic characteristics at basin boundaries, hydraulic properties and recharge dynamics of the aquifer system, and three-dimensional characteristics of the Basin well infrastructure.[50]

The primary source of groundwater recharge is from streambed seepage from portions of the Petaluma River and its tributaries. Additionally, the GSP describes that the groundwater system discharges to streams as baseflow. The GSP further explains the gaining and losing conditions in the evaluation of the historic and current groundwater

[45] 23 CCR § 354.12 *et seq*.
[46] 23 CCR § 354.14 *et seq*.
[47] Petaluma Valley GSP, Section 3.1, pp. 110-136.
[48] Petaluma Valley GSP, Section 3.1.5, p. 127.
[49] Petaluma Valley GSP, Section 3.1.5, pp. 127-128.
[50] Petaluma Valley GSP, Section 3.1.9, p. 135.

budget in which stream leakage to groundwater represents the largest volume of water acting as an inflow to the groundwater system.[51]

As stated in the Plan, water sources for the Basin consist of groundwater, local surface water, imported surface water (from the Russian River), and recycled water.[52] Water use sectors include municipal (i.e., the City of Petaluma), irrigated and non-irrigated agriculture, native vegetation, rural residential, unincorporated urban-residential, and unincorporated commercial and industrial. Additionally, recycled water from the Ellis Creek Water Recycling Facility, which is treated to tertiary standards, is used for irrigation of agriculture, golf courses, school yards, parks, and other landscaped areas. The Plan states that groundwater in the Basin supplies water for stream baseflow, native vegetation, riparian habitat, domestic wells, irrigation wells, industrial wells, and municipal water systems.

The information provided in the GSP that comprises the hydrogeologic conceptual model substantially complies with the requirements outlined in the GSP Regulations. In general, the Plan's descriptions of the regional geologic setting, the Basin's physical characteristics, the principal aquifer, and hydrogeologic conceptual model appear to utilize the best available science. Department staff are aware of no significant inconsistencies or contrary technical information to that presented in the Plan.

4.2.2 Groundwater Conditions

The GSP Regulations require a written description of historical and current groundwater conditions for each of the sustainability indicators and groundwater dependent ecosystems (GDEs).[53]

The GSP includes a collection of hydrographs depicting long-term groundwater elevations for the principal aquifer and provides a description of groundwater-level trends and the groundwater level monitoring network used to observe groundwater conditions throughout the Basin.[54] The GSP explains that the selection of hydrographs was provided based on the specific monitoring sites' relatively long period of record allowing for evaluation of noticeable trends. The periods of record for the hydrographs provided in the GSP varies, but generally begin in the 1980s and 1990s and extend through 2020. The groundwater level data analyzed in the GSP depict generally stable groundwater conditions throughout the Basin in both shallow (less than 200 feet below ground surface) and deep (greater than 200 feet below ground surface) wells; however, some wells near the northern portion of the Basin show declining trends.[55] The Plan explains that the boundary between the Petaluma Valley Basin and the Santa Rosa Plain Subbasin

[51] Petaluma Valley GSP, Section 3.1.8, pp. 131-133.
[52] Petaluma Valley GSP, Section 2.3, pp. 81-83.
[53] 23 CCR § 354.16 (a-g).
[54] Petaluma Valley GSP, Section 3.2.2.2, p. 143, Figures 3-12b-e, pp. 146-149.
[55] Petaluma Valley GSP, Figure 3-12e, p. 149.

coincides with a watershed and groundwater flow boundary; however, there is no known hydrogeologic feature that restricts flow between the two basins, meaning there may be basin boundary flow between the two groundwater basins. The GSA intends to coordinate with the Santa Rosa Plain GSA to further investigate the conditions at the north Basin boundary.

The Plan includes a discussion of change in groundwater storage and relates groundwater use to water year type.[56] The plan provides a graph showing the change in storage over time with water year type.[57] The cumulative change in storage shown indicates that near zero change in storage has accumulated over the 1969-2018 period.[58]

The Plan provides an assessment of the existing groundwater quality programs and agencies operating in the Basin and states groundwater quality is generally adequate to meet the needs of existing beneficial uses and users including drinking water users and agricultural uses.[59] The GSP includes maps[60] and descriptions of current and historical groundwater quality issues present in the Basin and has identified general minerals, major ions, total dissolved solids (TDS), specific conductance, arsenic, nitrate, boron, and chloride as the water quality constituents of interest as indicated from previous studies conducted in the Basin.[61]

The Plan discusses seawater intrusion conditions and the relationship of the intrusion front with the principal aquifer system and describes seawater intrusion as occurring beneath the tidal marshlands in the southern portion of the Basin near where the Petaluma River discharges to the San Pablo Bay.[62] The GSP describes the need for additional monitoring points to observe the characteristics of the saline-freshwater interface in the marshland areas of the Basin (i.e., the Baylands area).

The GSP states that current and historical subsidence monitoring data collected in the Basin suggest that groundwater extraction induced inelastic subsidence has not occurred, and that measured subsidence is consistent with monitoring stations in the region outside of the basin.[63] The GSP provides maps showing the locations of monitoring stations and Interferometric Synthetic Aperture Radar (InSAR) data.[64]

The GSP's analyses indicate much of the Petaluma River and Tolay Creek are interconnected with groundwater.[65] In addition to the Petaluma River and Tolay Creek,

[56] Petaluma Valley GSP, Section 3.2.3, p. 143, Figure 3-13, p. 150.
[57] Petaluma Valley GSP, Figure 3-13, p. 150.
[58] Petaluma Valley GSP, Table 3-1, p. 151.
[59] Petaluma Valley GSP, Section 3.2.5, pp. 154-162.
[60] Petaluma Valley GSP, Figures 3-16 to 3-19, pp. 157-160.
[61] Petaluma Valley GSP, Section 3.2.5, p. 154.
[62] Petaluma Valley GSP, Section 3.2.5.4, pp. 161-162.
[63] Petaluma Valley GSP, Section 3.2.4, p. 151.
[64] Petaluma Valley GSP, Figures 3-14 & 3-15, pp. 152-153.
[65] Petaluma Valley GSP, Section 3.2.6.1, p. 163.

the Plan states the lower reaches of the various streams contributing to the watershed in the Basin are likely interconnected with the groundwater system, such as Washington Creek and Capri Creek.[66] The Plan explains that although the analysis of shallow near-stream water levels relative to streambed and stream stage elevation data indicate surface water-groundwater interconnectivity, there is limited information and data to determine the extent of the interconnectivity and the influence groundwater pumping may have on quantity and timing of associated surface water depletions. The GSP identifies data gaps in the understanding of interconnected surface water in the northern, central, and southeastern portion of the basin.[67] The GSA has obtained Proposition 68 grant funding to install three additional groundwater monitoring wells near Petaluma River, Lichau Creek, and Adobe Creek.[68] The Plan also includes a discussion of the conditions associated with groundwater dependent ecosystems in the Basin.[69]

Overall, the Plan sufficiently describes the historical and current groundwater conditions throughout the Basin and the information included in the Plan substantially complies with the requirements outlined in the GSP Regulations.

