



CALIFORNIA DEPARTMENT OF WATER RESOURCES

SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

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February 27, 2025

Justin Jenson
Tehama County Flood Control and Water Conservation District GSA - Antelope
9380 San Benito Avenue
Gerber, CA 96035-9701
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RE: Approved Determination of the 2024 Groundwater Sustainability Plan Submitted for the Sacramento Valley - Antelope Subbasin

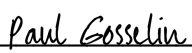
Dear Justin Jenson

The Department of Water Resources (Department) has evaluated the 2024 groundwater sustainability plan (GSP) for the Sacramento Valley - Antelope Subbasin in response to the Department's Incomplete Determination on October 26, 2023, 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 Sacramento Valley - Antelope Subbasin GSP has taken sufficient action to correct deficiencies identified by the Department, 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 GSAs are required to submit their periodic evaluation of the Sacramento Valley - Antelope Subbasin GSP no later than January 31, 2027.

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

Thank You,



Paul Gosselin
Deputy Director
Sustainable Groundwater Management

Attachment:
Statement of Findings Regarding the Determination of Approval of the Sacramento Valley – Antelope Subbasin 2024 Groundwater Sustainability Plan

**STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES**

**STATEMENT OF FINDINGS REGARDING THE
APPROVAL OF THE
SACRAMENTO VALLEY – ANTELOPE SUBBASIN
2024 GROUNDWATER SUSTAINABILITY PLAN**

Under the Sustainable Groundwater Management Act (SGMA or Act), 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 SGMA, 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 its GSP or impedes achievement of sustainability goals in an adjacent basin.¹ The Department is directed to issue an assessment of the Plan within two years of its submission.² If a Plan is determined to be Incomplete, the Department must identify deficiencies that preclude approval of the Plan and identify corrective actions required to make the Plan substantially compliant with SGMA and the GSP Regulations. The Groundwater Sustainability Agency (GSA or Agency) has up to 180 days from the date the Department issues its assessment to make the necessary corrections and submit a revised Plan.³ When evaluating a revised GSP that was determined to be incomplete, the Department reviews the materials provided by the GSA (e.g., revised or amended GSP) to address the deficiencies by the submission deadline. Part of the Department's review focuses on how the Agency addressed the deficiencies that precluded approval of the Plan. The Department shall find a Plan previously determined to be incomplete to be either:

1. Approved, if the Department determines the Agency has sufficiently addressed those deficiencies, the Department may evaluate other components of the Plan, particularly to assess whether and, if so, how revisions to address deficiencies may have affected other components of a Plan or its likelihood of achieving sustainable groundwater management.
2. Inadequate if, after consultation with the State Water Resources Control Board, the Agency has not taken sufficient action to correct the deficiencies previously identified by the Department.

This Statement of Findings explains the Department's determination regarding the revised Plan for the Sacramento Valley – Antelope Subbasin (Basin No. 5-021.54) by the

¹ Water Code § 10733.

² Water Code § 10733.4.

³ 23 CCR § 355.2(e)(2).

Tehama County Flood Control and Water Conservation District GSA - Antelope (GSA or Agency) submitted on April 22, 2024 (referred to as the 2024 GSP or 2024 Plan).

Department management have discussed the 2024 Plan with Department staff and have reviewed the written assessment titled Sustainable Groundwater Management Program Assessment of Incomplete Groundwater Sustainability Plan 2025 Staff Report (Staff Report), attached as Exhibit A, which recommends approval of the 2024 GSP. Department management are satisfied that staff have conducted a thorough evaluation and assessment of the 2024 Plan and concur with staff's recommendations and all the recommended corrective actions. The Department therefore **APPROVES** the 2024 Plan and makes the following findings:

- A. On January 31, 2022, the GSA submitted a GSP (referred to as the 2022 GSP or 2022 Plan) for the Department's evaluation.
- B. On October 26, 2023, the Department issued a Staff Report (referred to as the 2023 Incomplete Determination) and Findings determining the 2022 GSP to be incomplete, because the 2022 GSP did not satisfy the requirements of SGMA, nor did it substantially comply with the GSP Regulations. The Department's 2023 Incomplete Determination identified the following deficiencies that precluded approval and provided the GSA with corrective actions that were intended to address the deficiencies.
 1. Deficiency 1. The 2022 GSP did not establish sustainable management criteria for chronic lowering of groundwater levels in a manner substantially compliant with the GPS regulations.
 2. Deficiency 2: The 2022 GSP did not develop sufficient sustainable management criteria for degradation of groundwater quality.

The Department provided the Agency with 180 days to address the deficiencies.⁴

- C. On April 22, 2024, the GSA submitted a revised Plan (the 2024 GSP) to the Department. After staff's thorough evaluation of the 2024 Plan, the Department finds:
 1. The Agency has taken sufficient action to correct Deficiency 1, such that, at this time, the Department no longer finds this deficiency to preclude approval. The 2024 GSP has sufficiently identified the impacts to beneficial uses and users that would occur at an undesirable condition and has provided management criteria to identify the undesirable condition that reflect the identified impacts.

⁴ 23 CCR § 355.2(e)(2).

2. The Agency has taken sufficient action to correct Deficiency 2, such that, at this time, the Department no longer finds this deficiency to preclude approval. The 2024 GSP has established monitoring and sufficient sustainable management criteria for nitrate.

The 2024 Plan satisfies the required conditions as outlined in § 355.4(a) of the GSP Regulations⁵:

1. 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.⁶
 2. The Plan, either on its own or in coordination with other Plans, appears to cover the entire Subbasin sufficient to warrant a thorough evaluation.⁷
- D. 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 to achieve the sustainability goal for the Subbasin 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.⁸ 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 programs⁹; and the Legislature’s express intent under SGMA that groundwater basins be managed through the actions of local

⁵ 23 CCR § 350 et seq.

⁶ 23 CCR § 355.4(a)(2).

⁷ 23 CCR § 355.4(a)(3).

⁸ Water Code § 10733.

⁹ Water Code § 113.

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.¹⁰ The Department’s final determination 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.

- E. In making these findings and Plan determination, the Department also recognized that: (1) the Department 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 GSAs 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.¹¹
- F. The Plan conforms with Water Code §§ 10727.2 and 10727.4, substantially complies with 23 CCR § 355.4, and appears likely to achieve the sustainability goal for the Subbasin. It does not appear at this time that the Plan will adversely affect the ability of adjacent basins to implement their GSPs or impede achievement of sustainability goals.
1. The sustainable management criteria and the Plan’s sustainability goal is “to develop PMAs that result in the sustainable management of the groundwater resources of the Subbasin for long-term community, financial, and environmental benefits of residents and businesses in the Subbasin. This GSP’s approach to achieve sustainable management of groundwater resources within 20 years, while maintaining the unique cultural, community, and agricultural aspects of the Subbasin”¹² is sufficiently justified and explained. The Plan relies on credible information and science to quantify the groundwater conditions that the Plan seeks to avoid and provides an objective way to determine whether the Subbasin is being managed sustainably in accordance with SGMA.¹³
 2. The 2024 GSP has identified areas for improvement of its Plan including addressing data gaps related to hydrogeological conceptual model,

¹⁰ Water Code § 10720.1(h).

¹¹ Water Code §§ 10721(r); 10727.2(b); 10733(a); 10733.8.

¹² 2024 Antelope GSP, Section 3.1.1, p. 293.

¹³ 23 CCR § 355.4(b)(1).

groundwater conditions, water budgets, and monitoring networks, and plans to incorporate new information into the numerical model.¹⁴

3. The projects and management actions proposed are designed to recharge groundwater and allow for voluntary demand management to mitigate reductions in groundwater storage and groundwater level decline. They also include well mitigation to address dry wells. The projects and management actions are reasonable and commensurate with the level of understanding of the Subbasin setting. The projects and management actions described in the Plan provide a feasible approach to achieving the Subbasin's sustainability goal and should provide the GSAs with greater versatility to adapt and respond to changing conditions and future challenges during GSP implementation.¹⁵
4. The Plan provides a detailed explanation of how the varied interests of groundwater uses and users in the Subbasin were considered in developing the sustainable management criteria and how those interests, including... domestic wells, would be impacted by the chosen minimum thresholds.¹⁶
5. The Plan's projects and management actions appear feasible at this time and appear capable of preventing undesirable results and ensuring that the Subbasin is operated within its sustainable yield within 20 years. The Department will continue to monitor Plan implementation and reserves the right to change its determination if projects and management actions are not implemented or appear unlikely to prevent undesirable results or achieve sustainability within SGMA timeframes.¹⁷
6. The Plan includes a reasonable assessment of overdraft conditions and includes reasonable means to mitigate overdraft, if present.¹⁸
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 states that the GSA has established similar sustainable management criteria to neighboring subbasins.¹⁹
8. Because a single plan was submitted for the Subbasin, a coordination agreement was not required.²⁰

¹⁴ 23 CCR § 355.4(b)(2).

¹⁵ 23 CCR § 355.4(b)(3).

¹⁶ 23 CCR § 355.4(b)(4).

¹⁷ 23 CCR § 355.4(b)(5).

¹⁸ 23 CCR § 355.4(b)(6).

¹⁹ 23 CCR § 355.4(b)(7).

²⁰ 23 CCR § 355.4(b)(8).

9. The Tehama County Flood Control and Water Conservation District, has historically developed and implemented a groundwater management plan and basin management objectives in support of the groundwater management plan. The GSA's history of groundwater management provide a reasonable level of confidence that the GSAs have the legal authority and financial resources necessary to implement the Plan.²¹
 10. Through review of the Plan and consideration of 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).)
- G. In addition to the grounds listed above, DWR also finds that:
1. The Department developed its GSP Regulations consistent with and intending to further the State's human right to water 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 in its evaluation of the Plan.²²
 2. The Plan acknowledges and identifies interconnected surface waters within the Subbasin. The GSAs proposes initial sustainable management criteria to manage this sustainability indicator and measures to improve understanding and management of interconnected surface water. The GSAs acknowledge, 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 periodic evaluations of the Plan and amendments to the Plan should aim to improve the initial sustainable management criteria as more information and improved methodology becomes available.
 3. The basin is not currently in a state of long-term overdraft and projections of future basin extractions are likely to stay within current and historic

²¹ 23 CCR § 355.4(b)(9).

²² Water Code § 106.3; 23 CCR § 350.4(g).

ranges, at least until the next periodic evaluation by the GSA and the Department. Projections of future basin extractions appear likely to stay within current and historic ranges, at least until the next periodic evaluation by the GSA and the Department. Subbasin groundwater levels and other SGMA sustainability indicators appear unlikely to substantially deteriorate while the GSA implements the Department's recommended corrective action

4. Projections of future Subbasin extractions are likely to stay within current and historic ranges, at least until the next periodic evaluation by the GSA and the Department. Subbasin groundwater levels and other SGMA sustainability indicators appear unlikely to substantially deteriorate while the GSA implements the Department's recommended corrective actions.
5. The California Environmental Quality Act²³ does not apply to the Department's evaluation and assessment of the Plan.


²³ Public Resources Code § 21000 *et seq.*

Statement of Findings
Sacramento Valley – Antelope Subbasin (No. 5-021.54)

February 27, 2025

Accordingly, the 2024 GSP submitted by the Agency for the Sacramento Valley – Antelope Subbasin is hereby **APPROVED**. The recommended corrective actions identified in the Staff Report will assist the Department's future review of the Plan's implementation for consistency with SGMA and the Department therefore recommends the Agency address them in the next Periodic Evaluation, which is set to be submitted by January 31, 2027, as required by Water Code § 10733.8. Failure to address the Department's recommended corrective actions before future, subsequent plan evaluations, may lead to a Plan being determined incomplete or inadequate.

Signed:



Karla Nemeth, Director

Date: February 27, 2025

Exhibit A: Groundwater Sustainability Plan Assessment Staff Report – Sacramento Valley
– Antelope Subbasin

**State of California
Department of Water Resources
Sustainable Groundwater Management Program
Reassessment of Incomplete
Groundwater Sustainability Plan
2025 Staff Report**

Groundwater Basin Name: Sacramento Valley – Antelope Subbasin (No. 5-021.54)
Submitting Agency: Tehama County Groundwater Sustainability Agency
Submittal Type: Revised Plan in Response to Incomplete Determination
Submittal Date: April 22, 2024
Recommendation: Approve
Date: February 27, 2025

On April 22, 2024, the Tehama County Groundwater Sustainability Agency (GSA or Agency) resubmitted the Antelope Groundwater Sustainability Plan (2024 GSP or 2024 Plan)¹ for the Antelope Subbasin (Subbasin) to the Department of Water Resources (Department or DWR) for evaluation and assessment as required by the Sustainable Groundwater Management Act (SGMA)² and Groundwater Sustainability Plan (GSP or Plan) Regulations.³ This was in response to the Department’s Incomplete Determination⁴ of the initial GSP (2022 GSP or 2022 Plan)⁵ on October 26, 2023.⁶

After evaluation and assessment, Department staff conclude the GSA has taken sufficient actions to correct deficiencies identified by the Department; however, Department staff have provided additional recommended corrective actions which will be required to be addressed by the Plan’s periodic evaluation.

Overall, Department staff conclude the 2024 Plan contains the required components of a GSP, demonstrates a thorough understanding of the Subbasin 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 2024 Plan, and proposes a set of projects and management actions that, if successfully implemented, and address recommended corrective actions, are likely to achieve the sustainability goal defined for the Subbasin.⁷ Department staff will continue to monitor and evaluate the Subbasin’s progress toward achieving the sustainability goal

¹ 2024 Antelope GSP. <https://sgma.water.ca.gov/portal/service/gspdocument/download/10082>.

² Water Code § 10720 *et seq.*

³ 23 CCR § 350 *et seq.*

⁴ <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

⁵ 2022 Antelope GSP. <https://sgma.water.ca.gov/portal/service/gspdocument/download/8072>.

⁶ Water Code § 10733.4(b); 23 CCR § 355.4(a)(4).

⁷ 23 CCR § 354.24.

through annual reporting and future periodic evaluations of the 2024 GSP and its implementation.

- ***Based on the evaluation of the 2024 Plan, Department staff recommend the Plan be approved.***

This assessment includes six sections:

- **Section 1 – Summary**: Overview of the Department staff's assessment and recommendation.
- **Section 2 – Evaluation Criteria**: Describes the legislative requirements and the Department's evaluation criteria.
- **Section 3 – Required Conditions**: Describes the submission requirements of an incomplete resubmittal to be evaluated by the Department.
- **Section 4 – Deficiency Evaluation**: Provides an assessment of whether and how the contents included in the GSP resubmittal addressed the deficiencies identified by the Department in the initial incomplete determination.
- **Section 5 – Plan Evaluation**: Provides a detailed assessment of the contents included in the GSP organized by each Subarticle outlined in the GSP Regulations.
- **Section 6 – Staff Recommendation**: Includes the staff recommendation for the 2024 Plan.

1 SUMMARY

Department staff recommend **approval** of the 2024 Antelope GSP and have identified recommended corrective actions designed to address shortcomings of the Plan described in this Staff Report. In Section 4 of this report, Department staff reviewed how the 2022 Plan was updated in the 2024 Plan by comparing content from each plan in order to determine if sufficient action was taken in response to deficiencies identified in the 2022 plan. In Section 5, Department staff reviewed content in the 2024 GSP for its substantial compliance with GSP Regulations, and have provided recommended corrective actions for components of the plan that need improvement to support substantial compliance with GSP Regulations and for Subbasin sustainability.

The GSA has identified areas for improvement of its Plan including addressing data gaps related to hydrogeological conceptual model, groundwater conditions, water budgets, and monitoring networks, and plans to incorporate new information into the numerical model. 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 that the GSA should consider for the first periodic evaluation of the Plan (see Section 6). Addressing these recommended corrective actions will be important to demonstrate, on an ongoing basis, that implementation of the Plan is likely to achieve the sustainability goal. The recommended corrective actions generally focus on the following:

1. Provide a public process for the reporting of dry wells, fully explain the rationale and criteria used to select ‘tessellation polygons’ and focus areas.
2. Provide criteria used to select tessellation polygons and focus areas.
3. Remove condition for degraded water quality undesirable result that requires GSA actions to cause it, expand its monitoring network, consider all constituents of concern and coordinate with drinking water, environmental, and irrigation users to understand migration.
4. Identify the interconnectedness of the two proposed principal aquifers and provide rationale for identifying two principal aquifers.
5. Consider land uses and property interests while establishing undesirable results for subsidence and set an annual and cumulative total of subsidence that the GSA believes is undesirable based on those uses and interests.
6. Estimate the quantity and timing of depletions of interconnected surface water, consider beneficial uses and users while identifying what constitutes an undesirable result, and revise interconnected surface water sustainable management criteria.
7. Expand chronic lowering of groundwater levels monitoring network to monitor impacts to beneficial uses and users of groundwater in the upper and lower principal aquifer, and update land subsidence monitoring network to use the best available science including evaluating data more frequently.

2 EVALUATION CRITERIA

The Department evaluates whether a Plan conforms to the statutory requirements of SGMA⁸ and is likely to achieve the basin’s sustainability goal,⁹ whether evaluating a basin’s first Plan,¹⁰ a Plan previously determined incomplete,¹¹ an amended Plan,¹² or a GSA’s periodic evaluation to an approved Plan.¹³ To achieve the sustainability goal, each version of the Plan must demonstrate that implementation 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.¹⁴ The Department is also required to evaluate, on an ongoing basis, whether the Plan will adversely affect the ability of an adjacent basin to implement its groundwater sustainability program or achieve its sustainability goal.¹⁵

The Plan evaluated in this Staff Report was previously determined to be incomplete. An incomplete Plan is one which had one or more deficiencies that precluded its initial approval, may not have had supporting information that was sufficiently detailed or analyses that were sufficiently thorough and reasonable, or Department staff determined it was unlikely the GSAs in the basin could achieve the sustainability goal. After a GSA has been afforded up to 180 days to address the deficiencies and based on the GSA’s efforts, the Department can either approve¹⁶ the Plan or determine the Plan inadequate.¹⁷

The Department’s evaluation and assessment of a Plan previously determined to be incomplete, as presented in this Staff Report, continues to follow Article 6 of the GSP Regulations¹⁸ to determine whether the Plan, with revisions or additions prepared by the GSA, complies with SGMA and substantially complies with the GSP Regulations.¹⁹ As stated in the GSP Regulations, “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.”²⁰

⁸ Water Code §§ 10727.2, 10727.4, 10727.6.

⁹ Water Code § 10733; 23 CCR § 354.24.

¹⁰ Water Code § 10720.7.

¹¹ 23 CCR § 355.2(e)(2).

¹² 23 CCR § 355.10.

¹³ 23 CCR § 355.6.

¹⁴ Water Code § 10721(v).

¹⁵ Water Code § 10733(c).

¹⁶ 23 CCR §§ 355.2(e)(1).

¹⁷ 23 CCR §§ 355.2(e)(3).

¹⁸ 23 CCR § 355 *et seq.*

¹⁹ 23 CCR § 350 *et seq.*

²⁰ 23 CCR § 355.4(b).

The recommendation to approve a Plan previously determined to be incomplete does not signify that Department staff, were they to exercise the professional judgment required to develop a Plan for the basin, would make the same assumptions and interpretations as those contained in the revised Plan, but simply that Department staff have determined that the modified assumptions and interpretations relied upon by the submitting GSA(s) are supported by adequate, credible evidence, and are scientifically reasonable. The assessment of a Plan previously determined to be incomplete may involve the review of new information presented by the GSAs, including models and assumptions, and an evaluation of that information based on scientific reasonableness. In conducting its assessment, Department staff does not recalculate or reevaluate technical information or perform its own geologic or engineering analysis of that information.