4.2.3 Water Budget

GSP Regulations require a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical; current; and projected water budget conditions, and the change in the volume of water stored, as applicable.[70]

The Plan prepared water budgets using the Petaluma Valley Integrated Groundwater Flow Model (PVIHM) which contains a model simulation horizon of water years 1960 to 2018. The PVHIM was developed as a joint effort between the Sonoma County Water Agency and the United States Geological Survey (USGS).

The GSP provided the required components for water budgets. The Plan includes the required historical, current, and future water budgets.[71] The Plan also includes an assessment of the total annual volume of groundwater and surface water entering and leaving the Basin[72], and provides an estimate of the sustainable yield of the Basin[73].

Department staff conclude the historical, current, and projected water budgets included in the Plan substantially comply with the requirements outlined in the GSP Regulations.

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[66] Petaluma Valley GSP, Section 3.2.6.1, p. 163, Figure 3-20a, p. 164.
[67] Petaluma Valley GSP, Section 5.4.2, p. 303.
[68] Petaluma Valley GSP, Section 4.10.2.1, p. 269.
[69] Petaluma Valley GSP, Section 3.2.6.2, pp. 163-166.
[70] 23 CCR § 354.18 *et seq*.
[71] Petaluma Valley GSP, Section 3.3.3, pp. 177-187, Section 3.3.6, pp. 188-205.
[72] Petaluma Valley GSP, Tables 3-9 to 3-12, pp. 182-184.
[73] Petaluma Valley GSP, Section 3.4, pp. 205-206.

While the water budget described in the GSP substantially complies with the GSP Regulations, Department staff note a missing component related to the inclusion of surface water inputs to the PVIHM. The GSP states that imported surface water from the Russian River through the Petaluma Aqueduct is the primary water source for urban users principally the City of Petaluma.[74] However, this import of surface water to the Petaluma Valley appears to be missing from the historical water budget presented in the GSP. Department staff believe this is important because, water imported from the Russian River is the primary supply for urban areas. Surface water from the Russian River may contribute to other parts of the water budget including recycled water or discharge to streams. Since groundwater is a supplemental source for urban areas, there is the potential for its use to increase when surface water is not available. As a result, quantifying historical surface water availability or reliability is important to the historical water budget. Department staff conclude the GSA should quantify the volume of water imported from the Russian River to the Basin in the historic water budget (See Recommended Corrective Action 1).

4.2.4 Management Areas

The GSP Regulations provide the option for one or more management areas to be defined within a basin if the GSA has determined that the creation of the management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives, provided that undesirable results are defined consistently throughout the basin.[75]

There are no management areas proposed within the Plan area.

4.3 Sustainable Management Criteria

GSP Regulations require each Plan to include a sustainability goal for the basin and to characterize and establish undesirable results, minimum thresholds, and measurable objectives for each applicable sustainability indicator, as appropriate. GSP Regulations specify that an agency define conditions that constitute sustainable groundwater management for a basin, including the characterization of undesirable results and the establishment of minimum thresholds and measurable objectives for each applicable sustainability indicator.

4.3.1 Sustainability Goal

The GSP establishes a sustainability goal to "adaptively and sustainably manage, protect, and enhance groundwater resources while allowing for reasonable and managed growth through: careful monitoring of groundwater conditions; close coordination and collaboration with other entities and regulatory agencies that have a stake or role in

[74] Petaluma Valley GSP, Section 2.3, pp. 81-83.
[75] 23 CCR § 354.20 *et seq.*

groundwater management in the Basin; a diverse portfolio of projects and management actions that ensure clean and plentiful groundwater for future uses and users in an environmentally sound and equitable manner." [76] The GSA further states that it intends to adaptively manage groundwater resources through close coordination with stakeholders and existing regulatory agencies in the Basin.

4.3.2 Sustainability Indicators

Sustainability indicators are defined as any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results.[77] Sustainability indicators thus correspond with the six undesirable results – chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon, significant and unreasonable reduction of groundwater storage, significant and unreasonable seawater intrusion, significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies, land subsidence that substantially interferes with surface land uses, and depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water[78] – but refer to groundwater conditions that are not, in and of themselves, significant and unreasonable. Rather, sustainability indicators refer to the effects caused by changing groundwater conditions that are monitored, and for which criteria in the form of minimum thresholds are established by the agency to define when the effect becomes significant and unreasonable, producing an undesirable result.

The following subsections include three facets of sustainable management criteria: undesirable results, minimum thresholds, and measurable objectives for each sustainability indicator. GSAs are not required to establish criteria for undesirable results that the agency can demonstrate are not present and are not likely to occur in a basin.[79]

4.3.2.1 Chronic Lowering of Groundwater Levels

The GSP Regulations require the minimum threshold for chronic lowering of groundwater levels to be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results.[80]

For the chronic lowering of groundwater levels, the GSP describes the goal for managing groundwater levels as (1) maintain groundwater levels within or near historical conditions (i.e., above historical low groundwater levels) while accounting for future droughts and climate variability in areas with stable conditions; and (2) protect beneficial users that could be impacted by the declining groundwater levels and stabilize and reverse the

[76] Petaluma Valley GSP, Section 4.2, p. 215.
[77] 23 CCR § 351(ah).
[78] Water Code § 10721(x).
[79] 23 CCR § 354.26(d).
[80] 23 CCR § 354.28(c)(1).

declining trends in areas with declining conditions. The Plan describes the significant and unreasonable chronic lowering of groundwater levels as conditions that limit the ability of domestic, municipal, and agricultural well owners from accessing groundwater; declining groundwater levels near the Basin boundaries that impacts neighboring basins; and lowering groundwater levels to the point of causing impacts to groundwater dependent ecosystems. [81] The GSP describes the potential effects of chronic lowering of groundwater levels on beneficial uses and users including domestic, agricultural, and ecological uses. The Plan also states that the sustainable management criteria are set to avoid reaching historical low conditions or impacting existing supply wells which will avoid significant and unreasonable groundwater level conditions.

The GSP defines an undesirable result as occurring when 25 percent of the representative monitoring points exceed minimum thresholds for three consecutive fall measurements. The Plan incorporates future drought conditions into the undesirable results definition stating that minimum threshold exceedances caused by "emergency operational issues or droughts that extend for longer than the 4-year drought factor incorporated into the minimum thresholds" will not contribute to an undesirable result unless the groundwater levels do not recover in proceeding hydrologically normal to wet years. The GSP, however, provides little discussion of the process, information, and data considered when presenting the discussion of what constitutes emergency operations. Department staff recognize the GSP includes a description of what the Sonoma County GSAs consider drought conditions;[82] however, the lack of information related to how the 4-year drought period correlates with emergency operational issues makes it difficult for Department staff to understand how the GSA intends to manage the Basin during extended dry periods (i.e., drought conditions exceeding the 4-year drought buffer analysis). SGMA also identifies "overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods."[83] Department staff recommend providing further explanation and description related to emergency operations and the potential effects on beneficial uses and users if conditions extend beyond the 4-year drought factor (See Recommended Corrective Action 2).

The GSP set minimum thresholds for chronic lowering of groundwater at 11 representative monitoring points. The GSP explains the methodology to establish the minimum thresholds included evaluating historical groundwater elevation data; depths and locations of existing supply wells; maps of current and historical groundwater elevation data; input from stakeholders; and results from modeling future conditions. The

[81] Petaluma Valley GSP, Section 4.5.1, pp. 220-221.
[82] Petaluma Valley GSP, Appendix 4-B, pp. 621-627.
[83] Water Code § 10721(x)(1).

GSP further explains that the minimum thresholds set at each representative monitoring point are based on three criteria:

1. Identifying the lowest historical groundwater elevation
2. Calculation of well impact depths in the vicinity of each monitoring point
3. Calculation of a drought factor used as an additional buffer[84]

Per the GSP, the methodology for incorporating the potential impacts on existing well users involved the statistical evaluation of known well construction information for all water supply wells (i.e., domestic wells, irrigation wells, public supply wells, and industrial wells) located within the vicinity of each potential representative monitoring point. The minimum threshold was set at the 95th percentile shallowest supply well depth, plus a saturated thickness factor of 10 feet, for wells located in the vicinity of the representative monitoring point.[85] The GSP does not disclose the total number of wells that fall outside of the 95th percentile that could be potentially impacted. Additionally, the GSP does not describe how the 10-foot saturated thickness value was established. Department staff conclude that including this information in the GSP will provide additional technical details supporting the description of how the GSA established the sustainable management criteria for chronic lowering of groundwater levels (See Recommended Corrective Action 3).

The methodology for the drought buffer was based on either historical 4-year declines during historically dry periods or simulated declines for wells with less than 10 years of data. The drought buffer was then subtracted from the historical lows. The calculated drought buffers range from 3 to 20 feet.[86]

The final established minimum threshold value for each representative monitoring point was based on the shallower elevation between the historical low plus the drought buffer or the nearby well impact depth. Of the eleven representative monitoring points, three monitoring points contain the shallow well impact depth minimum threshold and the remaining eight representative monitoring points contain the minimum threshold based on the historical low with the drought buffer.[87]

The measurable objective for representative monitoring points with stable conditions is established at the historical median spring groundwater elevation. The GSP explains that for representative monitoring points that have stable long-term groundwater level trends the goal is to maintain groundwater levels within the historical range. For representative monitoring points that have historical groundwater level declines the goal is to stabilize and reverse the declining trends. The measurable objectives for representative

[84] Petaluma Valley GSP, Section 4.5.2.1, p. 222.
[85] Petaluma Valley GSP, Section 4.5.2.1, p. 224.
[86] Petaluma Valley GSP, Section 4.5.2.1, p. 225.
[87] Petaluma Valley GSP, Table 4-2, p. 227.

monitoring points with declining trends are set to stabilize and reverse the declining trend by establishing the measurable objective at the median spring groundwater level observed prior to 2010 which the GSP explains as conditions that "occurred prior to the onset of declining trends".[88] The GSP states that the interim milestones are based on recent and historical groundwater levels and are effectively equivalent to the measurable objectives in monitoring points with stable conditions. Interim milestones in monitoring points with declining conditions are initially set at current spring conditions for the first five years of implementation.[89]

Department staff conclude that the sustainable management criteria for groundwater levels to be commensurate with the understanding of current conditions, responsive to interested party feedback, and reasonably protective of the groundwater uses and users in the Basin. The approach to maintain stable groundwater level conditions in wells with no history of declines and reversing declining trends in wells that have had declining water levels is a reasonable approach that will help avoid a significant and unreasonable depletion of supply in the Basin. The Plan provides a credible and sufficient assessment of the impacts the minimum thresholds would have on supply wells – including domestic wells – by evaluating the well impact depth and comparing that to the historical low with a drought factor to establish the minimum thresholds at individual representative monitoring points. However, as highlighted in the recommended corrective actions above, the GSP should include some additional supporting technical details that provide further description as to how the minimum thresholds will help the GSA achieve its sustainability goal and avoid undesirable results as identified in the recommended corrective actions.

4.3.2.2 Reduction of Groundwater Storage

The GSP Regulations require the minimum threshold for the reduction of groundwater storage to be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.[90]

The GSP describes a significant and unreasonable reduction of groundwater storage as conditions that would result in "impacts on long-term sustainable beneficial use of groundwater in the basin, as caused by: long-term reductions in groundwater storage; and pumping exceeding the sustainable yield."[91]

The GSP states that "based on well-established hydrogeologic principles, stable groundwater elevations maintained above the minimum threshold will indicate that

[88] Petaluma Valley GSP, Section 4.5.3.1, p. 233.
[89] Petaluma Valley GSP, Section 4.5.3.2, p. 233.
[90] 23 CCR § 354.28(c)(2).
[91] Petaluma Valley GSP, Section 4.6.1, p. 236.

groundwater storage is not being depleted."[92] The GSP further describes chronic lowering of groundwater levels criteria and representative monitoring points will be used as a proxy for groundwater storage sustainable management criteria. The GSP quantitively defines an undesirable result as when 25 percent of the representative monitoring points exceed the groundwater level minimum threshold for three consecutive fall measurements.[93] Additionally, the GSP states that the measurable objectives and interim milestones are the same as those established for the chronic lowering of groundwater.[94]

The GSP provides a description of the potential causes of the reduction of groundwater storage undesirable results and the possible effects on beneficial uses and users in the Basin.[95]

Based on review of the materials referenced in the GSP, staff conclude that the GSP's discussion and presentation of information related to significant and unreasonable reduction of groundwater storage, including the rational that maintaining stable groundwater levels indicates groundwater storage is not being reduced, covers the specific items listed in the GSP Regulations in an understandable format using appropriate data.

4.3.2.3 Seawater Intrusion

The GSP Regulations require the minimum threshold for seawater intrusion to be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results.[96]

The San Pablo Bay borders the Baylands area in the southern portion of the Basin. This area consists of brackish groundwater, and the GSP describes that a "seawater/freshwater interface" occurs beneath the tidal marshlands in the Baylands area. The GSP further describes that the interface is not clearly defined due to data gaps in this area but includes maps displaying the available TDS and chloride concentrations from wells in the southern portion of the Basin.[97] Existing beneficial users of groundwater water in this area are described as limited agricultural and residential supply wells, which according to the GSP, have been pumping brackish groundwater for decades. The GSP states the limited pumping and use of the brackish groundwater in the Baylands area do not indicate that current conditions are significant and unreasonable.[98]

The GSP considers any seawater intrusion inland of areas of existing brackish groundwater that may affect beneficial uses of groundwater to be a significant and

[92] Petaluma Valley GSP, Section 4.6.2, p. 236.
[93] Petaluma Valley GSP, Section 4.6.4.1, p. 239.
[94] Petaluma Valley GSP, Section 4.6.3, p. 238.
[95] Petaluma Valley GSP, Section 4.6.4.2, p. 239.
[96] 23 CCR § 354.28(c)(3).
[97] Petaluma Valley GSP, Figures 3-17 & 3-18, pp. 158-159.
[98] Petaluma Valley GSP, Section 4.7.1, p. 240.

unreasonable condition.[99] The GSP states that an undesirable result occurs when the following two conditions are experienced: [100]

1. Three consecutive years of minimum threshold exceedances (exceedances occur when monitoring data indicate that the current extent of groundwater with 250 milligrams per liter (mg/L) of chloride is inland relative to the minimum threshold contour).
2. The minimum threshold exceedance is determined to be caused by groundwater pumping using a correlation methodology to determine if seawater intrusion-related undesirable results have occurred as a result of groundwater level declines due to groundwater pumping.