The recommendation to not approve a Plan previously determined to be incomplete and instead determine it to be inadequate signifies that the resubmitted Plan contains significant deficiencies based on one or more of the criteria identified in 23 CCR § 355.4(b), or the GSAs in the basin have not taken sufficient actions to correct the deficiencies previously identified by the Department when it found the Plan incomplete. The Department engages in consultation with the State Water Resources Control Board before finding a Plan inadequate. A Plan determined to be inadequate is subject to the state intervention provisions contained in Chapter 11 of SGMA.²¹

²¹ Water Code § 10735 *et seq.*

3 REQUIRED CONDITIONS

For a Plan that the Department previously determined to be incomplete, the Department provided required corrective actions that address minor or potentially significant deficiencies that the Department identified in the initially submitted Plan. The GSAs in a basin, whether developing a single GSP covering the basin or multiple GSPs, must attempt to sufficiently address those required corrective actions within the time provided, not to exceed 180 days, for the Plan to be reevaluated by the Department and potentially approved.

3.1 INCOMPLETE RESUBMITTAL

GSP Regulations specify that the Department shall evaluate a resubmitted GSP in which the GSA has taken corrective actions within 180 days from the date the Department issued an incomplete determination to address deficiencies.²²

The Department issued the incomplete determination on October 26, 2023.²³ The GSA resubmitted the GSP to the Department on April 22, 2024, in compliance with the 180-day deadline.

The GSA has provided a redline/strikeout version of the resubmitted GSP. The redline/strikeout version highlights the changes made from the initial 2022 submission to the 2024 submission.²⁴

²² 23 CCR § 355.4(a)(4).

²³ <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

²⁴ <https://sgma.water.ca.gov/portal/service/gspdocument/download/10069>.

4 DEFICIENCY 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.

In its initial incomplete determination, the Department identified deficiencies in the Plan which precluded approval in October 2023.²⁵ The GSA was given 180 days to take corrective actions to remedy the identified deficiencies. Consistent with the GSP Regulations, Department staff are providing an evaluation of the resubmitted Plan to determine if the GSAs have taken sufficient actions to correct the deficiencies identified in the 2022 Plan. For each deficiency, the corrective actions are repeated, the 2022 Plan content is summarized, the 2024 Plan is then described, followed by Department staff’s evaluation.

4.1 DEFICIENCY 1. THE GSP DOES NOT ESTABLISH SUSTAINABLE MANAGEMENT CRITERIA FOR CHRONIC LOWERING OF GROUNDWATER LEVELS IN A MANNER SUBSTANTIALLY COMPLIANT WITH THE GSP REGULATIONS.

4.1.1 Corrective Action 1

The GSA must provide more detailed explanation and justification regarding the selection of the sustainable management criteria for groundwater levels, particularly undesirable results and minimum thresholds, and quantitatively describe the effects of those criteria on the interests of beneficial uses and users of groundwater. Department staff recommend the GSA consider and address the following:

- a. Refine the description of undesirable results to clearly describe the significant and unreasonable conditions the GSA is managing the Subbasin to avoid. This must include a quantitative description of the negative effects to beneficial uses and users that would be experienced at undesirable result conditions.²⁶ The GSA should fully disclose and describe and explain its rationale for determining the number of wells that may be dewatered and the level of impacts to groundwater dependent ecosystems that may occur without rising to significant and unreasonable levels constituting undesirable results. Lastly, the GSA should explain how potential alternate supplies of water or well mitigation will be

²⁵ <https://sgma.water.ca.gov/portal/gsp/assessments/134>.

²⁶ 23 CCR § 354.28 (b)(3).

considered by the GSA during its management of the Subbasin in a project or management action as part of the GSP. Department staff also encourage the GSAs to review the Department's April 2023 guidance document titled *Considerations for Identifying and Addressing Drinking Water Well Impacts*.²⁷

- b. The GSA should revise minimum thresholds to be set at the level where the depletion of supply across the Subbasin may lead to undesirable results²⁸ and provide the criteria used to establish and justify minimum thresholds.²⁹ Fully document the analysis and justifications performed to establish the criteria used to establish minimum thresholds. Clearly show each step of the analysis and provide supporting information used in the analysis.³⁰
- c. Provide an evaluation of how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.³¹ Identify the number and location of wells that may be negatively affected when minimum thresholds are reached. Compare well infrastructure for all well types in the Subbasin with minimum thresholds at nearby, suitably representative monitoring sites. Document all assumptions and steps clearly so that it will be understood by readers of the GSP. Include maps of potentially affected well locations, identify the number of potentially affected wells by well type, and provide a supporting discussion of the effects.

4.1.2 Evaluation of Resubmitted Plan

4.1.2.1 Corrective Action 1a – Undesirable Results

The Department's Incomplete Determination³² directed the GSA to refine the description of undesirable results to quantitatively describe the significant and unreasonable negative effects to beneficial uses and users that the GSA is managing the Subbasin to avoid. In response, the GSA provided a quantitative description of conditions at undesirable results.

The 2022 GSP did not provide a clear definition of undesirable results. The Subbasin was already experiencing dry wells,³³ and the 2022 GSP had elected to establish a threshold that will allow up to 20 percent or approximately 260 additional wells to go dry without causing an undesirable result.³⁴ The 2022 GSP qualitatively described the undesirable result: "Chronic lowering of groundwater elevations in the Subbasin cause significant and unreasonable declines if they are sufficient in magnitude to lower the rate of production

²⁷ <https://water.ca.gov/Programs/Groundwater-Management/Drinking-Water-Well>.

²⁸ 23 CCR 354.28 (c)(1).

²⁹ 23 CCR 354.28 (c)(1).

³⁰ 23 CCR 354.28 (b)(1).

³¹ 23 CCR 354.28 (b)(4).

³² <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

³³ Department of Water Resources, Dry Well Reporting System, Accessed September 2023, <https://mydrywatersupply.water.ca.gov/report/>.

³⁴ Antelope GSP, Section 3.3.8, p. 301.

of pre-existing groundwater wells below that necessary to meet the minimum required to support overlying beneficial use(s) where alternative means of obtaining sufficient water resources are not technically or financially feasible.”³⁵ The Department’s Incomplete Determination noted that the Plan limits the applicability of significant and unreasonable conditions to instances when alternative means of obtaining sufficient water resources are not technically or financially feasible but does not indicate what would constitute technical or financial feasibility, or who would make that determination.³⁶

The 2024 GSP includes significant revisions to the definition and methodology for determining what would be an undesirable result. The 2024 GSP defines the negative effects to beneficial uses and users that would be experienced at undesirable result conditions as either of two conditions. The first condition is when 10 supply wells become dry within each tessellation hexagon after the GSP revision.³⁷ The 2024 GSP was adopted on April 22, 2024.³⁸ The second condition is identified to be when water levels at any representative monitoring point decline 7.5 ft or more per year over a five (5) year period at any [representative monitoring site] RMS.³⁹

The 2024 GSP includes vast improvements in how it defines the specific conditions the GSA is managing the Subbasin to avoid. The 2024 GSP now identifies a clear, quantitative number of wells that may be dewatered at an undesirable condition, whereas the 2022 Plan did not. Staff are encouraged that the 2024 GSP also now identifies a rate of decline (7.5 feet over 5 years) that would be significant and unreasonable at any representative monitoring site and avoiding an undesirable result through this condition will show progress in sustainable management. These revisions are significant and clearly outline what constitutes an undesirable result in the Subbasin.

Staff also note that during the update of the GSP to respond to corrective actions, the GSA removed the quantitative combination of the 2022 GSP (25% of groundwater elevations measured at the same RMS wells exceeding minimum thresholds for two consecutive measurement) and replaced it with the description of negative effects on beneficial uses and users described above.⁴⁰ Staff note that the GSP explains why this change was made and states: “The uncertainty in predictions in potential dry wells at lower water levels is the reason the GSA will use reported and confirmed dry wells in each tessellation hexagon as one of two metrics for undesirable results.”⁴¹ Staff interpret this statement to mean that the GSA has indicated the 10 dry wells per tessellation hexagon or 7.5 feet over 5 years at any representative monitoring site is the criteria it is using to indicate the presence of an undesirable result.

³⁵ Antelope GSP, Section 3.3.1.1, p 292.

³⁶ <https://sgma.water.ca.gov/portal/gsp/assessments/134>.

³⁷ 2024 Antelope GSP, Section 3.3.1.4, p. 317.

³⁸ <https://sgma.water.ca.gov/portal/service/gspdocument/download/10071>.

³⁹ 2024 Antelope GSP, Section 3.3.1.4, p. 317.

⁴⁰ 2024 Antelope GSP, Table 3-15, p. 326.

⁴¹ 2024 Antelope GSP, Section 3.0, p. 289.

Staff note that the 2024 GSP does not include a process for the public to report dry wells to the GSA. Because reports of dry wells constitute an undesirable result, this is necessary for the GSA's undesirable result to be reasonable. If the GSA cannot accurately track the number of dry wells, it will not be able to detect an undesirable result. Staff note that the 2024 GSP includes in its suite of potential options that the "GSA may wish to implement as needed"⁴² the "Tehama County Domestic Well Tracking and Outreach Program" which if implemented, could create a county-wide system to track dry domestic wells,⁴³ but does not provide a start date, nor a set of conditions that would trigger the start of this management action.⁴⁴ In order for the GSA's definition of an undesirable result, which is based on reported dry wells, to be meaningful, the GSA must provide a public mechanism for the reporting of dry wells and Department staff recommend the GSA describe how it will track dry wells in a clear and transparent manner. The GSA should also describe how the public should report dry wells to the GSA. Lastly, the GSA must provide the reported number of dry wells in its annual reports and evaluations as it is necessary to understand whether an undesirable result is occurring (see [Recommended Corrective Action 1a](#)).

Staff believe this is sufficient action in response to the deficiency, because it meets the intent of the California Water Code for identifying undesirable results and sustainability. The definition of undesirable results for the chronic lowering of groundwater are defined as a significant and unreasonable depletion of supply,⁴⁵ and sustainable groundwater management is managing groundwater without causing undesirable results.⁴⁶ By identifying a depletion of supply (10 wells per tessellation hexagon), and a maximum decline (7.5 feet over five years), the GSA has described both what is significant and unreasonable depletion of supply, and what are the significant and unreasonable conditions for the chronic lowering of groundwater levels the GSA is managing to avoid.

While the GSA's revisions related to undesirable results in the 2024 GSP represent a significant improvement, staff note there is an issue that needs to be addressed in future updates to the GSP. GSP Regulations require GSAs to provide the criteria used to define when and where the effects of groundwater conditions cause undesirable results.⁴⁷ Staff note that the GSP uses 'tessellation hexagons' as part of its definition of undesirable results. The tessellation hexagons are shown on a map,⁴⁸ but the GSP does not describe the criteria used to establish the tessellation hexagons, nor describe the relationship between beneficial uses and users and the hexagons, nor why the shape and size of the tessellation hexagons are suitable for defining undesirable results. Staff recommend the GSA clearly provide the criteria used and an explanation for why each tessellation hexagon is suitable to support the undesirable result definition with consideration of

⁴² 2024 Antelope GSP, Table 4-2, p. 369.

⁴³ 2024 Antelope GSP, Table 4-2, p. 369, Section 4.5.2.5, pp 415-416.

⁴⁴ 2024 Antelope GSP, Table 4-25, pp. 415-416.

⁴⁵ CWC § 10721 (x)(1).

⁴⁶ CWC § 10721 (v).

⁴⁷ 23 CCR § 354.26 (b)(2).

⁴⁸ 2024 Antelope GSP, Figure 3-2, p. 292.

beneficial uses and users by the periodic evaluation of the GSP (see [Recommended Corrective Action 1b](#)).

The Department's Incomplete Determination⁴⁹ also noted the GSA did not fully disclose, describe and explain the rationale for determining the number of wells that may be dewatered and the level of impacts to groundwater dependent ecosystems that may occur without rising to significant and unreasonable levels constituting undesirable results. In response, the GSA developed a well mitigation program that appears capable of addressing more wells than the number of dry wells defined as an undesirable result. The GSA explains that it will address every dry well through supplemental supplies and mitigation, which promises to eliminate impacts to well users of groundwater.

The 2024 GSP also states, "The impacts to groundwater dependent ecosystems that may occur without rising to significant and unreasonable levels constituting undesirable results will be evaluated within the next three years of GSP implementation (by January 2027)."⁵⁰ The 2024 GSP promises to identify the impacts to groundwater dependent ecosystems prior to the next periodic evaluation. Department staff will track implementation progress in annual reports and periodic evaluations to ensure the GSA is identifying impacts to groundwater dependent ecosystems as indicated in the 2024 GSP.

Department staff conclude that the 2024 GSP has sufficiently explained the GSA's rationale for determining the number of wells that may be dewatered and the level of impacts to groundwater dependent ecosystems.

The Department's Incomplete Determination⁵¹ also directed the GSA to explain how potential alternate supplies of water or well mitigation will be considered by the GSA during its management of the Subbasin. The 2022 GSP described a well deepening or replacement program that "would create a program to deepen or replace shallow wells and/or wells that have gone dry in Tehama County."⁵² The well deepening or replacement program was listed in the "Potential Management Actions" that could be implemented as needed.⁵³ The 2022 GSP described the timeline for the project as "currently in the early planning stage. Thus, the start and completion dates for this management action have yet to be determined."⁵⁴

The 2024 GSP includes significantly more information about well mitigation efforts than the 2022 GSP. The Plan describes a well mitigation program that "will provide assistance to owners of wells adversely impacted by declining groundwater levels since 2015 that interfere with groundwater production or quality."⁵⁵ The 2024 GSP identifies that the

⁴⁹ <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

⁵⁰ 2024 Antelope GSP, Section 3, p. 287.

⁵¹ <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

⁵² 2022 Antelope GSP, Section 4.5.2.7, p. 389.

⁵³ 2022 Antelope GSP, Section 4.5.2, p. 379.

⁵⁴ 2022 Antelope GSP, Section 4.5.2.7, p. 389.

⁵⁵ 2024 Antelope GSP, Table 4-2, p. 362.

program will start no later than January 1, 2027.⁵⁶ The 2024 GSP provides a copy of a resolution⁵⁷ of the Board of the Tehama County Flood Control and Water Conservation District dated April 15, 2024 to show its commitment to establish the well mitigation program.⁵⁸ The resolution provides an estimate of \$3,000,000 for mitigation measures to cover 150 wells across the Red Bluff, Antelope, and Los Molinos Subbasins.⁵⁹

Staff note that the establishment and commitment by the GSA to implement a well mitigation program sufficiently explains how alternate supplies or mitigation will be considered. The GSA has provided a schedule for implementation, a Board resolution showing commitment to the program, an estimated budget, and provided a number of wells anticipated to be mitigated, which shows the GSA has considered the program thoroughly. Staff also note that the program is under development, and look forward to seeing details about what processes the GSA may use to determine a water use ‘non-essential’⁶⁰ and how the determination of whether impacts are related to groundwater management during the GSP implementation period⁶¹ will be made. Staff encourage a robust and public process for any evaluation steps.

4.1.2.2 Corrective Action 1b – Minimum Thresholds

The Department’s Incomplete Determination⁶² directed the GSA that the GSA should revise minimum thresholds to be set at the level where the depletion of supply across the Subbasin may lead to undesirable results⁶³ and provide the criteria used to establish and justify minimum thresholds.⁶⁴ In response, the GSA provided updated minimum thresholds and selection criteria.

The 2022 GSP established minimum thresholds “based on these historical and projected data and the GSA’s consideration of undesirable results. The [minimum thresholds] for chronic lowering of groundwater elevations are based on documented screen intervals of key wells located both in the upper and lower aquifers in the Subbasin. The MTs were set to the following: Upper Aquifer: Spring groundwater elevation where less than 10 to 20% (on average) of domestic wells could potentially be impacted. Lower Aquifer: Spring groundwater elevation minus 20 to 120 feet.”⁶⁵ Staff note that the 2022 GSP did not

⁵⁶ 2024 Antelope GSP, Section 4.4.4.2.1, p. 388.

⁵⁷ The resolutions contain statements that characterize the local agency’s understanding of the law and regulations and appear intended to limit GSA liability, which statements have been the focus of public comments. The Department takes no position and offers no comments on those statements, which are not material to determining the adequacy of the Plan in terms of its compliance with SGMA and the GSP Regulations.

⁵⁸ 2024 Antelope GSP, Appendix 4-C, pp. 4163-4170.

⁵⁹ 2024 Antelope GSP, Appendix 4-C, p. 4167.

⁶⁰ 2024 Antelope GSP, Appendix 4-C, p. 4165.

⁶¹ 2024 Antelope GSP, Appendix 4-C, p. 4166.

⁶² <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

⁶³ 23 CCR § 354.28 (c)(1).

⁶⁴ 23 CCR § 354.28 (a).

⁶⁵ 2022 Antelope GSP, Section 3.3.1.1, p. 292.

further explain the criteria, nor provide analysis supporting its claims of less than 10-20% of domestic well impacts.⁶⁶

The 2024 GSP includes revised minimum thresholds from the 2022 GSP. The 2024 GSP now establishes minimum thresholds based on the lowest measured water level from 2020-2022 for representative monitoring wells in the focus area, and 20 feet deeper than the lowest measured water level from 2020-2022 for representative monitoring wells outside the focus area.⁶⁷ The GSP provides a map of the focus area,⁶⁸ describes the focus area as “an area that has observed impacts on beneficial users (ex., reports of dry wells)”⁶⁹ and defines impacts to beneficial users as “reported dry wells, reduction in pumping capacity, deepening wells (sic), adverse effects on the surface water environment.”⁷⁰

By revising the minimum threshold to be set at the lowest measurement from 2020 to 2022, the GSA is attempting to provide criteria to establish and justify minimum thresholds that represent the level where depletion of supply across the Subbasin may lead to undesirable results. Using a recent historic low measurement at the minimum threshold should limit new dry wells from occurring should the GSA manage the Subbasin to maintain levels above the minimum thresholds, as there is no further lowering of the water table that may impact wells into the future. Staff believe the GSA has taken sufficient action to respond to this corrective action.

Staff note that the GSA has not described its process to delineate the focus area clearly and note that some areas with reported dry wells are not included within focus area.⁷¹ Staff additionally note that the GSA uses a focus area to establish minimum thresholds, which are 20 feet deeper in areas outside the focus area.⁷² Staff note that the spatial nature of the focus and non-focus area means they may be used in the future to qualify sustainable management criteria on newly selected RMS wells. Because focus areas drive the selection of minimum thresholds, their delineation must consider the beneficial uses and users of groundwater in the Subbasin, as required by regulation.⁷³ Staff recommend the GSA clearly delineate the criteria used to establish the boundaries of the focus area with consideration of beneficial uses and users, so that the GSA may use them to inform minimum threshold development on future representative monitoring wells as they are established (see [Recommended Corrective Action 1c](#)).

⁶⁶ 2022 Antelope GSP, Section 3.3.1.1, p. 292.

⁶⁷ 2024 Antelope GSP, Section 3.3.1.1, p. 309.

⁶⁸ 2024 Antelope GSP, Figure 3-1, p. 286.

⁶⁹ 2024 Antelope GSP, Section 3, p. 287.

⁷⁰ 2024 Antelope GSP, Section 3, p. 285.

⁷¹ 2024 Antelope GSP, Figure 301, p. 286.

⁷² 2024 Antelope GSP, Section 3, p. 309.

⁷³ 23 CCR § 354.28 (b)(4).

4.1.2.3 Corrective Action 1c – Interests of Beneficial Uses and Users

The Department’s Incomplete Determination⁷⁴ directed the GSA that the GSA should provide an evaluation of how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests, including the number and location of wells that may be negatively affected.⁷⁵ In response, the GSA provided a well impact analysis describing the potential impacts at minimum thresholds.

The 2022 GSP included an inventory of domestic wells, including figures showing the best available information for the location of wells and charts of their depths, but did not provide a well impact analysis. The 2022 GSP did include a broad, unsubstantiated estimation that “10-20% (on average) of domestic wells could potentially be impacted” in the upper aquifer.⁷⁶

The 2024 GSP now includes a detailed and thorough well impact analysis.⁷⁷ The analysis includes all well types, and all wells regardless of age, and includes well records added after the 2022 GSP was written. The number of wells estimated to go dry when water levels reach the minimum threshold were calculated by comparing well depth values modified by hydraulic gradient and topographic gradient estimates compared to minimum threshold values at representative monitoring sites. Wells were associated with representative monitoring sites by comparing well locations and the tessellation hexagon associated with each representative monitoring site.⁷⁸ Well depths were either the bottom of the perforated interval, if that record was available, or 10 feet higher than the total depth of the well. The results of the analysis indicate that up to 119 wells may be impacted at minimum thresholds across the Subbasin,⁷⁹ and the 2024 GSP provides a map of estimated locations of potential dry wells at minimum thresholds.⁸⁰

The 2024 GSP discusses the accuracy of the impact analysis and the GSA’s concerns about its accuracy.⁸¹ The 2024 GSP notes that the well dataset it used includes uncertainty as it includes wells that are destroyed or abandoned, and records that lack information about well construction or have missing location information.⁸² The analysis includes adjustments to account for changes in topography and groundwater gradient between representative monitoring sites and wells being analyzed, which introduces assumptions and errors, but is likely more accurate than not adjusting analysis for those factors. The 2024 GSP notes that water levels in deeper wells such as agricultural and municipal wells are generally lower than levels in shallower wells such as domestics, and thus the comparison used may over-represent the impacts to domestic wells when the

⁷⁴ <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

⁷⁵ 23 CCR 354.28 (b)(4).

⁷⁶ 2022 Antelope GSP, Section 3.3.1.1, p. 292.

⁷⁷ 2024 Antelope GSP, Section 3.3.1.1, pp. 310-315.

⁷⁸ 2024 Antelope GSP, Section 3.3.1.1, p. 311.

⁷⁹ 2024 Antelope GSP, Table 3-8, p. 314.

⁸⁰ 2024 Antelope GSP, Figure 3-11, p. 315.

⁸¹ 2024 Antelope GSP, Section 3.3.1.1, pp. 310-311.

⁸² 2024 Antelope GSP, Section 3.3.1.1, p. 310.

representative monitoring site is a deeper monitoring well.⁸³ The 2024 GSP notes that the uncertainty in predictions in potential dry wells at lower water levels is the reason the GSA will use reported and confirmed dry wells in each tessellation hexagon as one of two metrics for undesirable results.⁸⁴ Staff additionally note that the tessellation hexagons are 6 miles long,⁸⁵ and due to the few RMS wells in the Subbasin the analysis may be comparing well depths to a representative monitoring site that is 5 or more miles distant from it, potentially introducing errors as well, indicating that the Subbasin may need additional monitoring to monitor impacts to beneficial uses and users of groundwater.⁸⁶

Department staff conclude that the GSA has sufficiently responded to the request to provide an evaluation of how minimum thresholds may affect the interests of beneficial uses and users of groundwater. The 2024 GSP includes an analysis that provides the number and location of wells that may be negatively affected, and provides sufficient description of the analysis undertaken to estimate those impacts. In addition, the 2024 GSP discusses the limitations of this analysis, how the GSA has chosen to define undesirable results in light of these limitations and promises to update both the analysis and undesirable results as part of the periodic evaluation, providing a thorough and rigorous discussion of beneficial uses and users, minimum thresholds, and undesirable results.

4.1.3 Conclusion

Staff conclude that the GSA has taken sufficient action to respond to Deficiency 1. The 2024 GSP has provided an updated description of the conditions the GSA is managing the Subbasin to avoid by identifying the number of wells in a tessellation hexagon and rate of decline in water levels that is significant and unreasonable, and providing a mitigation program for the wells that may be impacted before an undesirable result. The 2024 GSP has revised minimum thresholds that are established at a level where the depletion of supply across the Subbasin may lead to undesirable results and has provided an evaluation of how those minimum thresholds may affect the interests of beneficial uses and users of groundwater. Finally, the 2024 GSP has proactively discussed the relationship of the minimum thresholds and the undesirable result definition and is planning to update them as more information becomes available.

⁸³ 2024 Antelope GSP, Section 3.3.1.1, p. 312.

⁸⁴ 2024 Antelope GSP, Section 3 p. 289.

⁸⁵ 2024 Antelope GSP, Figure 3-2, p. 292.

⁸⁶ 23 CCR 354.34 (b)(2).

4.2 DEFICIENCY 2. THE GSP DOES NOT DEVELOP SUFFICIENT SUSTAINABLE MANAGEMENT CRITERIA FOR DEGRADATION OF GROUNDWATER QUALITY.

4.2.1 Corrective Action 2

The GSA must provide more detailed explanation and justification regarding the selection of sustainable management criteria for degraded groundwater quality, particularly the selection and exclusion of constituents of concern for monitoring and sustainable management. Quantitatively describe the effects of the constituents of concern on beneficial uses and users of groundwater. Department staff recommend the GSA consider and address the following:

- a. Establish sustainable management criteria for nitrate and develop a monitoring network or program for nitrate to demonstrate sustainable groundwater management in regards to this constituent. The GSA should consider beneficial uses and users of groundwater,⁸⁷ and local, state, and federal water quality standards⁸⁸ when establishing these sustainable management criteria. Fully document the analysis and rationale used to establish these criteria, particularly those used to establish minimum thresholds. Clearly show each step of the analysis and provide supporting information.⁸⁹

4.2.2 Evaluation of Resubmitted Plan

4.2.2.1 Corrective Action 2a- Sustainable Management Criteria for Nitrate

The Departments Incomplete Determination⁹⁰ directed the GSA to establish sustainable management criteria for nitrate considering beneficial uses and users of the Subbasin, and local, state and federal water quality standards, and develop a monitoring network or program for nitrate to demonstrate sustainable groundwater management for this constituent. In response, the GSA established sustainable management criteria for nitrate and developed a monitoring network and program to monitor concentrations for all constituents of concern, including nitrate.

The 2022 GSP did not establish monitoring or sustainable management criteria for nitrate and referred to total dissolved solids as the only constituent of concern for groundwater quality in the Subbasin.⁹¹ The 2022 GSP described that nitrate concentrations were reported above the maximum contaminant level (MCL) at least once in 10 percent of tested wells and at consistently high and increasing trends in municipal wells in the Subbasin.⁹² The 2022 GSP noted that elevated levels of nitrate in drinking water pose a

⁸⁷ 23 CCR § 354.28 (b)(4).

⁸⁸ 23 CCR § 354.28 (c)(4), § 354.28 (b)(5).

⁸⁹ 23 CCR 354.28 (b)(1).

⁹⁰ <https://sgma.water.ca.gov/portal/service/gspdocument/download/9947>.

⁹¹ 2022 Antelope GSP, Section 3.3.4.1, p. 297.

⁹² 2022 Antelope GSP, Section 2.2.2.3, p. 183.

serious human health hazard,⁹³ but was unclear why or how the GSA determined not to include nitrate as a constituent of concern for management under the GSP. The 2022 GSP states that the “GSA is aware of issues with nitrate in the Subbasin but total dissolved solids will be used to monitor the overall groundwater quality,”⁹⁴ but the GSA did not consider how nitrate-contaminated groundwater could affect beneficial uses and users in the Subbasin such as domestic users,⁹⁵ or may be mobilized as a result of groundwater extraction, well construction, or well placement, which are within the regulatory authority of the GSA.

The 2024 GSP includes significant revisions to the sustainable management criteria for degraded water quality by establishing monitoring and sustainability management criteria for nitrate. The 2024 GSP identifies an undesirable result for degraded water quality in the Subbasin as either of two conditions. The first condition is “[Total Dissolved Solids]: at least 25% of [representative monitoring sties] exceed the minimum threshold for water quality for 2 consecutive years at each well,”⁹⁶ and the second condition is “Nitrate: one [representative monitoring point] exceeds the minimum threshold for water quality once”.⁹⁷ The 2024 GSP limits the undesirable result definition with a stipulation for both [total dissolved solids] TDS and nitrate only if GSP implementation is the cause of the exceedance.⁹⁸

The 2024 GSP’s definition of undesirable results is problematic. GSP Regulations require that the definition of undesirable results be a quantitative combination of minimum threshold exceedances that cause significant and unreasonable effects in the Subbasin.⁹⁹ Department staff note that an undescribed process to establish that GSP implementation is the cause of the exceedance is not a quantitative combination of minimum threshold exceedances. Additionally, the GSP’s description of significant and unreasonable conditions and definition for undesirable results for degraded water quality, which solely focus on water quality impacts caused directly by the GSA implementing an action, represents an improperly narrow reading of SGMA. SGMA includes in its definition of undesirable results the “significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.”¹⁰⁰ SGMA specifies that the significant and unreasonable effects are those “caused by groundwater conditions occurring throughout the basin,”¹⁰¹ which does not limit them to only impacts directly caused by a GSA’s implementation of physical projects or actions in the Subbasin. Staff consider this to be inconsistent with the intent of SGMA, which requires GSAs to ensure management of groundwater conditions in the Subbasin, including any action taken by

⁹³ 2022 Antelope GSP, Section 2.2.2.3, p. 183.

⁹⁴ 2022 Antelope GSP, Section 3.2.4.1, p. 287.

⁹⁵ 2022 Antelope GSP, Figure 2-6, p. 72.

⁹⁶ 2024 Antelope GSP, Table 3-12, p. 327.

⁹⁷ 2024 Antelope GSP, Table 3-12, p. 327.

⁹⁸ 2024 Antelope GSP, Table 3-15, p. 327.

⁹⁹ 23 CCR § 354.26(b)(2).

¹⁰⁰ CWC § 10721 (x)(4).

¹⁰¹ 23 CCR 354.26 (a).

the GSA, will not significantly and unreasonably degrade water quality. Therefore, degraded water quality caused by groundwater pumping, changes in groundwater levels, changes in the direction of groundwater flow, or changes in horizontal or vertical movement of groundwater within the Subbasin, whether the GSA has implemented pumping regulations or not, should be considered in the assessment of undesirable results in the Subbasin. Department staff recommend the GSA revise the description of significant and unreasonable conditions and undesirable results such that groundwater pumping and other factors, whether due to action or inaction of the GSA with respect to Subbasin management, are considered and not excluded (see [Recommended Corrective Action 2a](#)).

The 2024 GSP explains that the development of undesirable results for nitrate considered beneficial uses and users as drinking water consumers in the Subbasin and claims that that GSA “is not responsible for ongoing nitrate loading since it is regulated by the Regional Water Quality Control Board.”¹⁰² The GSAs indication that existing water quality agencies and programs exist does not excuse the GSA from avoiding its statutory responsibilities. The GSP Regulations require GSAs to characterize and describe groundwater conditions that, when significant and unreasonable, represent an undesirable result. The GSAs descriptions must include the possible causes that would lead to undesirable groundwater conditions, quantitative metrics that relate the minimum thresholds to the undesirable results, and the potential effects the undesirable results could have on beneficial uses and users. GSAs are required to establish minimum thresholds that are commensurate with the level of understanding of the historic and current groundwater quality conditions in the Subbasin. It is not the responsibility of the existing agencies and programs to establish minimum thresholds for the purposes of achieving the sustainability goal of the Subbasin and avoiding undesirable results during GSP implementation. The existing programs and agencies may have established standards and monitoring networks that the GSAs can leverage when establishing quantitative metrics to determine whether or not groundwater management activities are contributing or causing degradation of water quality. Staff recommend the GSA coordinate with other water quality regulatory agencies to ensure the GSA understands constituents of concern in the Subbasin, so it can manage them sustainably.

The 2024 GSP established minimum thresholds for nitrate equal to the minimum contaminant level (MCL) concentration of 10 milligrams per liter (mg/l) at five representative monitoring points.¹⁰³ The 2024 Antelope GSP explains that that minimum thresholds for degraded water quality are set in consideration of agricultural and domestic beneficial uses and users in the Subbasin.¹⁰⁴ The 2024 GSP presents measurable objectives for nitrate at “half of the [minimum contaminant level] MCL or superior, if current water concentrations are below 5 milligrams per liter nitrate as nitrogen.”¹⁰⁵ This is

¹⁰² 2024 Antelope GSP, Section 3, pp. 287-288.

¹⁰³ 2024 Antelope GSP, Section 3.3.4.1, p. 321.

¹⁰⁴ 2024 Antelope GSP, Section 3.3.4.5, p. 323.

¹⁰⁵ 2024 Antelope GSP, Section 3.2.4.1, p. 302.

supported by interim milestones initially set above measurable objectives in two representative monitoring points with subsequent interim milestones decreasing to measurable objective concentrations throughout GSP implementation.¹⁰⁶ Staff note that areas of elevated nitrate concentrations at the northwestern area of the Subbasin have exceeded measurable objective and minimum threshold concentrations¹⁰⁷ and the GSA explains that groundwater conditions may temporarily exceed minimum thresholds during the GSP implementation period while monitoring and project management actions are occurring.¹⁰⁸

Department staff note that the 2024 GSP does not include projects or management actions that are focused on improving nitrate conditions.¹⁰⁹ The 2024 GSP states the GSA has a commitment to “attempt to establish a connection between groundwater management and increasing groundwater concentrations, and the GSA aims to deter or mitigate undesirable results by evaluation of groundwater trends and deployment of projects and managements.”¹¹⁰ Staff note that the 2024 GSP only includes one groundwater quality project or management action, which is the GSP’s “One-Time Groundwater Quality Snapshot and Evaluation” project, a project that does not include a start date nor a description for the conditions that would cause the GSA to choose to perform this study.¹¹¹ Staff recommend the GSA consider developing projects and management actions on its own or in collaboration with other groundwater quality agencies to address nitrate concerns in the Subbasin.

The 2024 GSP presents a groundwater monitoring plan to evaluate changes in spatial and temporal trends of total dissolved solids and nitrate. The groundwater monitoring plan includes annual sampling at five representative monitoring sites for groundwater quality.¹¹² The 2024 GSP explains that, “[a]ll water quality monitoring wells are constructed in the upper aquifer as TDS and nitrate is not a concern in the lower aquifer and more pumping occurs from the upper aquifer.”¹¹³ Staff note that representative monitoring point TSS is a multi-screened well installed in both the upper and lower aquifers and, due to the potential for migration of contaminants from groundwater pumping, data from this representative monitoring point will be used to substantiate the GSA’s claim that concentrations of total dissolved solids and nitrate are not a concern for the lower aquifer in the Subbasin.¹¹⁴ Evaluation of trends for total dissolved solids and nitrate will be used to ensure that minimum thresholds are not exceeded, undesirable

¹⁰⁶ 2024 Antelope GSP, Table 3-6, p. 303.

¹⁰⁷ 2024 Antelope GSP, Figure 2-46, p. 193.

¹⁰⁸ 2024 Antelope GSP, Section 3, p. 285.

¹⁰⁹ 2024 Antelope GSP, Table 4-2, pp. 361-369.

¹¹⁰ 2024 Antelope GSP, Section 3.3.4.4, p. 322.

¹¹¹ 2024 Antelope GSP, Section 4.5.3.6, pp. 426-427, Table 4-33, pp. 426-427.

¹¹² 2024 Antelope GSP, Section 3.3.4.2, p. 322.

¹¹³ 2024 GSP, Section 3.2.4.1, p. 302.

¹¹⁴ 2024 GSP, Table 3-26, p. 341.

results are not being experienced by beneficial users in the Subbasin¹¹⁵ and to assist in identifying areas needing project management actions in the future.¹¹⁶

Department staff have determined that the proposed groundwater quality monitoring network is not designed to collect sufficient spatial data from both the upper and lower principal aquifer systems. GSP Regulations require GSAs to collect sufficient spatial and temporal data from each principal aquifer to determine groundwater quality trends,¹¹⁷ and to monitor impacts to beneficial uses or users of groundwater.¹¹⁸ Since the 2024 GSP proposes to not monitor the lower aquifer, the GSA cannot determine groundwater quality trends, nor impacts to beneficial uses and users in the lower aquifer. The degraded water quality monitoring network does not sufficiently meet GSP Regulations. Department staff recommend that the GSA add additional monitoring wells to the groundwater quality monitoring network for both the upper and lower aquifer (see [Recommended Corrective Action 2b](#)).

The 2024 GSP has made vast improvements to the sustainable management criteria for degraded water quality. Staff believe that this is sufficient action in response to this deficiency because the 2024 GSP now includes monitoring and sustainable management criteria for contaminants in the Subbasin including nitrate,¹¹⁹ applicable water quality standards and impacts to beneficial uses and users were considered in developing minimum thresholds for nitrate¹²⁰ and the 2024 GSP presents how nitrate will be quantitatively measured using a monitoring network in the Subbasin.¹²¹ The 2024 GSP includes recent water quality data collected from two representative monitoring sites and other wells in the Subbasin in the year 2024.¹²²

4.2.3 Conclusion

Staff conclude that the GSA has taken sufficient action to respond to Deficiency 2. The 2024 GSP has established adequate sustainable management criteria for nitrate considering beneficial uses and users in the Subbasin, and local, state and federal water quality standards. The 2024 GSP has also developed a monitoring network and program describing how minimum thresholds will be quantitatively measured to evaluate groundwater quality during GSP implementation.

¹¹⁵ 2024 Antelope GSP, Section 3.3.4.2, p. 322.

¹¹⁶ 2024 Antelope GSP, Section 3.6.5, p. 341.

¹¹⁷ 23 CCR §354.34 (c)(4).

¹¹⁸ 23 CCR §354.34 (b)(2).

¹¹⁹ 23 CCR § 354.28 (c)(4).

¹²⁰ 23 CCR § 354.28 (b)(5), 23 CCR § 354.28(b)(4).

¹²¹ 23 CCR § 354.28 (b)(6).

¹²² 2024 Antelope GSP, Appendix 2-L, pp. 4070-4084.

5 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 Subbasin is provided below. Department staff consider the information presented in the Plan to satisfy the general requirements of the GSP Regulations.

5.1 ADMINISTRATIVE INFORMATION

The GSP Regulations require each Plan to include administrative information identifying the submitting Agency, its decision-making process, and its legal authority;¹²³ a description of the Plan area and identification of beneficial uses and users in the Plan area;¹²⁴ and a description of the ability of the submitting Agency to develop and implement a Plan for that area.¹²⁵

The 2024 GSP describes the GSA, discusses its decision-making process, and provides its legal authority. The GSA was formed by a resolution of the Tehama County Flood Control and Water Conservation District (Tehama County FCWCD), which is a public agency within Tehama County.¹²⁶ The Tehama County FCWCD is governed by a five-member board of directors, which are the same five members as the Tehama County Board of Supervisors, who are elected officials serving 4-year terms.¹²⁷ The board is advised by an 11 member groundwater commission. Meetings of the board and the groundwater commission are open to the public.¹²⁸ The GSA is additionally supported by an AB3030 Technical Advisory Committee which provides technical assistance as needed.¹²⁹ The 2024 GSP provides a timeline of GSA formation,¹³⁰ and includes the GSA formation documents in an appendix.¹³¹

A map showing the Subbasin and adjacent subbasins is shown in Figure 1 below.