The GSP explains that three years of minimum threshold exceedances was used to define an undesirable result due to significant uncertainty related to the extent of the chloride isocontour in the Baylands area and to account for chloride fluxes related to conditions other than groundwater pumping. The GSP also describes the correlation analysis to be used to determine if groundwater pumping is influencing the encroachment of seawater including analysis of monitored groundwater levels, chloride and TDS concentrations, estimated groundwater pumping, and the movement of the 250 mg/L chloride isocontour.[101]

The GSP establishes the minimum threshold for seawater intrusion at the 250 mg/L chloride isocontour for the southern portion of the Basin that abuts the San Pablo Bay. The minimum threshold intends to be protective of beneficial uses such as cultivation of grapes and other agricultural commodities produced in and near the Baylands area. The GSP describes the methodology used to develop the 250 mg/L isocontour and relates the minimum threshold to other sustainability indicators and beneficial uses and users.[102] The GSP acknowledges that there are data gaps in defining the 250 mg/L chloride concentration isocontour due to a limited amount of monitoring in the Baylands area. The GSP also states that understanding the potential impacts resulting from climate change (i.e., sea level rise) will be incorporated into filling data gaps associated with sea water intrusion.[103]

The measurable objective and interim milestones for seawater intrusion are defined as the current 250 mg/L chloride isocontour. The interim milestones are equivalent to the measurable objective set at the current chloride isocontour.[104]

[99] Petaluma Valley GSP, Section 4.7.1, p. 241.
[100] Petaluma Valley GSP, Section 4.7.4.1, p. 246.
[101] Petaluma Valley GSP, Section 4.7.4.1, pp. 246-247.
[102] Petaluma Valley GSP, Section 4.7.2, pp. 241-245.
[103] Petaluma Valley GSP, Section 4.7.1, p. 240.
[104] Petaluma Valley GSP, Section 4.7.3, p. 246.

Based on the contents of the GSP, Department staff conclude that the GSP justifies the sustainable management criteria using the best available information. Department staff encourage the GSA to refine the minimum thresholds in future updates to the GSP as new data and information are acquired.

4.3.2.4 Degraded Water Quality

The GSP Regulations require the minimum threshold for degraded water quality to be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.[105]

The GSP defines significant and unreasonable water quality conditions as occurring when "an increase in the concentration of constituents of concern 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; or undesirable results occurring for other sustainability indicators."[106] Three constituents of concern – arsenic, nitrate, and TDS – were identified in the GSP based on three criteria including, whether the constituents have an established water quality standard, whether the constituents have occurred in the Basin above the standard, and whether the constituent is present throughout the Basin.[107] The GSP explains that point source contaminants are not observed on a regional extent and are regulated and monitored through other regulatory programs. The GSP describes the regulated point source contamination sites in the Basin and the requirements to analyze point source contaminants in the supply well monitoring network used to establish sustainable management criteria concluding that the GSA, at this time, does not consider localized point source contaminants constituents of concern in the GSP. The GSP states the GSA will coordinate with other regulatory agencies to evaluate water quality conditions and adjust constituents of concerns as needed during implementation.[108]

The GSP states a water quality undesirable result occurs "if, during [two] consecutive years, a single groundwater quality minimum threshold is exceeded when computing annual averages at the same well, as a direct result of projects or management actions taken as part of GSP implementation."[109] The GSP further provides a process the GSA

[105] 23 CCR § 354.28(c)(4).
[106] Petaluma Valley GSP, Section 4.8.1, p. 248.
[107] Petaluma Valley GSP, Section 4.8.1, p. 249.
[108] Petaluma Valley GSP, Section 4.8.1, p. 249.
[109] Petaluma Valley GSP, Section 4.8.4.1, p. 259.

will employ to evaluate whether the minimum threshold exceedances are associated with GSP implementation, including assessment of the spatial relationships between the exceedances and GSA projects, and whether other sustainability indicator minimum thresholds have been exceeded. The GSP describes the potential causes of undesirable results and the possible effects on beneficial users and land use if undesirable results were to occur.[110]

The GSP establishes minimum thresholds based on a number of supply wells exceeding the water quality standard for the constituents of concern. The supply wells are described as public supply wells where the constituents of concern will be monitored against the maximum contaminant limit (MCL) or secondary maximum contaminant limit (SMCL). The GSP explains that a review of available data between 2015 and 2020 provided the total number of wells that had existing MCL/SMCL exceedances. The GSP further states that the minimum threshold for each of the three constituents of concern – arsenic, nitrate, and TDS – is established at two additional supply wells exceeding the associated standard. The GSP sets the minimum threshold at two total well exceedances for arsenic and nitrate as there were no reported exceedances for these constituents between 2015 and 2020. The number of allowable exceedances is set at three wells for TDS as one well had historical exceedances during the above-mentioned timeframe. [111]

The measurable objectives for degraded water quality are established at the number of wells exceeding the regulatory standard for the constituent of concern from 2015 to 2020. The GSP states that the measurable objective "is to have no additional supply wells exceeding the applicable MCL or SMCL for any of the constituents of concern." [112] The GSP states that zero wells exceeded the arsenic standard, zero wells exceeded the nitrate standard, and one well exceeded the TDS standard, the GSP therefore sets the measurable objectives at zero wells with exceedances for arsenic, zero wells with exceedances for nitrate, and one well with exceedances for TDS.[113]

Based on review of the GSP's discussion of the established sustainable management criteria, Department staff conclude the GSP's discussion and presentation of information on degradation of water quality covers the specific items listed in the Regulations in an understandable format using appropriate data.

4.3.2.5 Land Subsidence

The GSP Regulations require the minimum threshold for land subsidence to be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.[114] Minimum thresholds for land subsidence shall be supported by

[110] Petaluma Valley GSP, Section 4.8.4.2, p. 259.
[111] Petaluma Valley GSP, Section 4.8.2.3, p. 252.
[112] Petaluma Valley GSP, Section 4.8.3, p. 258.
[113] Petaluma Valley GSP, Section 4.8.3, p. 258.
[114] 23 CCR § 354.28(c)(5).

identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects and maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.[115]

The GSP states that the best available data and information indicate that inelastic subsidence due to groundwater pumping is not present in the Basin. Specifically, the GSP states that subsidence measurements have been collected at one discrete location in the Basin, and "[t]otal subsidence measured by [global positioning system (GPS)] survey at the discrete location was less than 0.5-inch (or 0.042 foot) since 2004".[116] The GSP adds that InSAR measurements indicate 0.25 inches of total land subsidence since 2015. The GSP explains that measured subsidence shows regional consistency and is not likely attributed to groundwater pumping, but rather associated with tectonics or hydrostatic loading. The GSP concludes that due to the minimal total subsidence and the lack of correlation with groundwater pumping, significant and unreasonable inelastic subsidence has not occurred in the Basin.[117]