¹²³ 23 CCR § 354.6 *et seq.*

¹²⁴ 23 CCR § 354.8 *et seq.*

¹²⁵ 23 CCR § 354.6(e).

¹²⁶ 2024 Antelope GSP, Section 1.3, p. 53.

¹²⁷ 2024 Antelope GSP, Section 1.3.1, p. 53.

¹²⁸ 2024 Antelope GSP, Section 1.3.1, p. 54.

¹²⁹ 2024 Antelope GSP, Section 1.3.1, p. 55.

¹³⁰ 2024 Antelope GSP, Table 1-2, p. 56.

¹³¹ 2024 Antelope GSP, Appendix 1-B, pp. 486-523.

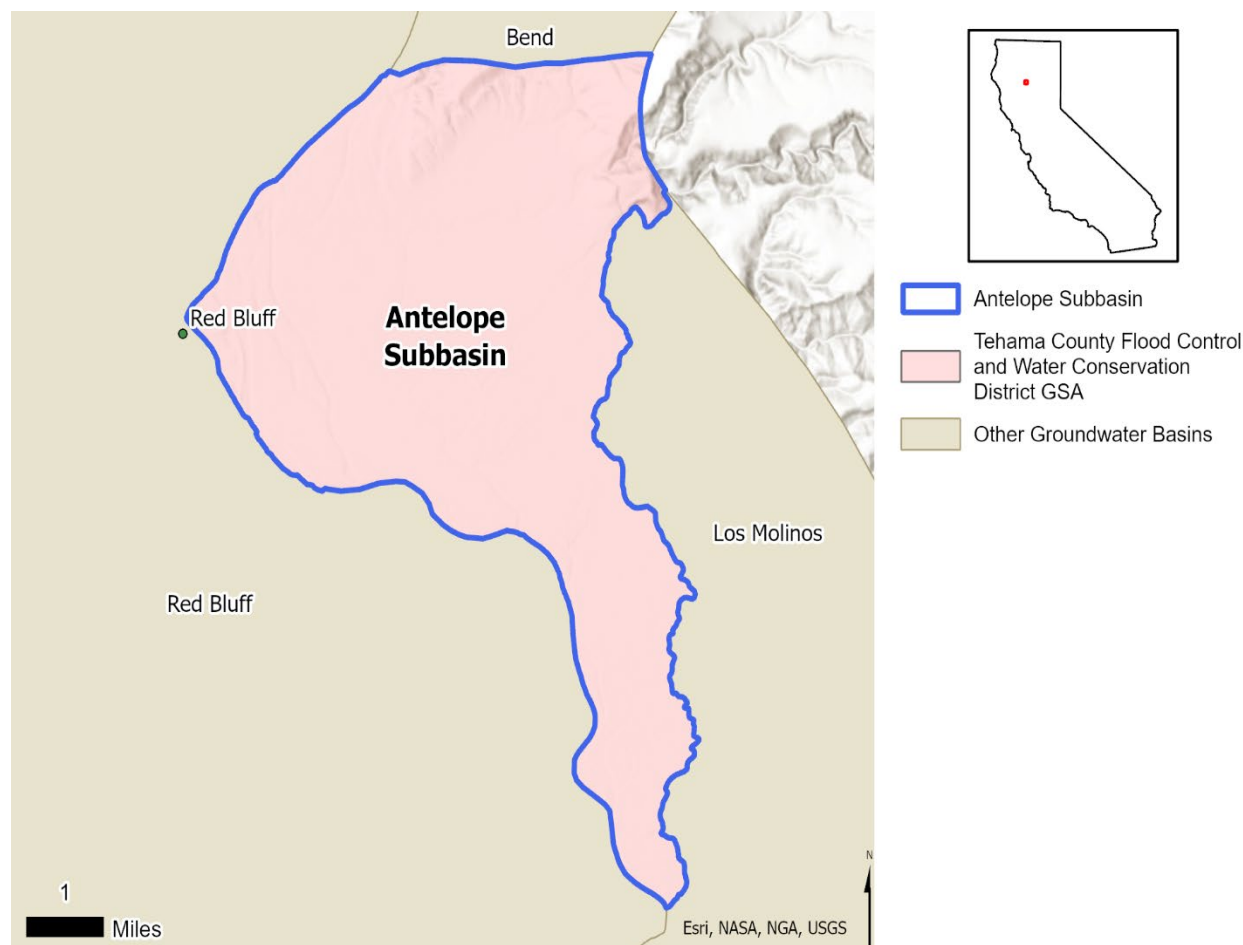


Figure 1: Antelope Subbasin Location Map.

The 2024 GSP provides a description of the plan area. The Antelope Subbasin (DWR Subbasin No. 5-021.54) covers 19,100 acres located in the Northern Sacramento Valley Groundwater Basin (Figure 1). The Subbasin is 95.25% privately owned, with 43% of land use being designated as native and riparian, 47% agriculture, 10% urban use, and 0.06% refuge areas.¹³² Agricultural land use in 2019 was designated as 844 acres of grain, 1,214 acres of pasture, 228 acres of almonds and pistachios, 6,663 acres of other deciduous, and 178 acres designated as other.¹³³ The Subbasin includes several disadvantaged communities.¹³⁴

The 2024 GSP describes the beneficial uses and users in the Subbasin. The Subbasin has 1,506 wells, of which 1,299 are categorized as domestic, 189 are production, and 18 are public supply.¹³⁵ The 2024 GSP includes maps of well density, by each type¹³⁶ and a map of Groundwater Dependent Ecosystems (GDEs).¹³⁷ The 2024 GSP includes a table

¹³² 2024 Antelope GSP, Section 2.1.1.2, p. 71.

¹³³ 2024 Antelope GSP, Table 2-2, p. 76.

¹³⁴ 2024 Antelope GSP, Figure 2-11, p. 96.

¹³⁵ 2024 Antelope GSP, Table 2-3, p. 77.

¹³⁶ 2024 Antelope GSP, Figures 2-6, 2-7, and 2-8, pp. 78-80.

¹³⁷ 2024 Antelope GSP, Figure 2-53, p. 204.

identified as the beneficial uses and users of groundwater and includes groups from general public, land use, urban and commercial, municipal, environmental and ecosystem, surface water, economic development, human right to water, tribes, and integrated water management categories.¹³⁸

The 2024 GSP identifies that the GSA will incur costs for administrative tasks including administrative and finance staff, insurance, meetings, reporting, record keeping, bookkeeping, legal advice, outreach, government relations, engineering services, permitting, public outreach, and miscellaneous supplies and materials.¹³⁹ The estimated annual cost for GSA administration, monitoring, periodic updates, and a contingency is \$470,000.¹⁴⁰ The 2024 GSP states that the GSA will pursue funding from state and federal sources, may further evaluate funding mechanisms and fee criteria, and may perform a cost-benefit analysis for fee collection.¹⁴¹ The information presented in the 2024 GSP related to the GSA's authority and financial plan to implement the Plan provides a reasonable level of confidence that the Agency can manage groundwater to progress towards the sustainability goal in the Subbasin.

The administrative information section included in the 2024 GSP is substantially compliant with the requirements outlined in the GSP Regulations. Department staff consider the information presented in the Plan to satisfy the general requirements of the GSP Regulations for administrative information.¹⁴²

5.2 BASIN SETTING

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.¹⁴³

5.2.1 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model is a non-numerical model of the physical setting, characteristics, and processes that govern groundwater occurrence within a basin, and represents a local agency's understanding of the geology and hydrology of the basin that support the geologic assumptions used in developing mathematical models, such as those that allow for quantification of the water budget.¹⁴⁴ The GSP Regulations require a

¹³⁸ 2024 Antelope GSP, Table 2-6, pp. 108-109.

¹³⁹ 2024 Antelope GSP, Section 5.1.1, pp. 439-440.

¹⁴⁰ 2024 Antelope GSP, Table 5-1, p. 440.

¹⁴¹ 2024 Antelope GSP, Section 5.1.6, p. 444.

¹⁴² 23 CCR §§ 354.2 *et seq.*

¹⁴³ 23 CCR § 354.12 *et seq.*

¹⁴⁴ DWR Best Management Practices for the Sustainable Management of Groundwater: Hydrogeologic Conceptual Model, December 2016: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-3-Hydrogeologic-Conceptual-Model_ay_19.pdf.

descriptive hydrogeologic conceptual model that includes a written description of geologic conditions, supported by cross sections and maps,¹⁴⁵ and includes a description of basin boundaries and the bottom of the basin,¹⁴⁶ principal aquifers and aquitards,¹⁴⁷ and data gaps.¹⁴⁸

The 2024 GSP describes the regional and structural setting of the Subbasin as a basin of sedimentary deposits part of the northern Sacramento Valley region.¹⁴⁹ The Subbasin is bounded by the Bend Subbasin to the north, the Sacramento River to the south, the Sacramento River and Red Bluff Subbasin to the west and the Cascade Range geologic province, Antelope Creek and Los Molinos Subbasin to the east.¹⁵⁰ The Los Molinos Syncline is the only major geological structure in the Subbasin and “may influence the direction of groundwater flow.”¹⁵¹

The 2024 GSP provides a map showing the locations of two east-west and one north-south trending cross sections which provide a stratigraphic evaluation based on lithology, borehole data, and electric logs.¹⁵² The cross sections generally depict the geologic contact between the Tehama and Tuscan Formations, but Department staff note that there are data gaps in this evaluation due to the lack of cross sectional coverage at the central and southern areas of the Subbasin.¹⁵³ Department staff recommend that the GSA fill these data gaps to complete a stratigraphical evaluation for the entire Subbasin and update the hydrogeological conceptual model accordingly.

The 2024 GSP identifies two principal aquifers within the Subbasin defined as an Upper Aquifer and a Lower Aquifer.¹⁵⁴ The 2024 GSP states that this designation is based on an examination of time-series groundwater elevation hydrographs, electric resistivity data from geophysical logs, lithologic logs, well construction details, and review of previous studies in the Subbasin.¹⁵⁵ The Plan also states the “complexity of the geologic materials and formations makes it difficult to define a singular widespread aquitard or distinctive change in geologic materials separating an Upper and Lower Aquifer” and that highly variable groundwater conditions occur throughout the Subbasin as a result of the complex depositional environment.¹⁵⁶ The 2024 GSP notes that confined and unconfined groundwater conditions are observed in the Tehama and Tuscan Formations. The 2024 GSP states that well construction data were used to “delineate between areas with a

¹⁴⁵ 23 CCR §§ 354.14 (a), 354.14 (c).

¹⁴⁶ 23 CCR §§ 354.14 (b)(2-3).

¹⁴⁷ 23 CCR § 354.14 (b)(4) *et seq.*

¹⁴⁸ 23 CCR § 354.14 (b)(5).

¹⁴⁹ 2024 Antelope GSP, Section 2.2.1.3, p. 138.

¹⁵⁰ 2024 Antelope GSP, Section 2.2.1.1, p. 134, Figure 2-14, p. 135.

¹⁵¹ 2024 Antelope GSP, Section 2.2.1.3.3, p. 157.

¹⁵² 2024 Antelope GSP, Figures 2-22 - 2-24, pp. 149-151.

¹⁵³ 2024 Antelope GSP, Figure 2-21B, p. 148.

¹⁵⁴ 2024 Antelope GSP, Section 2.2.1.5, p. 168.

¹⁵⁵ 2024 Antelope GSP, Section 2.2.1.5, p. 168.

¹⁵⁶ 2024 Antelope GSP, Section 2.2.1.5, p. 168.

higher likelihood of confined conditions.”¹⁵⁷ Most of the wells in the Subbasin are screened shallower than 400 feet below ground surface (bgs), which closely correlates to the bottom of the numerical groundwater model layer 5, and the 2024 GSP uses the bottom of model layer 5 as the boundary between the Upper Aquifer and Lower Aquifer.¹⁵⁸

The 2024 GSP describes that the Upper Aquifer is largely used for domestic purposes with its water-bearing formations consisting of Quaternary formations and the upper portions of the Tehama and Tuscan Formations.¹⁵⁹ The Upper Aquifer is described as having both unconfined and semiconfined groundwater conditions extending to depths ranging from 350 to 450 feet below ground surface throughout the Subbasin. The 2024 GSP explains that site-specific aquifer data is not available for the Subbasin, and aquifer properties are estimated based on aquifer tests performed in surrounding subbasins. Transmissivity estimates are provided for the Tuscan Formation based on data from a single well cross screened well between the Upper and Lower Aquifers in the adjacent Los Molinos Subbasin, and hydraulic conductivity estimates are provided for the Tehama Formation based on data from the neighboring Red Bluff Subbasin.¹⁶⁰ Department staff note that aquifer properties do not clearly apply to the Upper Aquifer alone, nor do they specifically apply to the Subbasin.

The 2024 GSP defines the Lower Aquifer as the lower portions of the Tehama and Tuscan Formations with confined to semi-confined conditions. The 2024 GSP states that wells screened in the Lower Aquifer are largely used for non-domestic purposes and the “lack of wells screened in the Lower Aquifer in the Subbasin creates a data gap for [understanding] hydraulic properties.”¹⁶¹ Although hydraulic conductivity has not been directly measured in the Subbasin, the 2024 GSP provides hydraulic conductivity estimates for the Tuscan Formation in the Lower Aquifer based on data collected from the adjacent Los Molinos Subbasin, and transmissivity and storativity estimates from data measured in the neighboring Red Bluff Subbasin.¹⁶²

Department staff are concerned that the principal aquifers identified in the 2024 GSP are not representative of physical conditions in the Subbasin. It is not clear in the 2024 GSP how well construction data relates to the differentiation of confined and unconfined groundwater conditions or the distinction of two aquifers.¹⁶³ The presence of confined and unconfined groundwater conditions is not well-defined due to data gaps with respect to Subbasin stratigraphy and hydrogeologic properties (see data gap discussion below). The cross-sections depict the boundary between the Upper and Lower Aquifers, but the boundary is not correlated with geologic formations or by the stratigraphy defined in

¹⁵⁷ 2024 Antelope GSP, Section 2.2.1.5, p. 168.

¹⁵⁸ 2024 Antelope GSP, Section 2.2.1.5, p. 168.

¹⁵⁹ 2024 Antelope GSP, Section 2.2.1.5, p. 168.

¹⁶⁰ 2024 Antelope GSP, Section 2.2.1.5, p. 169.

¹⁶¹ 2024 Antelope GSP, Section 2.2.1.5, p. 169.

¹⁶² 2024 Antelope GSP, Section 2.2.1.5, p. 169.

¹⁶³ 23 CCR 354.14 (b)(4) *et seq.*

lithologic logs.¹⁶⁴ Department staff note that neighboring GSPs within the Sacramento Valley (specifically Corning and Vina) identify a single principal aquifer. Department staff recommend the GSA provide additional rationale to support the presence of two distinct principal aquifers, if they are present, or identify one principal aquifer (see [Recommended Corrective Action 3a](#)).

The 2024 GSP defines the bottom of the Subbasin as the base of the post-Eocene continental deposits where the transition of marine-derived sediments and terrestrial-derived sediments corresponds from saline/brackish groundwater to fresh groundwater. The 2024 GSP's review of geophysical logs and water quality studies identifies that the base of freshwater ranges from 800 to 1,200 feet mean sea level in the northern portion of the Subbasin to deeper than 2,000 feet mean sea level in the western portion of the Subbasin which correlate closely to the base of post-Eocene continental deposits.¹⁶⁵ The 2024 GSP provides base to freshwater and base to post-Eocene contour maps to support this assessment.¹⁶⁶

The 2024 GSP identifies data gaps and uncertainty in the hydrogeologic conceptual model. First, it states that thicknesses and lateral extent of formations are poorly understood, particularly in delineating the western extent of the Tuscan Formation where probable interfingering exists between the Tuscan and Tehama Formations.¹⁶⁷ Secondly, the 2024 GSP acknowledges that aquifer properties often vary considerably within geologic formations and very limited data are available within the Subbasin.¹⁶⁸ There is also a lack of hydrogeologic data collected from the Subbasin limiting the understanding of parameters including storativity, transmissivity, and hydraulic conductivity specific to principal aquifers in the Subbasin.¹⁶⁹ The 2024 GSP also reports a need for shallow wells near stream gages for monitoring recharge related to surface water and shallow groundwater interaction.¹⁷⁰ GSP Regulations require GSAs to identify the steps that will be taken to fill data gaps prior to the next periodic evaluation.¹⁷¹ Department staff recommend the GSA develop a project or management action with an implementation schedule to address the hydrogeologic conceptual model's data gaps, especially to better define the principal aquifers and understand the potential interconnectivity between them (see [Recommended Corrective Action 3b](#)).

The hydrogeologic conceptual model section included in the 2024 GSP will be considered substantially compliant with the requirements outlined in the GSP Regulations,¹⁷² if the GSA responds sufficiently to recommended corrective actions for this section.

¹⁶⁴ 2024 Antelope GSP, Figures 2-22 through 2-24, pp. 149-151.

¹⁶⁵ 2024 Antelope GSP, Section 2.2.1.1, p. 134, and Section 2.2.1.6, p. 169.

¹⁶⁶ 2024 Antelope GSP, Figures 2-15 and 2-16, pp. 136-137.

¹⁶⁷ 2024 Antelope GSP, Section 2.2.1.8, p. 174.

¹⁶⁸ 2024 Antelope GSP, Section 2.2.1.8, p. 174.

¹⁶⁹ 2024 Antelope GSP, Section 2.2.1.8, p. 174.

¹⁷⁰ 2024 Antelope GSP, Section 2.2.1.8, p. 174.

¹⁷¹ 23 CCR § 354.38 (d).

¹⁷² 23 CCR § 354.14 *et seq.*

5.2.2 Groundwater Conditions

The GSP Regulations require a written description of historical and current groundwater conditions for each of the applicable sustainability indicators and groundwater dependent ecosystems that includes the following: groundwater elevation contour maps and hydrographs,¹⁷³ a graph depicting change in groundwater storage,¹⁷⁴ maps and cross-sections of the seawater intrusion front,¹⁷⁵ maps of groundwater contamination sites and plumes,¹⁷⁶ maps depicting total subsidence,¹⁷⁷ identification of interconnected surface water systems and an estimate of the quantity and timing of depletions of those systems,¹⁷⁸ and identification of groundwater dependent ecosystems.¹⁷⁹

The 2024 GSP provides groundwater elevation contour maps representing seasonal high and low conditions in the Upper Aquifer for the years 2013, 2015, 2017, and 2019.¹⁸⁰ A groundwater level contour map representing the change in spring groundwater elevations from 1990 to 2018 in the Upper Aquifer is also provided.¹⁸¹ Wells screened in shallow zones (upper 50 feet below ground surface) and cross screened between aquifers are determined to not be representative of aquifer specific conditions and are excluded from contour maps. Department staff note that general groundwater flow direction in the Subbasin is to the southwest with an increase in groundwater elevation toward the western and northern portions of the Subbasin.¹⁸² The 2024 GSP states that groundwater data indicate a downward vertical gradient in the Subbasin; however, the GSA notes that this data cannot be quantified due to long well screens and limited groundwater data.¹⁸³ The 2024 GSP did not include groundwater level contour maps representing groundwater conditions in the Lower Aquifer. Instead, the 2024 GSP identifies groundwater elevation data in the Lower Aquifer as a data gap.¹⁸⁴ Data gaps for the groundwater monitoring well network are further discussed in [Section 5.4](#) of this report.

Department staff note that there is a poor distribution or lack of monitoring wells at the northern and southern portions of the Subbasin indicating that groundwater conditions are not adequately monitored in these areas.¹⁸⁵ Limited monitoring may affect the GSA's ability to monitor impacts to beneficial uses or users of groundwater,¹⁸⁶ understand conditions relative to measurable objectives and minimum thresholds,¹⁸⁷ and quantify

¹⁷³ 23 CCR §§ 354.16 (a)(1-2).

¹⁷⁴ 23 CCR § 354.16 (b).

¹⁷⁵ 23 CCR § 354.16 (c).

¹⁷⁶ 23 CCR § 354.16 (d).

¹⁷⁷ 23 CCR § 354.16 (e).

¹⁷⁸ 23 CCR § 354.16 (f).

¹⁷⁹ 23 CCR § 354.16 (g).

¹⁸⁰ 2024 Antelope GSP, Figure 2-36 – 2-43, pp. 180-181 and 183-188.

¹⁸¹ 2024 Antelope GSP, Figure 2-44, p. 190.

¹⁸² 2024 Antelope GSP, Figure 2-36 – 2-43, pp. 180-181 and 183-188.

¹⁸³ 2024 Antelope GSP, Section 2.2.2.1.2, p. 179.

¹⁸⁴ 2024 Antelope GSP, Section 2.2.2, p. 174.

¹⁸⁵ 2024 Antelope GSP, Figure 2-36 – 2-43, pp. 180-181 and 183-188.

¹⁸⁶ 23 CCR § 354.34 (b)(1).

¹⁸⁷ 23 CCR 354.34 (b)(2).

water budget components in these areas.¹⁸⁸ This is particularly important since adverse impacts are predicted to occur at northern and southern areas of the Subbasin if water levels reach minimum threshold groundwater elevations.¹⁸⁹ Staff's review of monitoring networks is further discussed in [Section 5.4](#) of this report.

The 2024 GSP includes four hydrographs depicting long-term trends in groundwater elevation for the Upper Aquifer.¹⁹⁰ Additional groundwater data and hydrographs dating back to the 1950s are included in the appendices but are not discussed in the groundwater conditions section of the 2024 GSP.¹⁹¹ Hydrographs are not included for the Lower Aquifer due to lack of data. Department staff note that the analysis of hydrographs generally indicates a gradual decrease in groundwater levels over time with seasonal fluctuation and some recovery during drought periods. The 2024 GSP explains that increased groundwater decline since 2008 in the west and northwest areas of the Subbasin may be influenced by a reduction in water levels in the Sacramento River due to operational changes of the Red Bluff diversion dam that “potentially reduced the groundwater recharge [in the Subbasin] from river seepage.”¹⁹²

The 2024 Plan presents a statistical analysis of groundwater trends in the Subbasin and states that “the slightly decreasing trend in groundwater levels is not an indication of overdraft, but is likely due to removal of temporary surplus of groundwater” and the temporary surplus removal is unlikely to impact “beneficial users of groundwater to an unreasonable degree.”¹⁹³ Department staff note that this analysis relies on limited data from three wells in the Subbasin,¹⁹⁴ and note that this limited data set likely limits the accuracy of this analysis, the conclusions may not be representative of conditions throughout the entire Subbasin, and the 2024 Plan does not explain how results from this analysis support the GSA’s conclusion that current groundwater decline is unlikely to impact beneficial users. Impacts to beneficial uses and users from groundwater decline is addressed above in [Section 4.1.2.3](#) of this report in response to the Department’s Incomplete Determination of the 2022 GSP.

The 2024 GSP presents the estimated annual and cumulative changes in groundwater in storage for the Subbasin averaged over a 29-year historical study period from Water Years 1990 to 2019.¹⁹⁵ The changes in groundwater storage are estimated using the GSAs Tehama Integrated Hydrologic Model (Tehama IHM).¹⁹⁶ The 2024 GSP includes a description of the change in groundwater storage and graphs depicting the annual and cumulative change in groundwater storage during the historical period.¹⁹⁷ The graph

¹⁸⁸ 23 CCR 354.34 (b)(3).

¹⁸⁹ 2024 Antelope GSP, Figure 3-11, p. 315.

¹⁹⁰ 2024 Antelope GSP, Figure 2-34, p. 176.

¹⁹¹ 2024 Antelope GSP, Appendix 2-F, pp. 765-789.

¹⁹² 2024 Antelope GSP, Section 2.2.2.1.1, p. 178.

¹⁹³ 2024 Antelope GSP, Section 2.2.2.1.1, p. 175.

¹⁹⁴ 2024 Antelope GSP, Appendix F-2, Figure 1 and Table 1, pp. 766 -767.

¹⁹⁵ 2024 Antelope GSP, Section 2.3.2.1, p. 222.

¹⁹⁶ 2024 Antelope GSP, Section 2.3, p. 217.

¹⁹⁷ 2024 Antelope GSP, Section 2.3.2.1, p. 222, Figure 2-62, p. 245.

includes groundwater use, water year type, annual change in storage, and cumulative change in storage. The 2024 GSP states the total loss of cumulative groundwater storage during the historical period is -18,000 acre-feet, or about -610 acre-feet per year.¹⁹⁸ Department staff note that the cumulative change in storage for the historical period appears to be inconsistently stated in the 2024 GSP. In the Historical Groundwater Water Budget Summary section in the 2024 GSP the cumulative change in storage for the historical period is stated “about -7 [thousand acre-feet],”¹⁹⁹ whereas the change in cumulative groundwater storage for the same historical period is stated at “about -18 [thousand acre-feet]” in the appendices²⁰⁰ and in the historical water budget summary table.²⁰¹ Department staff recommend that this inconsistency be corrected to present a consistent reporting of the estimated historical water budget throughout the 2024 GSP.

The change in groundwater storage was also estimated in the 2024 GSP by evaluation of the change in groundwater elevation during the 1990 to 2018 period,²⁰² but Department staff note that the estimate appears to under-estimate the decrease in storage due to a lack of suitable groundwater elevation monitoring. Department staff note that the change in storage calculation only applies to localized northcentral and southern portions of the Upper Aquifer (51% of the Subbasin area) thereby excluding northern and northeastern areas of the Subbasin due to the lack of groundwater data. During this period the change in groundwater elevation decreased by approximately 10 feet in the northcentral area of the Subbasin but increased by over two feet in the southern portion of the Subbasin near the Sacramento River,²⁰³ corresponding to a loss of approximately -5,000 acre-feet in this area of the Upper Aquifer.²⁰⁴ Department staff note that the change in groundwater storage estimated from this study is based on limited groundwater data, only applies to a limited area of the Upper Aquifer, and does not use the best available data and science to estimate the change in groundwater storage for the Subbasin.²⁰⁵

The 2024 GSP states that seawater intrusion “is not an applicable sustainability indicator for the Antelope Subbasin because it is not likely to occur in the Subbasin due to its distance from the Pacific Ocean (about 90 miles).”²⁰⁶ Given the geographic setting of the Subbasin, Department staff regard the reasoning of the 2024 GSP as sufficient to demonstrate that sea water intrusion is not present in the Subbasin and not likely to occur in the future.

The 2024 GSP includes a description of current and historical groundwater quality. The GSP states that all present water quality data is only available for the Upper Aquifer, thus Department staff note that water quality is not evaluated for the Lower Aquifer in the 2024

¹⁹⁸ 2024 Antelope GSP, Appendix 2-K, p. 3,860; Table 2-21, p. 246.

¹⁹⁹ 2024 Antelope GSP, Section 2.3.5.3, p. 243.

²⁰⁰ 2024 Antelope GSP, Appendix 2K, Section 1.1.6, p. 3,860.

²⁰¹ 2024 Antelope GSP, Table 2-21, p. 246.

²⁰² 2024 Antelope GSP, Section 2.2.2.2, p. 189.

²⁰³ 2024 Antelope GSP, Figure 2-44, p. 190.

²⁰⁴ 2024 Antelope GSP, Section 2.2.2.2, p. 189.

²⁰⁵ 23 CCR 354.18(e).

²⁰⁶ 2024 Antelope GSP, Section 2.2.2.4, p. 195.

GSP.²⁰⁷ As discussed in [Section 4.2.2.1](#) above, this is inconsistent with GSP Regulations that require GSAs to monitor groundwater quality in each principal aquifer in the Subbasin.²⁰⁸

The 2024 Plan focuses on four groundwater contaminants previously reported at “undesirable concentrations” in the Subbasin including TDS, nitrate, arsenic and boron. The 2024 GSP provides a discussion²⁰⁹ and concentration maps²¹⁰ for each groundwater contaminant. The 2024 GSP states that “widespread presence of contaminants at undesirable levels, except nitrate, have not been reported in groundwater samples in the Subbasin.”²¹¹ The 2024 Plan states that TDS and arsenic are not currently water quality concerns in the Subbasin, but increasing trends of nitrate concentrations exceeding Maximum Contaminant Levels necessitate “regular monitoring of nitrate, especially in the northwestern part of the Subbasin.”²¹² The 2024 GSP states that “all groundwater clean-up sites (including leaking underground storage tanks) within the Subbasin are closed or inactive.”²¹³ A discussion of sustainable management criteria and potential impacts to beneficial uses and users from nitrate is provided above in [Section 4.2](#).

The 2024 GSP notes that elevated boron concentrations have been reported in the northcentral area of the Subbasin and “should be monitored to avoid potential negative impacts on crop yield” for sensitive crops in the Subbasin.²¹⁴ Boron is a naturally occurring element “most likely sourced from minerals in Cretaceous marine sedimentary rocks.”²¹⁵ Department staff note that SGMA specifies that undesirable results for degraded water quality are to be defined by the GSA in terms of significant and unreasonable effects caused by groundwater conditions occurring in the basin²¹⁶ whether they are naturally occurring or not. Department staff’s review of the Subbasin’s sustainable management criteria for groundwater quality is discussed below in [Section 5.3.2.4](#).

The 2024 GSP includes a description of current and historical land subsidence conditions along with maps covering the extent, cumulative total, and annual rate of subsidence in the Subbasin.²¹⁷ The 2024 GSP utilizes Department provided Global Positioning Systems (GPS) survey data from 2008 and 2017, and Interferometric Synthetic Aperture Radar (InSAR) data from July 2015 to June 2019 to measure the rate and extent of subsidence in the Subbasin.²¹⁸ From this data, the 2024 GSP estimates maximum subsidence during

²⁰⁷ 2024 Antelope GSP, Section 2.2.2.3, p. 189.

²⁰⁸ 23 CCR §354.34 (c)(4).

²⁰⁹ 2024 Antelope GSP, Section 2.2.2.3, p.189, 192 and 195.

²¹⁰ 2024 Antelope GSP, Figures 2-45 - 2-48, pp. 191, 193, 194 and 196.

²¹¹ 2024 Antelope GSP, Section 2.2.2.3, p. 189.

²¹² 2024 Antelope GSP, Section 2.2.2.3, p. 192.

²¹³ 2024 Antelope GSP, Section 2.2.2.3, p. 189.

²¹⁴ 2024 Antelope GSP, Section 2.2.2.3, p. 195.

²¹⁵ 2024 Antelope GSP, Section 2.2.2.3, p. 195.

²¹⁶ CWC § 10721 (x)(4).

²¹⁷ 2024 Antelope GSP, Section 2.2.2.5, p. 195; Figures 2-50 and 2-51, pp. 198 and 200.

²¹⁸ 2024 Antelope GSP, Section 2.2.2.5, pp. 195 and 199.

these time periods of 0.021 feet (2008-2017)²¹⁹ to -0.09 feet (2015-2019).²²⁰ The 2024 GSP states that subsidence in the Subbasin is likely elastic, but Department staff note that the GSA does not provide justification to support this conclusion. Justification as to why the minor subsidence noted in the Subbasin is considered elastic should be provided in the next periodic evaluation for the Subbasin.

The 2024 GSP notes the difficulty of characterizing the connectivity of surface water systems to groundwater in the Subbasin due to the lack of active stream gages near shallow monitoring wells.²²¹ Modeling attempts were not made to estimate the depletion of interconnected surface water from groundwater pumping due to these data gaps, but the 2024 GSP does provide a map of likely interconnected, likely disconnected, interconnected and uncertain stream segments based on a dataset developed by The Nature Conservancy.²²² Plans to further evaluate interconnected surface water in the Subbasin are discussed in [Section 5.3.2.6](#) and [Section 5.4](#) of this report.

The 2024 GSP includes a description of GDEs in the Subbasin along with a map.²²³ The 2024 GSP identifies GDEs and freshwater species by using the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset from the Department, the California Freshwater Species Database from CDFW,²²⁴ and the Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act – Guidance for Preparing Groundwater Sustainability Plans by The Nature Conservancy and by evaluation of recent land cover, groundwater conditions and two vegetation metrics.²²⁵ The 2024 GSP presents the methodology used to analyze and prioritize GDEs in the Subbasin in an appendix in the 2024 GSP.²²⁶ From this analysis, the 2024 GSP classified 72 acres of the Subbasin as high priority GDEs,²²⁷ and the GSA states that “low priority GDEs will be observed outside of the established monitoring program and may be reclassified as high priority depending on future conditions.”²²⁸ Furthermore, the 2024 GSP claims that 50 acres of “high priority” GDEs near the Red Bluff Diversion Dam were primarily caused by the draining of Lake Red Bluff in 2011.²²⁹ Department staff note the 2024 GSP does not provide a map of potential GDEs that was refined into the high priority GDE list. Staff recommend the GSA show its work completely in explaining how it reduced the extent of GDEs from the initial set to the high priority set including graphs and maps if necessary. The 2024 Plan states that there is a lack of data to confirm potential areas of high priority GDEs in the Subbasin, and installation of shallow groundwater monitoring

²¹⁹ 2024 Antelope GSP, Section 2.2.2.5, p. 195 and 199.

²²⁰ 2024 Antelope GSP, Figure 2-51, p. 200.

²²¹ 2024 Antelope GSP, Figure 2-51, p. 200.

²²² 2024 Antelope GSP, Figure 2-52, p. 203.

²²³ 2024 Antelope GSP, Section 2.2.2.7, pp. 201-205, Figures 2-53, p. 204.

²²⁴ 2024 Antelope GSP, Appendix 2H, pp. 800-807.

²²⁵ 2024 Antelope GSP, Section 2.2.2.7, pp. 201-202.

²²⁶ 2024 Antelope GSP, Appendix 2-I, pp. 809-815.

²²⁷ 2024 Antelope GSP, Figure 2-53, p. 204.

²²⁸ 2024 Antelope GSP, Section 2.2.2.7, p. 202.

²²⁹ 2024 Antelope GSP, Section 2.2.2.7, p. 202.

wells near or within areas of potential GDEs is needed to confirm this.²³⁰ Plans to further evaluate and improve monitoring of GDEs in the Subbasin is further discussed in [Section 5.4](#) of this report.

Department staff note that the 2024 GSP prioritizes what it has identified as “high priority” GDEs and only commits to observe and possibly reclassify “low priority GDEs” without defining the criteria of how and when this will occur. GSP Regulations do not differentiate a level of priority between high or low priority GDEs, rather require that all GDEs be monitored.²³¹ Department staff recommend a consistent focus on evaluating both low and high priority GDEs in the Subbasin in accordance with SGMA Regulations in periodic evaluations for the Subbasin.

The groundwater conditions section included in the GSP will be considered substantially compliant with the requirements outlined in the GSP Regulations,²³² if the GSA responds sufficiently to the recommended corrective actions for this section.

5.2.3 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,²³³ and the sustainable yield.²³⁴

The Tehama IHM numerical groundwater model was used to develop water budgets for the Subbasin in the 2024 GSP.²³⁵ The Tehama IHM was calibrated for the period of 1990 to 2019 and uses foundational elements from the Departments SVSim regional model for the Sacramento Valley with local refinements.²³⁶ The 2024 GSP provides estimated water budgets for a 29 year historical period (1990-2019), five current periods (from which 2016-2018 was chosen as the most representative current period) and a fifty year projected water budget (years 2022 to 2072) with consideration of data from a fifty year historical period from 1968 to 2018.²³⁷ The 2024 GSP states that the “decrease of groundwater storage during relatively dry years is not an indication of overdraft, but likely due to removal of temporary surplus of groundwater”.²³⁸ Department staff observe that a general groundwater decline is occurring by review of hydrographs for the Subbasin²³⁹ and note that SGMA requires GSAs to manage groundwater levels sustainably. Department staff encourage the GSA to actively manage the Subbasin during implementation to arrest declining groundwater levels. Graphical representation of the change in groundwater

²³⁰ 2024 Antelope GSP, Section 2.2.2.7, p. 202.

²³¹ 23 CCR § 354.16(g).

²³² 23 CCR § 354.16 *et seq.*

²³³ 23 CCR §§ 354.18 (a), 354.18 (c) *et seq.*

²³⁴ 23 CCR § 354.18 (b)(7).

²³⁵ 2024 Antelope GSP, Section 2.3, pp. 217-218.

²³⁶ 2024 Antelope GSP, Section 2.3, pp. 217-218.

²³⁷ 2024 Antelope GSP, Sections 2.3.2.1 and 2.3.2.2, pp. 222-224.

²³⁸ 2024 Antelope GSP, Section 2.3.5.3. p. 243.

²³⁹ 2024 Antelope GSP, Figure 2-34, p. 176; Appendix 2-F, pp. 765-789.

storage during the historical and projected period considering future land use is provided in the 2024 GSP.²⁴⁰ The graphs include groundwater use, water year type, annual change in storage, and cumulative change in storage.

The historical water budget in the 2024 GSP indicates a total loss of cumulative groundwater storage during the historical period (1990-2019) of -18,000 acre-feet, or about -610 acre-feet per year.²⁴¹ As discussed in [Section 5.2.2](#) above, the cumulative change in historical groundwater storage is inconsistently reported in the 2024 GSP which should be revised to present a consistent reporting of the historical water budget throughout the 2024 GSP.

To demonstrate the variability of groundwater storage between water years during the current period, the current water budget was evaluated for five different periods including the most recent 3 years (2016-2018), 5 years (2014-2018) and 10 years (2009-2018) and single years 2018 and 2019.²⁴²

The 2024 GSP presents the projected water budget considering current and future land use conditions and with and without climate change for a 50-year period (2022-2072). The projected water budget considering future land use conditions and climate change is a loss in groundwater storage of about -390 acre-feet per year and cumulative loss in groundwater storage of about -20,000 acre-feet per in the Subbasin.²⁴³

The sustainable yield is estimated in the 2024 GSP to be 18,000 acre-feet per year.²⁴⁴ The 2024 Plan assumes a potential 25 percent uncertainty with estimated water budget estimates for the Subbasin and note that the true sustainable yield may be higher.²⁴⁵

Department staff conclude that the historical, current, and projected water budgets included in the 2024 GSP substantially comply with the requirements outlined in the GSP Regulations.

5.2.4 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.²⁴⁶

The 2024 GSP does not use management areas.

²⁴⁰ 2024 Antelope GSP, Figures 2-62 and 2-70, pp. 245 and 269.