The GSP states that because inelastic subsidence has not been observed, any rate of future inelastic subsidence caused by groundwater pumping is a significant and unreasonable condition.[118] The GSP states that "a land subsidence undesirable results will occur if:

- The land subsidence minimum threshold of 0.1 foot of total subsidence is exceeded over a geographic area of 50 acres in a single year, or
- Cumulative total subsidence of 0.2 foot is exceeded over a geographic area of 50 acres within a 5-year period, and
- The minimum threshold exceedance is determined to be correlated with (1) groundwater pumping, and (2) a minimum threshold exceedance of the chronic lowering of groundwater-level sustainable management criteria."[119]

The GSP defines the measurable objective as the same as the minimum threshold given that zero subsidence related to groundwater pumping is the goal of the GSP. Like the minimum threshold, the subsidence measurable objective allows for 0.1 foot of

[115] 23 CCR §§ 354.28(c)(5)(A-B).
[116] Petaluma Valley GSP, Section 4.9, p. 260.
[117] Petaluma Valley GSP, Section 4.9, p. 260-261.
[118] Petaluma Valley GSP, Section 4.9.1, p. 261.
[119] Petaluma Valley GSP, Section 4.9.4, p. 265.

measurement error per year. The interim milestones for subsidence are the same as minimum thresholds and measurable objectives.[120]

Based on review of the GSP, Department staff are aware of no significant inconsistencies or contrary information to what was presented in the GSP and therefore have no significant concerns regarding the quality, data, and discussion of land subsidence and the associated sustainable management criteria.

4.3.2.6 Depletions of Interconnected Surface Water

SGMA defines undesirable results for the depletions of interconnected surface water as those that have significant and unreasonable adverse impacts on beneficial uses of surface water and are caused by groundwater conditions occurring throughout the basin.[121] The GSP Regulations require that a Plan identify the presence of interconnected surface water systems in the basin and estimate the quantity and timing of depletions of those systems.[122] The GSP Regulations further require that minimum thresholds be set based on the rate or volume of surface water depletions caused by groundwater use, supported by information including the location, quantity, and timing of depletions, that adversely impact beneficial uses of the surface water and may lead to undesirable results.[123]

The GSP identifies interconnected surface water systems within the Basin and provides a map for interconnected surface water locations identified from modeling analyses.[124] Department staff are satisfied that the GSA has adopted a reasonable approach to identify the location of interconnected surface waters in the Basin.

The GSP does not quantify the rate or volume of surface water depletions due to groundwater pumping as the sustainable management criteria as required by the GSP Regulations.[125] Instead, the GSP proposes initial sustainable management criteria using shallow near-stream groundwater levels as a proxy for the rate and volume of depletions.[126] In addition, the Plan describes an adaptive management approach for developing new information and data to refine the initial sustainable management criteria in the first few years of Plan implementation. The GSP explains the approach to managing depletions was informed by two practitioner groups organized by the GSA that helped to: (1) map and understand groundwater dependent ecosystems in the Basin; and (2) establish the quantitative metrics for the initial sustainable management criteria and

[120] Petaluma Valley GSP, Section 4.9.3.2, p. 264.
[121] Water Code § 10721(x)(6).
[122] 23 CCR § 354.16 (f).
[123] 23 CCR § 354.28 (c)(6).
[124] Petaluma Valley GSP, Figure 3-20a, p. 164.
[125] 23 CCR § 354.28 (c)(6).
[126] Petaluma Valley GSP, Section 4.10.2, p. 268.

identify areas for developing new information and data that will improve the management criteria.[127]

The GSP describes significant and unreasonable depletions of interconnected surface water as occurring when "surface water depletion, caused by groundwater pumping within the Basin, exceeds historical depletion or adversely impacts the viability of [groundwater dependent ecosystems] or other beneficial users of surface water."[128] The GSP explains that the overarching goal is to maintain the gaining and losing conditions observed during 2019-2020, which the Plan describes as "a period in which data have been collected."[129] The Plan also states that the 2019-2020 groundwater level conditions were marginally higher than the groundwater levels observed during 2014-2016 which was a period that modeling simulations indicate resulted in the greatest amount of recent historical depletions.

Department staff note the GSP does not describe the magnitude or effect of those historic depletions on beneficial uses and users. To support the goal of maintaining 2019-2020 conditions relative to the greatest recent historical depletions (i.e., during the 2014-2016 period), the GSP should explain using available data and information (i.e., groundwater levels in shallow near-stream wells, flow rates on streams used in the model simulations, estimated pumping volumes, changes in pumping rates of nearby wells etc.) how the conditions in 2019-2020, which are described as "slightly" better than recent historical dry -season lows, will avoid adversely impacting "the viability of [groundwater dependent ecosystems] or other beneficial users of surface water."

The GSP defines an undesirable result for the depletion of interconnected surface water as occurring when the minimum threshold is exceeded at two wells during dry years or at one well during normal and wet years and is determined to be associated with groundwater pumping. The GSP describes the difference between dry years and normal and wet years as necessary to help avoid higher levels of depletions that have been observed in dry years from occurring in wet or normal years. The Plan also states that an exceedance of a minimum threshold in a single representative monitoring point will initiate an investigation to determine if the GSA should implement actions to avoid the potential occurrence of undesirable results.[130] The steps related to the investigation of a single minimum threshold exceedance includes a review of the entire groundwater level monitoring network to assess the extent of declining levels, review climatic data, assess changes in groundwater extraction, and engage with stakeholders to share information.[131]

[127] Petaluma Valley GSP, Section 4.10, pp. 266-267.
[128] Petaluma Valley GSP, Section 4.10.1, p. 268.
[129] Petaluma Valley GSP, Section 4.10.2.1, p. 269.
[130] Petaluma Valley GSP, Section 4.10.4.1, p. 274.
[131] Petaluma Valley GSP, Section 4.10.4.2, p. 275.

The minimum thresholds for depletions of interconnected surface water have been established for three representative monitoring sites all of which are groundwater level wells screened in the shallow aquifer zone and are within 100 feet of three different surface streams: the Petaluma River, East Washington Creek, and Capri Creek. The GSP explains that the three representative monitoring points were selected based on observed interconnectivity interpreted from streambed elevation data and stream surface- water measurements. The Plan also justifies the three representative monitoring points due to proximity to groundwater dependent ecosystems.[132] It appears, however, that based on Figure 1 in Appendix 4-D, the three representative monitoring points are collocated with City of Petaluma stream gauges, however those specific collocated stream gauges – and the several other stream gauges presented in Appendix 4-D – are not discussed in relation to identifying interconnectivity, estimated stream leakage as determined by the PVIHM, or the selection of representative monitoring points for depletions of interconnected surface water. The GSP further describes the minimum threshold as 1 foot below the observed 2020 dry-season minimum groundwater levels.[133] However, the minimum threshold for one representative monitoring point (i.e., PET0172) appears to be set at the groundwater level equivalent to the approximate streambed elevation obtained from LiDAR datasets. Additionally, the remaining two representative monitoring points (i.e., PET0173 and PET0174) are described as 1 foot below the approximate streambed elevation yet "slightly below 2019 and 2020 groundwater levels."[134] The GSP does not explicitly describe the correlation between the streambed elevations, the 2019-2020 groundwater elevations, and the application of those elevations to establishing the minimum thresholds for the three representative monitoring points (See Recommended Corrective Action 4a).