²⁴¹ 2024 Antelope GSP, Appendix 2-K, p. 3,860; Table 2-21, p. 246.

²⁴² 2024 Antelope GSP, Section 2.3.6, p. 247.

²⁴³ 2024 Antelope GSP, Tables 2-31, p. 273 and Table 2-33, p. 275.

²⁴⁴ 2024 Antelope GSP, 2.3.12, pp. 278-279.

²⁴⁵ 2024 Antelope GSP, Section 2.3.12, p. 279.

²⁴⁶ 23 CCR § 354.20.

5.3 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. The GSP Regulations require each Plan to define conditions that constitute sustainable groundwater management for the basin including the process by which the GSA characterizes undesirable results and establishes minimum thresholds and measurable objectives for each applicable sustainability indicator.²⁴⁷

5.3.1 Sustainability Goal

GSP Regulations require that GSAs establish a sustainability goal for the basin. The sustainability goal should be based on information provided in the GSP's basin setting and should include an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation.²⁴⁸

The sustainability goal for the Subbasin is “to develop [projects and management actions] that result in the sustainable management of the groundwater resources of the Subbasin for long-term community, financial, and environmental benefits of residents and businesses in the Subbasin. This GSP outlines the approach to achieve sustainable management of groundwater resources within 20 years, while maintaining the unique cultural, community, and agricultural aspects of the Subbasin. The GSA’s sustainability goal is to ensure that by 2042, and thereafter within the planning and implementation horizon of this GSP (50 years to 2072), the Subbasin is operated within its sustainable yield and does not exhibit undesirable results considered significant and unreasonable.”²⁴⁹

The 2024 GSP summarizes its plans to manage groundwater to reach the sustainability goal within 20 years, and states: “[to] ensure the Plan area meets its sustainability goal by 2042, the GSA has proposed several [projects and management actions], described in Chapter 4, to address any undesirable results that may occur”.²⁵⁰ The 2024 GSP explains that the “overarching sustainability goal and the absence of significant and unreasonable levels of undesirable results are expected to be achieved by 2042 through implementation of the [projects and management actions]” and provides a list of four projects and management actions to “ensure that the sustainability goal for the Subbasin is achieved by 2042”.²⁵¹ The sustainability goals “will be maintained through proactive monitoring and management by the GSA as described in the 2024 GSP.”²⁵²

²⁴⁷ 23 CCR § 354.22 *et seq.*

²⁴⁸ 23 CCR § 354.24.

²⁴⁹ 2024 Antelope GSP, Section 3.1.1, p. 293.

²⁵⁰ 2024 Antelope GSP, Section 3.1.1, p. 293.

²⁵¹ 2024 Antelope GSP, Section 3.1.1, p. 293

²⁵² 2024 Antelope GSP, Section 3.1.3, p. 294.

Staff conclude that the sustainability goal section included in the 2024 GSP is substantially compliant with the requirements outlined in the GSP Regulations.²⁵³

5.3.2 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.²⁵⁴ 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 water²⁵⁵ – 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.

GSP Regulations require that GSAs provide descriptions of undesirable results including defining what are significant and unreasonable potential effects to beneficial uses and users for each sustainability indicator.²⁵⁶ GSP Regulations also require that GSPs provide the criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.²⁵⁷

GSP Regulations require that the description of minimum thresholds include the information and criteria relied upon to establish and justify the minimum threshold for each sustainability indicator.²⁵⁸ GSAs are required to describe how conditions at minimum thresholds may affect beneficial uses and users,²⁵⁹ and the relationship between the minimum thresholds for each sustainability indicator, including an explanation for how the GSA has determined conditions at each minimum threshold will avoid causing undesirable results for other sustainability indicators.²⁶⁰

GSP Regulations require that GSPs include a description of the criteria used to select measurable objectives, including interim milestones, to achieve the sustainability goal

²⁵³ 23 CCR § 354.24.

²⁵⁴ 23 CCR § 351(ah).

²⁵⁵ Water Code § 10721(x).

²⁵⁶ 23 CCR §§ 354.26 (a), 354.26 (b)(c).

²⁵⁷ 23 CCR § 354.26 (b)(2).

²⁵⁸ 23 CCR § 354.28 (b)(1).

²⁵⁹ 23 CCR § 354.28 (b)(4).

²⁶⁰ 23 CCR § 354.28 (b)(2).

within 20 years.²⁶¹ GSP Regulations also require that the measurable objectives be established based on the same metrics and monitoring sites as those used to define minimum thresholds.²⁶²

The following subsections thus consolidate three facets of sustainable management criteria: undesirable results, minimum thresholds, and measurable objectives. Information, as presented in the Plan, pertaining to the processes and criteria relied upon to define undesirable results applicable to the Subbasin, as quantified through the establishment of minimum thresholds, are addressed for each applicable sustainability indicator. A submitting agency is 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.²⁶³

5.3.2.1 Chronic Lowering of Groundwater Levels

In addition to components identified in 23 CCR §§ 354.28 (a-b), for the chronic lowering of groundwater, 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 that is supported by information about groundwater elevation conditions and potential effects on other sustainability indicators.²⁶⁴

The 2024 GSP includes many revisions related to the sustainable management criteria for the chronic lowering of groundwater levels in response to Deficiency 1 identified with the 2022 GSP. For more information related to undesirable results, minimum thresholds, and impacts to beneficial uses and users please refer to the discussion in [Section 4.1](#) above.

The 2024 GSP describes the information and criteria relied upon to establish and justify the measurable objectives for the chronic lowering of groundwater levels. The 2024 GSP states: “To determine [measurable objectives], historical water elevations and projected water level trends were analyzed. The Subbasin aims to become sustainable by 2042 and therefore, [measurable objectives] were set to spring 2042 projected elevations minus five (5) feet for wells with a decreasing projected trend and at spring 2015 water levels minus five (5) feet for wells with an increasing projected trend in water elevations or with no trend.”²⁶⁵ The 2024 GSP provides tables of measurable objective values for the Upper Aquifer and Lower Aquifer and includes hydrographs showing measurable objectives in Appendix 3-B.²⁶⁶ Department staff note that measurable objectives were not established for well TSS-4U in the Upper Aquifer and well TSS-4L in the Lower Aquifer

²⁶¹ 23 CCR § 354.30 (a).

²⁶² 23 CCR § 354.30 (b).

²⁶³ 23 CCR § 354.26 (d).

²⁶⁴ 23 CCR § 354.28(c)(1) *et seq.*

²⁶⁵ 2024 Antelope GSP, Section 3.2.1.1, p. 295.

²⁶⁶ 2024 Antelope GSP, Tables 3-2 p. 3-3, pp. 296 and 299; Appendix 3-B, pp. 4094-4097.

due to insufficient data.²⁶⁷ Department staff recommend that measurable objective values be developed for these wells as part of the next periodic evaluation.

Department staff note that the description of the criteria used to establish measurable objectives is similar to the description of minimum thresholds that was deemed insufficient in the 2022 GSP. Department staff recommend that the GSA update the criteria used to develop measurable objectives consistent with sustainable management criteria revisions in the 2024 GSP. The GSA should also update all corresponding tables and hydrographs accordingly to reflect any changes to the measurable objective values. Staff recommend the GSA update the criteria to establish measurable objectives as part of the next periodic evaluation.

The 2024 GSP describes its interim milestones, including the criteria for their selection which is “the difference between the MOs and the starting point equally distributed over four interim milestones.”²⁶⁸ The 2024 Plan explains that spring 2021 groundwater levels were used to initiate interim milestones in the majority of representative monitoring sites except for monitoring well Ant-3U which initiates interim milestones from 2014 groundwater levels due to its location outside the focus area.²⁶⁹ The 2024 GSP provides a table of interim milestones.²⁷⁰ Department staff note that similar to measurable objectives, interim milestones were not developed for well TSS-4U in the Upper Aquifer and well TSS-4L in the Lower Aquifer which should be developed as part of the next periodic evaluation.

The location of wells used to monitor sustainable management criteria for the chronic lowering of groundwater is shown in a map provided in the 2024 GSP.²⁷¹ Department staff note that there is a poor distribution of wells in Upper Aquifer and Lower Aquifer in the Subbasin which is further discussed in the monitoring network [Section 5.4](#) below.²⁷²

The sustainable management criteria for the chronic lowering of groundwater levels section included in the 2024 GSP will be considered substantially compliant with the requirements outlined in the GSP Regulations once the GSA has responded to recommended corrective actions identified in [Section 4.1](#).

5.3.2.2 Reduction of Groundwater Storage

In addition to components identified in 23 CCR §§ 354.28 (a-b), for the 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

²⁶⁷ 2024 Antelope GSP, Table 3-2 and 3-3, pp. 296 and 299.

²⁶⁸ 2024 Antelope GSP, Section 3.2.1.2, p. 299.

²⁶⁹ 2024 Antelope GSP, Section 3.2.1.2, p. 299; Figure 3-1, p. 286.

²⁷⁰ 2024 Antelope GSP, Tables 3-2 and 3-3, pp. 296 and 299.

²⁷¹ 2024 Antelope GSP, Figures 3-3 and 3-4, pp. 297-298.

²⁷² 2024 Antelope GSP, Figures 3-3 and 3-4, pp. 297-298.

sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.²⁷³

The 2024 GSP explains that undesirable results for reduction of groundwater storage would occur when 25% of groundwater elevations measured at same RMS wells exceed the associated MTs for two (2) consecutive fall measurements.²⁷⁴ The 2024 GSP describes the conditions at an undesirable result for storage as impacts to the use of existing wells and beneficial users of groundwater, and states that the “significant and unreasonable decline in storage would result in limiting the volume of groundwater available for agriculture, municipal, industrial, and domestic uses without any [projects and management actions] to mitigate the impact by new and deeper wells.”²⁷⁵

The GSP Regulations require that GSAs establish minimum thresholds using a numeric value that represents a point in the basin, that, if exceeded, may cause undesirable results.²⁷⁶ The 2024 GSP states that the GSA plans to use groundwater levels as a proxy to monitor groundwater storage and states that the “minimum threshold for groundwater storage is set to the amount of groundwater storage when groundwater elevations are at their minimum threshold.”²⁷⁷ Then, the 2024 GSP explains that “[t]he minimum thresholds for reduction in groundwater storage is a single value of average groundwater elevation over the entire Subbasin. Therefore, the potential conflict between [minimum thresholds] at different locations in the Subbasin is not applicable.”²⁷⁸ Based on these contradictory statements, Department staff are unclear whether the GSA’s criteria to establish minimum thresholds for the reduction in groundwater storage is established using minimum threshold groundwater elevations at each representative monitoring site or is based on a single value of average groundwater elevation for the Subbasin. Department staff recommend the GSA clearly state the criteria to establish minimum thresholds for the reduction in groundwater storage in the next periodic evaluation.

The 2024 GSP identifies the criteria used to establish measurable objectives and interim milestones for groundwater storage. The 2024 GSP states: “The [measurable objectives] for reduction on groundwater storage were developed using the same methodology as the chronic lowering of groundwater elevations [measurable objectives]. They are set to the amount of groundwater storage that exists when the groundwater elevations are at their [measurable objectives].”²⁷⁹ The 2024 GSP used the 2021 spring measurement as the starting point in the development of interim milestones for all wells except well ANT-3

²⁷³ 23 CCR § 354.28(c)(2).

²⁷⁴ 2024 Antelope GSP, Section 3.4.1.2, p. 327; Table 3-15, p. 326.

²⁷⁵ 2024 Antelope GSP, Section 3.4.1.2, p. 327.

²⁷⁶ 23 CCR § 354.28(a).

²⁷⁷ 2024 Antelope GSP, Section 3.3.2.1, p. 317.

²⁷⁸ 2024 Antelope GSP, Section 3.3.2.2, p. 318.

²⁷⁹ 2024 Antelope GSP, Section 3.2.2.1, p. 300.

which started from the spring measurement in 2014.²⁸⁰ A summary of interim milestones are provided in the 2024 GSP in two tables.²⁸¹

Since the GSA is using groundwater elevation as a proxy to monitor the reduction of groundwater storage the same recommendations provided in [Section 5.3.2.1](#) regarding updates to the criteria to establish measurable objectives and establishment of sustainable management criteria of all representative monitoring wells also apply for the reduction in groundwater storage.

Department staff conclude that this section of the 2024 GSP is substantially compliant once the GSA responds to the recommended corrective action and fully updates the section to be consistent with the GSA's updates to groundwater levels sustainable management criteria.

5.3.2.3 Seawater Intrusion

In addition to components identified in 23 CCR §§ 354.28 (a-b), for 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.²⁸²

The 2024 GSP states that seawater intrusion “is not an applicable sustainability indicator for the Antelope Subbasin because it is not likely to occur in the Subbasin due to its distance from the Pacific Ocean (about 90 miles)”.²⁸³ Department staff regard this reasoning sufficient to demonstrate that seawater intrusion is not present in the Subbasin and not likely to occur in the future.

5.3.2.4 Degraded Water Quality

In addition to components identified in 23 CCR §§ 354.28 (a-b), for 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.²⁸⁴

The 2024 GSP states “the constituents being evaluated for all beneficial users [in the Subbasin] are total dissolved solids (TDS) and nitrate.”²⁸⁵ The 2024 GSP includes revisions related to the sustainable management criteria for the degradation of

²⁸⁰ 2024 Antelope GSP, Section 3.2.2.2, p. 300.

²⁸¹ 2024 Antelope GSP, Tables 3-2 and 3-3, pp. 296 and 299.

²⁸² 23 CCR § 354.28(c)(3).

²⁸³ 2024 Antelope GSP, Section 2.2.2.4, p. 195.

²⁸⁴ 23 CCR § 354.28(c)(4).

²⁸⁵ 2024 Antelope GSP, Section 3.2.4.1, p. 302.

groundwater quality in response to Deficiency 2 identified with the 2022 GSP. A discussion of undesirable results and evaluation of the monitoring network for TDS and nitrate, and impacts to beneficial uses and users, minimum thresholds and measurable objectives exclusively for nitrate is provided in [Section 4.2](#). A discussion of impacts to beneficial uses and users, minimum thresholds and measurable objectives for TDS is presented below.

The 2024 GSP discusses potential effects on beneficial uses and users from TDS, and states: “The effect of degraded groundwater quality from [total dissolved solids] on agricultural beneficial users is manifested crop damage and reduced yields, and a reduction in the use of land for irrigated agriculture if the sole water supply is groundwater. Urban and domestic beneficial uses are impacted if degraded water is the only source for potable use. The impacts include the need to use alternative sources of water that may be more expensive than groundwater and potential undesirable aesthetic qualities without pre-treatment of the degraded water prior to use.”²⁸⁶

The 2024 GSP establishes sustainable management criteria for TDS in consideration of water quality standards and beneficial uses and users in the Subbasin. The 2024 GSP establishes minimum thresholds for TDS at a concentration of 750 milligrams per liter which is a lower concentration than the California State Water Resources Control Board upper secondary maximum containment level (SMCL).²⁸⁷ Measurable objectives for total dissolved solids are stated in the 2024 GSP at 500 milligrams per liter consistent with the secondary drinking water standard for urban and domestic use.²⁸⁸ The 2024 GSP explains that minimum threshold and measurable objective concentrations are “tolerable for most crops grown in the Subbasin without blending with surface water supplies”.²⁸⁹ Interim milestones are presented below measurable objectives in the 2024 GSP and the GSA states that “the path forward [for] interim milestones is to stay below the [measurable objective]”.²⁹⁰ The 2024 GSP presents minimum thresholds, measurable objectives and interim milestones for TDS in a table.²⁹¹

The 2024 GSP notes that boron should be monitored to avoid impacts to beneficial uses and users of the Subbasin,²⁹² but neglected to explain why boron was excluded from sustainable management criteria for groundwater quality. Department staff recommend the GSA should provide justification why boron is excluded from sustainable management criteria to monitor groundwater quality for beneficial uses and users in the Subbasin in the next periodic evaluation.

Staff note that GSAs are required to manage future groundwater extraction to ensure that groundwater use subject to its jurisdiction does not significantly and unreasonably

²⁸⁶ 2024 Antelope GSP, Section 3.3.4.5, p. 322.

²⁸⁷ 2024 Antelope GSP, Section 3.3.4.1, p. 321.

²⁸⁸ 2024 Antelope GSP, Section 3.2.4.1, p. 302.

²⁸⁹ 2024 Antelope GSP, Section 3.2.4.1, p. 302.

²⁹⁰ 2024 Antelope GSP, Table 3-12, p. 321.

²⁹¹ 2024 Antelope GSP, Table 3-12, p. 321.

²⁹² 2024 Antelope GSP, 2.2.2.3, p. 195.

exacerbate existing degraded water quality conditions. Where natural and other human factors are contributing to water quality degradation, the GSA may have to confront complex technical and scientific issues regarding the causal role of groundwater extraction and other groundwater management activities, as opposed to other factors, in any continued degradation; but the analysis should be on whether groundwater extraction is causing the degradation in contrast to only looking at whether a specific project or management activity results in water quality degradation. Department staff recommend that the GSA coordinate with the appropriate water quality regulatory programs and agencies in the Subbasin to understand and develop a process for determining when groundwater management and extraction is resulting in degraded water quality in the Subbasin (see [Recommended Corrective Action 4](#)).

As discussed above in [Section 4.2](#), Department staff provided recommended corrective actions regarding the definition for undesirable results and for the monitoring network for degraded groundwater quality. Department staff conclude that the sustainable management criteria for degraded water quality included in the 2024 GSP will be considered substantially compliant with the requirements outlined in the GSP Regulations once the GSA has responded to recommended corrective actions identified in [Section 4.2](#).

5.3.2.5 Land Subsidence

In addition to components identified in 23 CCR §§ 354.28 (a-b), 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.²⁹³ Minimum thresholds for land subsidence shall be supported by 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 thresholds and measurable objectives.²⁹⁴

The 2024 GSP establishes sustainable management criteria for land subsidence including undesirable results, minimum thresholds and measurable objectives.²⁹⁵

The 2024 GSP defines an undesirable result for subsidence occurring in the Subbasin when “50% of [representative monitoring sites] exceed the [minimum threshold] over a 5-year period that is irreversible and is caused by lowering of groundwater elevations.”²⁹⁶ The 2024 GSP describes significant and unreasonable conditions with the following statement: “Conditions that may lead to an undesirable result of a significant and unreasonable amount for land subsidence arise due to groundwater extraction that

²⁹³ 23 CCR § 354.28(c)(5).

²⁹⁴ 23 CCR §§ 354.28(c)(5)(A-B).

²⁹⁵ 2024 Antelope GSP, Section 3.4.1.3, pp. 327-328; Section 3.3.3, pp. 319-320; and 3.2.3, pp. 300-302.

²⁹⁶ 2024 Antelope GSP, Section 3.4.1.3, pp. 327-328; Table 3-15, pp. 326-327.

causes reductions in the viability of the use of water conveyance and flood control infrastructure over the planning and implementation horizon of this GSP.”²⁹⁷

The 2024 GSP discusses minimum thresholds for subsidence. The 2024 GSP selected four locations in the Subbasin to compare to InSAR subsidence data provided by the Department.²⁹⁸ At each location, the GSA has selected a single ‘pixel’ of the InSAR coverage and plans to compare values at the four ‘pixels’ of InSAR data to the minimum threshold. The 2024 GSP selected a minimum threshold of “two (2) feet over 20 years (i.e., no more than 0.5 feet of cumulative subsidence over a five (5)-year period (beyond the measurement error), solely due to lowering of groundwater elevations.”²⁹⁹ The GSA will also evaluate InSAR data in conjunction with water level data to determine whether changes in water levels can be used as an early detection method for compaction.³⁰⁰

Department staff note the GSA’s decision to evaluate the InSAR dataset, which is released quarterly, once every five years is problematic and is not using the best available science.³⁰¹ Department staff recommend the GSA evaluate InSAR data against the proposed thresholds as it is released during plan implementation (see [Recommended Corrective Action 5a](#)).

Staff are concerned that limiting the data evaluated to a monitoring network that consists of single pixels is also not using the best available science,³⁰² which is discussed further in this report in [Section 5.4](#).

Department staff are additionally concerned about the GSA’s selection of the undesirable result definition and minimum threshold selection criteria. Staff note that the 2024 GSP has selected a 50% exceedance of monitoring points as the undesirable result but does not provide an explanation to support this selection. Land subsidence can impact beneficial uses and users in localized areas which would be missed with the current requirement for exceedances to occur at more than 50% of the locations in the Subbasin.³⁰³ Department staff recommend the GSA revise the sustainability management criteria to account for impacts to beneficial uses and users in localized areas (see [Recommended Corrective Action 5b](#)).

The 2024 GSP also described criteria used to select minimum thresholds as “established by calculating the vertical displacement from June 2015 to September 2019 and doubling the value.”³⁰⁴ Staff note that the criteria used to establish the minimum threshold for subsidence doubles the ongoing subsidence rate and is not connected to impacts to beneficial uses and users. GSP Regulations require that GSAs consider impacts to

²⁹⁷ 2024 Antelope GSP, Section 3.3.3.4, p. 320.

²⁹⁸ 2024 Antelope GSP, Table 3-11, p. 320.

²⁹⁹ 2024 Antelope GSP, Section 3.3.3.1, p. 319.

³⁰⁰ 2024 Antelope GSP, Section 3.7.7, p. 347.

³⁰¹ 23 CCR § 355.4 (b)(1).

³⁰² 23 CCR § 355.4 (b)(1).

³⁰³ 23 CCR § 354.26 (b)(3).

³⁰⁴ 2024 Antelope GSP, Section 3.3.3.1, p. 319.

beneficial uses and users of groundwater or land uses and property interests.³⁰⁵ Staff recommend the GSA set sustainable management criteria while considering beneficial uses and users, not by projecting pre-SGMA conditions. Department staff additionally note that the minimum threshold as currently defined would allow 0.49 feet of subsidence to occur every five years without leading to undesirable results and is multiple times greater than the maximum land subsidence that the 2024 GSP reports.³⁰⁶ Allowing subsidence to occur into the future is not minimizing or avoiding subsidence as intended by SGMA.³⁰⁷ Department staff recommend the GSA set an annual rate and cumulative total amount of subsidence that will lead to undesirable results (see [Recommended Corrective Action 5c](#)).

The 2024 GSP establishes measurable objectives for subsidence. The 2024 GSP selected 0.05 feet per year (0.25 feet per 5 years, or 1 foot per 20 years), and the GSA assumes any subsidence measurements less than 0.1 feet are instrument error and not accurate and would not be considered inelastic subsidence.³⁰⁸ The GSA provides measurable objectives in Table 3-4.³⁰⁹

Department staff conclude that the 2024 GSP has substantially complied with GSP Regulations if recommended corrective actions are addressed.

5.3.2.6 *Depletions of Interconnected Surface Water*

SGMA defines undesirable results for the depletion 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.³¹⁰ 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.³¹¹ 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.³¹²

The Plan acknowledges the presence of interconnected surface waters in the Subbasin and identifies their location by relying on a dataset developed by the Nature Conservancy.³¹³ The GSA plans to address data gaps that currently preclude evaluation of surface water interconnectivity in the Subbasin and “will update the Undesirable Results definition to include depletion of interconnected surface water in the 5-year GSP

³⁰⁵ 23 CCR § 354.28 (b)(4).

³⁰⁶ 2024 Antelope GSP, Section 3.3.3.1, p. 319.

³⁰⁷ CWC § 10720 (e)

³⁰⁸ 2024 Antelope GSP, Section 3.2.3.1, p. 300.

³⁰⁹ 2024 Antelope GSP, Table 3-4, p. 302.

³¹⁰ CWC § 10721(x)(6).

³¹¹ 23 CCR § 354.16 (f).

³¹² 23 CCR § 354.28 (c)(6).

³¹³ 2024 Antelope GSP, Section 2.2.2.6.1, p. 201.

Periodic Evaluation due in January 2027, and following the release of DWR’s guidance on interconnected surface water analysis and SMC setting.”³¹⁴ The 2024 GSP provides a map that identifies the locations of likely interconnected streams and classifies the streams into three classes: (1) likely interconnected, (2) likely disconnected, and (3) uncertain.³¹⁵ The 2024 GSP states that “[l]osing and gaining stream segments categorized using the calibrated Tehama Integrated Hydrologic Model are included in Sub-appendix G of Appendix 2-J”;³¹⁶ however, no sub-appendices are included in Appendix 2-J. The 2024 GSP does not quantify the rate or volume of surface water depletions due to groundwater pumping in the sustainable management criteria as required by GSP Regulations.³¹⁷ Instead, the 2024 GSP explains that the GSA will continue to evaluate new monitoring information and determine these thresholds later.”³¹⁸ Department staff recommend the GSA estimate the quantity and timing of depletions of interconnected surface water systems³¹⁹ prior to the next periodic evaluation (see [Recommended Corrective Action 6a](#)).

The 2024 GSP establishes an interim undesirable result for interconnected surface water and states: “Initial undesirable results for depletion of interconnected surface water were developed for this GSP due to data gaps. These interim undesirable results mirror those established for chronic lowering of groundwater elevations. Therefore, undesirable results will occur when 25% of groundwater elevations measured at RMS wells drop below the associated threshold during two (2) consecutive fall measurements.”³²⁰ The 2024 GSP does not describe the potential effects on the beneficial uses and users of groundwater, nor other potential effects that may occur or are occurring from undesirable results, which is required by GSP Regulations.³²¹ Department staff recommend the GSA define and describe what conditions constitute undesirable results including the effects on beneficial uses and users for the depletion of interconnected surface water in the Subbasin (see [Recommended Corrective Action 6b](#)).

The 2024 GSP describes minimum thresholds for interconnected surface water. The 2024 GSP states that the “[m]inimum thresholds are interim and will be the same water levels used in for the chronic lowering of groundwater elevations described in Section 3.3.1.1” for Upper Aquifer wells in the Subbasin.³²² The GSA explains that due to extensive data gaps the GSA “will continue to evaluate new monitoring information and determine these thresholds later” and “[f]or the interim, [minimum thresholds] for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters.”³²³ The

³¹⁴ 2024 Antelope GSP, Section 3, p. 287.

³¹⁵ 2024 Antelope GSP, Section 2.2.2.6.1, p. 201; Figure 2-52, p. 203.

³¹⁶ 2024 Antelope GSP, Section 2.2.2.6.1, p. 201.

³¹⁷ 23 CCR § 354.28 (c)(6).

³¹⁸ 2024 Antelope GSP, Section 3.3.5.1, p. 324.

³¹⁹ 23 CCR 354.16 (f).

³²⁰ 2024 Antelope GSP, Section 3.4.1.5, p. 328.

³²¹ 23 CCR § 354.26 (b)(3).

³²² 2024 Antelope GSP, Section 3.3.5.1, p. 323.

³²³ 2024 Antelope GSP, Section 3.3.5.1, p. 323.

minimum thresholds are summarized in a table.³²⁴ The 2024 GSP describes data gaps for interconnected surface water in Section 3.7.8.7,³²⁵ but does not provide a clear plan or schedule to fill the identified data gaps. Department staff note that GSP Regulations requires the GSA to identify steps to fill data gaps before the next five year assessment³²⁶ and recommend that the GSA identify the planned actions to address data gaps for interconnected surface water by the next periodic evaluation.

The 2024 GSP described measurable objectives for interconnected surface water. The 2024 GSP states: “The [measurable objectives] for the chronic lowering of groundwater elevations will be used as a proxy for interconnected surface waters” and “upper aquifer [wells] will be used for monitoring”.³²⁷ The GSA explains that future shallow groundwater monitoring wells will be used to provide data to characterize stream-aquifer interaction, and “[u]ntil sufficient data is available, it is assumed that existing surface water – groundwater interactions will not considerably change when sustainable groundwater levels occur in the Subbasin.”³²⁸

Department staff note that many projects and management actions described in the 2024 GSP intended to fill data gaps are not identified as projects to be implemented upon plan adoption, rather, they are optional projects that the GSA may determine to implement at an unknown future date.³²⁹ Staff additionally note that the efforts to fill data gaps do not include a schedule, and that GSP Regulations require GSAs to fill data gaps by the next periodic evaluation.³³⁰ Department staff recommend the GSA expeditiously works toward identification of the steps to provide the necessary information and methodologies to estimate the location, quantity, and timing of depletion of interconnected surface waters as required by the Regulations ([see Section 5.4](#)).

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. Accordingly, Department staff believes 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.

³²⁴ 2024 Antelope GSP, Table 3-14, p. 323.

³²⁵ 2024 Antelope GSP, Section 3.7.8.7, pp. 349.

³²⁶ 23 CCR § 354.38 (d).

³²⁷ 2024 Antelope GSP, Section 3.2.5.1. p. 305.

³²⁸ 2024 Antelope GSP, Section 3.2.5.1, pp. 305.

³²⁹ 2024 Antelope GSP, Section 4.1.1.1, p. 357; Table 4-3, p. 370.

³³⁰ 23 CCR § 354.38 (d).

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 evaluations of the GSP (see [Recommended Corrective Action 6c](#)). 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 6d](#)). 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 6e](#)).

5.4 MONITORING NETWORK

The GSP Regulations describe the monitoring network that must be developed for each sustainability indicator including monitoring objectives, monitoring protocols, and data reporting requirements. Collecting monitoring data of 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.³³¹ Specifically, a monitoring network must be able to monitor impacts to beneficial uses and users,³³² monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds,³³³ capture seasonal low and high conditions,³³⁴ include required information such as location and well construction and include maps and tables clearly showing the monitoring site type, location, and frequency.³³⁵ Department staff encourage GSAs to collect monitoring data as specified in the GSP, follow SGMA data and reporting standards,³³⁶ fill data gaps identified in the GSP prior to the first periodic evaluation,³³⁷ update monitoring network information as needed, follow monitoring best management practices,³³⁸ and submit all monitoring data to the Department's Monitoring Network Module immediately after collection including any additional groundwater

³³¹ 23 CCR § 354.32.

³³² 23 CCR § 354.34(b)(2).

³³³ 23 CCR § 354.34(b)(3).

³³⁴ 23 CCR § 354.34(c)(1)(B).

³³⁵ 23 CCR §§ 354.34(g-h).

³³⁶ 23 CCR § 352.4 *et seq.*

³³⁷ 23 CCR § 354.38(d).

³³⁸ Department of Water Resources, 2016, [Best Management Practices and Guidance Documents](#).

monitoring data that is collected within the Plan area that is used for groundwater management decisions. Department staff note that if GSA does not fill its identified data gaps, the GSA's basin understanding may not represent the best available science for use to monitor basin conditions.

The 2024 GSP includes monitoring networks for the chronic lowering of groundwater levels, degraded water quality, and land subsidence sustainability indicators. The 2024 GSP uses the groundwater level monitoring network as a proxy for the reduction of groundwater in storage and depletion of interconnected surface water sustainability indicators. The GSA commits to evaluating the monitoring networks on a yearly basis and performing a comprehensive assessment of the monitoring networks as part of periodic evaluations for the Subbasin.³³⁹ The proposed monitoring network for all sustainability indicators monitored in the Subbasin is provided in a table.³⁴⁰

The 2024 GSP states that the representative monitoring network for the chronic lowering of groundwater levels was developed from a subset of monitoring wells exclusively screened in the Upper Aquifer or Lower Aquifer and with adequate geographical variation and historical record. The 2024 GSP explains that the number and spatial distribution of wells in the monitoring network was determined using the Hopkins Method provided in the Department's best management practices and using hexagonal tessellation polygons,³⁴¹ but does not explain how the polygons are used to guide monitoring nor what was considered to establish the polygons. The 2024 GSP identifies four monitoring wells in the Upper Aquifer³⁴² and one monitoring well in the Lower Aquifer³⁴³ and provides the rationale for selection of each well.³⁴⁴ The 2024 GSP provides maps showing the locations of the wells in the Upper Aquifer³⁴⁵ and Lower Aquifer.³⁴⁶

Department staff note that GSP Regulations require that monitoring for the chronic lowering of groundwater levels must include a sufficient density of monitoring wells to evaluate groundwater conditions in all principal aquifers,³⁴⁷ monitor impacts to beneficial uses and users of groundwater,³⁴⁸ monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds³⁴⁹ and provide adequate data to quantify changes in water budget components.³⁵⁰ The Department's best management practices provide general guidance to aid in the development of a monitoring network but do not

³³⁹ 2024 Antelope GSP, Section 3.7.8.1, p. 348.

³⁴⁰ 2024 Antelope GSP, Table 3-16, p. 331.

³⁴¹ 2024 Antelope GSP, Section 3.6.2, p. 332.

³⁴² 2024 Antelope GSP, Table 3-17, p. 334.

³⁴³ 2024 Antelope GSP, Table 3-18, p. 334.

³⁴⁴ 2024 Antelope GSP, Table 3-19, p. 334.

³⁴⁵ 2024 Antelope GSP, Figure 3-3, p. 297.

³⁴⁶ 2024 Antelope GSP, Figure 3-4, p. 298.

³⁴⁷ 23 CCR § 354.34 (c)(1)(A).

³⁴⁸ 23 CCR § 354.34 (b)(2).

³⁴⁹ 23 CCR § 354.34 (b)(3).

³⁵⁰ 23 CCR § 354.34 (b)(4).

replace GSP Regulations.³⁵¹ Department staff note significant gaps in the monitoring network that affect the GSA’s ability to effectively monitor impacts to beneficial uses or users of groundwater,³⁵² adequately monitor groundwater conditions and measurable objectives and minimum thresholds in all principal aquifers,³⁵³ and quantify representative water budget components for the entire Subbasin.³⁵⁴ Specifically, the well network presented in the 2024 Plan neglects to monitor the southern half of the Subbasin where uses and users are present,³⁵⁵ lacks well coverage at the northern and southern portions of the Subbasin where impacts to wells have historically occurred and are predicted to occur if water levels reach minimum threshold groundwater elevations,³⁵⁶ and a single well in the Lower Aquifer and poor spatial distribution of wells in the Upper Aquifer is insufficient to evaluate groundwater conditions in all areas and principal aquifers in the Subbasin.³⁵⁷ Staff conclude that this lack of spatial distribution of wells in the upper and lower aquifers represents a data gap that should be addressed to effectively monitor groundwater conditions across the entire Subbasin and in all principal aquifers as required by the GSP Regulations (see [Recommended Corrective Action 7a](#)).

The 2024 GSP states that “wells selected for monitoring changes in groundwater storage will be the same wells used for groundwater level monitoring” since the “[c]hanges in groundwater storage cannot be measured directly.”³⁵⁸ As discussed above in [Section 5.3.2.2](#), the 2024 GSP generally indicates that it plans to use groundwater levels as a proxy for storage, but does not clearly state that levels minimum thresholds are being used as storage thresholds. Department staff cannot infer commitments by the GSA, and the quantitative value for the minimum thresholds for reductions in storage is not provided.

Should the GSA plan to use the monitoring network for the chronic lowering of groundwater levels as a proxy for storage, Department staff recommend that the GSA clearly indicate its intent to do so and provide a justification for the appropriateness of using levels as a proxy. GSP Regulations require GSAs to demonstrate that significant correlation exists between groundwater elevations and the reduction in storage,³⁵⁹ and that levels measurable objectives take into consideration basin setting to avoid undesirable results for reduction in storage.³⁶⁰

Since the GSA is planning to use the same monitoring well as a proxy to monitor the reduction of groundwater storage, the same recommendation provided for the chronic

³⁵¹ Department of Water Resources, 2016, [Best Management Practices and Guidance Documents](#).

³⁵² 23 CCR § 354.34 (b)(2).

³⁵³ 23 CCR 354.34 (b)(3); 23 CCR § 354.34 (c)(1)(A).

³⁵⁴ 23 CCR 354.34 (b)(4).

³⁵⁵ 2024 Antelope GSP, Figure 2-6, p. 78.

³⁵⁶ 2024 Antelope GSP, Figures 3-1 and 3-11, pp. 286 and 315.

³⁵⁷ 2024 Antelope GSP, Figures 3-3 and 3-4, pp. 297 and 298.

³⁵⁸ 2024 Antelope GSP, Section 3.6.3, p. 335.

³⁵⁹ 23 CCR § 354.36 (b)(1).

³⁶⁰ 23 CCR § 354.36 (b)(2).

lowering of groundwater levels monitoring network above also applies to the reduction in groundwater storage monitoring network.

The 2024 GSP states that the “Subbasin is isolated from the Pacific Ocean; therefore, this GSP does not provide monitoring for seawater intrusion sustainability indicators.”³⁶¹ Department staff agree the sustainability indicator for seawater intrusion is not present in this Subbasin and therefore, the monitoring of seawater intrusion is not required.

The 2024 GSP describes its degraded water quality monitoring network³⁶² and provides a map of their locations.³⁶³ The 2024 GSP includes many revisions related to the sustainable management criteria for degraded water quality in response to Deficiency 2 identified with the 2022 GSP. Please refer to the Department staff’s evaluation of the monitoring network for degraded water quality in [Section 4.2](#) above.

The 2024 GSP describes the land subsidence monitoring network and elects to monitor land surface elevation at four InSAR data pixels near groundwater level monitoring wells in the Subbasin.³⁶⁴ The 2024 GSP states that InSAR data “spanned the entirety of the Subbasin” and “has a relatively small error margin (18 [millimeters] or 0.06 [feet]) and is available to download on a monthly or annual basis with continuous measurements.”³⁶⁵ Despite InSAR covering the entire Subbasin, the GSA has limited monitoring for subsidence in the Subbasin at the four ‘pixel’ locations shown in a map.³⁶⁶ The 2024 GSP justifies this selection by claiming that this limitation of data selected will “allow the GSA to study the impact of falling and rising water levels on subsidence in the same location and develop a relationship between water levels and subsidence over time.”³⁶⁷ Department staff note that the data could be used for that purpose without restricting which ‘pixels’ are used to monitor for subsidence.

Department staff note that this approach artificially limits the monitoring data that is considered by the GSA and does not monitor for subsidence in areas of the Subbasin where maximum vertical displacement of the land surface has occurred.³⁶⁸ The GSA has available to it, as noted in the 2024 GSP, data from three different monitoring programs: “PBO stations within the vicinity of the Subbasin, 2017 GPS Survey Data from DWR, and InSAR satellite vertical displacement data”³⁶⁹ but how the GSA plans to use non-InSAR data is not clear in the 2024 GSP. Staff additionally note that a measurable amount of subsidence has occurred in the Subbasin based on data measured in the vicinity of

³⁶¹ 2024 Antelope GSP, Section 3.6.1, p. 329.

³⁶² 2024 Antelope GSP, Section 3.6.5, pp. 339 and 341; Table 3-25, p. 340.

³⁶³ 2024 Antelope GSP, Figure 3-6, p. 304.

³⁶⁴ 2024 Antelope GSP, Section 3.6.4, p. 337.