The measurable objectives for the depletion of interconnected surface water were established to represent achievable target groundwater elevations near streams that allow for operational flexibility over a range of climate and hydrologic variability.[135] The Plan states that "[i]n the absence of sufficient observed historical data at the three representative monitoring points to evaluate hydrologic variability over a range of climate conditions, the initial measurable objectives are set at the halfway point between the minimum threshold value and the average observed dry-season surface water stage for the available period of record (November 2019 through December 2020)."[136] The interim milestones for this sustainability indicator are identical to the measurable objectives being

[132] Petaluma Valley GSP, Appendix 4-D, p. 870.
[133] Petaluma Valley GSP, Section 4.10.2.1, p. 270.
[134] Petaluma Valley GSP, Appendix 4-D, p. 871.
[135] Petaluma Valley GSP, Section 4.10.3, p. 273.
[136] Petaluma Valley GSP, Section 4.10.3, p. 273.

that the measurable objectives are set at the near observed groundwater elevations during recent years.[137]

The GSP describes an adaptive management approach to address data gaps that will inform the improvement and refinement of the initial sustainable management criteria. The adaptive management approach is broken out into two groups: characterization of cause and effect of depletions; and monitoring network improvements and special studies. The characterization of depletions activities includes the improvement of data and information from wells and stream diversions, focused numeric model calibration of surface water and groundwater interaction, and better understanding of groundwater dependent ecosystems. The monitoring networks and special studies include additional shallow monitoring wells and stream gauges, geophysical surveys, and geomorphic and habitat assessments. The Plan also provides a description of the future methodology the GSA intends to implement prior to the first periodic update, including developing a modeling framework to isolate impacts of groundwater pumping on stream flow, improving correlation between groundwater levels and depletions, and refining the process for setting groundwater levels as a proxy for minimum thresholds.

As mentioned, the GSP identifies several data gaps that currently limit the GSA's understanding of the timing and location of interconnectivity, including a need to develop more sophisticated modeling simulations.[138] Department staff encourage addressing those data gaps to the extent that they can improve the GSA's overall understanding of the conditions leading to depletions in the Basin.

Department staff understand that quantifying depletions of surface water from groundwater extractions is a complex task that likely requires developing new, specialized tools, models, and methods to understand local hydrogeologic conditions, interactions, and responses. During the initial review of GSPs, Department staff have observed that most GSAs have struggled with this new requirement of SGMA. However, staff believe that most GSAs will more fully comply with regulatory requirements after several years of Plan implementation that includes projects and management actions to address the data gaps and other issues necessary to understand, quantify, and manage depletions of interconnected surface waters. Department staff further advise that at this stage in SGMA implementation it is appropriate to approve Plans with recommended corrective actions to address deficiencies related to interconnected surface water depletion where GSAs are still working to fill data gaps related to interconnected surface water and where these data will be used to inform plan components that will be subject to future review. Accordingly, Department staff believe that affording GSAs adequate time to refine their Plans to address interconnected surface waters is appropriate and remains consistent with SGMA's timelines and local control preferences.

[137] Petaluma Valley GSP, Section 4.10.3.2, p. 273.
[138] Petaluma Valley GSP, Appendix 4-D, pp. 871-873.

The Department will continue to support GSAs in this regard by providing, as appropriate, financial and technical assistance to GSAs, including the development of guidance describing appropriate methods and approaches to evaluate the rate, timing, and volume of depletions of interconnected surface water caused by groundwater extractions. Once the Department's guidance related to depletions of interconnected surface water is publicly available, the GSA, where applicable, should consider incorporating appropriate guidance approaches into their future periodic updates to the GSP (See Recommended Corrective Action 4b). GSAs should consider availing themselves of the Department's financial or technical assistance, but in any event must continue to fill data gaps, collect additional monitoring data, and implement strategies to better understand and manage depletions of interconnected surface water caused by groundwater extractions and define segments of interconnectivity and timing within their jurisdictional area (See Recommended Corrective Action 4c). Furthermore, GSAs should coordinate with local, state, and federal resources agencies as well as interested parties to better understand the full suite of beneficial uses and users that may be impacted by pumping induced surface water depletion (See Recommended Corrective Action 4d).

4.4 Monitoring Networks

The GSP Regulations describe the monitoring network that must be developed for each basin including monitoring objectives, monitoring protocols, and data reporting requirements. Collecting monitoring data of a sufficient quality and quantity is necessary for the successful implementation of a groundwater sustainability plan. The GSP Regulations require a monitoring network of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.[139] Specifically, a monitoring network must be able to monitor impacts to beneficial uses and users,[140] monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds,[141] capture seasonal low and high conditions,[142] include required information such as location and well construction and include maps and tables clearly showing the monitoring site type, location and frequency.[143] Department staff encourage GSAs to collect monitoring data as specified in the GSP, fill data gaps identified in the GSP prior to the first five-year update,[144] update monitoring network information as needed, follow monitoring best management practices,[145] and submit all monitoring data to the Department's Monitoring Network Module immediately after

[139] 23 CCR § 354.32.
[140] 23 CCR § 354.34(b)(2).
[141] 23 CCR § 354.34(b)(3).
[142] 23 CCR § 354.34(c)(1)(B).
[143] 23 CCR §§ 354.34(g-h).
[144] 23 CCR § 354.38(d).
[145] Department of Water Resources, 2016, Best Management Practices and Guidance Documents.

collection including any additional groundwater monitoring data that is collected within the Plan area that is used for groundwater management decisions. Staff note that if GSAs do not fill their identified data gaps, the GSA's basin understanding may not represent the best available science for use to monitor basin conditions.

The GSP has identified 25 monitoring wells to include in the groundwater level monitoring network.[146] Fifteen of the 25 wells in the groundwater level monitoring network are located within the principal aquifer of the Basin, and 10 additional monitoring wells are located just outside of the Basin to monitor basin boundary conditions in the adjacent basin and subbasin. A total of 11 wells are used as representative monitoring points in the Basin. The GSP has identified three well depth categories within the principal aquifer of the Basin; Shallow (0-200 feet below top-of-casing), Medium (200-500 feet below top-of-casing, and Deep (greater than 500 feet below top-of-casing).[147] Of the 15 wells included in the monitoring network within the Basin, seven wells are screened within the Shallow category, seven wells are screened within the Medium category, and one well is screened within the Deep category.