³⁶⁵ 2024 Antelope GSP, Section 3.6.4, p. 337.

³⁶⁶ 2024 Antelope GSP, Figure 3-5, p. 301.

³⁶⁷ 2024 Antelope GSP, Section 3.6.4, p. 337.

³⁶⁸ 2024 Antelope GSP, Section Figure 2-51, p. 200.

³⁶⁹ 2024 Antelope GSP, Section 3.6.4, p. 337.

monuments surveyed by DWR³⁷⁰ and InSAR data,³⁷¹ but the 2024 GSP does not discuss the use of the GPS Survey data as part of its monitoring program.

GSP Regulations require GSAs to monitor for subsidence to identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method,³⁷² and to monitor impacts to beneficial uses or users.³⁷³ Additionally, Department staff evaluate GSP's to determine whether the GSP is reasonable and supported by the best available information and science.³⁷⁴ Department staff conclude the GSA's proposed monitoring network does not sufficiently identify the rate and extent of land subsidence, consider beneficial uses and users nor reflect the best available science as the approach to limit review of monitoring to pixels of data does not provide spatial coverage to understand the extent of subsidence. Department staff recommend that the GSA update its monitoring network using a method that addresses these concerns (see [Recommended Corrective Action 7b](#)).

The 2024 GSP discusses interconnected surface water monitoring. The 2024 GSP states that the "interconnected surface water indicator had the most prominent data gaps compared to all other indicators,"³⁷⁵ and due to these data gaps "[g]roundwater level monitoring wells within the Upper Aquifer will be used as a proxy for this indicator."³⁷⁶ The 2024 GSP includes a table of the monitoring sites,³⁷⁷ shows that wells used for the interconnected surface water network have screened intervals ranging from 30 to 210 feet deep and includes a second table that shows the basis for selection is that the well is an 'upper aquifer well'.³⁷⁸ Department staff note that wells screened in deeper groundwater zones may not be applicable to monitor interconnected surface water conditions and acknowledge that the GSA recognizes the lack of shallow wells (<50 feet) as a data gap to monitor interconnected surface water as discussed below.

The 2024 GSP includes a map showing the locations of representative monitoring wells to monitor interconnected surface water.³⁷⁹ The 2024 Plan states that "[g]roundwater level monitoring wells within one (1) mile of water bodies will be used as a proxy for monitoring."³⁸⁰ Department staff note that three of the four wells to monitor interconnected surface water are located greater than one mile from the nearest water body, including two wells (TSS-4 and Ant-2U) located greater than two miles from the Sacramento River.³⁸¹ This is inconsistent with the GSA's own criteria for selection of wells used as a

³⁷⁰ 2024 Antelope GSP, Section 2.2.2.5, pp. 195 and 199; Figure 2-50, p. 198.

³⁷¹ 2024 Antelope GSP, Figure 2-51, p. 200.

³⁷² 23 CCR § 354.34 (c)(5).

³⁷³ 23 CCR § 354.34 (b)(2).

³⁷⁴ 23 CCR § 354.4 (b)(1).

³⁷⁵ 2024 Antelope GSP, Section 3.7.8.7, p. 349.

³⁷⁶ 2024 Antelope GSP, Section 3.7.6, p. 347; Section 3.7.8.7, p. 349.

³⁷⁷ 2024 Antelope GSP, Table 3-27, p. 342.

³⁷⁸ 2024 Antelope GSP, Table 3-28, p. 342.

³⁷⁹ 2024 Antelope GSP, Figure 3-7, p. 306.

³⁸⁰ 2024 Antelope GSP, Section 3.6.6, p. 341.

³⁸¹ 2024 Antelope GSP, Figure 3-7, p. 306.

proxy to monitor interconnected surface water, and due to the distance of these wells from surface water bodies, the effectiveness of these wells to evaluate the interconnectivity of surface water to groundwater in the Subbasin is questionable. Department staff recommend that the GSA revise the monitoring network for interconnected surface water in the next periodic evaluation.

A discussion of which streams are considered interconnected stream reaches was not included in the section. The 2024 GSP proposes that all monitoring wells have a semi-annual (fall and spring) monitoring frequency³⁸² but does not explain how or why the proposed frequency is appropriate to characterize the spatial and temporal exchanges between surface water and groundwater.

The 2024 GSP provides a discussion of data gaps for interconnected surface water. The 2024 GSP indicates that the GSA considers the lack of wells shallower than 50 feet deep in the vicinity of interconnected surface water and near groundwater dependent ecosystems, and a lack of stream gages as a data gap.³⁸³ The 2024 GSP identifies these gaps as ‘the most prominent data gaps compared to all other indicators.’³⁸⁴ The 2024 GSP states that “the GSA will look at the data gaps brought forth in the GDE and surface water data assessment and aim to bridge these gaps through the installation of shallow monitoring wells and stream gages near areas of concern. Also, it will consider conducting synoptic stream gaging where conditions are safe to do so.”³⁸⁵ Department staff note that a management action called ‘Additional Studies of GDEs and Groundwater – Surface Water Interactions’ is listed in the 2024 GSP’s Potential Other Activities in the list of potential management actions section,³⁸⁶ that may evaluate monitoring of interconnected surface water and GDEs, but will only be implemented “if determined to be necessary or useful... pending future conditions” and the “start and completion date have yet to be determined.”³⁸⁷ Because the plan to fill data gaps for interconnected surface water relies on a study that may not occur, Department staff conclude the GSA is unlikely to fill this data gap with the information provided in the 2024 GSP. Staff note that GSP Regulations require GSAs to provide the steps that will be taken to fill data gaps before the next five year assessment, including the location and purpose of newly added monitoring sites.³⁸⁸ Staff note that the 2024 GSP has not provided the steps to be taken, the location and purpose of future monitoring sites and implementation schedule to address the data gaps identified for interconnected surface water, and recommend the GSA develop this required information as soon as possible.

³⁸² 2024 Antelope GSP, Figure 3-27, p. 342.

³⁸³ 2024 Antelope GSP, Figure Section 3.7.8.7, p. 349.

³⁸⁴ 2024 Antelope GSP, Figure Section 3.7.8.7, p. 349.

³⁸⁵ 2024 Antelope GSP, Section 3.7.8.8, p. 349.

³⁸⁶ 2024 Antelope GSP, Table 4-2, p. 367; Section 4.5.3.2, pp. 419-420.

³⁸⁷ 2024 Antelope GSP, Table 4-29, pp. 419-420.

³⁸⁸ 23 CCR § 354.38 (d).

Lastly, the GSP Regulations require GSPs to provide specific information about each monitoring site per the data and reporting standards.³⁸⁹ 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.³⁹⁰

Once the GSA has sufficiently responded to the recommended corrective actions for this section, the 2024 GSP will have demonstrated substantial compliance with the GSP Regulations.

5.5 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.³⁹¹ Each Plan’s description of projects and management actions must include details such as: how projects and management actions in the GSP will achieve sustainability, the implementation process and expected benefits, and prioritization and criteria used to initiate projects and management actions.³⁹²

The 2024 GSP includes projects and management actions to be implemented by an adaptive management process. The 2024 Plan states that the Subbasin is “expected to be sustainable through 2042 and beyond” without projects and management actions, but projects and management actions will be initiated as needed to “support ongoing sustainability and adapt to potential future changes in Subbasin conditions.”³⁹³ Department staff note that in the basin setting section of the 2024 GSP the historical water budget indicates a total loss of cumulative groundwater storage during the historical period of -18,000 acre-feet, or about -610 acre-feet per year,³⁹⁴ and the projected water budget with consideration of future land use indicated an annual loss of -390 acre feet per year.³⁹⁵ Staff recommend the GSA update its project and management action portfolio to address these declines in storage so that the Subbasin is managed sustainably.

The 2024 GSP includes projects and management actions that are separated into two categories: 1) projects and management actions developed for implementation, and 2) a portfolio of other potential projects and management actions that may be implemented as

³⁸⁹ 23 CCR § 352.4 *et seq.*

³⁹⁰ 23 CCR § 354.36.

³⁹¹ 23 CCR § 354.44 (a).

³⁹² 23 CCR § 354.44 (b) *et seq.*

³⁹³ 2024 Antelope GSP, Section 4.4, p. 375.

³⁹⁴ 2024 Antelope GSP, Appendix 2-K, p. 3860; Table 2-21, p. 246.

³⁹⁵ 2024 Antelope GSP, Tables 2-31, p. 273.

needed.³⁹⁶ The GSA states that “[projects and management actions] developed for implementation are planned to be implemented before 2042”, whereas “[o]ther potential [projects and management actions] could be implemented, as needed, to achieve and maintain long-term groundwater sustainability, depending on changing conditions in the Antelope Subbasin.”³⁹⁷

The 2024 GSP presents projects developed for implementation including:

1. “The Multi-Benefit Recharge Project is a program developed with The Nature Conservancy (TNC) to provide a dual benefit of creating critical habitat for migrating bird species while recharging groundwater supplies.
2. The Grower Education Relating to On-Farm Practices Program will provide growers with educational resources to implement practices that will result in more efficient water use while improving agricultural productivity.
3. Demand Management includes various measures to reduce demand on existing groundwater resources in the Subbasin.
4. The Well Mitigation Program will provide assistance to domestic, small water system, and municipal wells adversely impacted by declining groundwater levels since 2015 that interfere with groundwater production or quality.”³⁹⁸

The GSP describes the above project and management action with a description, general plan for implementation, the relationship to sustainability criteria, expected benefits, metrics for evaluation and legal authority.³⁹⁹ Department staff note that funding sources are in development for many of the projects⁴⁰⁰ and implementation of many listed projects is stated in GSP to occur before 2042 though the precise year is to be determined.⁴⁰¹

Projects and management actions in the “Portfolio of Other Potential Projects and Management Actions” are described in the 2024 GSP;⁴⁰² however the descriptions provided are vague. Department staff note that descriptions of all projects in this group do not include locations, cost estimates, estimates of benefits, or start dates and many projects and management actions in this group are described as currently in the early planning stage.⁴⁰³ Staff note that projects to identify and fill data gaps are included in this group and that these projects are also not described in detail. GSP Regulations require GSAs to describe the steps taken that will fill data gaps by the next five-year assessment, including the location and purpose of newly added monitoring, and Department staff

³⁹⁶ 2024 Antelope GSP, Section 4.1.1.2, p. 359.

³⁹⁷ 2024 Antelope GSP, Section 4.2.1, p. 360.

³⁹⁸ 2024 Antelope GSP, Section 3.1.3, p. 294.

³⁹⁹ 2024 Antelope GSP, Sections 4.4.1-4.4.4, pp. 375-391; Table 4-2, pp. 361-391.

⁴⁰⁰ 2024 Antelope GSP, Section 4.6, p. 429.

⁴⁰¹ 2024 Antelope GSP, Table 4-3, p. 370.

⁴⁰² 2024 Antelope GSP, Section 4.5.1 - 4.5.3.7, pp. 392-429; Table 4-10, p. 392.

⁴⁰³ 2024 Antelope GSP, Section 4.5.1 - 4.5.3.7, pp. 392-429.

would like to remind the GSA that it may not be using the best available science⁴⁰⁴ if it fails to fill data gaps in a timely manner.

Department staff conclude the 2024 GSP's projects and management actions substantially comply with the GSP Regulations, once corrective actions have been addressed.

5.6 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."⁴⁰⁵ Furthermore, the GSP Regulations state that minimum thresholds defined in each GSP should be designed to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.⁴⁰⁶

The Antelope Subbasin is adjacent to several subbasins that may be affected by the management of the Antelope Subbasin:

- a. Red Bluff Subbasin: The Red Bluff Subbasin is also managed by the Tehama County Flood Control and Conservation District GSA and is being managed to similar undesirable results and minimum threshold conditions to the Antelope Subbasin and is unlikely to be adversely affected.
- b. Los Molinos Subbasin: The Los Molinos Subbasin is also managed by the Tehama County Flood Control and Conservation District GSA and is being managed to similar undesirable results and minimum threshold conditions to the Antelope Subbasin and is unlikely to be adversely affected.
- c. Bend Subbasin: The Bend Subbasin is a very low priority basin that is not managed under SGMA. The Bend Subbasin is also managed by the Tehama County Flood Control and Conservation District.

5.7 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.⁴⁰⁷

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

⁴⁰⁴ 23 CCR § 355.4(b)(1)

⁴⁰⁵ Water Code § 10733(c).

⁴⁰⁶ 23 CCR § 354.28(b)(3).

⁴⁰⁷ 23 CCR § 354.18.

manage groundwater within their jurisdictional areas. Specifically, the Department encourages GSAs to:

- Explore how their proposed groundwater level thresholds have been established in consideration of groundwater level conditions in the basin based on current and future drought conditions.
- 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.
- Take into consideration changes to surface water reliability and that impact on groundwater conditions.
- Evaluate updated watershed studies that may modify assumed frequency and magnitude of recharge projects, if applicable, and
- 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 to evaluate how their Plan's groundwater management strategy aligns with drought planning, response, and mitigation efforts within the basin.

6 STAFF RECOMMENDATION

Department staff believe sufficient action has been taken by the GSA to address the deficiencies identified in the 2022 GSP. Department staff recommend **APPROVAL** of the 2024 GSP with the required and recommended corrective actions listed below. The 2024 Plan conforms with Water Code Sections 10727.2 and 10727.4 of SGMA and substantially complies with the GSP Regulations. Implementation of the Plan will likely achieve the sustainability goal for the Antelope Subbasin. The GSA has identified several areas for improvement of its 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 GSA for the first periodic evaluation 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 GSA should address the following related to the sustainable management criteria for the chronic lowering of groundwater levels:

- a. Describe how the GSA will track dry wells in a clear and transparent manner. Develop and implement a process for the public to report dry wells if they occur. The GSA should provide a public record of reported dry wells and include reports of dry wells in its annual reports and periodic evaluations.
- b. Provide the criteria used to select tessellation polygons for its selection of undesirable results.⁴⁰⁸ The GSA should also provide an explanation for how each tessellation polygon is representative of beneficial uses and users in the area, specifically how many wells are located within each tessellation hexagon.
- c. Provide the criteria and processes used to delineate spatial areas of the focus area used to establish minimum thresholds,⁴⁰⁹ which should consider the potential effects on beneficial uses and users.⁴¹⁰ Include an explanation of why some reported dry wells are not included in the focus area.

RECOMMENDED CORRECTIVE ACTION 2

The GSA should address the following related to the sustainable management criteria for degradation of groundwater quality:

- a. Revise the description of degraded water quality sustainable management criteria so that groundwater conditions, whether caused by direct actions by the GSA to

⁴⁰⁸ 23 CCR § 354.26 (b)(2).

⁴⁰⁹ 23 CCR § 354.28 (b)(1).

⁴¹⁰ 23 CCR § 354.28 (b)(4).

implement this GSP or not, are considered in the assessment of significant and unreasonable conditions in the Subbasin.

- b. Expand the degraded water quality monitoring network's spatial extent for the upper aquifer and lower principal aquifers to sufficiently monitor impacts to beneficial uses or users of groundwater in all areas of the Subbasin⁴¹¹ and to collect sufficient spatial and temporal data from each principal aquifer to determine groundwater quality trends.⁴¹²

RECOMMENDED CORRECTIVE ACTION 3

The GSA should address the following related to the hydrogeologic conceptual model:

- a. Describe its rationale for identifying two principal aquifers, including describing significant differences between the two aquifers or a regional aquitard between them.⁴¹³ The GSA should, after filling data gaps, identify how interconnected the Upper and Lower Aquifer are, and explain how managing them separately improves the GSA's ability to manage sustainability.
- b. Describe the steps that will be taken to fill data gaps before the next periodic evaluation of the GSP, with a focus on the lack of understanding of the Lower Aquifer, including its formation thicknesses, defining hydraulic properties, and interconnectivity with the Upper Aquifer.⁴¹⁴

RECOMMENDED CORRECTIVE ACTION 4

The GSA should coordinate with the appropriate groundwater users, including drinking water, environmental, and irrigation users as identified in the Plan, and water quality regulatory agencies and programs in the Subbasin to understand and develop a process for monitoring and determining if groundwater management and extraction is resulting in migration of constituents of concern or degraded water quality in the Subbasin.

RECOMMENDED CORRECTIVE ACTION 5

The GSA should address the following related to the sustainable management criteria for land subsidence:

- a. Evaluate InSAR data against the proposed thresholds as it is released (rather than once every five-years) during plan implementation so that it may consider impacts to beneficial uses and users.

⁴¹¹ 23 CCR § 354.34 (b)(1).

⁴¹² 23 CCR 354.34 (c)(4).

⁴¹³ 23 CCR § 354.14 (b)(4) *et seq.*

⁴¹⁴ 23 CCR § 354.38 (d).

- b. Consider localized impacts to beneficial uses and users of groundwater, land uses, and property interests⁴¹⁵ while establishing the quantitative combination of minimum threshold exceedances that represents an undesirable result.
- c. Set an annual rate and cumulative total amount of subsidence that would lead to undesirable results. Establish minimum thresholds and undesirable results definitions for land subsidence that consider impacts to beneficial uses and users of groundwater, land uses, and property interests⁴¹⁶ while using the best available science.⁴¹⁷

RECOMMENDED CORRECTIVE ACTION 6

Department staff understand that estimating the location, quantity, and timing of stream depletion due to ongoing, Subbasin-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 evaluation of the GSP:

- a. Estimate the quantity and timing of depletions of interconnected surface water systems.⁴¹⁸
- b. Define what constitutes undesirable results for the depletion of interconnected surface water in the Subbasin. Describe the potential effects on the beneficial uses and users of groundwater, or other potential effects that may occur or are occurring from undesirable results.⁴¹⁹
- c. Consider utilizing the interconnected surface water guidance, as appropriate, when issued by the Department to establish quantifiable minimum thresholds, measurable objectives, and management actions.
- d. 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.
- e. Prioritize collaborating and coordinating with local, state, and federal regulatory agencies as well as interested parties to better understand the full suite of

⁴¹⁵ 23 CCR § 354.28 (b)(4).

⁴¹⁶ 23 CCR § 354.28 (b)(4).

⁴¹⁷ 23 CCR § 355.4 (b)(1).

⁴¹⁸ 23 CCR § 354.16 (f).

⁴¹⁹ 23 CCR § 354.26 (b)(3).

beneficial uses and users that may be impacted by pumping induced surface water depletion within the GSA's jurisdictional area.

RECOMMENDED CORRECTIVE ACTION 7

The GSA should address the following related to the monitoring networks and provide updates on progress in annual reports:

- a. Expand the chronic lowering of groundwater levels monitoring network's spatial extent for both the Upper Aquifer and Lower Aquifer to sufficiently monitor impacts to beneficial uses or users of groundwater,⁴²⁰ evaluate groundwater conditions in all principal aquifers and areas of the Subbasin,⁴²¹ and provide the necessary data to quantify water budget components for the entire Subbasin.⁴²²
- b. Update the land subsidence monitoring network using the best available science⁴²³, so that it can identify the rate and extent of land subsidence,⁴²⁴ and monitor for impacts to beneficial uses or users.⁴²⁵

⁴²⁰ 23 CCR § 354.34 (b)(2).

⁴²¹ 23 CCR 354.34 (c)(1)(A).

⁴²² 23 CCR 354.34 (b)(4).

⁴²³ 23 CCR § 354.4 (b)(1).

⁴²⁴ 23 CCR § 354.34 (c)(5).

⁴²⁵ 23 CCR § 354.34 (b)(2).