The GSP proposes to use the groundwater level monitoring network as a proxy for the groundwater storage monitoring network because changes in groundwater storage are directly dependent on changes in groundwater levels.[148]

The GSP identifies nine potential public water supply wells to be included in the seawater intrusion monitoring network which are all within two miles of the Baylands portion of the Basin.[149] The GSP is proposing to monitor the spatial distribution of saline groundwater through semi-annual chloride sampling and through groundwater level monitoring.[150]

The GSP states that public supply wells regulated by the SWRCB's Division of Drinking Water (DDW) will make up the groundwater quality monitoring network.[151] The GSP states that the DDW wells are analyzed routinely to meet California Code of Regulations Title 22 water quality reporting requirements and include arsenic, nitrate, and TDS, which are identified as constituents of concern for the Basin.[152]

The GSP states that in addition to utilizing InSAR data, one continuous GPS site will be included in the monitoring network.[153]

[146] Petaluma Valley GSP, Section 5.2.1.2, pp. 282-283, Table 5-1, p. 284.
[147] Petaluma Valley GSP, Table 5-1, p. 284.
[148] Petaluma Valley GSP, Section 4.6, p. 236.
[149] Petaluma Valley GSP, Section 5.2.5, p. 287, Figure 5-3, p. 290.
[150] Petaluma Valley GSP, Section 5.2.5, p. 287.
[151] Petaluma Valley GSP, Section 5.2.2, p. 283.
[152] Petaluma Valley GSP, Section 5.2.2, p. 283, Section 4.8.1, p. 249.
[153] Petaluma Valley GSP, Section 5.2.4, p. 287.

The GSP has identified three shallow stream-adjacent monitoring wells to include in the monitoring network for depletions of interconnected surface water.[154] Each of the shallow stream-adjacent monitoring wells contains a pressure transducer to collect temperature and groundwater level data at hourly intervals. The shallow monitoring wells in the network are adjacent to the Petaluma River and its tributaries in the central portion of the Basin. The monitoring network also includes one USGS stream gage and 15 City of Petaluma stream gages.[155] All stream gages collect continuous data. Three of the stream gages have an adjacent shallow monitoring well.[156] The three stream gages include the City of Petaluma stream gage in the Petaluma River at Corona Road, City of Petaluma stream gage in East Washington Creek at Garfield Drive, and the City of Petaluma stream gage in Capri Creek at Casella Way.

The description of the monitoring network included in the Plan substantially complies with the requirements outlined in the GSP Regulations. Overall, the Plan describes in sufficient detail a monitoring network that promotes the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Basin and evaluate changing conditions that occur through Plan implementation. The GSP provides a good explanation for the conclusion that the monitoring network is supported by the best available information and data and is designed to ensure adequate coverage of sustainability indicators. The Plan also describes existing data gaps and the steps that will be taken to fill data gaps and improve the monitoring network prior to the next five-year assessment. Department staff consider the information presented in the Plan to satisfy the general requirements of the GSP Regulations regarding the monitoring network.

While the information included in the GSP for the monitoring network does not preclude plan approval, Department staff have recommended corrective actions for further improvement of the Plan. The GSP provides a robust monitoring network that will monitor the sustainability indicators and assist in achieving the sustainability goal; however, there are some components of the GSP Regulations which the GSP does not address.

Department staff have determined the proposed density of monitoring sites for the chronic lowering of groundwater level monitoring network may not be sufficient to monitor the Basin given its amount of current and projected groundwater use because only one monitoring well is located within the Deep well depth category.[157] The GSP identifies the water supply well depth distribution within the Basin, with a significant number of water supply wells having depths greater than 500 feet;[158] however, the GSP categorizes one

[154] Petaluma Valley GSP, Section 5.2.3, p. 287.
[155] Petaluma Valley GSP, Section 5.2.3, p. 287, Table 5-2, p. 288.
[156] Petaluma Valley GSP, Section 5.2.3, p. 287, Table 5-2, p. 288.
[157] Petaluma Valley GSP, Table 5-1, p. 284.
[158] Petaluma Valley GSP, Figure 2-6b, p. 85.

well as Deep within the chronic lowering of groundwater levels monitoring network.[159] As required in the GSP Regulations, the GSA shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends. [160] Department staff recommend that the GSP provide justification for the use of one Deep well in the monitoring network and recommend that the GSA assess the feasibility and necessity of adding additional Deep monitoring wells in the vicinity of areas with a high density of water supply wells that are at least 500 feet deep (See Recommended Corrective Action 5).

While the GSP does provide a map identifying the location of the representative monitoring sites for degradation of water quality and representative monitoring sites have been identified in the monitoring network module, Department staff have determined additional information should be provided in the GSP regarding the monitoring network for degraded water quality. The GSP did not report, in tabular format, the monitoring site type or measurement frequency for the degraded water quality monitoring network as required by the GSP Regulations. [161] Providing this information will provide the Department additional clarity on how other water quality programs are being leveraged by the Basin to comply with the requirements of the GSP Regulations and SGMA (see Recommended Corrective Action 6).

The GSP Regulations require GSPs to provide specific information about each monitoring site per the data and reporting standards.[162] As an example, well construction information is required for monitoring sites, but is not provided for wells in the seawater intrusion and degraded water quality monitoring networks. It is imperative the GSA work to ensure the information defining the monitoring network is consistent within the GSP, consistent with the Department's Monitoring Network Module, and follow the data and reporting standards. Department staff recommend there be a reconciliation between the details of the monitoring network provided in the GSP with the requirements of the data and reporting standards in the GSP Regulations. (See Recommended Corrective Action 7).

4.5 Projects and Management Actions

The GSP Regulations require a description of the projects and management actions the submitting agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.[163]

[159] Petaluma Valley GSP, Table 5-1, p. 284.
[160] 23 CCR § 354.34 (f).
[161] 23 CCR § 354.34 (h).
[162] 23 CCR §§ 352.4, 354.34(g)(2).
[163] 23 CCR § 354.44 *et seq.*

To reach the sustainability goal, the GSP outlines a collection of projects and management actions that the GSA will rely on to "ensure clean and plentiful groundwater for future uses and users in an environmentally sound and equitable manner." The Plan describes a suite of four projects and two management actions that the GSA intends either to begin implementing or begin preliminary studies and investigations to facilitate implementation.[164] The Plan's primary project consists of actions to facilitate water-use efficiency and alternate water sources, including voluntary, incentive-based water-use efficiency programs (e.g., turf removal, rainwater harvesting, and irrigation efficiency practices). The management actions are focused on refining or developing policies and coordination efforts that include improvements to well permitting, construction, and measurement requirements and partnering with agricultural planning groups to promote water use efficiency.

The Plan adequately describes proposed projects and management actions in a manner that is generally consistent and substantially complies with the GSP Regulations.[165] The projects and management actions, which focus largely on reducing water demand; increasing groundwater in storage; and increasing non-groundwater water supply, are directly related to the sustainable management criteria and present a generally feasible approach to achieving the sustainability goal of the Basin. As projects and management actions are implemented, the Department expects that progress reports be included in annual reports and any addition or removal of project and management actions be documented in periodic updates.

4.6 Consideration of Adjacent Basins/Subbasins

SGMA requires the Department to "…evaluate whether a groundwater sustainability plan adversely affects the ability of an adjacent basin to implement their groundwater sustainability plan or impedes achievement of sustainability goals in an adjacent basin."[166] Furthermore, the GSP Regulations state that minimum thresholds defined in each GSP be designed to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.[167]

The Petaluma Valley has four adjacent basins/subbasins: Sonoma Valley, Santa Rosa Plain, Wilson Grove Formation Highlands, and Novato Valley. The Wilson Grove Formation Highlands Basin and Novato Valley Basin are designated very-low priority basins and are not required to be managed under a GSP. The Plan includes an analysis of potential impacts to adjacent basins with the defined minimum thresholds for each

[164] Petaluma Valley GSP, Section 6, pp. 307-324.
[165] 23 CCR § 354.44 *et seq*.
[166] Water Code § 10733(c).
[167] 23 CCR § 354.28(b)(3).

sustainability indicator. The Plan does not anticipate any impacts to adjacent basins resulting from the minimum thresholds defined in the Plan.

4.7 Consideration of Climate Change and Future Conditions

The GSP Regulations require a GSA to consider future conditions and project how future water use may change due to multiple factors including climate change.[168]

Since the GSP was adopted and submitted, climate change conditions have advanced faster and more dramatically. It is anticipated that the hotter, drier conditions will result in a loss of 10% of California's water supply. As California adapts to a hotter, drier climate, GSAs should be preparing for these changing conditions as they work to sustainably manage groundwater within their jurisdictional areas. Specifically, the Department encourages GSAs to explore how the proposed groundwater level thresholds have been established in consideration of groundwater level conditions in the Basin based on current and future drought conditions. The Department encourages GSAs to also explore how groundwater level data from the existing monitoring network will be used to make progress towards sustainable management of the Basin given increasing aridification and effects of climate change, such as prolonged drought. Lastly, the Department encourages GSAs to continually coordinate with the appropriate groundwater users, including but not limited to domestic well owners and state small water systems, and the appropriate overlying county jurisdictions developing drought plans and establishing local drought task forces[169] to evaluate how the Agency's groundwater management strategy aligns with drought planning, response, and mitigation efforts within the Basin.

[168] 23 CCR § 354.18.
[169] Water Code § 10609.50.

5 STAFF RECOMMENDATION

Department staff recommend approval of the GSP with the recommended corrective actions listed below. The Petaluma Valley Basin GSP conforms with Water Code Sections 10727.2 and 10727.4 of SGMA and substantially complies with the GSP Regulations. Implementation of the GSP will likely achieve the sustainability goal for the Petaluma Valley Basin. The GSAs have identified several areas for improvement of the Plan and Department staff concur that those items are important and should be addressed as soon as possible. Department staff have also identified additional recommended corrective actions that should be considered by the GSAs for the first five-year assessment of its GSP. Addressing these recommended corrective actions will be important to demonstrate that implementation of the Plan is likely to achieve the sustainability goal.

The recommended corrective actions include:

RECOMMENDED CORRECTIVE ACTION 1

The GSP should include all sources of water in the historical water budget and, specifically, identify surface water imports to the Basin from the Russian River.

RECOMMENDED CORRECTIVE ACTION 2

The GSP's undesirable results definition for chronic lowering of groundwater levels is modified for drought conditions, stating that minimum threshold exceedances caused by "emergency operational issues or droughts that extend for longer than the 4-year drought factor incorporated into the minimum thresholds" will not contribute to an undesirable result unless the groundwater levels do not recover in proceeding hydrologically normal to wet years. The GSP, however, provides little discussion of the process, information, and data considered when presenting the discussion of what constitutes emergency operations. The GSP should provide further explanation and description related to what constitutes emergency operations. Additionally, the GSP should analyze the anticipated groundwater conditions that would lead to emergency operations and the potential effects on beneficial uses and users if conditions extend beyond the 4-year drought factor.

RECOMMENDED CORRECTIVE ACTION 3

The minimum threshold for chronic lowering of groundwater levels was set at the 95th percentile shallowest supply well depth, plus a saturated thickness value of 10 feet. Although groundwater levels management under the Plan essentially intends to protect or maintain the production 95% of wells, the GSP does not disclose the total number of wells that could be potentially impacted at the proposed minimum threshold. To ensure full disclosure to potentially affected interests and informed decision making, the GSA should more explicitly analyze and report the total number of wells that may be impacted by the proposed minimum thresholds. The GSA should also provide a description related to the spatial relationship of the potentially impacted wells and the representative

monitoring point associated with each of the vicinity area polygons used for the statistical well impact depth analysis.[170]

The minimum threshold for chronic lowering of groundwater levels also includes a saturated thickness factor of 10 feet, for wells located in the vicinity of the representative monitoring point.[171] The GSP does not describe how the 10-foot saturated thickness value was established. The GSP should provide further discussion related to the process, information, and data considered when performing and presenting the saturated thickness values associated with the potential drawdown in the well impact depth analysis.

RECOMMENDED CORRECTIVE ACTION 4

Department staff understand that estimating the location, quantity, and timing of stream depletion due to ongoing, Basin-wide pumping is a complex task and that developing suitable tools may take additional time; however, it is critical for the Department's ongoing and future evaluations of whether GSP implementation is on track to achieve sustainable groundwater management. The Department plans to provide guidance on methods and approaches to evaluate the rate, timing, and volume of depletions of interconnected surface water and support for establishing specific sustainable management criteria in the near future. This guidance is intended to assist GSAs to sustainably manage depletions of interconnected surface water.

In addition, the GSA should work to address the following items by the first periodic update:

a. Elaborate on the analysis of the LiDAR data used to approximate streambed elevations and how the collocated surface stream gauge measurements were applied to the PVIHM, identification of interconnected surface water, and the establishment of sustainable management criteria for the depletions of interconnected surface water. In concert with further description of the LiDAR and stream gauge analyses, the GSP should more clearly explain which representative monitoring points are associated with streambed elevations versus historic dry-season groundwater lows and why those criteria were used to establish the initial minimum thresholds for the specific representative monitoring points.

b. Consider utilizing the interconnected surface water guidance, as appropriate, when issued by the Department to establish quantifiable minimum thresholds, measurable objectives, and management actions.

[170] Petaluma Valley GSP, Figure 5-B-9, p. 901.
[171] Petaluma Valley GSP, Section 4.5.2.1, p. 224.

c. Continue to fill data gaps, collect additional monitoring data, and implement the current strategy to manage depletions of interconnected surface water and define segments of interconnectivity and timing.
d. Prioritize collaborating and coordinating with local, state, and federal regulatory agencies as well as interested parties to better understand the full suite of beneficial uses and users that may be impacted by pumping induced surface water depletion within the GSA's jurisdictional area.

RECOMMENDED CORRECTIVE ACTION 5

Department staff recommend that the GSP provide justification for the use of one Deep well (greater than 500 feet below top-of-casing) in the monitoring network and recommend that the GSA assess the feasibility and necessity of adding additional Deep monitoring wells in the vicinity of areas with a high density of water supply wells that are at least 500 feet deep.

RECOMMENDED CORRECTIVE ACTION 6

Define the monitoring site type and data collection frequency in tabular format for the degraded water quality monitoring network in the GSP.

RECOMMENDED CORRECTIVE ACTION 7

Conduct a reconciliation between the details of the monitoring network provided in the GSP with the requirements of the data and reporting standards in the GSP Regulations. Where requirements of the data and reporting standards are not provided, the GSA should include this information in the periodic update of the GSP. As a reminder, updates to the monitoring network must be reflected in the SGMA Portal's Monitoring Network Module.